UNIVERSITY OF CALIFORNIA

SANTA CRUZ

PROJECTING THE ADJECTIVE: THE SYNTAX AND SEMANTICS OF GRADABILITY AND COMPARISON

A dissertation submitted in partial satisfaction of
the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

LINGUISTICS

by

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September 1997

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Projecting the Adjective

The Syntax and Semantics of Gradability and Comparison

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September 1997
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Abstract

This dissertation argues that gradable adjectives like *bright, dense* and *short* denote *measure functions*–functions from objects to abstract representations of measurement, or *scales* and *degrees*. This proposal is shown to provide a foundation for principled explanations of a wide range of syntactic and semantic properties of gradable adjectives and the constructions in which they appear, ranging from the syntactic distribution of gradable adjectives to the scopal characteristics of comparatives and the empirical effects of adjectival polarity.

Chapter 1 presents an overview of the core semantic properties of gradable adjectives and outlines the two primary approaches to their meaning that have appeared in the literature. Building on a number empirical observations, the chapter reaches two conclusions: first, the meaning of gradable adjectives should be characterized in terms of scales and degrees, and second, the traditional analysis of gradable adjectives as relations between objects and degrees and complex degree constructions such as comparatives as expressions that quantify over degrees does not account for the scopal properties of comparatives.

Chapter 2 presents the analysis of gradable adjectives as measure functions and argues that gradable adjectives combine with a degree morphology to generate

properties of individuals, which are defined in terms of relations between two degrees. This analysis not only provides an explanation for the facts discussed in chapter 1, but also supports a robust account of the compositional semantics of a range of degree constructions within a syntactic framework in which gradable adjectives project extended functional structure headed by degree morphology.

Finally, chapter 3 investigates the ontology of degrees and the characterization of adjectival polarity, focusing on the anomaly of comparatives constructed out of antonymous pairs of adjectives and the monotonicity properties of polar adjectives. The facts are shown to support an ontology in which degrees are formalized as intervals on a scale, or *extents*, and a structural distinction is made between two sorts of extents: positive extents and negative extents. This distinction forms the basis for a sortal characterization of adjectival polarity.

Acknowledgments

The problem of finding a thesis topic is often more difficult than the problems a thesis sets out to solve; in my case, however, the topic came in a flash on Interstate 5 somewhere between Santa Cruz and Los Angeles: I would work on comparatives. What better topic for a thesis than something I knew next to nothing about? It is a testament to the trust, support, and good humor of my committee–co-supervisors Donka Farkas and Bill Ladusaw and committee member Sandy Chung–that I was able to convince them to agree (or coerce them into agreeing) to sign on to a project that started out looking at comparatives and ended up being about gradable adjectives in general. It is an even stronger testament to their depth of knowledge and strength as teachers that I was able to work the unstructured and various ideas, hypotheses, and questions that came up over the course of my research into the document presented here. I feel extremely fortunate and grateful to have had the opportunity to work with Bill, Donka, and Sandy, both in the construction of this thesis and throughout my five years in Santa Cruz.

In addition to my committee, Jorge Hankamer and Jim McCloskey played important roles in the development of my thinking about the specific issues discussed in this thesis and in my personal development as a researcher and a teacher, and I would like to express my gratitude to both of them. I would also like to take this opportunity to thank those people outside of the Santa Cruz community whose generous gifts of time and thoughts contributed to the progress of my work, in particular, Ewan Klein, Chris Barker, Bran Boguraev, Irene Heim, Robert May, and Ivan Sag.

I was extremely fortunate to end up as a graduate student at UC Santa Cruz.

Although the circumstances of my arrival were a bit unusual (but happily for my colleagues at Yale, ultimately not realized!), the consequences were excellent. My gratitude to three people in particular runs very deep: Jason Merchant and Rachel Walker have been the very best of colleagues and friends, and Jaye Padgett has somehow managed to combine those two roles with that of teacher since the very first day I got into this business. I would like to thank Judith Aissen, Junko Itô, Armin Mester, and Geoff Pullum for the quality of their teaching and the standards of excellence they set, the UCSC graduate students for creating an outstanding intellectual environment, the undergraduates for keeping us on our toes, Tanya Honig, whose support and help in any number of areas made the bad stuff bearable, Sylvia Zito and Cher Bergeon for helping to make it all work, and those who came with, before, and during, in particular, Chris Albert, Geoff Duke, Ted Fernald, Anastasia Giannakidou, Klaus von Heusinger, Michael Johnston, Motoko Katayama, Eric Potsdam, Philip Spaelti, Peter Svenonius, and Kari Swingle. Finally, a special shout to Frederic Evans, who immediately convinced me that I made the right choice in becoming a linguist, and whose spirit persists in the excitement of asking questions about language.

Four final things were instrumental to the successful completion of this thesis: Hillary, Lyosha, the Sub-Mersians (and the transcendental groove of surf music), and last, but certainly not least, the *Haynes Guide to the Volvo 140 Series.*

Introduction

Gradable adjectives can be identified in (at least) two ways: in terms of their basic semantic characteristics, or in terms of their syntactic distribution.[1] Semantically, gradable adjectives can be informally defined as predicative expressions whose domains can be partially ordered according to some property that permits grading. For example, the domain of the adjective *tall* can be ordered according to a measure of *height*, the domain of the adjective *dense* can be ordered according to a measure of *density*, and the domain of *bright* according to a measure of *brightness*. In contrast, adjectives like *dead, octagonal,* and *former* do not introduce the same kind of orderings on their domains. Although the domains of these adjectives are partially ordered–those objects for which it is true to say e.g., *x is dead* or *a former x* are distinguished from those objects for which these claims are false–it is not the case that objects can be *dead, octagonal,* or *former* to varying degrees.

Distributionally, the class of gradable adjectives has two defining characteristics (cf. Klein 1980:6). First, gradable adjectives can be modified by degree adverbials such as *quite, very,* and *fairly*. According to this criterion, *inexpensive, dense,* and *bright* are identified as gradable adjectives, but *dead, octagonal,* and *former* are not, as shown by (1)-(6).

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[1]I assume the class of *adjectives* in general to include those expressions that can appear in predicative position (as complements of verbs like *be*, *seem*, and *become*) or attributive position (in the context [(Det) __ N]), and that have certain syntactic characteristics (e.g., they do not assign abstract case to their complements). See Siegel 1976 for an overview of the semantic properties of adjectives; see also Hamman 1991.

(1) The Mars Pathfinder mission was quite inexpensive.

(2) The neutron star in the Crab Nebula is very dense.

(3) The city lights are fairly bright tonight.

(4) ??Giordano Bruno is very dead.

(5) ??I want the new spacecraft to be quite octagonal.

(6) ??Carter is a fairly former president, and Lincoln is an extremely former president.

Although non-gradable adjectives like *dead* do sometimes occur with degree modifiers, as in e.g., *Giordano Bruno is quite dead*, such uses are marked, and tend to convey a sense of irony or humor. Such uses indicate is that (at least some) non-gradable adjectives can be coerced into having gradable interpretations in contexts that are otherwise incompatible with their canonical meanings.

The second distributional characteristic of gradable adjectives is that they can appear in a class of complex syntactic environments, which I will refer to as *degree constructions*. Roughly speaking, a degree construction is a construction formed out of an adjective and a *degree morpheme*–an element of {*er/more, less, as, too, enough, so, how, ...*}. For concreteness, I will identify degree constructions as structures in which an adjective occurs in the environments specified in (7), where 'Deg' is a degree morpheme.

(7) [Deg (Adv)* __]

[__ Deg]

Typical examples of degree constructions are given in (8)-(14): comparatives, equatives, *too* and *enough* constructions, *so...that* constructions, *how* questions, and anaphoric *this/that* constructions. These examples, like the data discussed above, indicate that *expensive, dense,* and *bright,* as well as *distant, old* and *fast,* are gradable adjectives.

(8) Mars Pathfinder was less expensive than previous missions to Mars.

(9) Venus is brighter than Mars.

(10) Neptune is not as distant as Pluto.

(11) The equipment is too old to be of much use to us.

(12) Current spacecraft are not fast enough to approach the speed of light.

(13) The black hole at the center of the galaxy is so dense that nothing can escape the pull of its gravity, not even light.

(14) How bright is Alpha Centauri?

Examples (15)-(17) show that non-gradable adjectives such as *dead, octagonal,* and *former* cannot appear in degree constructions.

(15) ??Giordano Bruno is too dead to fly on the space shuttle.

(16) ??The new spacecraft is more octagonal than the old one.

(17) ??How former a president is Carter?

Degree constructions, and comparatives in particular, have been the focus of much of the work on the syntax and semantics of gradable adjectives in the tradition of generative grammar. The syntactic complexity of these constructions was recognized and discussed in very early work (see e.g., Lees 1961, Smith 1961, Pilch 1965, Huddleston 1967, and Hale 1970), and has formed the basis for important developments in the theory of phrase structure, exemplified by Bresnan's (1973, 1975) detailed analysis of the syntax of comparatives and the adjective phrase and Jackendoff's (1977) investigation of X-bar theory, as well as important work on ellipsis (e.g., Hankamer 1973, Bresnan 1973, 1975, Chomsky 1977, Kuno 1981, Pinkham 1982, Napoli 1983, Hazout 1995). Recent work in the Principles and Parameters framework has sought to reevaluate and recast many of Bresnan's and Jackendoff's insights in light of more current thinking about phrase structure and the relation between lexical and functional categories (see in particular Abney 1987, Corver 1990, 1997, and Grimshaw 1991; see also Larson 1991 and Izvorski 1994).

On the semantic side, the interest in degree constructions can be explained very straightforwardly: they provide important insight into the core meaning of gradable adjectives. Simply put, there is a strong intuition that the anomaly which results from inserting adjectives like *dead, octagonal* and *former* into the context of a degree construction is semantic, not syntactic. If this is true, then it is some aspect of the meaning of gradable adjectives that is responsible for the fact that they can occur in these constructions, and it is this component of their meaning which distinguishes them from non-gradable ones like *dead, octagonal,* and *former*. The most obvious semantic difference between *tall, old, bright* and *dense* on the one hand, and *dead, octagonal,* and *former* on the other, is the one observed above: the domains of the former can be partially ordered according to some gradient property; the domains of the latter cannot be. If degree morphemes are sensitive to the ordering on the domain of a gradable adjective (i.e., if their meaning is such that they require the adjectives with which they combine to be assoicated with partially ordered domains), then the distribution of gradable and non-gradable adjectives illustrated by the examples above can be explained. Degree constructions, then, provide an empirical foundation upon which to build an investigation of the semantic characteristics of gradable adjectives and, more generally, the expression of ordering relations in natural language.

The intuition that the core meaning of gradable and non-gradable adjectives determines their felicity in degree constructions, combined with the general hypothesis that the syntactic distribution of meaningful expressions should follow from the interaction of their meanings with the meanings of the expressions with which they combine, provides the foundation for the thesis of this dissertation. Specifically, I will argue that gradable adjectives denote *measure functions*–functions from objects to abstract representations of measurement, or *degrees*–and degree constructions denote properties of individuals that are characterized as relations between degrees, and I will support this proposal by showing that it provides principled explanations of a wide range of semantic properties of gradable adjectives and degree constructions, ranging from the distribution of gradable and non-gradable adjectives in degree constructions to the scopal characteristics of comparatives and the behavior of antonymous pairs of "positive" and "negative" adjectives.

The organization of the dissertation is as follows. Chapter 1 provides a detailed introduction to the semantic characteristics of gradable adjectives–the core facts that any theory must explain–and introduces the two most prominent approaches to the semantic analysis of gradable adjectives. The first, articulated in the work of McConnell-Ginet 1973, Kamp 1975, Klein 1980, 1982, 1991, van Benthem 1983, Larson 1988, and Sánchez-Valencia 1994, builds on the hypothesis that gradable adjectives are of the same semantic type as other predicates–they denote (possibly partial) functions from individuals to truth values–but differ in having partially ordered domains. I survey the basic claims of this type of analysis, then discuss several sets of facts which are problematic for it, concluding that the analysis, in its basic form, cannot be maintained. The second account, adopted by a number of researchers on gradable adjectives and comparatives (see e.g., Seuren 1973, Cresswell 1976, Hellan 1981, Hoeksema 1983, von Stechow 1984a, Heim 1985, Lerner and Pinkal 1992, 1995, Moltmann 1992a, Gawron 1995, Rullmann 1995, Izvorski 1995), analyzes gradable adjectives as relations between objects and abstract representations of measurement, or *degrees*, and degree constructions are analyzed as expressions which quantify over degrees. I show that this type of approach contains the machinery necessary for an explanation of the data which are problematic for the vague predicate analysis. I conclude by laying out some additional facts involving the scopal properties of comparatives which are problematic for this type of theory in its basic form.

Taking the observations about the scopal properties of comparatives as a starting point, chapter 2 develops an alternative to the relational analysis discussed in chapter 1 in which gradable adjectives are analyzed as functions from objects to degrees (cf. Bartsch and Vennemann 1973). I argue that propositions in which the main predicate is headed by a gradable adjective φ have three primary semantic constituents: a *reference value*, which denotes the degree to which the subject is φ, a *standard value*, which corresponds to another degree or to a proposition, and a *degree relation*, which is introduced by a degree morpheme and which defines a relation between the reference value and the standard value. Building on a syntactic analysis in which gradable adjectives project extended functional structure headed by a degree morpheme (as in Abney 1987, Corver 1990, 1997, and Grimshaw 1991), I show that this analysis supports a straightforward compositional semantics for degree constructions in English, and that it explains the scopal properties of comparatives that are problematic for the traditional scalar analysis.

Finally, chapter 3 addresses the ontological status of degrees, arguing that degrees should be analyzed as intervals on a scale, or *extents*, rather than as points on a scale, as traditionally assumed. Using the anomaly of comparatives constructed out of positive and negative pairs of adjectives as the empirical basis for my claims, I argue that gradable adjectives denote functions from objects to extents, and adopt an ontology originally proposed in Seuren 1978, which distinguishes between two sorts of extents: positive extents and negative extents. I claim that the difference between positive and negative adjectives is a sortal one: positive adjectives denote functions from objects to positive extents, and negative adjectives denote functions from objects to negative extents. After setting this analysis into the semantic framework developed in chapter 2, I show that the approach supports an explanation of the facts that were problematic for the traditional degree-based analysis. The chapter continues with an examination of a set of constructions, which at first glance appear to be counterexamples to the analysis, but upon closer examination turn out to provide interesting support. Finally, I show that the algebra of extents has the additional positive result of providing an independently motivated explanation of the monotonicity properties of gradable adjectives.

1 Gradable Adjectives

This chapter provides an overview of the semantic properties of gradable adjectives–the core set of facts that any theory must explain–and surveys the primary approaches to the semantic analysis of gradable adjectives that have been developed in the literature, focusing on two approaches. The first, which I refer to as the "vague predicate analysis", builds on the hypothesis that gradable adjectives denote partial functions from individuals to truth values. I survey the basic claims of this type of analysis, then discuss several sets of facts which are highly problematic for it, concluding that the analysis, in its basic form, cannot be maintained. I then discuss a second account, which I refer to as the "scalar analysis", in which gradable adjectives are analyzed as expressions that denote relations between objects and abstract measures, or *degrees*, and degree constructions are analyzed as expressions which quantify over degrees. I show that this type of approach contains the machinery necessary for an explanation of the data which is problematic for the vague predicate analysis. I conclude by laying out some additional facts which are problematic for a traditional scalar analysis, focusing on the scopal properties of comparatives.

1.1 The Semantic Characteristics of Gradable Adjectives

A defining characteristic of gradable adjectives is that there is some gradient property associated with their meaning with respect to which the objects in their domains can be ordered. For example, any set of objects that have some positive linear dimension can be ordered according to how *long* the objects are or how *short* they are, and any set of objects that move can be ordered according to how *fast* or *slow* they are.[1] Some connection between gradable adjectives and ordering relations is incorporated into all approaches to their semantics; what distinguishes the two analyses that I will discuss in the sections 1.2 and 1.3 of this chapter is the way in which the ordering on the domain is determined, in particular, whether the ordering on the domain is presupposed and the adjective is analyzed as a function from objects in an ordered set to truth values, or whether the ordering on the domain is actually determined by the meaning of the adjective. In order to appreciate the differences between the two approaches, however, it is necessary to first review some of the crucial facts that any analysis must explain. One important set of facts was discussed in the introduction: the presence of gradable adjectives in comparatives and other degree constructions. The goal of this section is to introduce several additional empirical domains that provide important insight into the semantic characteristics of gradable adjectives.

1.1.1 Vagueness

Sentences containing adjectives are inherently vague; (1), for example, may be judged true in one context and false in another.

(1) The Mars Pathfinder mission is expensive.

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[1]The distinction between so-called "positive" adjectives like *long* and *fast* and "negative" adjectives like *short* and *slow* is discussed below in section 1.1.4, and forms the focus of chapter 3.

In a context in which the discussion includes all objects that have some cost associated with them, (1)would most likely be judged true, since the cost of sending a spacecraft to Mars is far greater than the cost of most things (e.g., nails, dog food, a used Volvo, etc.). If the context is such that only missions involving interplanetary exploration are salient, however, then (1) would be judged false, since a unique characteristic of the Mars Pathfinder mission was its low cost compared to other projects involving the exploration of outer space.

This discussion brings into focus an important aspect of the vagueness of gradable adjectives: determining the truth of a sentence of the form *x is* φ (where φ is a gradable adjective in its absolute form) involves a judgment of whether x "counts as" φ in the context of utterance. The problem of resolving the vagueness of a gradable adjective, then, can be viewed as the problem of answering the question *does x count as* φ *in context c?* Although there may be many different ways to construct an algorithm for answering this question, two approaches have predominated in research on the semantics of gradable adjectives. In the following paragraphs, I will present an informal outline of these two approaches, returning to a more formal discussion of the same issues in Sections 1.2 and 1.3.

The first approach, which I will refer to as the "vague predicate analysis" (see McConnell-Ginet 1973, Kamp 1975, Klein 1980, 1982, 1991, van Benthem 1983, Larson 1988a, and Sánchez-Valencia 1995), starts from the assumption that gradable adjectives are of the same semantic type as non-gradable adjectives and other predicates: they denote functions from objects to truth values. What distinguishes gradable adjectives from other predicative expressions is that the domains of the former are partially ordered with respect to some property that permits gradation, such as *cost, temperature, height,* or *brightness.* On this view, the observation that objects can be ordered according to the amount to which they possess some property is interpreted as basic principle (see Sapir 1941 for relevant discussion), and the meaning of a gradable adjective is built on top of it. Specifically, a gradable adjective φ is analyzed as a function that induces a partitioning on a partially ordered set into objects ordered above some point and objects below that point: for objects ordered towards the upper end of the set, *x is* φ is true, and for objects ordered towards the lower end, *x is* φ is false.[2]

In this type of approach, the problem of vagueness can be characterized as the problem of determining how the domain of a gradable adjective should be partitioned in a particular context. One way to go about solving this problem is to assume a very general algorithm whereby a gradable adjective partitions any partially ordered set according to some "norm value", and to allow for the possibility that in different contexts, instead of applying the adjective to its entire domain, only a subset of the domain is considered.[3] Specifically, when evaluating a sentence of the form *x is* φ in a

[2]Klein 1980, 1982 argues that gradable adjectives should actually be analyzed as *partial* functions, allowing for the possibility that for some objects in the domain of φ, *x is* φ is undefined (see also Kamp 1975), resulting in a three-way partitioning of the domain. I will return to this issue in section 1.2.

[3]How exactly the norm value is determined in this type of analysis is not a question that I will attempt to answer here, though I will return to this question in the context of a different analysis in chapter 2. See Siegel 1979 for a general survey of different approaches to this question; see also Bierwisch 1989 for related discussion of the notion of "norm".

context *c*, attention is restricted to a subset of the domain of φ that contains only objects that are deemed to be "like *x*" in some relevant sense in *c* (assuming that the relation "is like *x*" is reflexive, this subset will always include *x*), and then checking to see whether the partitioning of the subset by φ is such that *x is* φ is true.

Following Klein, I will refer to this contextually relevant subset as a *comparison class*. Intuitively, a comparison class is a subset of the domain of a gradable adjective that contains just those objects that are determined to be relevant in a particular context of utterance, in particular, those objects that are similar to *x* in some appropriate respect. The intuition underlying this type of approach is that in order to make a precise judgment about whether an object "counts as" φ, it is first necessary to focus attention on a subset of the domain that contains objects that are in some way similar to *x*, and then check to see whether *x* falls "at one end of the other" of the ordered subset. The basic idea can be illustrated by considering example (1). Assume that the domain of the adjective *expensive* is the set of entities that can have some cost value. Among this set are the objects in (2), which are ordered according to increasing cost.

(2) $D_{expensive}$ = {... a nail ... a bag of dog food ... a Hank Mobley album ... a copy of *Stricture in Feature Geometry* ... a dinner at Chez Panisse ... a new BMW ... a house in San Francisco ... the Mars Pathfinder mission ... a manned mission to Mars ...}

If all of the objects in the domain of *expensive* must be considered when evaluating the truth of (1), then it is clear that (1) should be true, since the cost of the Mars Pathfinder mission is greater than the cost of most things. If, however, the context is such that only projects in the space program are relevant, then the comparison class would consist of the subset of $D_{expensive}$ illustrated in (3).

(3) {the Mars Pathfinder mission ... a 15 day space shuttle mission ... a mission to the moon ... the international space station ... a manned mission to Mars}

In this context, (1) would be false, because the Mars Pathfinder mission falls at the low end of the ordering. Other contexts might give rise to comparison classes in which the Mars Pathfinder mission falls at the upper end of the ordered set (e.g., contexts in which the comparison class consists of expeditions involving 6-wheeled vehicles), in which case (1) would again be true.

The initial assumption that the domain of a gradable adjective has an inherent ordering imposed upon it is crucial to the vague predicate analysis, since the truth or falsity of a sentence of the form *x is* φ is determined by the position of x in the ordered set (whether it is ordered at the upper end or whether it is ordered at the lower end). Moreover, the inherent ordering on the domain plays an important role in the analysis of vagueness outlined here, as well, since it is necessary that any comparison class constructed from an ordered set S preserves the ordering on S. If the ordering on the domain was not inherent, but could change from context to context, then a subset of the domain of *expensive* as presented in (2) with the ordering indicated in (1) would be a possible comparison class for (1), with the result that (5) would be false and (6) true *in the same context*.

(4) {a manned mission to Mars ... the international space station ... a mission to the moon ... a 15 day space shuttle mission ... the Mars Pathfinder project}

(5) The Mars Pathfinder mission is expensive.

(6) A manned mission to Mars is expensive.

This would be an unacceptable result: there is a clear intuition that if the basic ordering on the domain of *expensive* is as in (2), then any context in which (6) is true should also be one in which (5) is true. In order to avoid this problem, Klein (1982:126) stipulates that the ordering on a comparison class must preserve the initial ordering on the domain of the adjective, pointing out that this is not an unjustified assumption; rather, it is "fundamental to the expression of ordering relations in natural language." This claim raises the following question, however: should a principle like this be made to follow more directly from the meaning of a gradable adjective itself? More generally, should the ordering on the domain of a gradable adjective be viewed as a primitive, or should it be determined in some way by the meaning of the adjective itself? The analysis that I have outlined here takes the former position; in the following paragraphs, I will sketch an alternative approach that makes the latter assumption.

The second approach to the problem of vagueness, first articulated in Cresswell 1976 (see also Seuren 1973) but since incorporated into many analyses of the semantics of gradable adjectives (see e.g., Hellan 1981, Hoeksema 1983, von

Stechow 1984a, Heim 1985, Lerner & Pinkal 1992, 1995, Moltmann 1992a, Gawron 1995, Rullmann 1995, Hendriks 1995), provides a means of answering the question *does x count as φ in c?* by constructing an abstract representation of measurement and defining the interpretation of a gradable adjective in terms of this representation.[4] This abstract representation, or *scale*, can be construed as a set of points ordered by a relation $\leq$, where each point represents a measure or *degree* of "φ-ness". The introduction of scales and degrees into the ontology makes it possible to analyze gradable adjectives as relational expressions; specifically, as expressions whose semantic function is to establish a relation between objects in its domain and degrees on the scale. A more general consequence of defining the interpretation of an adjective in terms of a scale is that the ordering on the domain of a gradable adjective is determined by a semantic property of the adjective itself: by establishing a relation between objects and points in a totally ordered set, the adjective imposes a partial order on its domain.

For illustration, consider the domain of the adjective *expensive*, repeated below as (7).

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[4] In Cresswell's analysis, scales are actually constructed out of equivalence classes of objects partially ordered according to some gradable property; in this respect, the analysis starts from the same assumption as the approach discussed above: that objects can be ordered according to the degree to which they possess some property, independently of the meaning of particular adjectives. In the discussion that follows, however, I will treat scales as abstract objects with respect to which the ordering on a set is determined (see Bierwisch 1989). I will go into the formalization of scales in more detail in section 1.3, and, in particular, in chapter 3.

(7) D = {a nail ... a bag of dog food ... a Hank Mobley album ... a copy of *Stricture in Feature Geometry* ... dinner at Chez Panisse ... a new BMW ... a house in San Francisco ... the Mars Pathfinder project ... a 15 day space shuttle mission ... a mission to the moon ... the international space station ... sending people to Mars}

In the vague predicate analysis outlined above, the ordering represented in (7) is assumed to be an inherent property of the domain of the adjective. In the alternative "scalar" analysis, however, the domain of the adjective is unordered, but an ordering corresponding to the one illustrated in (7) can be derived as a consequence of the fact that the adjective *expensive* establishes relations between the objects in $D_{expensive}$ and elements in a totally ordered set of points, i.e., degrees on a scale of *expensiveness*.

The characterization of gradable adjectives as relational expressions supports an alternative approach to the interpretation of vague sentences like (1). Specifically, a sentence of the form *x is* φ is taken to mean *x is at least as* φ *as d*, where *d* is a degree on the scale associated with φ that identifies a "standard" of φ-ness. Intuitively, a standard-denoting degree is a value that provides a means of separating those objects for which the statement *x is* φ is true from those objects for which *x is* φ is false, in some context. The structure of scales–specifically, the fact that they are defined as totally ordered sets–ensures that the relative ordering of a standard-denoting degree and a degree which corresponds to the measure of an object's "adjectiveness" can always be determined.

For example, a sentence like (1), on this view, is assigned an interpretation that can be paraphrased as (8), which is true just in case the degree that indicates the expensiveness of the Mars Pathfinder mission is at least as great as the standard value (I will return to a more formal discussion of this approach in section 1.3).

(8) The Mars Pathfinder mission is at least as expensive as a standard of expensiveness.

Within this type of analysis, the problem of vagueness can be cast as the problem of determining the actual value of the standard in the context of utterance. The standard assumption is that the standard value is set indexically, and that its value may be determined by the a contextually relevant comparison class (see Cresswell 1976, von Stechow 1984a, and, in particular, Bierwisch 1989 for discussion).[5] For example, assume that in a context in which the comparison class is determined to be projects in the space program, as in (3) above, the relation between the projections of the objects in the comparison class onto the scale of expensiveness may (i.e., their "degrees of expensiveness") stand in relation to the standard degree d_{stnd} as shown in (9).

(9) *expensive:* $— d_{Pathfinder} — d_{Shuttle} — d_{stnd} — d_{Moon} — d_{Station} — d_{People\ to\ Mars} \longrightarrow$

[5]In chapter 2, I will undertake a detailed discussion of how the makeup of the comparison class affects the actual value of the standard. For the moment, we may make the simplifying assumption (as above) that the standard value represents a "norm" for a particular comparison class (cf. Bartsch and Vennemann 1972, Cresswell 1976, von Stechow 1984a, Bierwisch 1989).

In this context, (8) is true, because $d_{Pathfinder}$–the degree to which the Pathfinder mission is expensive–is ordered below d_{stnd}. In an alternative context, however, in which the comparison class were such that the standard value were to shift to a point below $d_{Pathfinder}$, (8) would be false. What the scalar analysis "gets for free" is the preservation of the ordering on the domain, because a change in comparison class, with a concomitant change in the value of the standard, does not affect the overall ordering of the degrees on the scale. Since the scale determines the ordering on the domain of the adjective, this ordering remains constant, regardless of a shift in comparison class.

An important similarity between the two approaches to vagueness discussed here is that the context-dependence of vague sentences like (1) is ultimately explained in the same way: in terms of comparison classes. In order to know whether a sentence of the form *x is* φ is true in a context c–whether x "counts as" φ in c–it is first necessary to determine what subset of the domain of the gradable adjective that is taken to be relevant in the context. This subset–the comparison class–is then used as the basis for evaluating the truth of the sentence. In the first account, the comparison class introduces the set that is partitioned by the adjective; in the second account, the comparison class is used as the basis for fixing the value of the standard. In both cases, when the comparison class is changed, the truth of the original sentence may be affected: either the partitioning induced by the adjective may change, or the standard value may be shifted accordingly.

Despite this similarity, the two analysis outlined here differ in a fundamental way. Specifically, they make very different claims about the relation between the meaning of a gradable adjective and the ordering on its domain. In the vague predicate analysis, the ordering on the domain is assumed to be inherent. This assumption not only permits a straightforward semantic analysis of gradable adjectives as predicative expressions, it also provides justification for the assumption the construction of a comparison class always preserves the ordering on the domain. In contrast, the scalar analysis derives the ordering on the objects in the domain of a gradable adjective from the meaning of the adjective itself, which establishes a relation between domain objects and degrees on a scale (i.e., points in a totally ordered set). This result does not come without a cost, however. Although the scalar approach derives the ordering on the domain, it gives up the analysis of gradable adjectives as simple predicates, treating them instead as relational expressions. In addition, it requires the introduction of abstract objects into the ontology, namely scales and degrees.

The latter difference is of primary importance, as it introduces a potential basis for making an empirical distinction between the two analyses sketched here. If scales and degrees do play a role in the interpretation of gradable adjectives, then it should be possible to show that there are facts which can be explained only if scales and degrees are part of the ontology; such facts would then constitute an argument for a scalar approach. One of the goals of this thesis is to make exactly this argument. In section 1.2, I will introduce several sets of facts which are problematic for the analysis of gradable adjectives as simple predicates, and in section 1.3, I will show that these facts can be straightforwardly explained if scales and degrees are part of the ontology.[6] Before moving on to this discussion, though, some additional semantic characteristics of gradable adjectives that will play crucial roles in the argument will be introduced.

1.1.2 Indeterminacy and the Dimensional Parameter

In most cases, the resolution of vagueness–the judgment of whether an object x "counts as" φ–can be accomplished as described above: either by restricting attention to a particular comparison class, or by determining an appropriate standard. Both of these operations presuppose that the ordering associated with the adjective (either on the domain or with respect to the scale) is determinate, however, since it is with respect to this ordering that the ultimate judgment is made. For many adjectives, however, this presupposition is not met. Consider, for example, the following sentences:

(10) Richard is smart.

(11) *The Devils* is a slow book.

(12) William is liberal.

The truth of a sentence like (10) is *indeterminate* in a way that is different from that of a typical vague sentence such as *Richard is tall*. A particular individual might be

[6] In chapter 3, I will address the question of the actual structure of scales and degrees, arguing that degrees should be formulated as intervals on a scale or "extents", rather than points, as standardly assumed.

considered smart in the role of, for example, a political advisor, but decidedly *not* smart when it comes to social behavior and discreetness. As a result, the truth or falsity of a general statement like (10) is unclear, raising the following question: *smart in what sense?* (11) and (12) are similarly indeterminate. A book might be exciting and engaging, but nevertheless be slow to read due to the complexity of its characters and language. Similarly, an individual might be judged liberal with respect to some issues (e.g., health care, affirmative action); but with respect to other issues (e.g., welfare, immigration), the same individual might not be.

One way to approach the problem of indeterminacy would be to assume that it is a kind of vagueness, arising from a difficulty in some contexts of determining an appropriate comparison class. Although this might be true of (12), examples like (10) and (11) call this characterization of indeterminacy into question. What is at issue in these sentences is not the content of the comparison class, but rather the actual ordering on the domain of the adjective. Adjectives like *smart, slow* and *liberal* have a wider range of interpretations than an adjective like *tall*, in that they permit different orderings on their domains in different contexts of use. For example, *smart* may involve an ordering according to political or strategic skill, or it may be associated with an ordering according to more general notions of social behavior and personal conduct. In the former case, (10) might be judged true; in the latter case (10) might be judged false. What is important to note is that even if the comparison class remains constant–the set of political consultants, for example–the truth value of a sentence like (10) can still vary depending on which of these two interpretations of *smart* is chosen.[7]

Indeterminacy is a characteristic of a large number of gradable adjectives in English, which McConnell-Ginet (1973) and Kamp (1975) refer to as the NON-LINEAR adjectives (see also Klein 1980). A defining characteristic of non-linear adjectives is that comparative constructions in which they appear do not have definite truth values, in contrast to comparative constructions in which otherwise vague adjectives appear; indeed, this characteristic explicitly distinguishes indeterminacy from the type of vagueness discussed in section 1.1.1. For example, (13) has the same status as (10)–we cannot evaluate the truth of this sentence without first knowing the sense in which *smart* is used–i.e., what the criteria for "smartness" are. In contrast, (14) can be evaluated simply by determining the costs of the different missions.

(13) Richard is smarter than George.

(14) The Mars Pathfinder mission was less expensive than the Viking missions.

What the facts discussed here indicate is that the relation between an adjective and a particular ordering relation is not one to one: some gradable adjectives may be associated with more than one ordering on a domain. For example, consider the adjective *large* in the context of cities. Cities can be ordered according to different aspects of largeness, such as volume, population, or even size of the bureaucracy (see Klein 1991:686 and Cresswell 1976:270-271 for discussion); not surprisingly, the NP

[7]The interpretation of *slow*, particularly in attributive contexts, is similar (cf. *a slow book, a slow car, a slow student*). See Pustejovsky and Boguraev 1993 for relevant discussion.

a large city is ambiguous in at least these three ways. In the discussion that follows, I will refer to the aspect according to which objects in a set are ordered as a DIMENSION (cf. Bierwisch's (1989) notion of ASPECT). The underlying idea is that a dimension corresponds to a property that permits grading, i.e., a property such as *temperature, monetary cost, physical size, social grace, skill at manipulating people,* etc., that can be used as a basis for imposing an ordering on a set of objects. Dimensions play a fundamental role in the analysis of gradable adjectives, as they determine the actual ordering of the objects in a gradable adjective's domain.

To make things concrete, I will assume that every gradable adjective is associated with a *dimensional parameter*, which identifies the dimension that a particular adjective is associated with, and so determines how the objects in an adjective's domain should be ordered. How this is accomplished differs depending on which of the two approaches discussed in the previous section is adopted, as the implementation of dimensions differs in the two accounts. In the vague predicate analysis, the dimensional parameter specifies the dimension according to which the initial ordering on the domain of the adjective is constructed; in effect, it identifies which of many possible orderings on the set of objects that satisfy the selectional restrictions of the adjective should be used to build the (partially ordered) domain of the function denoted by the adjective. Crucially, since different dimensions may determine different orderings, the domains of adjectives with different dimensional parameters may have distinct orderings, even if they contain the same objects.

In the scalar analysis, the dimensional parameter plays a slightly different role, but ultimately has the same effect. Specifically, the dimensional parameter identifies the scale onto which the adjective maps the objects in its domain. The underlying idea is that dimensions distinguish one scale from another: a scale along a dimension of *temperature* and a scale along a dimension of *brightness* are different objects. The consequence of this distinction is that adjectives with different dimensional parameters may impose different orderings even if their domains are the same, since the mapping between a set of objects and one scale need not be the same as the mapping between the same set of objects and a different scale.[8]

Given these basic assumptions, the fact that non-linear adjectives support more than one ordering on their domains can be taken as evidence that they are underspecified for their dimensional parameter. In other words, the difference between adjectives like *smart* and *tall* is that the dimensional parameter of the former may take on different values in different contexts, while the dimensional parameter of the latter is fixed. If this is correct, then indeterminacy is a type of ambiguity, rather than a type of vagueness: it is the problem of determining in some context of use what the actual value of the dimensional parameter of a non-linear adjective is. Once the dimensional parameter of a non-linear adjective is fixed, however, sentences like those discussed here can be evaluated in the same way as sentences with other gradable adjectives. The fact that a sentence like (10) might be true on one interpretation of *smart* and false on the other, even with respect to the

[8]A second consequence of this distinction is that degrees on different scales are elements of different ordered sets. This aspect of the scalar analysis will play a crucial role in the discussion of *incommensurability*, a phenomenon that will be introduced in the next section and used as a basis for distinguishing between the vague predicate and scalar analyses in sections 1.2 and 1.3.

same comparison class, follows from the fact that the two interpretations of *smart* have different dimensional parameters, which in turn introduce different orderings on the adjective's domain.

1.1.3 Incommensurability

It is often the case that the object of which a non-linear gradable adjective is predicated indicates which of several dimensions associated with the adjective is appropriate for a particular sentence. For example, the adjective *long* is associated with at least two dimensions: one that supports an ordering according to *linear extent*, and one that supports an ordering by *temporal duration*. Because of the sortal restrictions associated with the corresponding interpretations of the adjective, neither (15) nor (16) is indeterminate: the former has the *temporal duration* interpretation; the latter the *linear extent* reading.

(15) The class was long.

(16) The table is long.

An important fact is that when an adjective like *long* appears in a comparative construction, the compared objects must be ordered along the same dimension. If they are not, as in (17) and (18), the comparative is anomalous (see Hale 1970).

(17) #The class was longer than this table is.

(18) #*The Devils* isn't as slow as the people in this class.

The anomaly of (17) and (18) is actually a specific instance of a more general phenomenon that will play a crucial role in the discussion to follow: *incommensurability* (see Klein 1991:686 for discussion). Incommensurability is illustrated by (19) and (20), which show that adjectives that are associated with different dimensions are anomalous in comparative constructions.

(19) #Larry is more tired than Michael is clever.

(20) #My copy of *The Brothers Karamazov* is heavier than my copy of *The Idiot* is old.

That the anomaly of these sentences is due to a mismatch of dimension, rather than a general constraint prohibiting different adjectives from appearing in comparative constructions, is shown by (21)-(22).

(21) Most boats are longer than they are wide.

(22) Our Norfolk Island Pine is almost as tall as the bedroom ceiling is high.

Although the comparatives in these examples are constructed out of different adjectives, the pairs of adjectives arguably have the same or very similar dimensional parameters, as they all introduce orderings according to different aspects of the same basic property: some notion of "linear extent".[9]

[9] It should be observed that while sentences like (17)-(20) are anomalous in a "basic" interpretation, as shown by the clear contrast between these examples and (21)-(22),

The contrast between (19)-(20) and (17)-(18) on the one hand, and (21)-(22) on the other, suggests the descriptive generalization stated in (23).

(23) A comparative construction is semantically well-formed only if the compared adjectives have the same dimensional parameter.

A plausible explanation for this generalization is that a necessary condition for comparison is that the compared objects be ordered along the same dimension. Ideally, this condition should follow as a general consequence of the semantic analysis of gradable adjectives and comparative constructions; it should not have to be stipulated. This requirement suggests a potential point of difference between the vague predicate and scalar analyses of gradable adjectives. Since the role of the dimensional parameter of a gradable adjective differs in the two accounts–in the former, it identifies how the objects in the domain of the adjective should be ordered; in the latter, it identifies the scale onto which the objects in the domain of the adjective should be mapped–the two analysis should differ in their approaches to the problem of incommensurability. In sections 1.2 and 1.3, I will take a closer look at

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sentences of this type are often used with a sense of irony or humor. In these contexts, a sentence of the form *"x is more/as φ than/as y is ψ"*, where φ and ψ are otherwise incommensurable adjectives, takes on a "metalinguistic" interpretation: roughly, "it's more/as appropriate to say that '*x* is φ' than/as it is to say that '*y* is ψ'" ((18), for example, clearly has this kind of interpretation; see McCawley 1988 and Klein 1991 for some discussion of this phenomenon). The possibility of a metalinguistic interpretation does not eliminate the need for an account of incommensurability, however, since the contrast between sentences like (17)-(20) and (21)-(22) must still be explained.

these issues, arguing that only an analysis that introduces scales and degrees into the ontology provides an explanatorily adequate account of this phenomenon.

1.1.4 Polarity

The final semantic characteristic of gradable adjectives that I will consider here is *polarity* (see Seuren 1978, Rusiecki 1985, Bierwisch 1989, Sánchez-Valencia 1994, and H. Klein 1996 for relevant discussion). Many (though not all) gradable adjectives come in antonymous pairs, such as *tall/short*, *safe/dangerous*, *sharp/dull*, *liberal/conservative*, and so forth. At some fundamental level, the members of such pairs provide the same kind of information about an object: they provide a characterization of an object according to some property that permits grading. What distinguishes the "positive" and "negative" members of these pairs is that they do this from different (and in some sense *complementary*) perspectives. For example, both *tall* and *short* are used to make claims about the height an object has, but the information conveyed by a sentence like *Carmen is tall* is qualitatively different from that conveyed by *Mike is short*. This difference in perspective has several important empirical consequences that are relevant to the overall semantic analysis of gradable adjectives.

1.1.4.1 Montonicity Properties

As shown by (24)-(29), antonymous adjectives differ with respect to the licensing of negative polarity items (NPIs): the negative member of the pair licenses NPIs in a clausal complement of the adjective; the positive member does not (Seuren 1978, Ladusaw 1979, Linebarger 1980, Sanchez-Valencia 1996).

(24) It's difficult for Tim to admit that he has *ever* been wrong.

(25) *It's easy for Tim to admit that he has *ever* been wrong.

(26) It's sad that you have to talk to *any* of these people *at all.*

(27) *It's great that you have to talk to *any* of these people *at all.*

(28) It would be foolish of her to *even bother to lift a finger* to help.

(29) *It would be clever of her to *even bother to lift a finger* to help.

Similarly, (30)-(33) show that negative adjectives license downward entailments in clausal complements, while positives license upward entailments.

(30) It's dangerous to drive in Rome. ⇒ It's dangerous to drive fast in Rome.

(31) It's safe to drive in Des Moines. ⇐ It's safe to drive fast in Des Moines.

(32) It's strange to see Frances playing electric guitar. ⇒ It's strange to see Frances playing electric guitar poorly.

(33) It's common to see Frances playing electric guitar. ⇐ It's common to see Frances playing electric guitar poorly.

The conclusion to be drawn from these facts is that negative adjectives generate monotone decreasing contexts, while positives generate monotone increasing contexts. A plausible hypothesis, then, is that positive and negative adjectives are associated with inverse ordering relations. The validity of statements like (34)-(35) provides initial support for this idea.

(34) Venus is brighter than Mars if and only if Mars is dimmer than Venus.

(35) Driving in Rome is more dangerous than driving in Los Angeles if and only if driving in Los Angeles is safer than driving in Rome.

More generally, the facts discussed here suggest that gradable adjectives have logical properties that are connected to the way in which the ordering on their domains is introduced. As a result, adjectival polarity provides an empirical domain for exploring the relation between gradable adjectives and ordering relations. The important questions are: how is adjectival polarity represented in the lexical semantics of pairs of adjectives like *tall* and *short*, *safe* and *dangerous*, and so on, and how does the representation of polarity explain the logical properties of the adjectives discussed above: licensing of negative polarity items, entailments, and the validity of statements like (34) and (35)? These questions will be addressed in chapter 3.

1.1.4.2 Cross-Polar Anomaly

Sentences such as (36)-(39) show that comparatives constructed out of positive and negative pairs of adjectives are anomalous, a phenomenon that I will refer to as *cross-polar anomaly* (see Hale 1970 and Bierwisch 1989 for discussion of similar facts).

(36) #Mike is shorter than Carmen is tall.

(37) #*The Brothers Karamazov* is longer than *The Idiot* is short.

(38) #The Tenderloin is dirtier than Pacific Heights is clean.

(39) #A Volvo is safer than a Fiat is dangerous.

(36)-(39) contrast with structurally similar sentences in which the polarity of the adjectives is the same, such as (40) and (41), which are perfectly interpretable (cf. (21)-(22)).

(40) The desk is longer than the table is wide.

(41) Luckily, the ficus is shorter than the ceiling is low, so it'll fit in the room.

An initially promising hypothesis is that cross-polar anomaly is a type of incommensurability; i.e., (36)-(39) are anomalous for the same reason as sentences like (17)-(20), discussed in section 1.1.3: positive and negative adjectives are associated with different dimensional parameters, and so are incomparable. An analysis of this sort faces two important difficulties, however. The first comes from tautologies like (34) and (35). As the discussion of indeterminacy in section 1.1.2 showed, different dimensions may introduce different orderings on the same domain. As a result, it is not possible to make "cross-dimensional" inferences: given two dimensions d_1 and d_2 that define partial orderings on a set A, the fact that two objects a and b in A stand in a particular ordering relation with respect to d_1 does not tell us anything about the relative ordering of a and b with respect to d_2. The importance of examples like (34) and (35) is that they show that there is a non-arbitrary relation between positive and negative pairs of adjectives: the ordering relation associated with the latter is the inverse of the ordering associated with the former. Without additional stipulations, an analysis of cross-polar anomaly that asserts that positive and negative adjectives have different dimensional parameters would lose this crucial relation.

The second difficulty facing this account of cross-polar anomaly that it would conflict with the basic characterization of a dimension as an ordering with respect to a property that permits grading. As noted in the introduction to this section, there is a strong intuition that antonymous adjectives provide complementary perspectives on how an object is characterized with respect to the same gradable property, e.g. a dimension of *height* for the adjectives *tall* and *short*. One way to account for this intuition would be to assume that antonymous adjectives introduce inverse orderings along *the same* dimension; indeed, it is this assumption that provides the basis for an explanation of the validity of examples like (34) and (35). If positive and negative adjectives have different dimensional parameters, however–an assumption required by an explanation in terms of incommensurability–then this explanation would be unavailable, and the underlying intuition would remain unexplained.

Despite these difficulties, the intuition that cross-polar anomaly is a kind of incommensurability remains. The challenge facing an analysis that seeks to explain the anomaly of sentences like (36)-(39) *and* sentences like (17)-(20) in terms of the same underlying principles is to do so in a way that maintains the assumption that antonymous adjectives have the same dimensional parameter. In section 1.3 and in more detail in chapter 3, I will show that a positive result of a scalar analysis of gradable adjectives is that, given an appropriate formalization of degrees, both cross-polar anomaly and incommensurability can be explained in terms of a failure of the comparison relation to be defined for the compared degrees.

1.1.4.3 Comparison of Deviation

A set of facts that bears directly on the analysis of cross-polar anomaly consists of sentences which are superficially similar to examples like (36)-(39), in that they involve comparative (and equative) constructions constructed out of positive and negative pairs of adjectives but are not anomalous. These sentences, which I will refer to as *comparison of deviation* constructions, are exemplified by (42)-(45).

(42) Robert is as short as William is tall.

(43) Alex is as slim now as he was obese before.

(44) Frances is as reticent as Hilary is long-winded.

(45) It's more difficult to surf Maverick's than it is easy to surf Steamer Lane.

Comparison of deviation constructions differ semantically from standard comparatives and equatives in two important ways.[10] First, they differ in terms of

[10]A third difference between comparison of deviation constructions and standard comparatives is that they do not license morphological incorporation of the adjective and the comparative morpheme. This is clearly illustrated by the minimal pair (i)-(ii). (i) has a comparison of deviation interpretation, but (ii) is an example of cross-polar anomaly.

(i) San Francisco Bay is more shallow than Monterey Bay is deep.

basic interpretation. Roughly speaking, sentences like (42)-(45) compare the relative extents to which a pair of objects differ from some "standard" associated with the relevant adjectives. This is clearly illustrated by an equative construction like (42), which can only mean that the extent to which Robert exceeds some standard of shortness is (relatively) the same as the extent to which William exceeds some standard of tallness. (42) *cannot* mean that Robert and William are equal in height.[11]

Second, unlike standard comparatives, comparison of deviation constructions entail that the property predicated of the compared objects is true in the absolute sense. For example, (45) entails that surfing Maverick's is difficult and surfing Steamer Lane is easy, as shown by (46), which is contradictory.

(46) It's more difficult to surf Maverick's than it is easy to surf Steamer Lane, though Maverick's is quite easy.

In contrast, (47) does not entail that surfing either location is difficult, although this information is conveyed as a cancelable implicature, as shown by (48).

(ii) #San Francisco Bay is shallower than Monterey Bay is deep.

[11]In this way, the interpretation of (42) differs from that of a more typical equative, such as (i), which asserts that the length of Robert's feet and the width of William's feet are the same.

(i) Robert's feet are as long as William's feet are wide.

(47) It's more difficult to surf Maverick's than it is to surf Steamer Lane.

(48) It's more difficult to surf Maverick's than it is to surf Steamer Lane, though they're both quite easy.

The challenge presented by comparison of deviation is to construct an analysis that both accounts for the inferences associated with sentences like (42)-(45) *and* supports an explanation of cross-polar anomaly. In sections 1.2 and 1.3, I will show that only a scalar analysis achieves this result.

1.1.5 Summary

This section provided an overview of the empirical domain that a theory of the semantics of gradable adjectives and degree constructions must explain, and it gave an informal introduction to two approaches to these issues: the vague predicate analysis and the scalar analysis. The vague predicate analysis assumes a partial ordering on the domain of a gradable adjective and constructs a semantic analysis of gradable adjectives as partial functions from objects to truth values; the scalar analysis extends the ontology to include abstract representations of measurement, or "scales", and characterizes the interpretation of gradable adjectives in terms of such objects. In the next two sections, I will focus in more detail on these two analyses. Although the two are very similar in terms of their empirical coverage, I will show that three of the phenomena discussed in this section–incommensurability, cross-polar anomaly, and comparison of deviation–provide evidence that the interpretation of gradable adjectives should be formalized in terms of scales and degrees.

1.2 The Vague Predicate Analysis

The first approach to the problem of vagueness discussed in section 1.1.1, which can be found in the work of McConnell-Ginet 1973, Kamp 1975, Klein 1980, Klein 1982, van Benthem 1983, Larson 1988a, and Sanchez-Valencia 1994 (see also Lewis 1973), analyzes gradable adjectives as predicates whose domains are partially ordered according to some dimension. In the following sections, I will examine the basic assumptions of this type of approach in more detail, focusing on the versions articulated in Klein 1980, 1982. I will show first how this type of analysis explains the interpretation of gradable adjectives in the absolute form, then how it explains the interpretation of more complex degree constructions, focusing on the analysis of comparatives. Finally, I will discuss several problematic sets of data, concluding that the analysis in its basic form cannot be maintained.

1.2.1 Overview

As observed in section 1.1.1, the vague predicate analysis starts from the assumption that gradable adjectives are of the same semantic type as non-gradable adjectives: they denote functions from objects to truth values. Gradable adjectives are distinguished from non-gradable adjectives (and other predicative expressions) in that their domains are partially ordered according to some gradable property, such as *cost, temperature, height*, or *brightness*; in section 1.1.2, I assumed that the ordering on a gradable adjective's domain is determined by its dimensional parameter. Klein (1980, 1982) (building on Kamp 1975) makes a second distinction between gradable and non-gradable adjectives: the latter always denote complete functions from individuals to truth values, but the former can denote *partial* functions from individuals to truth values. In other words, non-gradable adjectives like *hexagonal* and *Croatian* always denote functions that return a value in $\{0,1\}$ when applied to objects in their domains, but gradable adjectives like *dense, bright*, and *shallow* can denote functions that return 0, 1 or no value at all when applied to objects in their domains.

The interpretation of a proposition with a gradable adjective as the main predication can be stated as follows. First, assume as above that the domain of a gradable adjective is partially ordered according to some dimensional. A gradable adjective φ in a context c can then be analyzed as a function that induces a tripartite partitioning of its (ordered) domain into: (i) a *positive extension* ($pos_c(\varphi)$), which contains objects above some point in the ordering (objects that are definitely φ in c), (ii) a *negative extension* ($neg_c(\varphi)$), which contains objects below some point the ordering (objects that are definitely not φ in c), and (iii) an *extension gap* ($gap_c(\varphi)$), which contains objects that fall within an "indeterminate middle", i.e., objects for which it is unclear whether they are or are not φ in c. The net effect of these assumptions is that the truth conditions of a sentence of the form *x is* φ in a context c can be defined as in (49) (where $\varphi(x)$ is the logical representation of "*x is* φ").[12]

(49) i. $||\varphi(x)||^c = 1$ iff x is in the positive extension of φ at c,

[12] As noted in section 1.1.1, the point that identifies the "lower edge" of the positive extension corresponds to a "norm" value for a given adjective, which Klein (1982) suggests can be identified with the extension gap.

ii. $||\varphi(x)||^c = 0$ iff x is in the negative extension of φ at c, and

iii. $||\varphi(x)||^c$ is undefined otherwise.

As observed in section 1.1.1, the partitioning of the domain into a positive and negative extension and extension gap is context-dependent, determined by the choice of *comparison class*. Roughly speaking, a comparison class is a subset of the domain of discourse that is determined to be somehow relevant in the context of utterance, and it is this subset that is supplied as the domain of the function denoted by the adjective. The role of the comparison class can be illustrated by considering an example like (50).

(50) Bill is tall

If the entire domain of discourse were taken into consideration when evaluating the truth of (50), then it would turn out to be either false or undefined, since relative to mountains, redwoods, and skyscrapers, humans fall at the lower end of an ordering along a dimension of *height*. As a result, the individual denoted by *Bill* would be at the lower end of the ordered domain of the adjective, and so would fall within the negative extension of *tall* (or possibly in the extension gap). When attention is restricted to humans, however, then a comparison class consisting only of humans is used as the basis for the partitioning of the domain of *tall*, and the truth or falsity of (50) depends only on the position of *Bill* in this smaller set.

An important constraint on the construction of a comparison class is that it must preserve the original ordering on the domain, in order to avoid undesirable entailments. For example, consider a context in which the ordering on the domain of *tall* is as in (51). If no restrictions were placed on the construction of a comparison class from D_{tall}, then the ordered set K_{tall} in (52) would be a possible comparison class, allowing for a partitioning of the domain as shown in (53).

(51) D_{tall} = {..., *Nadine, Bill, Aisha, Chris, Tim, Frances, Polly, Erik, ...*}

(52) K_{tall} = {..., *Aisha, Frances, Polly, Nadine, ...*}

(53) pos_c(*tall*)= {*Polly, Nadine*}

neg_c(*tall*) = {*Aisha*}

gap_c(*tall*) = {*Frances*}

In this context, (54) would be true while (55) would be false, a result which is inconsistent with our intuitions if the actual ordering on the domain of *tall* is as in (51).

(54) Nadine is tall.

(55) Frances is tall.

This undesirable result is avoided by invoking the "Consistency Postulate" informally defined in (56) (see Klein 1980, 1982, van Benthem 1983, Sanchez-Valencia 1994, and (63) below), which requires any partitioning of a subset of the domain of a gradable adjective to preserve the original ordering on the entire domain.

(56) *Consistency Postulate (informal)*

For any context in which *a is* φ is true and $b \geq a$ with respect to the ordering on the domain of φ, then *b is* φ is also true, and for any context in which *a is* φ is false, and $a \geq b$, then *b is* φ is also false.

A consequence of this condition is that (53) is not a possible partitioning: since the partitioning indicated in (53) makes (54) true, and *Frances* ≥ *Nadine* with respect to the original ordering in (51), the Consistency Postulate requires it to also be the case that (55) is true.

The Consistency Postulate has another important consequence: it entails that any objects in the domain of a gradable adjective that are ordered above objects in the positive extension of some comparison class in context *c* fall in the positive extension of a corresponding partitioning of the entire domain in *c*. For example, assume that the domain of *tall* is as shown above in (51), and in context *c*, the partitioning on the comparison class (57) is as shown in (58).

(57) $K_{tall} = \{..., Nadine, Aisha, Frances, Polly, ...\}$

(58) $pos_c(tall) = \{Frances, Polly\}$

$neg_c(tall) = \{Aisha\}$

$gap_c(tall) = \{Nadine\}$

In this context (59) is true, and according to the Consistency Postulate, (60) is true as well, since *Erik* ≥ *Polly* with respect to the ordering in (51).

(59) Polly is tall.

(60) Erik is tall.

This discussion brings into focus the fundamental ideas underlying the vague predicate analysis. Given any set of objects partially ordered along a dimension δ, it is possible to define a family of (possibly partial) functions that induce a partitioning on the set in accord with the consistency postulate informally stated in (56). In effect, the vague predicate analysis claims that the interpretation of a gradable adjective with dimensional parameter δ is a value selected from this family of functions, though it may vary from context to context. On this view, the vagueness of sentences constructed out of gradable adjectives is due to the fact that it is necessary to choose a value from this family of functions for the adjective. The importance of the comparison class is that it provides a means of narrowing down the set of possible choices.

1.2.2 Comparatives

The analysis of comparative constructions within the vague predicate analysis builds on the intuitions underlying the Consistency Postulate (see McConnell-Ginet 1973, Kamp 1975, Klein 1980, 1982, van Benthem 1983, Larson 1988a, Sánchez-Valencia 1994).[13] Consider, for example, (61) and (62).

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[13] I will focus here on the analysis of comparative and equative constructions; see Klein 1980, 1982 for discussion of *how adj* questions and anaphoric *that adj* constructions.

(61) Jupiter is larger than Saturn (is).

(62) The earth is as large as Venus (is).

Given the conditions imposed by the Consistency Postulate, it follows that if there is a context that makes the proposition expressed by *Jupiter is large* true but makes *Saturn is large* false, then it must be the case that the object denoted by *Jupiter* is ordered above the individual denoted by *Saturn* with respect to the ordering on the domain of *large*, i.e., it must be the case that Jupiter is larger than Saturn. Similarly, if every context in which the proposition expressed by *Venus is large* is true is such that *the earth is large* is true as well, then it must be the case that the object denoted by *the earth* is ordered at least as high as the object denoted by *Venus* in the domain of *large*, i.e., that the earth is as large as Venus.

This analysis can be made precise by building on the observation made at the end of the previous section that the interpretation of a gradable adjective in a context *c* is a member of a family of functions that partition a partially ordered set in accord with the Consistency Postulate. Specifically, we can introduce a set of *degree functions* that apply to a gradable adjective and return some member of this family; in particular, following Klein 1980, we can assume that the result of applying a degree function to a gradable adjective is always a complete function.[14] The underlying idea is that a degree function performs the role normally played by context: it fixes the denotation of the adjective, ultimately determining how the domain is to be

[14] In Klein's analysis, the denotations of *very*, *fairly*, and other degree modifiers are taken from the set of degree functions.

partitioned. The difference is that all of the partitionings induced by a degree function are bipartite: none contain an extension gap.

Once we have degree functions, the Consistency Postulate can be restated more formally, as in (63) (where *GrAdj* is the set of gradable adjective meanings, *D* is the domain of discourse, and *Deg* is the set of degree functions; cf. Klein 1982:126).[15]

(63) *Consistency Postulate*

For all $\varphi \in GrAdj$, $a,b \in D$, $c \in C$, and $d \in Deg$:

$$\left[[\![(d(\varphi))(a)]\!]^c = 1 \wedge b \geq_\varphi a\right] \rightarrow \left[[\![(d(\varphi))(b)]\!]^c = 1\right] \text{ and}$$

$$\left[[\![(d(\varphi))(a)]\!]^c = 0 \wedge a \geq_\varphi b\right] \rightarrow \left[[\![(d(\varphi))(b)]\!]^c = 0\right]$$

The net effect of the Consistency Postulate is to ensure that the only admissible degree functions are those that induce partitionings of the domain of a gradable adjective in a way that is consistent with the inferences discussed in the previous section. Given this constraint, the interpretation of comparatives and equatives can be straightforwardly formalized in terms of quantification over degree functions, as in (64) and (65) the formalism adopted here is most similar to that in Klein 1982).[16]

[15] For two objects a,b in the domain of a gradable adjective φ, $a \geq_\varphi b$ iff a is at least as great as b with respect to the ordering determined by the dimension identified by φ's dimensional parameter.

[16] I focus here on comparatives with *more* for perspicuity; see Klein 1980 and Larson 1988a for some discussion of comparatives with *less*. In addition, see Larson 1988a for some refinements of the basic analysis developed to handle the interpretation of quantificational expressions in the comparative clause (the complement of *than* or *as*).

(64) *a is more* φ */*φ*-er than b:* $\exists d[(d(\varphi))(a)\ \&\ \neg\ (d(\varphi))(b)\ ]$

(65) *a is as* φ *as b:* $\forall d[(d(\varphi))(b)\ \rightarrow (d(\varphi))(a)]$

Consider the analysis of (61), which has the logical representation in (66).

(61) Jupiter is larger than Saturn (is).

(66) $\exists d[(d(large))(Jupiter)\ \&\ \neg\ (d(large))(Saturn)\ ]$

According to (66), (61) is true just in case there is a function that, when applied to *large*, induces a partitioning of the domain of *large* so that the positive extension includes *Jupiter*, while the negative extension contains *Saturn*. Assuming the domain of *large* to be as in (67) (limiting the domain to the planets in the solar system), (61) is true, because there is a partitioning of the domain of *large* such that *Jupiter* is in the positive extension and *Saturn* is in the negative extension, namely the one shown in (68) (where the notation *a/b* indicates that *a* and *b* are nondistinct with respect to the ordering on the domain; I'm assuming for the sake of argument that Venus and the earth are the same size). [17]

(67) $D_{large} = \{Pluto, Mercury, Mars, Venus/Earth, Neptune, Uranus, Saturn, Jupiter\}$

[17]To distinguish the partitioning introduced by a degree function from the context-dependent partitioning associated with the absolute construction, I will represent the positive and negative extensions of a gradable adjective φ with respect to a particular degree function d as $pos_d(\varphi)$ and $pos_d(\varphi)$, respectively.

(68) $pos_d(large) = \{Jupiter\}$

$neg_d(large) = \{Pluto, Mercury, Mars, Venus/Earth, Neptune, Uranus, Saturn\}$

Since the possible values of the function *d* must satisfy Consistency Postulate, partitionings such as (69) are impossible, and we derive the desired result that (61) entails that for any context, *Jupiter* is ordered above *Saturn* in the domain of *large*; i.e., that Jupiter is larger than Saturn is.

(69) $pos_d(large) = \{Uranus, Saturn\}$

$neg_d(large) = \{Pluto, Mercury, Mars, Venus/Earth, Neptune, Jupiter\}$

The analysis of the equative construction is very similar. The logical representation of (62) is (70).

(62) The earth is as large as Venus (is).

(70) $\forall d[(d(large))(Venus) \rightarrow (d(large))(the\ earth)]$

(62) is true just in case every value of *d* that results in a partitioning of the domain of *large* in which the object denoted by *Venus* is in the positive extension is also a partitioning in which the object denoted by *the earth* is in the positive extension. Since all values for *d* must obey the Consistency Postulate, this will be the case in a context in which the ordering on the domain of *large* is as in (67).[18]

[18] A positive result of this analysis is that it accounts for the fact that (i) and (ii) are

Finally, it should be observed that this analysis does not entail that the two conjuncts in the logical representation of the comparative (or equative) are true in the context of utterance. Consider, for example, the analysis of (71).

(71) My Volvo is faster than Jason's Honda.

(72) $\exists d[(d(\mathit{fast}))(\mathit{my\ Volvo})\ \&\ \neg\ (d(\mathit{fast}))(\mathit{Jason's\ Honda})\ ]$

All that is necessary to satisfy the truth conditions of (71) is that there be some partitioning of the domain of *fast* that makes *my Volvo is fast* true and *Jason's Honda is fast* false; for example, the one in (73).

(73) $pos_d(fast)$ = {*my Volvo, my old Dodge, ..., Ken's Jaguar, Jorge's Morgan, Kari's Dodge*}

$neg_d(fast)$ = {*..., Rachel's scooter, Jason's Honda, ...*}

It does not follow, however, that this partitioning is the one derived contextually (relative to an appropriate comparison class) in the context of utterance. For example, it might be the case that the actual partitioning of the domain of *fast* in the context of utterance of (71) is as in (74), in which case neither (75) nor (76) would be

logically equivalent (see Klein 1980).

(i) Mars is not as large as Jupiter.

(ii) Jupiter is larger than Mars.

true, according to the analysis of the absolute form outlined above.

(74) pos_c(*fast*) = {..., *Ken's Jaguar, Jorge's Morgan, Kari's Dodge*}

neg_c(*fast*) = {..., *Rachel's scooter, Jason's Honda, my Volvo, ...*}

gap_c(*fast*) = {..., *my old Dodge, ...*}

(75) My Volvo is fast.

(76) Jason's Honda is fast.

1.2.3 Problems with the Vague Predicate Analysis

The following sections discuss a number of problems for the analysis of comparative constructions outlined here, and, by extension, for the general analysis of gradable adjectives within the vague predicate approach. I will focus on four problems specifically, which involve facts from two of the domains discussed in section 1.1: polarity and incommensurability.

1.2.3.1 Cross-Polar Anomaly

Although Klein (1980) does not explicitly discuss the differences between antonymous pairs of positive and negative adjectives such as *tall/short, clever/stupid,* and *safe/dangerous*, a natural approach to adjectival polarity within a vague predicate analysis is to assume, building on the observations about the logical properties of gradable adjectives discussed in section 1.1.4.1, that the domains of antonymous pairs are distinguished by their orderings: one is the inverse of the other.[19] A positive result of this assumption is that it explains why sentences like (77) are valid.

(77) Jason's Honda is more dangerous than my Volvo if and only if my Volvo is safer than Jason's Honda.

If the domains of *safe* and *dangerous* are identical except for the ordering on the objects they contain, and if the ordering of one is the inverse of the other, then any partitioning of the domain of *dangerous* that satisfies the truth conditions of the first conjunct in (77)–i.e., any partitioning that makes *Jason's Honda is dangerous* true and *my Volvo is dangerous* false–will have the opposite effect on the domain of *safe*, since the two sets, in effect, stand in the dual relation to each other. For example, any function that partitions the domain of *dangerous* as in (78) must induce a corresponding partitioning on the domain of *safe* as shown in (79), with the result that both conjuncts of (77), shown in (80) and (81), are true.

(78) $D_{dangerous} = \{..., c, b, my\ Volvo, a, ..., x, Jason's\ Fiat, y, x, ...\}$

$pos_d(dangerous) = \{..., x, y, Jason's\ Fiat, z, ...\}$

$neg_d(dangerous) = \{a, my\ Volvo, b, c, ...\}$

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[19]This idea is implicit in Klein's (1980:35) discussion of examples like *Mona is more happy than Jude is sad* (see the discussion of comparison of deviation in section 1.2.3.2 below). Sánchez-Valencia (1994) shows how this assumption can be used to build an explanation of the monotonicity properties of polar adjectives.

(79) $D_{safe} = \{..., x, y, \textit{Jason's Fiat}, z, ..., a, \textit{my Volvo}, b, c, ...\}$

$pos_d(safe) = \{a, \textit{my Volvo}, b, c, ...\}$

$neg_d(safe) = \{..., x, y, \textit{Jason's Fiat}, z, ...\}$

(80) $\exists d[(d(dangerous))(\textit{Jason's Fiat}) \: \& \: \neg(d(dangerous))(\textit{my Volvo})]$

(81) $\exists d[(d(safe))(\textit{my Volvo}) \: \& \: \neg(d(safe))(\textit{Jason's Fiat})]$

This analysis runs into problems when confronted with examples of cross-polar anomaly, however, which is illustrated by (82) and (83).

(82) #Mona is happier than Jude is sad.

(83) #Bill is older than Chelsea is young.

Consider, for example, the case of (82), which has the logical representation in (84).

(84) $\exists d[(d(happy))(Mona) \: \& \: \neg(d(sad))(Jude)]$

According to (84), (82) is true just in case there is a function that effects a partitioning of the domains of *happy* and *sad* in such a way that *Mona is happy* is true and *Jude is sad* is false; e.g., if Mona is very happy and Jude is not very sad. Given the assumption that the domains of the antonymous pair *happy* and *sad* have opposite ordering relations, in a context in which the domain of *happy* is (85), the domain of *sad* is (86).

(85) $D_{happy} = \{x, y, Jude, z, Mona\}$

(86) $D_{sad} = \{Mona, z, Jude, y, x\}$

In such a context, there is a function that satisfies the truth conditions associated with (84), for example, the one that induces the partitioning of the domains of *happy* and *sad* shown in (87).

(87) $pos_d(happy) = \{Jude, z, Mona\}$

$neg_d(happy) = \{x, y\}$

$pos_d(sad) = \{y, x\}$

$neg_d(sad) = \{Mona, z, Jude\}$

As a result, (82) should be true. More generally, (82) should be perfectly interpretable: nothing about the architecture of the analysis predicts that comparatives constructed out of antonymous pairs of adjectives should be anomalous. The basic problem is that the assumption that the domains of positive and negative adjectives contain the same objects under inverse ordering relations–an assumption that is necessary to account for the validity of sentences like (77)–predicts that it should be possible to interpret sentences like (82) in the way I have outlined here. One could stipulate that comparison between positive and negative pairs of adjectives is impossible, but there is no aspect of the analysis of comparatives within the vague predicate approach that derives this constraint. Moreover, such a stipulation would be empirically unmotivated, since comparison of deviation constructions, discussed in the next section, show that comparison between positive and negative adjectives is possible in certain circumstances.

1.2.3.2 Comparison of Deviation

The problems presented by cross-polar anomaly for a vague predicate analysis extend to comparison of deviation constructions such as (88) and (89), though their effects are somewhat different.

(88) Robert is as short as William is tall.

(89) Mona is more happy than Jude is sad.

In the discussion of these constructions in section 1.1.4.3, I observed that they have two important semantic characteristics. First, they compare the relative extents to which two objects deviate from some contextually-determined "standard" value associated with the adjective, and second, they entail that the properties predicated of the compared objects are true in the absolute in the context of utterance. The problem that comparison of deviation presents for the vague predicate analysis is that the semantic analysis of sentences like (88) and (89) does *not* derive the fact that comparison of deviation constructions, unlike standard comparatives, entail that the corresponding absolute sentences are true in the context of utterance.

Consider the case of (89), which has the logical representation in (90) (see Klein 1980:35-36 for discussion of the same example).

(90) $\exists d[(d(happy))(Mona)\ \&\ \neg(d(sad))(Jude)]$

The logical representation in (90) is exactly the same as the logical representation assigned to the example of cross-polar anomaly (82) discussed above. The problem presented by cross-polar anomaly was that there was no way to explain why such examples are anomalous; the problem of comparison of deviation is not the case that the analysis is inconsistent with the interpretations of these structures–as noted in the previous section, the logical representation in (90) would be true if e.g. Mona were very happy and Jude were not very sad, which is a rough paraphrase of what (89) means–but rather that it is too weak: it does not entail that Mona is happy and Jude is sad. To see why, assume that the domains of *happy* and *sad* are as in (91) and (92), and assume also that the contextual partitionings of the domains–the partitionings relevant to the interpretation of the absolute construction (e.g., *Jude is happy*)–are as in (93) and (94).

(91) $D_{happy} = \{x, Mona, y, z, Jude\}$

(92) $D_{sad} = \{Jude, z, y, Mona, x\}$

(93) $pos_c(happy) = \{z, Jude\}$

$neg_c(happy) = \{x, Mona, y\}$

(94) $pos_c(sad) = \{y, Mona, x\}$

$neg_c(sad) = \{Jude, z\}$

In this context, (95) is false, because *Mona* falls in the negative extension of the adjective, while (96) is true, since *Jude* appears in the positive extension of *happy*.

(95) Mona is happy.

(96) Jude is happy.

Similarly, (97) is false, because *Jude* falls in the negative extension of *sad*, and (98) is true.

(97) Jude is sad.

(98) Mona is sad.

Unfortunately, the comparison of deviation construction (89) is also true in this context, since there is a function d that introduces alternative partitionings of the domains of *happy* and *sad*–those shown in (99) and (100)–which satisfies the truth condition of (90).

(99) $pos_d(happy) = \{Mona, y, z, Jude\}$

$neg_d(happy) = \{x\}$

(100) $pos_d(sad) = \{x\}$

$neg_d(sad) = \{Jude, z, y, Mona\}$

With respect to the partitionings in (99) and (100), *Mona is happy* is true and *Jude is sad* is false, therefore (89) should be true. In other words, since the analysis requires only that there is a possible partitioning of the domain of *happy* and *sad* in which *Mona is happy* is true and *Jude is sad* is false, it allows for the possibility that (89) is true while (95) and (97) are false. This result is inconsistent with the facts of comparison of deviation, however: (89) entails that *Mona is happy* is true and *Jude is sad* is false in the context of utterance.

In fact, the analysis of (89) is even more problematic. If the ordering on the domains of *happy* and *sad* are as specified in (91) and (92), (101) is also true, since there is a function that partitions the domain so that *Jude is happy* true and *Mona is happy* false, namely the one that generates partitionings equivalent to those shown in (93) and (94).

(101) Jude is happier than Mona.

The analysis thus allows for the possibility that (89) and (101) can be true in the same context. The fact that (102) is a contradiction, however, shows that this result is incorrect.[20]

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[20] Comparison of deviation constructions involving equatives are similarly problematic. Consider an example like (i), which has the interpretation in (ii).

(i) Mona is as happy as Jude is sad.

(ii) $\forall d[(d(sad))(Jude) \rightarrow (d(happy))(Mona)]$

(102) Mona is more happy than Jude is sad, but Jude is happier than Mona.

1.2.3.3 Incommensurability

A third problem for the vague predicate analysis comes from the phenomenon of incommensurability, illustrated by sentences like (103) and (104).

(103) #Morton is as tall as Richard is clever.

(104) #My copy of *The Brothers Karamazov* is heavier than my copy of *The Idiot* is old.

(103) and (104) contrast quite clearly with sentences like (105).

(105) Our Norfolk Island Pine is as tall as its branches are long.

In section 1.1.3, I used the contrast between examples like (103)-(104) and (105) as the basis for the descriptive generalization in (106).

(106) A comparative construction is semantically well-formed only if the compared adjectives have the same dimensional parameter.

The logical representation in (ii) is *consistent* with the interpretation we want to derive–it is true, for example, in a context in which Mona is quite happy and Jude is quite sad–but it has the same problem as the comparative: it does not entail that the propositions *Mona is happy* and *Jude is sad* are true in the context of utterance.

(106) reflects the general hypothesis that comparison of two objects is possible only if they are ordered according to the same dimension. For example, in the case of a sentence like (105), the dimension common to both *tall* and *long* could be described as "linear measurement": both adjectives order the objects in their domain according to some general notion of length, a vertical one in the case of *tall*, and a horizontal one in the case of *long* (cf. Cresswell 1976). The problem with an example like (104), on this view, is that *long* and *tragic* have different dimensional parameters, therefore the objects in the domains of the adjectives are not ordered according to the same dimension, and comparison is impossible.

Although this approach to incommensurability seems reasonable, it should nevertheless be the case that the actual constraint underlying the descriptive generalization in (106) is sensitive to the *linguistic* properties of gradable adjectives and the comparative construction. That is, the explanation of incommensurability should be stated in terms of the semantic properties of linguistic expressions (i.e., gradable adjectives and comparative morphology), rather than in terms of a general, conceptual constraint on comparison. This is shown by a sentence like (107).

(107) My copy of *The Brothers Karamazov* is higher on a scale of heaviness than my copy of *The Idiot* is on a scale of age.

(107) represents a coherent thought, and moreover is a reasonable paraphrase of the intended meaning of a sentence like (104). Most importantly, the fact that (107) is a perfectly acceptable *linguistic* expression indicates that the anomaly of examples like

(103) and (104) must be due to the interaction of the meanings of the "incomparable" adjectives *in the context of* the comparative construction. In other words, it must be some semantic property of the adjectives in these examples which, when they are inserted into the comparative, triggers incommensurability.

The problem for the vague predicate analysis is that it does not provide a means of explaining incommensurability in these terms. To see why, first consider the analysis of a typical example of comparative subdeletion such as (108).[21]

(108) The tree is taller than the ceiling is high.

(109) $\exists d[(d(tall))(tree) \;\&\; \neg(d(high))(ceiling)]$

According to (109), (108) is true just in case there is a function *d* that introduces a partitioning on the domain of *tall* so that *the tree is tall* is true, and also introduces a partitioning on the domain of *high* so that *the ceiling is high* is false (e.g., if the tree is very tall and the ceiling is not very high). Note that in any context, the domains of *tall* and *high* may contain the same objects, but they need not be ordered in the same way. The fact that (109) is interpretable indicates that it must be the case that *d* can apply to sets with unrelated orderings.

Now consider the analysis of a context in which the domain of discourse is restricted to include only my copies of Dostoevski's novels, and the ordering on the

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[21]"Subdeletion" structures are those of the form *x is more* A_1 *than* A_2, where A_1 and A_2 are lexically distinct (cf. Bresnan 1973, 1975, Grimshaw 1987, Corver 1990, 1993, Izvorski 1995).

domain of *heavy* is (110), while the ordering on the domain of *old* is (111).

(110) D_{heavy} = {*Crime and Punishment, The Devils, The Idiot, The Brothers K*}

(111) D_{old} = {*The Idiot, The Devils, The Brothers K, Crime and Punishment*}

According to the analysis of comparatives outlined in section 1.2.2, the interpretation of (104) is (112).

(112) $\exists d[(d(heavy))(\textit{The Brothers K}) \mathbin{\&} \neg(d(old))(\textit{The Idiot})]$

In order to determine whether the vague predicate analysis supports an explanation of incommensurability, we first need to ask the following question: is there a function that partitions the domain so that *The Brothers Karamazov* is in the positive extension of *heavy* and *The Idiot* is in the negative extension of *old*? Such a function would have to apply to sets with unrelated orderings, but as we saw above with the analysis of (108), such functions must be available. Consider then a function *d*, which partitions the domains of *heavy* and *old* so that the highest-ranked object in each set falls in the positive extension and the rest are in the negative extension. The partitionings induced by *d* on the domains of *heavy* and *old* in the context specified above are shown in (113) and (114).

(113) $pos_d(heavy)$ = {*The Brothers Karamazov*}

$neg_d(heavy)$ = {*Crime and Punishment, The Devils, The Idiot*}

(114) $pos_d(old) = \{Crime\ and\ Punishment\}$

$neg_d(old) = \{...The\ Idiot,\ The\ Devils,\ The\ Brothers\ Karamazov\}$

Since *d* satisfies the truth conditions specified in (112), (104) should be true. But if the vague predicate analysis supports an explanation of the anomaly of a sentence like (104), it must be the case that the computation outlined in the previous paragraph is impossible. Note that it is not enough to show that a function such as *d* is actually unavailable–this would have the result that (104) is false, rather than the desired result that the sentence is anomalous. It must be shown that it is impossible to even ask the question "is there a function that partitions the domains of *long* and *tragic* in the relevant way".

Indeed, one way to derive this result would be to build on the initial assumption that the objects in the domains of *heavy* and *old* are ordered according to different dimensions, and to somehow encode a "dimension identity" requirement into the semantics of the comparative construction. The problem for a vague predicate analysis is that there is no way to achieve this result, since the ordering relations associated with the adjectives are presumed, and so do not play a direct role in the compositional interpretation of a construction like (104). If the truth conditions for the comparative require only that there be a function which partitions the domains of the adjectives as in (113) and (114), then, at least in a context in which the domains of the adjectives are the same, as in (110) and (111), comparison should be possible. The only way to rule out these sentences is by stipulating the dimension identity requirement. (107), however, shows that this stipulation must be localized to comparative constructions; it cannot be a general conceptual constraint on comparison. Ideally, then, the anomaly of examples like (104) should follow from the semantics of gradable adjectives and the comparative construction, and not from a general stipulation.

1.2.3.4 Negative Adjectives and Measure Phrases

Klein (1980:27-28) discusses the analysis of sentences such as (115), which involve gradable adjectives and measure phrases.

(115) Mona is three feet tall.

Klein suggests that measure phrases such as *three feet* denote equivalence classes of objects that are three feet in height (see also Cresswell 1976, von Stechow 1984a, Klein 1991), and that *Mona is three feet tall* is true just in case there is some object in the denotation of *three feet* (the equivalence class of objects which are three feet in height) and Mona is nondistinct from that object with respect to the ordering imposed by *tall*. On this view, (115) has the truth conditions in (116).

(116) $(\mathit{three\ feet}(\mathit{tall}))(\mathit{Mona}) = 1$ iff $\exists y \in \mathit{three\ feet}: \mathit{Mona} =_{tall} y$

This analysis fails to make a distinction between positive and negative adjectives, however. As a result, it does not support an explanation of the well-known fact that negative adjectives such as *short* do not permit measure phrases:

(117) #Mona is three feet short.

Assuming that *tall* and *short* are extensionally equivalent, but associated with the opposite ordering relations, (117) should not only be non-anomalous, it should be logically equivalent to (115):

(118) $(\mathit{three\ feet}(\mathit{short}))(\mathit{Mona}) = 1$ iff $\exists y \in$ *three feet*: $\mathit{Mona} =_{short} y$

1.2.4 Summary

The primary claim of the vague predicate analysis is that gradable adjectives are of the same semantic type as other predicative expressions–they denote (possibly partial) functions from objects to truth values–but their domains are partially ordered with respect to some dimension. An important aspect of this type of analysis–one that distinguishes it from the type of analysis I will discuss in section 1.3–is that gradable adjectives are of the same semantic type as non-gradable adjectives. The difference between gradable and non-gradable adjectives is, in effect, a *sortal* one: they denote different sorts of predicates (partial vs. complete functions; ordered vs. unordered domains). This difference can be used as the basis for an explanation of the distributional characteristics I discussed in the introduction–the fact that gradable adjectives, but not non-gradable ones, can appear in degree constructions (and with degree modifiers). If we assume that the set of degree functions contains functions from partial functions from individuals to truth values to complete functions from individuals to truth values, then only gradable adjectives provide appropriate arguments for degree functions. The anomaly of sentences like (119) and (120) follows from the analysis of comparatives (and other degree constructions) in terms of quantification over degree functions, and the assumption that degree modifiers (such as *extremely, very, quite*) denote degree functions (Klein 1980, McConnell-Ginet 1973).

(119) ??Nixon is extremely dead.

(120) ??Nixon is more dead than Reagan.

The problem with both examples is that the non-gradable adjective *dead* denotes a complete function from objects to truth values. When the denotation of *dead* is supplied as an argument to the degree functions in these sentences–*extremely* in (119), and *d* (the variable quantified over by the comparative) in (120)–the result is sortal anomaly, since a degree functions expect a partial function from objects to truth values as its argument.

This discussion suggests that the vague predicate analysis supports an explanation of the distributional characteristics of gradable adjectives; the facts discussed in the previous section, however, show that it fails to provide an explanation of several other important sets of facts: cross-polar anomaly, comparison of deviation, incommensurability, and the unacceptability of measure phrases with negative adjectives. In the next section, I will outline an alternative semantic analysis of gradable adjectives, which differs from the vague predicate analysis in that it expands the ontology to include abstract representations of measurement, and defines the interpretation of gradable adjectives in terms of such abstract objects.

1.3 The Scalar Analysis

There are two primary differences between the vague predicate analysis of gradable adjectives and the analysis that I referred to in section 1.1.1 as the "scalar analysis". The first difference concerns the semantic type of a gradable adjective. Whereas the vague predicate analysis assumes that gradable adjectives have the same semantic type as other adjectives (and other predicative expressions in general)–they denote functions from individuals to truth values–the scalar analysis reanalyzes gradable adjectives as relational expressions, specifically, relations between individuals and abstract representations of measurement, or "degrees". The second difference concerns the nature of the ordering on the domain of the adjective. Both analyses claim that a partial ordering can be imposed on the domain of the adjective, but they differ in their assumptions about how the ordering is derived. In the vague predicate analysis, the ordering on the domain is presumed; in the scalar analysis, however, the adjective imposes an ordering on its domain by relating objects to degrees on a scale.

In the following sections, I will go over the basic assumptions of the scalar analysis in more detail. As in the discussion of the vague predicate analysis, I will focus on the interpretation of comparatives. In particular, I will show that the introduction of scales and degrees into the ontology provides the basis for an explanation of the facts that were problematic for a vague predicate analysis: cross-polar anomaly, comparison of deviation, incommensurability, and the distribution of measure phrases. In section 1.4, however, I will introduce a set of facts involving comparatives and scope that are problematic for the traditional scalar analysis of gradable adjectives and comparatives. These facts will provide the empirical basis for the analysis of gradable adjectives and degree constructions that I will develop in chapter 2, which falls within the general category of scalar analyses, but differs it its claims about the core meaning of gradable adjectives and the compositional semantics of comparatives and other degree constructions.

1.3.1 Degree Arguments

Cresswell (1976:266) suggests that "[w]hen we make comparisons we have in mind points on a scale". Building on this intuition, Cresswell develops a theory in which gradable adjectives are analyzed as expressions whose semantic function is to define a mapping between objects and points on a scale. Intuitively, a scale is an abstract representation of measurement: an infinitely long measuring stick, which provides a representation of the amount to which an object possesses some gradable property. To make things precise, I will define a scale as a dense, linearly ordered set of points, or "degrees", where the ordering is relativized to a DIMENSION. As noted in section 1.1.2, a dimension corresponds to a gradable property such as *height, length, speed, density, beauty*, etc., and provides a means of differentiating one scale from another.[22]

Once scales and degrees are introduced into the ontology, it becomes possible

[22]This aspect of the scalar analysis is crucial to the analysis of incommensurability that I will discuss below in section 1.3.3.1; in chapter 3, I will show that a similar distinction provides the basis for an explanation of cross-polar anomaly.

to analyze gradable adjectives as relational expressions, specifically, as expressions that relate objects in their domains to degrees on a scale, where the particular scale is specified by the dimensional parameter the adjective (see e.g. Seuren 1973, Cresswell 1976, Hellan 1981, Hoeksema 1983, von Stechow 1984a, Heim 1985, Bierwisch 1989, Lerner and Pinkal 1992, 1995, Moltmann 1992a, Rullmann 1995, Gawron 1995 and others for approaches along these lines).[23] A consequence of defining the interpretation of a gradable adjective in this way is that the ordering that can be imposed on its domain is derived from a semantic property of the adjective itself: by relating objects in a set to degrees on a scale (a totally ordered set of points), a gradable adjective determines a partial ordering on that set.[24] This property of a gradable adjective's meaning represents the fundamental difference between the scalar analysis and the vague predicate analysis discussed in section 1.2, since in the latter the ordering of the domain of a gradable adjective is presumed.

Within a framework in which gradable adjectives are analyzed as relational expressions, the logical representation of a sentence of the form *x is* φ can be stated

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[23]A different type of analysis, in which adjectives denote *functions* from objects to scalar values, is developed in Wunderlich 1970 and Bartch and Vennemann 1972, and forms the basis for the analysis I will develop in chapter 2. I will have more to say about the general characteristics of this alternative approach there; for now, it should simply be observed that these approaches fall into the general category of scalar analyses, since they assume that scales and degrees are part of the ontology.

[24]Although a scale is defined as a totally ordered set of points, nothing prohibits a gradable adjective from relating different objects in its domain to the same degree on the scale; as a result, the ordering on the domain is partial.

as in (121), which has the truth conditions in (122), where δ_φ is a function that maps objects to the scale associated with φ.

(121) $\varphi(x,d)$

(122) $||\varphi(x,d)|| = 1$ iff $\delta_\varphi(x) \geq d$

Stated informally, *x is* φ is true just in case the projection of x on the scale associated with φ (i.e., the degree to which x is φ) is at least as great as d. The first question raised by this analysis is the following: what is the value of d in (121)? For a sentence of the form *x is* φ (an absolute construction), the answer is that d represents a "standard". Intuitively, a standard-denoting degree is a degree that identifies the point on a scale that can be used to separate those elements for which the statement *x is* φ is true from those elements for which *x is* φ is false in some context.

For illustration of this idea, consider an example like (123), which has the logical representation in (124), where $d_{s(long)}$ is the degree argument of *long* and denotes a contextually determined standard of "longness".

(123) *The Brothers Karamazov* is long.

(124) $long(BK,d_{s(long)})$

According to the truth conditions in (122), (123) is true if and only if $\delta_{long}(BK) \geq d_{s(long)}$ holds, i.e., just in case the projection of *The Brothers Karamazov* on a scale of length is at least as great as the standard of longness in the context of utterance. Note that the structure of the scale–specifically, the fact that scales are defined as totally ordered sets of points along some dimension–ensures not only that the relative ordering of the standard-denoting degree and the degree that represents the measure of *The Brothers Karamazov*'s length can be determined, but also that the standard value must be a degree of length. If it were a degree along some other dimension, then it would not be an element of the same scale as $\delta_{long}(BK)$. As a result, the partial ordering relation associated with the absolute would be undefined, rendering the sentence uninterpretable. I will return to this point in section 1.3.3.

For the moment, I will leave open the question of how exactly the standard value is determined, and assume following Bierwisch 1989 that the standard value is determined contextually, relative to a particular comparison class.[25] As observed in section 1.1.1, this hypothesis forms the basic explanation of vagueness in a scalar analysis of gradable adjectives. The context-dependency of a sentence of the form *x is φ* in the scalar analysis is parallel to the context-dependency of this type of sentence in the vague predicate analysis: the actual value of the standard in a context is determined by some subset of the domain of the gradable adjective that is taken to be relevant in that context, i.e., the comparison class. If the comparison class is changed, then the standard value may be shifted accordingly. Changing the identity of the standard does not affect the overall ordering of the degrees on the scale, however, so the scalar analysis derives the result that the ordering of objects in a comparison class preserves the ordering on the entire domain, as observed in section

[25]In chapter 2, section 2.2.2, I will go into the identification of the standard value in much greater detail.

1.1.1.[26]

1.3.2 Comparatives

In a traditional scalar analysis, in which gradable adjectives denote relations between objects and degrees, comparatives are typically analyzed as quantificational expressions, specifically, as expressions that quantify over degrees (see e.g., Seuren 1973, Hellan 1981, von Stechow 1984a,b, Heim 1985, Lerner & Pinkal 1992, 1995, Gawron 1995, Hazout 1995, Rullmann 1995). For example, in Heim 1985, comparatives are analyzed as *indefinite degree descriptions*, which restrict the possible values of the degree argument of a gradable adjective.[27] In this analysis, the

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[26] It should also be observed that nothing requires e.g. the standard of *tallness* to be the same as the standard of *shortness*. As a result, we allow for the possibility that an object may be neither tall nor short in a particular context. For example, if the standard of *tallness* for humans is 5'11" and the standard of shortness is 5'5", then objects whose projections on the scale of height fall between these two degrees are neither tall nor short. (In the terminology of the vague predicate analysis, such objects fall in the "extension gap".) Of course, it must be the case that the standard of shortness cannot *exceed* the standard of tallness. That is, we must assume a general constraint that prohibits a context in which the standard of *tallness* is, for example, 5'9" and the standard of shortness is 5'11", otherwise some objects could be both tall and short. See Bierwisch 1989 for relevant discussion.

[27] Two remarks are in order here. First, although many scalar analyses of comparatives are stated in terms of existential quantification over degrees, some analyzes comparatives as universal quantification structures (Cresswell 1976; see also Postal 1974, Williams 1977) or as generalized quantifiers (Moltmann 1992, Hendriks 1995). I focus here on the existential analysis for perspicuity, but I will examine the other accounts in more detail below.

Second, in the subsequent discussion, I will ignore the distinction between *phrasal* comparative morpheme denotes a relation between two degrees: one bound by an existential quantifier, and one introduced by the comparative clause (the complement of *than* or *as*). The logical representation of a typical comparative like (125) is (126).

(125) *x is more* φ *than* d_c

(126) $\exists d[d > d_c][\varphi(x,d)]$

Given the truth conditions for the absolute construction presented in section 1.3.1, a statement of the form *x is more* φ *than* d_c, where d_c is the degree denoted by the comparative clause, is true just in case there is a degree d such that d exceeds d_c and x is at least as φ as d. Throughout this thesis, I will adopt von Stechow's (1984a) position that the comparative clause is a type of definite description that denotes a maximal degree (see also Rullmann 1995 for extensive discussion of this issue).[28]

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comparatives–comparatives in which the complement of *than* is a non-clausal constituent, and *clausal* comparatives–comparatives in which the complement of *than* is a (possibly reduced) clause. Although this distinction is an important one, it is not crucial to the general discussion here. It will be examined in detail in chapter 2, however.

[28]A number of researchers, including Cresswell 1976, Lerner & Pinkal 1992, Moltmann 1992a, and Gawron 1995, have proposed that the comparative clause is a universal quantification structure rather than a definite description. On this view, a sentence like (i) has an interpretation that corresponds roughly to the paraphrase in (ii).

(i) Some star is brighter than Venus has ever been.

(ii) Some star is brighter than every degree *d* such that Venus has ever been *d*-bright.

According to von Stechow, the complement of *than* denotes the set of degrees that satisfy the restriction derived by abstracting over the degree variable in the comparative clause (in (128), the set of degrees that are at least as great as the degree to which *The Idiot* is long; the mapping from the syntactic structure to this interpretation is straightforward if, as argued in Chomsky 1977, the complement of *than* is a *wh*-construction). This set is then supplied as the argument of a covert maximality operator, which I have represented as MAX. The interpretation of MAX is given in (127), where *D* is a totally ordered set of degrees (cf. Rullmann 1995).

(127) $\text{MAX}(D) = \iota d \in D[\forall d' \in D: d \geq d']$

Although I will not attempt to resolve this debate here, I will point out two facts that argue in favor of a definite description analysis. First, the comparative clause supports discourse anaphora, as shown by (iii), in which the anaphor *that* picks up its reference from the comparative clause in the first conjunct: it denotes the degree to which Venus is bright.

(iii) Mars isn't brighter than Venus is, but the earth is brighter than that.

Second, the comparative clause does not show the kind of scope ambiguities we expect of a universal quantification structure. If the comparative clause involved universal quantification, then (i) should permit a reading in which the comparative clause has scope over the indefinite subject, as in (iv).

(iv) For every degree *d* such that Venus has been *d*-bright, some star is brighter than *d*.

But (i) does not have such a reading: this sentence can only be interpreted as an existential claim about stars. Note that the unavailability of this reading is not due to a constraint on the complement of *than*: the ambiguity of e.g. *Some star is larger than every planet* shows that the complement of *than* can take scope over an indefinite subject.

For an illustration of the basic approach consider the analysis of (128), which has the logical representation in (129).

(128) *The Brothers Karamazov* is longer than *The Idiot.*

(129) $\exists d[d > \textsc{max}(\lambda d'.long(Idiot,d'))][long(BK,d)]$

According to (129), (128) is true iff there is a degree such that *d* exceeds the maximal degree to which *The Idiot* is long, and *The Brothers K.* is at least as long as *d*. In a context such as (130), then, where d_I denotes the degree of *The Idiot's* length and d_{BK} denotes the degree of *The Brothers Karamazov*'s length, (128) is true.

(130) LENGTH: 0 ———————— d_I ———————— d_{BK} ———————— ∞

Equatives and comparatives with *less* are analyzed in essentially the same way, the only difference being the ordering relation introduced by the degree morpheme: $\geq$ for equatives; $<$ for *less.*

An important aspect of this analysis is that although the comparative construction establishes a relation between the projections of two objects on a scale, it does not make reference to a standard value. Since the truth conditions for the absolute construction are stated in term of a relation between the projection of an object on a scale and a standard value, the comparative does not support inferences to the absolute. That is, a sentence like (128) supports neither the inference in (131) nor the inference in (132), since the truth of both of these expressions can be determined only by evaluating the relation between the degrees identifying the subjects' lengths and the degree which denotes a standard of length (in some context).

(131) *The Brothers Karamazov* is long.

(132) *The Idiot* is not long.

1.3.3 Solutions to the Problems for the Vague Predicate Analysis

The primary difference between the scalar analysis and the vague predicate analysis is that the former introduces scales and degrees into the ontology. It is precisely this difference that provides a basis for empirically distinguishing between these two approaches. Specifically, the introduction of scales, and the characterization of scales as sets of degrees ordered along a dimension, provides a basis for explaining the facts that were problematic for the vague predicate analysis: incommensurability, cross-polar anomaly, the distribution of measure phrases, and comparison of deviation. In the following sections, I will reexamine the phenomena, showing how the hypothesis that gradable adjectives define mappings between objects and scales supports explanations of the facts.

1.3.3.1 Incommensurability

The general problem of incommensurability, illustrated by examples like (133), can be stated as follows: how do we explain the fact that subdeletion constructions involving adjectives that are in some intuitive sense "incomparable" are anomalous?

(133) #My copy of *The Brothers Karamazov* is heavier than my copy of *The Idiot* is old.

As observed in section 1.2.3.3, the anomaly of (133) must be explained in terms of the linguistic properties of the adjectives and the comparative construction, rather than in terms of a general conceptual restriction on comparison of objects ordered according to different dimensions. The problem for the vague predicate analysis was that this requirement could not be derived from the semantic properties of gradable adjectives and the comparative construction. In contrast, in the scalar analysis, this requirement follows directly from basic assumptions about scales.

In section 1.3.1, degrees were defined as elements of a scale, and a scale was defined as a totally ordered set of points along some dimension. The importance of the dimension is that it distinguishes one scale from another. For example, a scale S_ϕ of degrees ordered along dimension ϕ and a scale S_ψ of degrees ordered along dimension ψ are different sets. As a result, for any $d_\phi \in S_\phi$ and any $d_\psi \in S_\psi$, the expression $d_\phi \mathbf{R} d_\psi$ is undefined, where $\mathbf{R}$ is an ordering on degrees. Put another way, for any two degrees d_1 and d_2, $d_1 \mathbf{R} d_2$ is defined only if d_1 and d_2 are degrees on the same scale. These general constraints on ordering relations interact with the semantics of comparatives to explain incommensurability.

According to the analysis of comparatives as quantificational structures that restrict the possible value of the degree argument of a gradable adjective to be a degree that satisfies the conditions imposed by the comparative, the logical representation of a sentence like (133) is (134).

(134) $\exists d[d > \textsc{max}(\lambda d'.old(my\ copy\ of\ The\ Idiot,d'))][heavy(my\ copy\ of\ The\ Brothers\ K,d)]$

The formula in (134) is true just in case for some degree d such that d exceeds the maximal degree to which my copy of *The Idiot* is old, the degree to which my copy of *The Brothers K* is heavy is at least as great as d. That is, there must be some degree that satisfies both the restriction in (134) and the formula in (135), which represent the truth conditions of the absolute form (see section 1.3.1), where δ_{heavy} is a function from objects to the scale associated with *heavy*.

(135) $\delta_{heavy}(my\ copy\ of\ The\ Brothers\ K) \geq d$

Since the ordering relation introduced by the comparative morpheme is defined only for degrees on the same scale, the only objects that satisfy the restriction imposed by the comparative are degrees on a scale of age; as a result, the comparative restricts the possible value of the degree argument of *heavy* to be a degree of age. The adjectives *old* and *heavy* define mappings from objects to scales with different dimensional parameters, however, with the result that the partial ordering relation introduced by the adjective in the nuclear scope–the relation shown in (135)–is undefined for the degrees introduced by the comparative. The anomaly of (133) is a result of this failure to provide an appropriate value for the degree argument of *heavy*.[29]

In general terms, incommensurability is predicted to arise whenever a comparative construction restricts the degree argument of a gradable adjective to be a degree on a scale that is distinct from the scale associated with the adjective. In such a context, the partial ordering relation introduced by the adjective in the nuclear scope is undefined, triggering anomaly. In order to avoid this anomaly, then, it must be the case that the comparative introduces a degree on the same scale as the one associated with the adjective in the nuclear scope; this will be the case only if both adjectives in the subdeletion construction have the same dimensional parameters. The scalar analysis thus derives the descriptive generalization adduced in section 1.1.3 and repeated below in (136) from basic assumptions about ordering relations and the analysis of gradable adjectives as expressions that map objects to degrees on a scale.

(136) A comparative construction is semantically well-formed only if the compared

[29] A possible criticism of this analysis is that it predicts that sentences like (133) should be contradictory, rather than anomalous, because the constraints on ordering relations described above entail that there is no degree which satisfies both the restriction and the nuclear scope in (134). Although I will assume for now that the interpretation of restricted quantification structures can be formulated in a way that avoid this criticism, I should note that the analysis of comparatives that I will develop in chapter 2, in which comparatives are *not* analyzed as quantificational expressions, avoids this criticism, because it has the consequence that the relation introduced by the comparative morpheme in examples like (133) is undefined. The most important point of the discussion in this section is that in order to construct the type of explanation outlined here in the first place, it is necessary to introduce scales and degrees into the ontology.

adjectives have the same dimensional parameter.

Most importantly, the anomaly of sentences like (133) is explained in terms of the *linguistic* properties of gradable adjectives and comparatives, rather than a general conceptual constraint on comparison.

This analysis also explains the fact that a comparative such as (137) must evaluate the compared objects with respect to the same dimension (see the discussion of this point in section 1.1.2).

(137) Richard is more clever than George is.

According to the analysis of incommensurability outlined above, the comparative must introduce a degree on the same scale as the one associated with the adjective in the main clause. Since scales are differentiated by their dimensional parameters, evaluating the compared objects in (137) with respect to different dimensions would amount to a violation of this constraint. Since such a violation triggers anomaly, the interpretation of (137) that would trigger it is unavailable.

Finally, it should be noted that the analysis of incommensurability outlined here has important consequences for the analysis of non-anomalous comparatives constructed out of different adjectives, such as (138), which has the logical representation in (139).

(138) Our Norfolk Island Pine is as tall as its branches are long.

(139) $\exists d[d \geq \textsc{max}(\lambda d'.long(our\ NI\ pine's\ branches,d'))][tall(our\ NI\ pine,d)]$

The comparative in (139) restricts the possible values of the degree argument of *tall* to be some degree which is at least as great as the (maximal) degree to which our Norfolk Island pine's branches are long; in other words, the degree argument of *tall* must also be a degree of *length*. The fact that (138) is not anomalous indicates that degrees of length and degrees of tallness must be objects on the same scale. That is, it must be the case that the adjectives *long* and *tall* have the same dimensional parameters, i.e., they must map objects to the same scale. Intuitively, this seems right: both adjectives order the objects in their domain according to different aspects of a general concept of "linear extent": a vertical one in the case of *tall*, and a horizontal one in the case of *long* (cf. Cresswell 1976). The fact that the actual orderings imposed on the domains are different is simply a result of the fact that *long* and *tall* define different relations between objects and degrees. Since the relations are distinct, there is no entailment that the orderings they support should be the same.

1.3.3.2 Cross-Polar Anomaly

Like the explanation of incommensurability, the explanation of cross-polar anomaly relies crucially on the assumption that the meaning of a gradable adjective is defined in relation to a scale. Recall that cross-polar anomaly is exemplified by sentences like (140)-(141), which show that comparatives formed out of positive and negative pairs of adjectives are anomalous.

(140) #Venus is brighter than Mars is dim.

(141) #*The Dream of a Ridiculous Man* is shorter than *The Brothers Karamazov* is long.

In order to develop an explanation for this phenomenon, it is first necessary to introduce a theory of adjectival polarity into the scalar analysis. This project is undertaken chapter 3; for now, I will limit the discussion to an overview of the aspects of the analysis that provide the basis for an explanation of cross-polar anomaly.

Antonymous pairs of adjectives such as *bright/dim* and *tall/short* provide fundamentally the same kind of information about the degree to which an object possesses some gradable property (for, example, both *tall* and *short* provide information about an object's height), but they do so from complementary perspectives. Intuitively, *tall* is used either neutrally or to highlight the height an object has, while *short* is used to highlight the height an object does *not* have. In chapter 3, I use this difference in perspective to develop a theory of adjectival polarity in which positive and negative degrees are treated as distinct objects on the same scale. Specifically, I show that if degrees are analyzed as intervals on a scale, as in Seuren 1978, von Stechow 1984a, and Löbner 1990 (cf. Bierwisch 1989), rather than as points on a scale, as traditionally assumed, the facts of cross-polar anomaly can be explained. At the same time, important inferences associated with antonymous pairs of adjectives are also captured (see section 1.1.4.1). I will not attempt to go into the details of the analysis here; instead, I will outline the basic claims of the analysis and point the reader to chapter 3 for detailed argumentation in support of these claims (see also Kennedy 1997b).[30]

First, assume that antonymous pairs of positive and negative adjectives define the same mapping of objects in their domains to a shared scale, but that positive and negative degrees are distinct objects. If this is correct, adjectival polarity can be characterized as a sortal distinction: positive adjectives denote relations between individuals and positive degrees; negative adjectives denote relations between individuals and negative degrees. These assumptions, combined with the analysis of comparatives as restricted quantification structures, provide the basis for an explanation of cross-polar anomaly as a type of sortal anomaly: the comparative restricts the degree argument of the adjective to be a degree of the wrong sort.[31]

For illustration, consider (140), repeated below with its logical representation.

(140) #Venus is brighter than Mars is dim.

(142) $\exists d[d > \textsc{max}(\lambda d'.dim(Mars,d'))][bright(Venus,d)]$

According to the analysis of the comparative outlined in section 1.3.2, (140) is true just in case for some degree d such that d exceeds the degree to which Mars is dim,

[30] The analysis of cross-polar anomaly that I will outline in this section is essentially the same as the one developed in Kennedy 1997b. The analysis to be presented in chapter 3 is the same in its basic assumptions, but differs slightly in implementation, keeping in line with the analysis of comparatives that I will present in chapter 2.

[31] In section 3.3 of chapter 3, I show that these assumptions derive the order-reversing properties of negative adjectives discussed above, and also provide a basis for an explanation of the monotonicity properties of gradable adjectives (see the discussion in section 1.1.3).

and Venus is at least as bright as *d*. The distinction between positive and negative degrees developed in chapter 3 is such that in a logical representation like (142), in which the adjective in the comparative clause is negative, the only objects which satisfy the restriction imposed by the comparative are negative degrees.[32] As a result, the comparative restricts the degree argument of the positive adjective *bright* to be a negative degree. Since *bright* is requires a positive degree as its argument, the comparative introduces an argument of the wrong sort, triggering a sortal anomaly. Examples in which the polarity of the adjectives are reversed, such as (141), can be explained in exactly the same way.

Although I have postponed detailed argumentation for the claims made here until chapter 3, the current discussion makes an important point. If an explanation of cross-polar anomaly along the lines of the one I have outlined here is correct, then it provides additional support for the general hypothesis that the interpretation of gradable adjectives should be characterized in terms of scales and degrees. In order to distinguish positive and negative degrees and use this distinction as the basis for a sortal characterization of adjectival polarity, it must be the case that scales and degrees are part of the ontology, and that the interpretation of gradable adjectives is formalized in terms of such objects.[33]

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[32]The reverse is true of examples such as (141), in which the adjective in the comparative clause is positive.

[33]In its basic respects, the explanation of cross-polar anomaly is of the same type as the explanation of incommensurability: the comparative construction restricts the value of the degree argument of the adjective to be a degree that is incompatible with its semantic

1.3.3.3 Negative Adjectives and Measure Phrases

The analysis of cross-polar anomaly outlined in the previous section has the additional positive result of providing an explanation for the distribution of measure phrases. A property of the distinction between positive and negative degrees that I will motivate and develop in chapter 3 is that measure phrases such as *3 feet* can only denote positive degrees, they cannot denote negative degrees. If polarity is represented as a sortal distinction between positive and negative adjectives, then the contrast between e.g. (143) and (144) can be explained in the same way as cross-polar anomaly.

(143) Benny is 4 feet tall.

(144) #Benny is 4 feet short.

Assuming that the role of the measure phrase in an example like (143) is to denote the degree argument of the adjective, then (144) is well-formed because *4 feet* denotes a positive degree, which is of a degree of the appropriate sort for the positive adjective *tall*. In contrast, since the negative adjective *short* requires a negative degree as argument, the positive degree introduced by the measure phrase triggers a sortal anomaly (see von Stechow 1984b for a similar explanation of these facts).

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requirements. Although this incompatibility stems from a conflict in polarity, rather than a conflict in dimensional parameter, the underlying problem is the same. In both constructions, the partial ordering relation introduced by the adjective in the nuclear scope is undefined for the degree introduced by the comparative. I will return to this point in more detail in chapter 3.

1.3.3.4 Comparison of Deviation

Comparison of deviation constructions, which are exemplified by sentences like (145)-(146), differ from examples of cross-polar anomaly in that they are constructed out of positive and negative pairs of adjectives, but they are not anomalous.

(145) Robert is as short as William is tall.

(146) It's more difficult to surf Maverick's than it is easy to surf Steamer Lane.

The challenge faced by an analysis of comparatives and gradable adjectives is to develop an account of these facts that both explains the unique semantic characteristics of comparison of deviation–in particular, the fact that comparison of deviation constructions entail the truth of the corresponding absolutes (see the discussion of this point in section 1.1.4.3)–and, at the same time, maintains an analysis of cross-polar anomaly. The vague predicate analysis was unable to achieve either of these goals: although it does succeed in constructing interpretations for comparison of deviation constructions, it does not account for their entailments, nor does it succeed in explaining cross-polar anomaly. In the following paragraphs, I will present an overview of how the scalar analysis succeeds in meeting this challenge. As in the earlier discussion of cross-polar anomaly, I postpone detailed argumentation until chapter 3.

One of the primary differences between the scalar analysis and the vague predicate analysis is that the former introduces an abstract representation of measurement, i.e. a scale. If scales are part of the ontology, then it should not only be possible to compare objects with respect to their measurements (i.e., to establish ordering relations between degrees, as in comparative constructions), it should also be possible to talk about *differences* between measurements. Comparatives such as (147) and (148), discussed extensively in Hellan 1981 and von Stechow 1984a, appear to verify this prediction.

(147) Red stars are typically 5000 degrees cooler than blue stars.

(148) The space telescope's orbit is now 100 kilometers higher than it used to be.

Following von Stechow (1984a), I will refer to examples like (147) and (148) as "differential comparatives". The interesting aspect of differential comparatives is the interpretation of the measure phrases: *5000 degrees* in (147) and *100 kilometers* in (148) denote the *difference* between the projections of the compared objects on the relevant scale. For example, (148) is accurately paraphrased by (149).

(149) The current height of the space telescope's orbit exceeds its former height by 100 kilometers.

The importance of differential comparatives is that they show that it is possible to make explicit reference to "differential degrees"–degrees that measure the difference between the projections of two objects on a scale.[34] Building on the

[34]Von Stechow (1984a) claims that differential comparatives provide another argument against the vague predicate analysis, since there is no way to represent such differences

initial observations about the basic meaning of comparison of deviation constructions, we can construct an analysis of this phenomenon in terms of quantification over such differential degrees: whereas standard comparatives quantify over degrees that represent the (positive or negative) projection of an object on a scale, comparison of deviation constructions are comparatives that quantify over degrees that denotes the *difference* between the projection of an object on a scale and an appropriate standard-denoting degree. Without going into the details of how this interpretation is derived (this will be the focus of section 3.2 in chapter 3), it can be shown that this analysis satisfies the requirements outlined above.

First, if this analysis is correct, it derives the entailment properties of comparison of deviation constructions. If the comparative and equative constructions in examples like (145) and (146) compare the degrees to which two objects exceed relevant standard values, then the truth conditions for the absolute construction are satisfied whenever the truth conditions for the comparison of deviation construction are satisfied. Second, this analysis explains why comparison of deviation constructions are not anomalous. An important characteristic of differential degrees is that they are "polarity neutral", as indicated by the fact that such differential degrees can be introduced by measure phrases regardless of the polarity of the adjective that heads the comparative construction, as shown by (150) and (151) (cf. the unacceptability of (144)).

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without a scale. See Klein 1991 for some suggestions as to how differential comparatives could be explained within a vague predicate analysis, however.

(150) Galileo was 6 inches taller than Copernicus.

(151) Copernicus was 6 inches shorter than Galileo.

According to the analysis outlined in section 1.3.3.2, cross-polar anomaly is triggered by a mismatch in the polarity of the compared degrees (where polarity is characterized in terms of a sortal distinction). If differential degrees are neutral in their polarity, and if comparison of deviation involves quantification over differential degrees, then no such mismatch is predicted to arise in the context of these constructions.

1.3.4 Summary

We are now in position to summarize the important aspects of the scalar analysis. The crucial difference between gradable adjectives and non-gradable adjectives in this approach is one of semantic type: non-gradable adjectives denote functions from individuals to truth values; gradable adjectives denote relations between objects and degrees. In other words, gradable adjectives actually have an extra "degree argument". This explains the unacceptability of non-gradable adjectives in comparatives and other degree constructions: if e.g. comparatives quantify over degrees, then the fact that non-gradable adjectives do not appear in these constructions can be explained in terms of vacuous quantification: non-gradable adjectives do not introduces a degree variable for the comparative to bind.

The fundamental differences between the scalar analysis and the vague predicate analysis are the introduction of scales and degrees into the ontology and the analysis of gradable adjectives as relational expressions. The empirical advantage of introducing scales and degrees into the ontology is that it supports explanations of the facts that were problematic for the vague predicate analysis: incommensurability, cross-polar anomaly, the distribution of measure phrases, and comparison of deviation. These facts thus provide compelling evidence in favor of the hypothesis that the semantics of gradable adjectives should be characterized in terms of scales and degrees. A separate question is whether the specific approach to adjective meanings discussed so far, in which adjectives are analyzed as relational expressions, is the correct one. An important component of this analysis is the claim that comparatives and other degree constructions are expressions that quantify over the degree argument of an adjective. Indeed, this analysis of degree constructions is closely tied to the general claim that gradable adjectives have a degree argument: if degrees are introduced by the adjective, then, like other arguments, they should support quantification. The claim that degree constructions are quantificational raises other expectations, however. Focusing on comparatives in particular, if these constructions quantify over degrees, then we would expect them to participate in scope ambiguities in contexts in which other quantificational expressions (e.g., quantified NPs) show similar ambiguities. In the next section, I will show that this expectation is not met.

1.4 Comparatives and Scope

The interpretation of quantified nominals indicates that the syntactic or semantic components of natural language contain mechanisms whose function is to associate surface strings with multiple logical representations, differing in the relative scope of quantificational (and intensional) expressions. If comparatives quantify over an argument of the adjective, then the expectation is that they should show the same sorts of interpretive possibilities as other quantificational expressions. That is, like other quantificational expressions, we expect them to interact with other operators (negation, universal quantification, intensional operators, etc.) to trigger scope ambiguities. In the following sections, I will show that this predicted parallelism is in fact *not* observed; instead. the facts indicate that if comparatives are quantificational, then the quantificational force they introduce always has narrow scope with respect to other operators in the sentence.

In order to demonstrate this, it is necessary to make a distinction is between the *scope of the comparative* and the *scope of the comparative clause*. The "scope of the comparative" is the scope of the quantificational expression that denotes the degree argument of a gradable adjective, which is the expression that, given general assumptions about quantification over argument expressions, we expect to participate in scope ambiguities. the "scope of the comparative clause", on the other hand, is the scope of the complement of *than*–the expression that introduces the degree that provides the basis for comparison. What will emerge from the discussion is that the comparative clause *does* show scope ambiguities; in particular, it has scopal characteristics that are similar to those of a definite description, an observation that is well-established in the literature on comparatives (see in particular von Stechow 1984a for an overview of the scopal properties of the comparative clause; see also Russell 1905, Hasegawa 1972, Postal 1974, Horn 1981, Heim 1985, Larson 1988a, Kennedy 1995, 1996, and Rullmann 1995).

A final note: in the discussion that follows, I will focus on the approach to comparatives outlined in section 1.3.2, in which comparatives are analyzed as restricted existential quantification structures (see e.g., Hellan 1981, von Stechow 1984a, Heim 1985, Lerner & Pinkal 1992, 1995, Gawron 1995, Hazout 1995, Rullmann 1995). I do this for perspicuity; I will, however, extend the discussion to include semantic analyses of comparatives as generalized quantifiers in 1.4 (see Moltmann 1992a, Hendriks 1995; cf. Postal 1974, Cresswell 1976, Williams 1977).

1.4.1 Negation

In general, existentially quantified nominals are ambiguous in the scope of negation, as shown by (152).

(152) Max didn't see a recent supernova in the Hercules Cluster.

The indefinite in (152) *a recent supernova in the Hercules Cluster* can be interpreted either inside or outside the scope of negation: on the former reading, Max didn't see any supernovas in the Hercules Cluster, on the latter reading, there is a supernova in the Hercules Cluster such that Max didn't see it. Although the favored interpretation of (152) may be one in which the indefinite has narrow scope, a wide scope reading is clearly available possible, and is in fact the only possible reading when (152) is followed by a pronoun that refers to the object introduced by the indefinite, as in (153).

(153) Max didn't see a recent supernova in the Hercules Cluster because it was obscured by cosmic dust.

Now consider a comparative construction such as (154) in the context of negation.[35]

(154) Max isn't taller than his brother is.

(154) does not have an interpretation in which the existential quantification associated with the comparative takes wide scope with respect to negation. That is, only (155), not (156), represents a possible interpretation of this sentence.

(155) $\neg\exists d[d > \text{MAX}(\lambda d'.tall(Max's\ brother,d'))][tall(Max,d)]$

(156) $\exists d[d > \text{MAX}(\lambda d'.tall(Max's\ brother,d'))]\neg[tall(Max,d)]$

On the reading represented by (155), (154) is true just in case it is not true that for some degree *d* which exceeds the degree of Max's brothers' tallness, Max is *d* tall; this is an accurate characterization of the interpretation of (154). On the wide scope interpretation in (156), (154) would be true if there were a degree *d* which exceeds

[35] I focus here on negation, but the following discussion applies to examples involving negative quantifiers such as (i) and (ii) as well, as can be easily verified.

(i) No one is taller than Max is.
(ii) Few people are taller than Max is.

the degree to which Max's brother is tall, and it is not the case that Max is *d* tall. If (156) were a possible interpretation of (154), then this sentence could be true in a situation in which Max's height actually *exceeds* Max's brother's height, as in the context illustrated by (157), because there is a degree–namely *d*–which exceeds the degree to which Max's brother is tall, and it is not the case that Max is at least as tall as that.

(157) HEIGHT: $0 \text{———} d_{M\text{'s brother}} \text{———} d_{Max} \text{———} d \text{———}\rightarrow \infty$

One response to this problem is that the wide scope reading of the comparative is a tautology: assuming there is no maximal degree of height (cf. von Stechow 1984b), it is always true that some degree which satisfies the restriction–*d is greater than Max's brother's height*–will also satisfy the nuclear scope–*Max is not at least as tall as d.* This response allows for the possibility that (154) is ambiguous, but claims that since the tautologous interpretation does not provide useful information about the actual relation between Max's height and his brother's height, it is ignored.

There are at least two problems with this explanation. The first is that even in contexts in which tautologous interpretations of sentences are strange or even anomalous, they are nevertheless *detectable.* Consider, for example, a sentence like (158) (see Lakoff 1970, Huddleston 1971, Carden 1977, Manaster-Ramer 1978, and Horn 1981 for discussion of sentences of this type).

(158) We were amazed that the Hale-Bopp comet was as bright as it was.

(158) allows a "sensible" reading, in which the actual brightness of the Hale-Bopp comet, in contrast to what was expected, is responsible for our amazement. It also has a "strange" interpretation in which we were amazed that the brightness of the comet was equal to (or at least as great as) the brightness of the comet. The strangeness of this interpretation clearly stems from the fact that the embedded equative is interpreted tautologously. What is crucial to the current discussion is that this reading is detectable; in contrast, the predicted tautologous reading of (154) is *not* detectable.

The second problem with this sort of explanation is that there is reason to believe that it is too weak. Ladusaw (1986) observes that two types of semantic filtering can be defined. A sentence can be semantically ill-formed either because its interpretation fails to meet conditions of informativity or because it has no interpretation at all. The explanation of the unavailability of wide-scope interpretations of comparatives with respect to negation outlined above is an example of the first type of filtering: the reading of (154) represented by (156) is unavailable because it is uninformative. A general characteristic of this type of filtering, however, is that it allows for the possibility that there are contexts in which the generally unavailable interpretation becomes available–indeed, the fact that tautologous equatives embedded under factive predicates permit a "sensible" interpretation, as described above, is a case in point.[36] The problem is that there is no context that supports a reading of (154) with the truth conditions in (156): this

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[36] See also Barwise and Cooper's (1981) discussion of definiteness and the English existential construction.

sentence simply cannot be used to describe the situation in (157), which is what such a reading should allow. The conclusion, then, should be that a wide-scope readings of a comparative under negation is ruled out by the second type of filtering mentioned by Ladusaw: the grammar of comparatives simply does not permit such interpretations to arise. If comparatives are quantificational expressions, however, then this result can be achieved only by stipulating that the existential quantification introduced by the comparative must take narrow scope (see e.g. von Stechow 1984a and Rullmann 1995 for proposals to this effect).

1.4.2 Distributive Quantifiers

A second context in which existentially quantified NPs typically show scope ambiguities is in sentences containing distributive quantifiers like *every, most, each,* etc. For example, (159) has the two readings characterized in (160)-(161), which are distinguished by the relative scope of the existential and universal quantifiers.

(159) Every student in Semantics 1 read a book on adjectives.

(160) $\forall x[\textit{student-in-semantics-1}(x)][\exists y[\textit{book-on-adjectives}(y)][\textit{read}(x,y)]]$

(161) $\exists y[\textit{book-on-adjectives}(y)][\forall x[\textit{student-in-semantics-1}(x)][\textit{read}(x,y)]]$

The crucial difference between (160) and (161) is that the former allows books to covary with students, while the latter requires that there be one book that every student read.

Comparatives in the scope of distributive quantifiers do not show a similar pattern of ambiguity. Consider (162).

(162) Every planet in the solar system is larger than Earth's moon.

If comparatives participate in scope ambiguities, then (162) should have the two logical representations in (163) and (164).

(163) $\forall x[planet(x)][\exists d[d > \textsc{max}(\lambda d'.large(Earth's\ moon,d'))][large(x,d)]]$

(164) $\exists d[d > \textsc{max}(\lambda d'.large(Earth's\ moon,d'))][\forall x[planet(x)][[large(x,d)]]$

(163) correctly captures the interpretation of (162): for every x such that x is a planet, for some degree d such that d exceeds the degree to which Earth's moon is large, x is d-large. At first glance, the interpretation in which the comparative has wide-scope appears to be equivalent. On the interpretation in (164), (162) is true just in case for some degree d such that d exceeds the degree to which Earth's moon is large, every planet is d-large. Although it appears on the surface that (164) should be true in the same contexts as (163), this is contingent on an additional assumption. (163) and (164) are equivalent only if the adjective in the nuclear scope of the comparative (i.e., the absolute form) introduces a partial ordering relation, rather than a relation of equality, as specified in (165) (recall from the discussion in section 1.3.1 that δ_φ is a function that maps objects onto the scale associated with φ).

(165) $||\varphi(a,d)|| = 1$ iff $\delta_\varphi(a) = d$

If the absolute were interpreted as in (165), however, (163) and (164) would have very different truth conditions. On the interpretation in (164), (162) would be true just in case every planet were large to the same degree (see Rullmann 1995 for discussion).

The fact that (162) does not have this type of interpretation appears to provide support for the hypothesis that the absolute form of a gradable adjective is stated in terms of a partial ordering relation, a hypothesis that up to now I have assumed without justification. Additional support for this hypothesis appears to be provided by exchanges like (166).

(166) A: You have to be at least 5 feet tall to be an astronaut.

B: I'm 5 feet tall; in fact, I'm over 5 feet tall.

Although the typical interpretation of a sentence such as *Benny is 5 feet tall* is one in which Benny is assumed to be *exactly* 5 feet tall, the fact that B's utterance in (166) is not contradictory suggests that the "exactly" interpretation is not an entailment, but rather a scalar implicature.[37]

If the absolute form is interpreted in this way, however, it presents a serious problem for the analysis of comparatives with *less*. Specifically, an analysis of *less* comparatives in terms of existential quantification ends up with the wrong truth conditions. Consider, for example, (167), which has the logical representation in (168).

[37] See Carston 1988 and Horn 1992 for relevant discussion of this issue.

(167) That red giant is less dense than the black hole it's orbiting.

(168) $\exists d[d < \textsc{max}(\lambda d'.dense(the\ black\ hole,\ d'))][dense(the\ red\ giant,d)]]$

According to (168), (167) is true just in case for some degree d such that d is exceeded by the maximal degree to which the back hole is dense, the red giant is at least as dense as d. The problem is that these truth conditions actually allow for the possibility that the density of the red giant exceeds that of the black hole, a result that is clearly incompatible with the actual meaning of (167). In the unlikely situation represented in (169), in which d_b denotes the density of the black hole and d_r denotes the density of the red giant, (167) would be true, because there is a degree–d_1–that satisfies the conditions imposed by (168): d_1 is exceeded by d_b, and d_r is at least as great as d_1.

(169) DENSITY: ———— d_1 ———— d_b ———— d_r ————→ ∞

If, on the other hand, the absolute construction is interpreted with respect to a relation of equality, as in (165), this problem disappears (this point is made in Rullmann 1995): (167) would be false in the context shown in (169), because there is no degree that is both exceeded by d_b and is equal to d_r.

Note that the problem of an "at least as" interpretation of the absolute for comparatives with *less* cannot be solved pragmatically. The fact that (170) is a contradiction indicates that unlike the case with the absolute, the "maximality" of *less* comparatives is not due to scalar implicature (cf. (171)).

(170) #That red giant is less dense than the black hole it's orbiting.; in fact, it's denser than the black hole.

(171) Some black holes are extremely dense; in fact, all black holes are extremely dense.

We thus arrive at a paradox. In order to construct an analysis of comparatives with *less* that has the correct truth conditions, it is necessary to assume that the absolute form is interpreted with respect to a relation of equality, as in (165), rather than a partial ordering relation, as I have assumed up to now. If the ordering relation associated with the absolute construction is one of equality, however, then a quantificational analysis of comparatives predicts that a sentence like (162) should be ambiguous; in particular, it should have a reading in which all the planets in the solar system are claimed to have the same size. (162) cannot be interpreted in this way, however. The conclusion to be drawn from these facts, then, is that if the quantificational analysis outlined here is to correctly capture the truth conditions of comparatives with *less*, it must also stipulate that the existential force introduced by the comparative has narrow scope with respect to distributive quantifiers, just as we saw with negation in the previous section.[38]

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[38]Carston (1988) argues that numerals can have an "exactly" reading in some contexts and an "at least as" reading in others, suggesting ultimately that their interpretations are indeterminate. Even if Carston's analysis can be carried over to the absolute form of gradable adjectives, it does not resolve the problems I have laid out here, since it allows for the possibility of an "exactly" interpretation of the absolute in examples like (162) and an "at least as" interpretation in examples like (170), predicting that both should be ambiguous.

1.4.3 Intensional Contexts

Although the discussion in the previous two sections illustrated that comparatives do not show scope ambiguities with respect to negation and distributive quantifiers, there are contexts in which comparatives clearly *are* ambiguous. The best known example of such contexts involves contradictory comparatives in intensional contexts, as in (172) (see Russell 1905, Hasegawa 1972, Postal 1974, Hankamer and Sag 1976, Williams 1977, Hellan 1981, Napoli 1983, von Stechow 1984a, Hoeksema 1984, Heim 1985, Larson 1988a, Kennedy 1995, 1996b and others for discussion).

(172) Max thinks the moon is larger than it is.

As originally observed by Russell (1905), a sentence like (172) is ambiguous between the reading paraphrased in (173), in which it is asserted that Max is mistaken about the size of the moon, and the one in (174), in which it is claimed that Max believes a contradiction.

(173) The size that Max thinks the moon is exceeds the size that it actually is.
(174) Max thinks that the size of the moon exceeds the size of the moon.

If comparatives are quantificational, then this contrast is expected, because

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The optimal solution to this problem, then, is one in which the interpretation of the comparative forms is not stated in terms of the interpretation of the absolute. This is exactly the type of analysis that I will develop in chapter 2.

(172) is assigned the two logical representations in (175) and (176), which differ in the relative scope of the comparative and the intensional verb *think*.

(175) $\exists d[d > \text{MAX}(\lambda d'.large(moon,d'))][think(Max,{}^{\wedge}large(moon,d))]$

(176) $think(Max,{}^{\wedge}\exists d[d > \text{MAX}(\lambda d'.large(moon,d'))][large(moon,d)])$

The interpretation of (172) in (175) accurately characterizes the reading in (173), while the interpretation in (176) corresponds to the reading in (174). On the surface, then, the ambiguity of (172) appears to provide support for the hypothesis that comparatives are quantificational.

Problems arise for this analysis when attention is expanded to include comparatives in other intensional contexts. Consider, for example, the interpretation of contradictory comparatives in counterfactuals, as in (177) (cf. Postal 1974, von Stechow 1984a).

(177) If Jones had been taller than he was, he would have been decapitated by the flying saucer.

(177) is ambiguous in the same way as (172): it has a "sensible" interpretation, in which the antecedent of the conditional describes a relation between Jones' height in some alternative world and Jones' height in the actual world, and a trivial interpretation, in which the antecedent of the conditional is contradictory. The problem presented by counterfactuals like (177), as pointed out by Von Stechow

(1984a), is that an analysis of this sentence along the lines of the one given for (172) above fails to get the right truth conditions.

I assume the semantics for the counterfactual is as in (178), where the symbol "$\Rightarrow$" indicates counterfactuality (cf. Lewis 1973a, Stalnaker 1968).

(178) $||\varphi \Rightarrow \psi||^w = 1$ iff (i) there are no possible worlds in which φ is true or (ii) there is a world w' in which φ and ψ are true and w' is closer to w than any world in which φ holds but ψ does not.

Building on the analysis of (172), the non-trivial interpretation of (177) is assigned the logical representation in (179).

(179) $\exists d[d > \text{MAX}(\lambda d'.\mathit{tall}(\mathit{jones},d'))][\mathit{tall}(\mathit{Jones},d) \Rightarrow \mathit{decapitate}(\mathit{flying\ saucer}, \mathit{jones})]$

Now consider a context in which the set of worlds consists of the five worlds in (180) where the specified facts obtain and w_0 is the world in which the sentence is interpreted.

(180)

WORLD	JONES' HEIGHT	DECAPITATED?
w_0	5'	no
w_1	5' 1"	no
w_2	5' 2"	no
w_3	5' 3"	no
w_4	5' 4"	yes

In this context, (179) is true, because there is a degree of height–the one corresponding to 5' 4"–that exceeds Jones' actual height and also satisfies the truth conditions of the counterfactual: there is no world closer to w_0 than w_4 in which it is true both that Jones is at least 5' 4" tall and that he is decapitated by the flying saucer. The problem is that (177) makes a stronger claim that this: (177) asserts that *any* increase in height would have resulted in Jones being decapitated. As a result, the truth conditions associated with (179) are too weak.

Von Stechow concludes from examples like this that it is not the entire comparative construction that interacts with intensional operators to generate scope ambiguities, rather it is the *comparative clause* that triggers scope ambiguities in intensional contexts. According to von Stechow, the actual logical representation of the non-trivial interpretation of (177) is something like (181), in which the comparative clause (MAX($\lambda d'.tall(jones,d')$)) has scoped out of the conditional, but the quantifier introduced by the comparative remains inside.

(181) $\lambda d_x[\exists d[d > d_x][tall(Jones,d)] \Rightarrow decapitate(flying\ saucer, jones)](\textsc{max}(\lambda d'.tall(jones,d')))$

(181) requires it to be the case that every world in which Jones' height exceeds his height in the actual world is such that he is decapitated. Therefore, unlike (179), (181) is false in the context illustrated by (180).

Von Stechow motivates this analysis by observing that the scopal properties of the comparative clause are entirely expected if it is a type of definite description, as originally claimed by Russell (1905) (and as assumed in this thesis; see the discussion of this point in section 1.3.2). What is relevant to the current discussion is that if von Stechow's analysis is correct in its basic claims, then facts like (172) do not provide evidence in favor of a quantificational analysis of the comparative, since the range of scope ambiguities of comparatives in intensional contexts can be explained if we assume that it is the comparative clause (qua definite description) that is responsible for the ambiguities.[39]

1.4.4 Summary

The starting point of this section was the observation that a basic prediction of an analysis in which comparatives involve quantification over degrees is that they should show scope ambiguities relative to other operators. The facts discussed here show that in contexts involving negation, distributive quantifiers, and counterfactual

[39] Indeed, this was Russell's original analysis of these facts.

conditionals, this prediction is not borne out: there is no evidence that the quantificational force introduced by the comparative interacts with other operators to generate scope ambiguities. At the same time, the interpretation of comparatives in intensional contexts, in particular, the interpretation of comparatives in counterfactual conditionals, shows that the comparative clause *does* participate in scope ambiguities, a result that is expected if it is a type of a definite description.[40] We thus arrive at a somewhat paradoxical generalization: the comparative does not show scope ambiguities; the comparative clause does. In effect, the comparative clause is behaving as if it, rather than the comparative construction, were the argument-denoting expression. In chapter 2, I will develop an alternative analysis of gradable adjectives and comparatives that makes exactly this claim; before I conclude this chapter, however, I will take a brief look at an alternative quantificational approach, showing that it also makes incorrect predictions with respect to scope ambiguities.

1.4.5 Comparatives as Generalized Quantifiers

An alternative to the analysis of comparatives as existential quantification structures is one in which they are analyzed as generalized quantifiers (see Moltmann 1992a and Hendriks 1995; see also Postal 1974, Cresswell 1976, and Williams 1977 for very

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[40] Note that if the comparative clause is a definite description, then the contexts in which it triggers scope ambiguities should be limited to those involving intensional expressions; it should not interact with quantificational determiners or negation to generate scope ambiguities. As observed in footnote 28, this does seem to be the case.

similar accounts). On this view, comparatives do not introduce a degree, but rather denote relations between sets of degrees (where one set is introduced by the comparative clause and the other is derived by abstracting over the degree argument associated with the adjective).

The basic form of the analysis is as follows. Assume that degree morphemes such as *er/more* and *less* denote determiners in the sense of Barwise and Cooper 1981; i.e., relations between sets. Unlike determiners in the nominal domain, which denote relations between sets of individuals, comparative determiners denote relations between sets of degrees. The interpretation of *more* on this view is shown in (182), where φ and ψ correspond to the comparative clause and main clause respectively, and denote sets of degrees.

(182) $||\textsc{more}(\varphi)(\psi)|| = 1$ iff $||\varphi|| \subset ||\psi||$

For an illustration of this type approach, consider the analysis of (183), which has the interpretation shown in (184) (cf. Moltmann 1992a).

(183) Jupiter's atmosphere is thicker than Titan's atmosphere.

(184) MORE(λ*d.thick(Titan's atmosphere,d)*)(λ*d.thick(Jupiter's atmosphere,d)*)

According to (184), (182) is true just in case the set of degrees which makes *Titan's atmosphere is d-thick* true is properly included by the set of degrees which makes *Jupiter's atmosphere is d-thick* true. Assuming the semantics of the absolute to be stated as in (185) (cf. the analysis of the absolute in section 1.3.1), (183) is true just in case the set of degrees which are ordered below the degree of thickness of Titan's atmosphere on a scale of thickness (inclusive) is a proper subset of the set of degrees which are ordered below the degree of thickness of Jupiter's atmosphere (inclusive).

(185) $||\varphi(a,d)|| = 1$ iff $\delta_{\varphi}(a) \geq d$, where δ is a function from objects to degrees.

Since scales are formalized as totally ordered sets of degrees, the truth conditions for the comparative in (182) entail that the degree of thickness of Titan's atmosphere exceeds the degree of thickness of Jupiter's atmosphere. An immediate positive result of this analysis is it avoids problems associated with the analysis of comparatives with *less* that were discussed in the previous section. Since the arguments of the comparative morpheme are sets which contain *all* of the degrees ordered below an object's projection on a scale, the "maximality" required to capture the correct truth conditions of *less* comparatives is derived.

There are two problems with the analysis of comparatives as generalized quantifiers, however. The first is essentially the same as the one discussed in section 1.4.1: like an analysis of comparatives as existential quantification structures, a generalized quantifier account predicts that comparatives should show scope ambiguities which do not actually exist. Whereas the unavailable readings discussed in section 1.4.1 were tautologies, the generalized quantifier approach predicts comparatives in certain scopal contexts to have *contradictory* interpretations. I will focus only on the case of negation to illustrate this point.

Given the basic assumptions outlined above, a sentence like (186) should have the two interpretations in (187) and (188).

(186) Titan's atmosphere is thicker than Jupiter's atmosphere.

(187) $\neg$MORE($\lambda d.thick(Jupiter's\ atmosphere,d))(\lambda d.thick(Titan's\ atmosphere,d))$

(188) MORE($\lambda d.thick(Jupiter's\ atmosphere,d))(\lambda d.\neg thick(Titan's\ atmosphere,d))$

(187) accurately captures the truth conditions for (186), but the formula in (188) is a contradiction: the denotation of the scope clause is the set of degrees which make *Titan's atmosphere is d-thick* false; this is the set of degrees which are ordered above the degree of Titan's atmosphere's thickness. Because of the ordering of the scale, it will never be the case that the set of degrees denoted by the restrictor clause–the degrees ordered below the degree of Jupiter's atmosphere's thickness (inclusive)–is properly included in the set denoted by the scope clause, so (188) is contradictory. (186) does not have a contradictory interpretation, however, any more than it has a tautological one.

The second problem with the analysis of comparatives as generalized quantifiers involves a fundamental principle of natural language determiners: *conservativity*. Conservativity, defined in (189), is a property shared by all natural language determiners (see Barwise and Cooper 1981, Keenan and Stavi 1986).

(189) A determiner D is conservative iff: $D(\varphi)(\psi) \Leftrightarrow D(\varphi)(\varphi \cap \psi)$

If the interpretation of *more* is as defined in (182), then according to(189) it is not conservative, because the equivalence in (190) does not hold (cf. Gawron 1995).

(190) $\varphi \subset \psi \Leftrightarrow \varphi \subset (\varphi \cap \psi)$

A possible response to this objection is that the semantic analysis of *more* in (182) is incorrect; its interpretation is actually that in (191), in which the main clause provides the restriction and the comparative clause the scope.

(191) $||\text{MORE}(\varphi)(\psi)|| = 1$ iff $||\varphi|| \supset ||\psi||$

If (191) is the correct analysis of *more*, then it is conservative, because the equivalence in (192) holds:

(192) $\varphi \supset \psi \Leftrightarrow \varphi \supset (\varphi \cap \psi)$

This analysis runs into problems with *less* however. The interpretation of *less* is the inverse of the interpretation of *more*, as shown by the validity of examples like (193).

(193) Titan's atmosphere is less thick than Jupiter's atmosphere if and only if Jupiter's atmosphere is thicker than Titan's atmosphere.

If (191) is the actual the interpretation of *more*, then the interpretation of *less* must be as in (194), in which case *less* is nonconservative.

(194) $||\text{LESS}(\varphi)(\psi)|| = 1 \text{ iff } ||\varphi|| \subset ||\psi||$

The bottom line is that if conservativity is a constraint on quantificational determiners in natural language, then degree morphemes can't be quantificational determiners, because they are nonconservative.

As the discussion here shows, an analysis of comparatives as generalized quantifiers not only leads to the same puzzles as the degree description account regarding scopal interpretation, it also forces us to abandon the assumption that all quantificational determiners in natural language are conservative. At the same time, this analysis contains a very intuitive analysis of degree morphemes as relational expressions. In chapter 2, I will develop an analysis of degree constructions that is similar to the generalized quantifier approach in this respect, but differs in that it does not analyze degree morphemes as quantificational determiners, and so avoids the problems of unattested scope ambiguities and nonconservativity.

1.5 Conclusion

The primary conclusion of this chapter is that the semantic analysis of gradable adjectives should be stated in terms of abstract representations of measurement, i.e., scales and degrees. This conclusion was arrived at by showing that a number of facts, including incommensurability, cross-polar anomaly, the distribution of measure phrases, and the interpretation of comparison of deviation constructions, receive a natural explanation only if scales and degrees are introduced into the ontology and the interpretation of gradable adjectives is characterized in terms of these abstract objects.

At the same time, a number of facts called into question the traditional scalar analysis of gradable adjectives as relational expressions and comparatives as expressions that quantify over degrees. The data discussed in sections 1.4 clearly showed that the quantification hypothesized to be introduced by the comparative construction does not interact with other quantificational expressions to generate scope ambiguities. It follows that if comparatives are analyzed as quantificational structures, then it is necessary to stipulate that they always have narrow scope with respect to other operators. This is an undesirable result, raising the following question: is the analysis of comparatives in terms of quantification over degrees correct, or should we look for an alternative analysis which does not introduce unrealized expectations regarding scope ambiguities.

One alternative to a quantificational analysis of comparatives (and other degree constructions) would be one in which the degree morpheme and gradable adjective combine directly to form a property-denoting expression which can be applied to the subject. Such an analysis would reject the claim that comparatives are quantificational, eliminating the expectation that they should show scope ambiguities. Exactly this type of approach will be developed in chapter 2, but it will require modifying a basic assumption about the interpretation of gradable adjectives. Specifically, the claim that gradable adjectives have a degree *argument* will be denied, in favor of an analysis in which gradable adjectives denote functions from objects to degrees.

2 Projecting the Adjective

This chapter motivates and develops a semantic analysis of gradable adjectives as *measure functions*: functions from objects to degrees. I argue that propositions in which the main predicate is headed by a gradable adjective φ have three primary semantic constituents: a *reference value*, which denotes the degree to which the subject is φ, a *standard value*, which corresponds to another degree, and a *degree relation*, which is introduced by a degree morpheme and which defines a relation between the reference value and the standard value. Building on a syntactic analysis in which gradable adjectives project extended functional structure headed by a degree morpheme (Abney 1987, Corver 1990, 1997, Grimshaw 1991), I show that this analysis supports a straightforward compositional semantics for comparatives and absolute degree constructions in English, and that it explains the restricted scopal properties of comparatives that were problematic for the traditional scalar analysis of gradable adjectives, in which gradable adjectives are relational expressions and comparatives quantify over degrees.

2.1 Measure Functions and Degree Constructions

2.1.1 Puzzles

Chapter 1 concluded with a puzzle. A number of facts, including cross-polar anomaly, incommensurability, and comparison of deviation, provided strong support for the semantic analysis of gradable adjectives as expressions that define a mapping between objects in their domain and degrees on a scale. An important component of this analysis was the claim that the basic meaning of a gradable adjective is that of a relational expression: a gradable adjective introduces two arguments, an object and a degree, and defines a mapping between them. A general characteristic of argument expressions is that they can be quantified; it follows that if degrees are actual arguments of a gradable adjective, they should provide a domain for quantification. The general success of the analysis of comparatives as expressions that quantify over degrees–this analysis played an important role in the explanations of incommensurability, cross-polar anomaly, and comparison of deviation–appears to verify this prediction.

The assumption that degree constructions are quantificational expressions raises other expectations, however. If these constructions quantify over degrees, then we expect them to participate in scope ambiguities in contexts in which other quantificational expressions (e.g., quantified NPs) show similar ambiguities. The facts discussed in section 1.4 of chapter 1 indicated that this is not the case for the comparative construction, however: there is no evidence that the quantificational force introduced by a comparative participates in scope ambiguities; in effect, a quantified degree argument always has narrow scope with respect to other quantificational operators. At the same time, the facts showed that a subconstituent of the comparative construction–the comparative clause–does show the scopal characteristics of an argument-denoting expression. These observations lead to the following conclusions. First, if comparatives never show scope ambiguities, then the hypothesis that they are quantificational must be called into question. Although one could modify the traditional analysis so that the quantification introduced by a degree construction must take narrow scope by explicitly encoding this constraint in the interpretation of the comparative morpheme (as in e.g., von Stechow 1984a, Rullmann 1995), an alternative explanation in which the scope facts are derived should be preferred. Second, if a property of arguments is that they provide a domain for quantification, then the semantic behavior of the comparative clause suggests that it is an argument-denoting expression. In the traditional account, however, this is not the case: the comparative clause is part of the restriction of the quantifier introduced by the comparative, but it does not denote the degree argument of the adjective.[1]

A more general problem for a relational analysis of gradable adjectives can be described of as the "problem of compositionality". A strong theme in work on

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[1]Overlying the scope issues was a separate problem which arose specifically in the case of analyses which treat the comparative in terms of existential quantification: the interpretation of comparatives with *less*. As observed in chapter 1, if the interpretation of the absolute construction is stated in terms of an "at least as" relation, as in (i), it is impossible to construct accurate truth conditions for comparatives with *less*. The logical representation of (ii), shown in (iii), is satisfied even if Molly's height exceeds Max's height, since it would be true in such a situation that for some d ordered below the degree of Max's tallness, Molly is *at least* as tall as d.

(i) $||\varphi(a,d)|| = 1$ iff the degree to which a is φ is at least as great as d.
(ii) Molly is less tall than Max is.
(iii) $\exists d[d < \textsc{max}(\lambda d'.tall(Max,d'))][tall(Molly,d)]$

Although a stipulation that the nuclear scope of a *less* construction has an "equals" interpretation would salvage this approach (see e.g. Rullmann 1995), an analysis which derives the right results should be preferred over one which must rely on such stipulations. In section 2.4, I will present an analysis that achieves this goal.

gradation, dating at least to Sapir 1944 (see also Fillmore 1965, Campbell and Wales 1969, Bartsch and Vennemann 1972, Cresswell 1976, Bierwisch 1989), is that comparison (i.e., a partial ordering relation) is a psychological primitive, and that the basic interpretation of gradable adjectives should be stated in terms of such a relation. Indeed, this hypothesis is the basis for the scalar analysis sketched in the last chapter, in which the core meaning of a gradable adjective is defined in terms of a partial ordering relation. This is most clearly illustrated by considering the truth conditions of a typical absolute construction such as (1), which are stated in terms of a partial ordering between two degrees.

(1) Benny is tall.

Benny is tall is true just in case the degree to which Benny is tall is at least as great as some contextually determined standard of tallness (possibly relativized to the comparison class to which Benny belongs). This is formalized in (2), where δ_{tall} denotes a function from objects to degrees on the scale associated with the adjective *tall*, and s denotes the appropriate standard value.

(2) $||tall(Benny,s)|| = 1$ iff $\delta_{tall}(Benny) \geq s$

The problem of compositionality, articulated by McConnell-Ginet (1973) and Klein (1980, 1982), is that the assumption that the comparison relation is somehow "basic" is not supported by the morphosyntactic facts of natural languages. If the comparison relation were a psychological or semantic primitive, then the expectation should be that the comparative form of the adjective should be less marked than the absolute form. This expectation is not supported by the facts, however: it appears to be true that in languages that have both a comparative and absolute form, the comparative is morphologically (and syntactically) more complex than the absolute (McConnell-Ginet 1973:96).[2] Given the fact that comparative constructions are always morphologically or syntactically complex, plus the observation that gradable adjectives appear in a variety of semantically distinct degree constructions, not all of which obviously involve a notion of comparison (see footnote 2), considerations of compositionality dictate that the basic interpretation of gradable adjectives should be

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[2]It should also be observed that if a comparison relation is an inherent component of the meaning of a gradable adjective, some notion of comparison should be involved in the interpretation of any sentence in which a gradable adjective appears. This is not obviously true, however. Consider the case of *too/enough* constructions. The truth conditions of a sentence like (i) *can* be stated in terms of a notion of comparison, as in (ii) (see von Stechow 1984a:68-69 for this type of analysis).

(i) Pug is too stinky to go to the Ritz

(ii) In order for Pug to go to the Ritz, he would have to be less stinky than he is.

Although (ii) is clearly an entailment of (i), it is not obvious that it is the best analysis of the meaning of (i). Arguably, a more accurate characterization of the meaning of (i) is (iii), which defines the truth conditions of (i) without reference to a comparison relation (cf. Moltmann 1992a:301).

(iii) The degree of Pug's stinkiness makes it impossible for him to go to the Ritz.

Although *too* and *enough* constructions will not be a focus of this thesis, I will include some discussion of them below.

specified independently of a notion of comparison, and that the interpretations of complex degree constructions should be derived as a function of the meanings of gradable adjectives and the meanings of degree morphology. This point is articulated by Klein (1980:4), who says:

> We also require a semantic theory for English to analyse the interpretation of complex expressions in terms of the interpretations of their components. An expression of the form $[_{AP}$ A-*er than* X] is clearly complex. How do its components contribute to the meaning of the whole?

I take it that a minimal requirement of any semantic analysis of comparatives and gradable adjectives is to provide a satisfactory answer to Klein's question.

With these considerations in mind, we can construct a list of requirements that an analysis of the semantics of gradable adjectives and degree constructions should aim to satisfy. First, it should provide a principled explanation for why the quantificational force introduced by a degree construction does not participate in scope ambiguities. Second, for comparative constructions at least, it should explain why a subpart of the degree construction–the comparative clause–*does* participate in scope ambiguities. Third, it should support an explanation of the crucial empirical facts discussed in chapter 1: incommensurability, cross-polar anomaly, and comparison of deviation. Finally, in order to adequately satisfy requirements of compositionality, it should characterize the meaning of gradable adjectives independently of a notion of comparison, and the interpretations of complex degree constructions should be explained in terms of the interaction of the meaning of the adjective and the meanings of degree morphemes.

The goal of this chapter is to develop an alternative to the traditional scalar analyses that satisfies these requirements. Specifically, I will reject the traditional claim that gradable adjectives have a degree argument, arguing instead that gradable adjectives denote *measure functions*: functions from individuals to degrees (cf. Bartsch and Vennemann 1972, Wunderlich 1970), and I will claim that degree morphemes do not introduce quantification over degrees, but rather combine with a gradable adjective to form a complex property whose meaning is roughly the same as the meaning of a gradable adjective on the traditional view (in particular, these expressions are of the same semantic type). Crucially, no notion of comparison is incorporated into the core meaning of a gradable adjective on this view; instead, a gradable adjective denotes a function that projects the objects in its domain onto the scale with which it is associated, and the relational (i.e., comparative) characteristics associated with absolute and degree constructions are introduced by degree morphology. Moreover, because this analysis of degree constructions is not quantificational, the expectation that they should participate in scope ambiguities disappears.

The rest of this chapter is organized as follows. In the remainder of this section, I will outline the core properties of the analysis. In section 2.2, I will introduce the syntactic analysis of degree constructions that I will adopt, in which adjectives project functional structure headed by degree morphemes (see Abney 1987, Corver 1990, and Grimshaw 1991). In the remainder of the chapter, I will show that this analysis supports a robust compositional semantics of degree constructions, focusing on the analysis of absolute and comparative constructions in English.

2.1.2 Identifying the Standard

To isolate the general differences between the analysis of gradable adjectives that I will propose here and the relational analysis outlined in chapter 1, it is useful to start with a closer look at the general notion of a "standard". A claim common to all scalar analyses (and implicit in vague predicate analyses) is that the truth of a sentence containing a gradable adjective φ is determined by evaluating some relation between the degree to which the subject is φ and some other value, which I will refer to as the *standard value*. This is most clearly illustrated by the interpretation of absolute constructions, both with and without measure phrases, such as (3) and (4).

(3) The neutron star in the Crab Nebula is dense.

(4) Benny is 4 feet tall.

For example, (3) is true just in case the degree to which the neutron star in the Crab Nebula is dense is at least as great as a standard degree of denseness (for galactic objects), and (4) is true just in case the degree to which Benny is tall is at least as great as the degree denoted by *4 feet* (I assume that measure phrases denote degrees; see von Stechow 1984a,b and Klein 1991 for general discussion).

Comparative and equative constructions such as (5)-(7) can also be analyzed in terms of a relation between the standard and a subject-oriented degree, but the determination of the standard value is more complex.

(5) The Hale-Bopp comet was brighter than Hyakutake was.

(6) The Mars Pathfinder mission was less expensive than the Viking missions.

(7) The earth is as large as Venus.

In an analysis in which degree constructions quantify over the degree argument of a gradable adjective, comparatives and equatives function as indefinite descriptions of a standard value: the value of the standard is a function of the denotation of the comparative clause and the meaning of the degree morpheme that heads the comparative.[3] This is illustrated by the semantic analyses of these sentences in (8)-(10), using the formalism adopted in chapter 1.

(8) $\exists d[d > \textsc{max}(\lambda d'.bright(Hyakutake,d'))][bright(Hale\text{-}Bopp,d)]$

(9) $\exists d[d < \textsc{max}(\lambda d'.expensive(the\ Viking\ missions,d'))][expensive(the\ MP\ mission,d)]$

(10) $\exists d[d \geq \textsc{max}(\lambda d'.large(Venus,d'))][large(the\ earth,d)]$

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[3]For now, I will continue to abstract away from the difference between comparatives like (5), in which the surface complement of *than* or *as* is a (possibly partial) clausal constituent, and comparatives like (6)-(7), in which this expression is a DP, referring to the complement of *than* or *as* in these constructions uniformly as the "comparative clause". In section 2.4, I will focus specifically on this distinction (see e.g., Hankamer 1973, Pinkham 1982, Hoeksema 1983, Napoli 1983, Heim 1985, and Hazout 1995 for relevant discussion).

For example, the comparative in (8) constrains the standard value to be some degree that exceeds the (maximal) degree to which Hyakutake was bright; the entire sentence is true just in case the degree to which Hale-Bopp was bright is *at least as great* as the standard. Note that although the different relations introduced by the comparative degree morphemes play a crucial role in determining the value of the standard, they do not affect the relation between the subject and the standard: in each of (8)-(10), as in the absolute constructions in (3) and (4), the relation between the degree to which the subject is φ and the standard degree is a partial ordering relation.

Although (8)-(10) provide accurate characterizations of the truth conditions of (5)-(7), the interpretations of these sentences could have been characterized more directly in terms of a relation between two degrees, rather than quantification over degrees. Specifically, (5)-(7) could have been analyzed in terms of a relation between the degree to which the subject is φ and a standard value, with the following adjustments: the comparative clause, rather than the entire comparative construction, provides the standard, and the relation between the standard and the subject-degree is determined by the comparative morpheme.[4] On this view, the truth conditions of (5)-(7) should be stated as in (11)-(13).

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[4]The observation that comparatives can be analyzed along these lines goes back at least to Russell 1905, who characterizes the *de re* interpretation of (i) as (ii):

(i) I thought your yacht was larger than it is.
(ii) The size that I thought your yacht was is greater than the size your yacht is.

(11) *The Hale-Bopp comet was brighter than Hyakutake was* is true just in case the degree to which Hale-Bopp was bright exceeds the degree to which Hyakutake was bright.

(12) *The Mars Pathfinder mission was less expensive than the Viking Missions* is true just in case the degree to which the Mars Pathfinder mission was expensive is exceeded by the degree to which the Viking missions were expensive.

(13) *The earth is as large as Venus* is true just in case the degree to which the earth is large is at least as great as the degree to which Venus is large.

The analyses in (8)-(10) and (11)-(13) differ in two important ways. The first is the relation between the standard values in comparative and absolute constructions. In (8)-(10), the comparative *qua* degree description is semantically parallel to the measure phrase and contextually determined standard in (3)-(4), while in (11)-(13), the semantic role of the comparative clause is parallel to that of the standard-denoting expressions in the absolute constructions. The second difference involves the relation between the degree to which the subject is φ and the standard value. In (8)-(10), this relation remains the same regardless of the particular degree morpheme involved. In contrast, in (11)-(13) this relation is determined by the particular degree morpheme used.

These differences represent the core of the alternative analysis of gradable adjectives and degree constructions that I will develop here. Specifically, I will argue that the interpretation of sentences constructed out of a gradable adjective φ should be characterized in terms of three semantic constituents, which are specified in (14).

(14) i. A *reference value*, which indicates the degree to which the subject is φ;
ii. a *standard value*, which corresponds to some other degree; and
iii. a *degree relation*, which is asserted to hold between the reference value and the standard value.

The analysis consists of three fundamental claims. First, gradable adjectives denote measure functions–functions from individuals to degrees–and the reference value in sentences like (3)-(7) is derived by applying the adjective to the subject. Second, the context-dependent standard in an absolute construction, a measure phrase in an absolute construction, and the comparative clause (the complement of *than* or *as*) perform the same semantic function: they introduce the standard value. Third, degree morphemes denote relations between the reference value and the standard value, i.e, they introduce the degree relation. In the following sections, I will consider these claims in more detail.

2.1.3 Measure Functions

Consider again the traditional analysis of absolute constructions like (3) and (4). What is important to recognize is that the underlying relational characteristics of these constructions in an analysis in which gradable adjectives denote relations between individuals and degrees comes from the meanings of the adjectives themselves. In order to construct the correct truth conditions for the absolute form, the meaning of a gradable adjective must include a function from objects to degrees, an assumption that is implicit in the truth conditions provided for the absolute in chapter 1 (see also

(2) above). For example, the meaning of *dense* must be something like (15), where δ_{dense} is a function from objects to the scale associated with *dense*.

(15) $dense = \lambda d \lambda x[\delta_{dense}(x) \geq d]$

On this view, the meaning of the adjective includes three components: a degree argument, a partial ordering relation, and a function from individuals to degrees, i.e., a *measure function* (for a detailed analysis along these lines, see Bierwisch 1989). If the relational component and the degree argument are removed, however, what remains is a measure function. The proposal that I will develop in the following paragraphs represents, in effect, a decomposition of the traditional meaning of a gradable adjective along exactly these lines.

The hypothesis that gradable adjectives denote measure functions has its roots in the work of Bartsch and Vennemann (1972) (see also Wunderlich 1970). Bartsch and Vennemann propose that the meanings of all gradable adjectives can be stated in terms of a single measure function f^M that takes two arguments: an object x and a scale S.[5] The adjectives *long* and *wide*, on this view, have the interpretations in (16)-(17): they denote functions which project their arguments onto scales of length and width, respectively.

[5]Bartsch and Vennemann actually claim that the second argument of the measure function f^M is a "dimension" rather than a scale. Although they do not explicitly define scales, their definition of a dimension as a "linearly ordered set of values" (p. 67) indicates that their notion of "dimension" is equivalent to the notion of "scale" that I have adopted in this thesis (see the discussion below).

(16) $long = \lambda x.f^M(x, \text{LENGTH})$

(17) $wide = \lambda x.f^M(x, \text{WIDTH})$

Bartsch and Vennemann's approach is designed to reflect the "psychological fact that 'measuring' is a unitary process" (1973:69; cf. Bierwisch 1989). While it may indeed be true that the psychological aspects of measurement should be characterized in terms of a single, general cognitive apparatus, this does not necessarily provide a compelling semantic argument for representing the meanings of all gradable adjectives in terms of a single function. Such an approach can only be justified by linguistic evidence; what turns out to be the case, however, is that the linguistic evidence argues against this view. To see why, it is necessary to take a closer look at scales and degrees.

As in chapter 1, I will assume that a scale is defined as a totally ordered set of points, and that scales are differentiated by their dimensional values (cf. Cresswell 1976). Like Cresswell and Bartsch and Vennemann, I assume that dimensions are semantic primitives: intuitively, a dimension is a quality or attribute that permits grading, or, put another way, a property with respect to which two objects can be compared (see also Sapir 1944 and Bierwisch 1989). As observed in chapter 1, the importance of the dimensional parameter is that it provides a means of distinguishing between two scales: a scale S_1 and a scale S_2 are distinct if and only if they are associated with different dimensions. This distinction provides the basis for a straightforward explanation of incommensurability (see the discussion in chapter 1, section 1.3.3.1): for any two degrees d_1 and d_2, d_1 and d_2 are commensurable just in case they are degrees on the same scale.[6] For example, assuming that the adjectives *tragic* and *long* define functions from objects to scales with different dimensional parameters, and that the comparative morpheme *more* denotes an ordering relation between two degrees, the anomaly of (18) is expected.

(18) #*The Idiot* is more tragic than it is long.

The reference value (the degree to which *The Idiot* is tragic) and the standard value (the degree to which *The Idiot* is long) are degrees on different scales, therefore the relation asserted to hold between the two degrees is undefined.

We can now return to the discussion of Bartsch and Vennemann's proposal. If the interpretation of all gradable adjectives is stated in terms of a single, general measure function and a scale specification, then it follows that no two lexically distinct adjectives share the same scale. For example, since the range of the measure function in the meaning of the adjective *long* is different from that of the measure function in the meaning of *wide*, as illustrated in (16) and (17) above (the former is a scale of length and the latter is a scale of width), it must be the case that the two adjectives project their arguments onto distinct scales. The problem for this analysis is that well-formed examples of comparative subdeletion such as (19) indicate that

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[6] As observed in chapter 1, this follows from the definition of ordering relations. For any two objects x and y, the relations $x > y$, $x < y$, and $x \geq y$ are defined only if x and y are members of the same set. Since scales associated with different dimensions are distinct sets, it follows that two degrees d_1 and d_2 are comparable only if they are degrees on the same scale.

degrees of length and degrees of width are commensurable; according to the analysis of incommensurability outlined above, (19) should be anomalous, however.

(19) Billy-Bob's tie is as wide as it is long.

Since the reference and standard values in (19) are degrees on different scales, the comparison relation should be undefined, and (19) should have the same status as (18). This is clearly the wrong result, as (19) is perfectly interpretable.

This problem could be avoided by assuming that *long* and *wide* share the same scale–for example, a scale along a dimension of "linear extent". If this were the case, then the fact that comparisons like (19) are possible would not be surprising: degrees of width and length would be elements of the same linearly ordered set, so the ordering relation introduced by the comparative would be defined.[7] The problem is that Bartsch and Vennemann's claim that the meanings of all adjectives are defined in terms of a single measure function is incompatible with this assumption. A crucial distinction between e.g. *long* and *wide* is that they may impose different orderings on their domains, even in contexts in which their domains are equivalent. If both adjectives were associated with the same scale and the same measure function, as in Bartsch and Vennemann's analysis, this fact could not be captured.

[7]An alternative solution to the problem posed by examples like (19) would involve assuming that the distinct scales of width and length are somehow similar enough to permit a mapping between them which licenses comparison. This approach weakens the strong constraint on commensurability defined above, however, and raises a number of questions, most important of which is: when are such mappings defined and when are they undefined?

That is, if the interpretations of *long* and *wide* were as shown in (20) and (21), then in a context in which their domains are the same, the analysis would incorrectly predict that the adjectives would impose exactly the same orderings on their domains, since their meanings are characterized in terms of the same measure function.

(20) *long* = $\lambda x.f^M(x,$ LINEAR EXTENT$)$

(21) *wide* =$\lambda x.f^M(x,$ LINEAR EXTENT$)$

Given these considerations, I conclude that the interpretations of gradable adjectives should not be characterized in terms of a single, general measure function. Instead, I will assume that every gradable adjective denotes a *distinct* measure function whose domain is the set of objects that satisfy the selectional restrictions of the adjective and whose range is a scale. This view allows for the possibility that distinct lexical items such as *long* and *wide* have identical dimensional parameters, and so map the objects in their domains to the same scale, predicting that comparisons such as (19) should be possible. But since *long* and *wide* denote *different* functions from objects to the same scale, they may impose distinct orderings on their domains. At the same time, this analysis maintains an account of the functional unity the class of gradable adjectives, which Bartsch and Vennemann derive from the assumption that the meanings of all gradable adjectives are stated in terms of a single measure function. In the analysis proposed here, this unity follows from the fact that gradable adjectives are all of the same semantic type: they are expressions of type $\langle\tau,d\rangle$, functions from expressions of type τ to degrees.

The interpretations of *long* and *wide* on this view can be stated as (22) and (23), where $\lambda x.long(x)$ and $\lambda x.wide(x)$ are distinct functions from objects to degrees on a scale of "linear extent".

(22) $long = \lambda x.long(x)$

(23) $wide = \lambda x.wide(x)$

The intuition underlying the hypothesis that *long* and *wide* denote different functions from objects to the same scale is that although they measure objects according to the same dimension, they do so according to different ("perpendicular") aspects.

An important difference between *long* and *wide* is that the dimensional parameter of *long*, unlike that of *wide*, may take on different values (i.e., *long* is associated with more than one scale). As shown by the examples in (24)-(26), *long* can measure spatial extent, temporal duration, or "page number".

(24) Billy-Bob's tie is long.

(25) The film was long.

(26) *The Brothers Karamazov* is long.

In section 1.1.2 of chapter 1, I referred to the possibility of a gradable adjective being associated with more than one dimension–and by extension, more than one scale–as *indeterminacy*. Within the framework outlined here, indeterminacy is represented as a kind of ambiguity. The lexical entry of any gradable adjective must provide information about its range–i.e., it must include a list of possible values of the dimensional parameter of the adjective, identifying the scale or scales onto which it maps the objects in its domain. The special characteristic of indeterminate (or "non-linear") adjectives like *long* is that they can measure objects with respect to more than one dimension. Since gradable adjectives are functions, however, on any occasion of use *long* must map its argument to some particular value, i.e., a degree on one of the scales with which it is associated. The problem of indeterminacy is the problem of figuring out for utterances of sentences like (24)-(26) which of the possible values of the dimensional parameter of the adjective is intended, which in turn determines the scale onto which it projects its argument.

2.1.4 Degree Constructions

The fundamental difference between the analysis of gradable adjectives as measure functions and the traditional scalar analysis is that in the latter, the meaning of a gradable adjective includes a function from objects to degrees, but this is only one component of the meaning of the adjective: it also includes a degree argument (the standard value) and a comparison relation (a partial ordering relation). In the alternative approach I have advocated, the comparison relation and the degree argument are eliminated, leaving only the measure function as the core meaning of the adjective. The intuition underlying this analysis is that the semantic function of a gradable adjective is to project its argument onto a scale. A result of the analysis is that it provides a starting point for an implementation of the tripartite analysis of propositions constructed out of gradable adjectives that I introduced in section 2.1.1.

Specifically, I suggested that the interpretation of absolute and degree constructions should be characterized in terms of three semantic constituents: a reference value, a standard value, and a degree relation. On this view, the meaning of a sentence like (27) can be paraphrased as (28), which is stated in terms of a partial ordering between two degrees.

(27) The neutron star in the Crab Nebula is dense.

(28) The degree to which the neutron star in the Crab Nebula is dense is at least as great as some standard of denseness (relativized to a comparison class for neutron stars).

The reference value in (28) is the degree to which the neutron star in the Crab Nebula is dense; given the analysis of gradable adjectives as measure functions, this value can be straightforwardly derived by applying the adjective to the subject, as in (29), which returns a degree: the projection of *the neutron star in the Crab Nebula* on a scale of density.

(29) *dense*(*the neutron star in the Crab Nebula*)

The formula in (29) supplies only one of the three constituents in (28), however, raising the following question: where do the standard value and the partial ordering relation come from? The answer that I will pursue here is that both the relational component and the standard value are introduced by the degree morphology. In this section, I will present a semantic analysis of degree morphology that implements this hypothesis, and in section 2.2, I will introduce a syntactic analysis of the adjectival projection that supports a compositional semantics of degree constructions in terms of the proposals made here. Specifically, I will claim, following Abney 1987, Corver 1990, 1997 and Grimshaw 1991, that gradable adjectives project extended functional structure headed by degree morphology. In order to motivate the analysis, I will first reconsider the relation between absolute constructions such as (27) and the more complex comparative constructions.

In the discussion up to now, I have maintained a distinction between absolute and comparative constructions. This distinction is an artifact of the relational analysis, however, since a claim of such an analysis is that the absolute form represents the basic meaning of the adjective, and the interpretations of complex degree constructions are stated in terms of the meaning of the absolute. Once the assumption that adjectives are relational has been discarded, however, the primacy of the absolute disappears. Instead, the line of reasoning that I have pursued here is built on the hypothesis that the basic meaning of a proposition constructed out of a gradable adjective in the absolute form and a proposition containing a more complex degree constructions is the same. Both have three primary semantic constituents: a reference value, a standard value, and a degree relation. (30)-(32) reiterate this point.

(30) Pluto is colder than Neptune.

(31) Jupiter is less cold than Neptune.

(32) Uranus is as cold as Neptune.

The meanings of these sentences can be characterized in exactly the same way as (27), as illustrated by (33)-(35).

(33) The degree to which Pluto is cold exceeds the degree to which Neptune is cold.

(34) The degree to which Jupiter is cold is exceeded by the degree to which Neptune is cold.

(35) The degree to which Uranus is cold is at least as great as the degree to which Neptune is cold.

As in the case of (27), the determination of the reference value in these examples is clear: it is derived by applying the adjective to the subject. What distinguishes (30)-(32) from the absolute construction in (27), is that in the former, it is also clear which constituents introduce the degree relations and the standard values: the degree morphemes and the comparative clauses, respectively. Given the overall parallelism between the interpretation of the absolute construction and the interpretations of the complex degree constructions as presented here, the natural assumption is that the absolute construction contains a phonologically null degree morpheme (cf. Cresswell 1976, von Stechow 1984a). In addition, given the observed dependency between the particular degree morpheme and the morphological form of the "standard marker" (i.e., the fact that *er/more* and *less* require their associated comparative clauses to be marked by *than*, and *as* requires its clause to be marked by *as*), we can assume that the degree morpheme introduces the standard value. On this view, the absolute is *not* fundamentally distinct from morphologically and syntactically complex degree constructions, rather it is a type of degree construction as well.

If this analysis is correct, we can adopt the general interpretation rule for degree constructions shown in (36), where *Deg* is a degree relation, *Ref* is the reference value, and *Stnd* is the standard value.

(36) $||Deg(Ref)(Stnd)|| = 1$ iff $\langle Ref, Stnd\rangle \in Deg$

According to (36), a proposition constructed out of a gradable adjective is true just in case the reference value and the standard value stand in the relation introduced by the degree morpheme. Although this analysis provides an accurate characterization of the truth conditions of propositions involving degree constructions, it does not yet explain an important fact: the predicative constituents in (27) and (30)-(31) denote properties of individuals, not relations between degrees. What remains to be developed is a semantic analysis of degree morphology in which the predicative constituents in these sentences denote properties of individuals.

In order to achieve this result, I will propose that a degree morpheme combines with a measure function (a gradable adjective) and a degree (the standard value) to generate a property of individuals, and it is this property that is the meaning of a degree construction. The basic interpretation of a degree morpheme is given in (37), where G is a gradable adjective meaning, *d* is the standard value, and **R** is the relation introduced by particular degree morphemes (e.g., a partial ordering for the absolute morpheme, a total ordering for *more*, etc.).

(37) $Deg = \lambda G \lambda d \lambda x[\mathbf{R}(G(x))(d)]$

The intuition underlying this analysis is that a degree construction denotes a function that picks out the subset of the domain of a gradable adjective that contains objects whose projection onto the scale associated with the adjective stand in some relation–the relation denoted by the particular degree morpheme involved–to the standard value. On this view, the meaning of a degree construction corresponds roughly to the meaning of a gradable adjective whose degree argument has been saturated in the traditional analysis–with one crucial difference. This difference concerns the relation at the core of a degree construction. In the traditional analysis, the interpretation of a gradable adjective φ is defined in terms of a partial ordering relation, as in (38) (where δ_φ is a function from objects to the scale associated with φ).

(38) $\varphi = \lambda d \lambda x[\delta_\varphi(x) \geq d]$

It follows from this analysis that the property derived by saturating the degree argument of a gradable adjective is always of the form "is at least as φ as the standard value". Quantification over the standard value provides a way of distinguishing between different degree constructions, but the relation between the reference and standard values remains the same: it is a partial ordering relation.

In contrast, the analysis I have advocated here removes the relational component from the meaning of the adjective, leaving only the measure function. As a result, the relation associated with a particular degree construction is determined by the meaning of the degree morpheme that heads the construction, allowing a range of different degree properties to be constructed through the combination of a gradable adjective meaning and whatever degree morphemes the language contains. Consider, for example, (30) and (31), discussed above and repeated below.

(30) Pluto is colder than Neptune.

(31) Jupiter is less cold than Neptune.

The degree morphemes in these examples introduce distinct relations; as a result, the degree constructions in the two sentences are differentiated by the relations they impose between the reference value and the standard value. Assuming that *er/more* introduces the relation "$>$" and *less* introduces the relation "$<$", the "more comparative" in (30) can be assigned the interpretation in (39), and the "less comparative" in (31) can be interpreted as in (40).

(39) $\lambda x[cold(x) > cold(Neptune)]$

(40) $\lambda x[cold(x) < cold(Neptune)]$

(39) denotes the property of being cold to a degree that exceeds the coldness of Neptune; (40) denotes the property of being cold to a degree that is exceeded by the

coldness of Neptune. The properties expressed by (39) and (40) are identical with respect to standard values; they differ only in their relational characteristics.

To summarize, the semantic analysis of degree constructions proposed here consists of two claims. First, the truth conditions of a proposition containing a gradable adjective should be characterized in terms of three primary semantic constituents: a reference value, a standard value, and a degree relation. Second, a degree construction composed of a gradable adjective φ and a degree morpheme *Deg* denotes a property of an individual: the property of being φ to a degree which stands in the *Deg* relation to the standard value. In sections 2.2 through 2.4, I will go through the compositional semantic analysis of absolute and comparative degree constructions in English in detail, showing how interpretations like (39) and (40) are derived from their syntactic representations. Although I will focus on absolute and comparative constructions, a superficial examination of other degree constructions, such as the *too, enough*, and *so...that* constructions in (41)-(43), suggests that the basic approach can be generalized.[8]

(41) Mercury is too hot to support life as we know it.

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[8]Another relevant class of degree constructions is *how* questions such as (i) and (ii).

(i) How close is the nearest galaxy?
(ii) Edric asked how long a light year is.

Assuming that *how* is a degree morpheme, syntactically and semantically on a par with *more, too*, and so on (Corver 1991), then a reasonable hypothesis is that *how* questions involve quantification over degree relations (see Klein 1980 for an approach along these lines).

(42) Hale-Bopp was bright enough for us to see without binoculars.

(43) The black hole at the center of the galaxy is so massive that even light can't escape the pull of its gravity.

If these degree constructions fit into the paradigm outlined here, then it should be possible to state the truth conditions of, for example, (41)-(43) in terms of a relation between a reference value (the degree to which Mercury is hot, the degree to which Hale-Bopp was bright, the degree to which the black hole at the center of the galaxy is massive) and some other value. The paraphrases of (41)-(43) in (44)-(46) suggest that this is indeed possible (cf. Moltmann 1992a:301).

(44) *Mercury is too hot to support life as we know it* is true just in case the degree to which Mercury is hot makes it impossible for the planet to support life as we know it.

(45) *Hale-Bopp was bright enough for us to see without binoculars* is true just in case the degree to which Hale-Bopp was bright made it possible for us to see it without binoculars.

(46) *The black hole at the center of the galaxy is so massive that even light can't escape the pull of its gravity* is true just in case the degree to which the black hole at the center of the galaxy is massive causes it to be true that light can't escape the pull of its gravity.

The difference between degree constructions like (41)-(43) and the absolute and comparative constructions discussed above is that the meanings of the former are characterized in terms of causal relations between degrees and states of affairs, rather than in terms of ordering relations between pairs of degrees. As a result, the question that must be answered is the following: what are the properties of a causal relation between a degree and a state of affairs, and how is such a relation constructed? The answer to this question has important empirical consequences, as statements like (41)-(43) have clear inferences that must be explained. For example, although the argument in (47) is valid, the one in (48) is not.[9]

(47) Kim is too old to qualify for the children's fare.
Sandy is older than Kim.
/∴ Sandy is too old to qualify for the children's fare.

(48) The bottle of milk in my refrigerator is too old to drink.
The bottle of wine in my closet is older than the bottle of milk in my refrigerator.
#/∴ The bottle of wine in my closet is too old to drink.

Although I will leave an investigation of these issues for future work, it should be noted that if a satisfactory answer to the question posed above can be constructed, then the analysis that I have proposed here will succeed in providing a

[9] See also Karttunen 1971 for a discussion of some additional puzzles involving the entailments of *too* and *enough* constructions.

characterization of the meanings of sentences like (41)-(43) without reference to a notion of comparison, a result that is impossible in a traditional relational analysis, which takes a comparison relation to be a basic component of the meaning of gradable adjectives. Since it is not obvious that the truth conditions of these sentences should be stated in terms of a notion of comparison (see footnote 2), this would be a positive result.

2.1.5 Evaluation

In section 2.1.1, I listed several desiderata that a semantic analysis of gradable adjectives and degree constructions should aim to satisfy. First, it should explain the scopal characteristics of the comparative and those of the comparative clause. Second, it should support an explanation of incommensurability, cross-polar anomaly, and comparison of deviation. Third, in order to satisfy concerns about compositionality, it should characterize the interpretation of gradable adjectives independently of a notion of comparison. The explanation of incommensurability in the analysis proposed here was outlined in section 2.1.2 and will be discussed further in section 2.4.1, and the explanation of cross-polar anomaly and comparison of deviation will be the focus of chapter 3. It should be clear that the analysis developed here satisfies the third requirement. Since the relational component is removed from the meaning of a gradable adjective, leaving only the measure function, no notion of comparison is involved in the core specification of a gradable adjective's meaning. At the same time, the interpretation of degree constructions is stated strictly in terms of the composition of a gradable adjective with degree morphology, a point that will become more apparent in the following sections, where I will discuss the compositional analysis of absolute and comparative constructions. This leaves the first point: what are the predictions of the analysis developed here regarding the scopal properties of the comparative and the comparative clause?

A central claim of the analysis of degree constructions outlined in the previous section is that the degree morpheme has no quantificational force; in this respect, it differs from all of the accounts discussed in chapter 1: the scalar analyses of comparatives as existential quantification structures and generalized quantifiers, as well as the vague predicate analysis, which involved existential quantification over degree functions. The empirical consequence of this difference is that it explains why comparatives do not participate in scope ambiguities. If degree morphemes do not head a construction that quantifies over the degree argument of a gradable adjective, then there is no expectation that comparatives (as a type of degree construction) should participate in quantificational scope ambiguities. More importantly, if degree morphemes are components of the predicative expression in a proposition constructed out of a gradable adjective, then their scopal properties should be the same as those of the predicate. Since predicates, in effect, always have narrow scope (i.e., they have no independent scopal characteristics), comparatives and other degree constructions should also always have narrow scope.

To see that this is indeed so, consider the case of negation. In section 1.4.1 of chapter 1, I observed that a sentence like (49) is not ambiguous: it can only be interpreted as a denial that Neptune is colder than Pluto, not as a claim that there is a degree which exceeds the degree to which Pluto is cold, and Neptune is not that cold.

(49) Neptune is not colder than Pluto.

The problem for quantificational analyses of comparatives was that without additional stipulations, such a reading cannot be ruled out: if comparatives are quantificational, then like other quantificational expressions, they should interact with negation to generate scope ambiguities. That is, a quantificational analysis should permit the two logical representations for (49) in (50) and (51): one in which the comparative has scope inside negation ((50), which represents the actual interpretation of (49)), and one in which the comparative has scope outside negation ((51), which represents the impossible interpretation).

(50) $\neg\exists d[d > max(\lambda d'.cold(Pluto,d'))][cold(Neptune,d)]$

(51) $\exists d[d > max(\lambda d'.cold(Pluto,d'))]\neg[cold(Neptune,d)]$

In contrast, the analysis of comparatives as degree properties generates a single logical representation for (49). Assuming that negation has clausal scope, (49) has the interpretation in (52): it asserts that it is not the case that Neptune has the property of being colder than Pluto.

(52) $\neg[(cold(Neptune)) > (cold(Pluto))]$

The failure of comparatives to show scope ambiguities in other contexts (e.g., in the scope of universal quantifiers, intensional contexts, etc.) can be explained in the same way.

Although the facts discussed in chapter 1 indicated that the comparative construction did not participate in scope ambiguities, this was not true of the comparative clause. Examples like (53) and (54), which have "sensible" (*de re*) and "contradictory" (*de dicto*) interpretations were presented as evidence that the comparative clause does show scope ambiguities in intensional contexts.

(53) Karl thought Neptune was colder than it was.

(54) If Venus were less hostile than it is, we would be able to land a probe on its surface.

Unlike the relational analysis, in which the standard value is denoted by the entire comparative construction (which includes the comparative clause as a subconstituent), the analysis that I have outlined in this section claims that the standard value is denoted by the comparative clause. In other words, in the analysis proposed here, it is the comparative clause that denotes the "degree argument" in a degree construction. If the comparative clause denotes an actual argument, then the fact that it participates in scope relations is not surprising. The exact way in which it interacts with other expressions to trigger scope ambiguities should be explained in terms of its internal semantics (e.g., whether it is a type of definite description, as I have assumed here, or a universal quantification structure); this is not a question that I will address here, but see Kennedy 1997c for arguments that the comparative clause is a type of definite description (see also Russell 1905, Hasegawa 1972, Postal

1974, Horn 1981, von Stechow 1984a, Larson 1988a, Lerner and Pinkal 1992, 1995, and others for relevant discussion).

2.1.6 Historical Context

Before moving on to a more detailed look at the compositional analysis of specific degree constructions, the approach to the semantics of gradable adjectives and degree constructions that I have proposed here should be situated in the context of previous work. In general terms, the analysis of gradable adjectives as measure functions bears some similarity to the analysis of gradable adjectives in the vague predicate analysis: in both accounts, gradable adjectives denote functions, and the interpretation of complex degree constructions involves the composition of degree morphology with the adjective to generate a complex property that is applied to the subject. The crucial difference between the measure function analysis and the vague predicate analysis is that the former includes the core assumptions of a scalar approach: scales and degrees are part of the ontology, and gradable adjectives define mappings from objects to degrees. More generally, the measure function analysis derives the ordering on the domain of a gradable adjective from a semantic property of the adjective itself, as does the traditional scalar analysis; it does not assume an inherent ordering on the domain, as the vague predicate analysis does. Since a scale is defined as a totally ordered set of points (degrees), a consequence of the analysis of gradable adjectives as functions from objects to degrees is that they are ordering functions, i.e., functions that directly impose an ordering on their domains by associating objects with degrees on a scale.[10]

In this respect, the measure function analysis is also similar to a "fuzzy logic" approach (see e.g. Lakoff 1972, 1973, Zadeh 1971). The basic claim of a fuzzy logic approach is that (at least some) expressions that are analyzed in classic model theory as functions from expressions of type τ to $\{0,1\}$ (e.g., adjectives and other one-place predicates) should instead be construed as a functions from objects of type τ to the interval $[0,1]$–the set of real numbers between 0 and 1, inclusive. Intuitively, functions of this type map objects to numerical values that represent the degree to which the object manifests some gradable property, for example, *tallness*. When objects that are definitely not tall are substituted for x in the formula $tall(x)$, the result is 0, for objects that are definitely tall the result is 1, and for all other objects, the result is some real number between 0 and 1. Comparison in this type of approach involves evaluating the values of $\varphi(x)$ and $\varphi(y)$ against a particular ordering relation (i.e., "$>$", " $<$", or "$\geq$").

Klein (1980) criticizes this analysis for failing to make a distinction among objects that definitely possess a gradable property like tallness, pointing out that in a context in which two objects a and b are both definitely tall, but a is taller than b, the value of $tall(a)$ and $tall(b)$ in a fuzzy logic analysis would be the same: 1. As a result, the proposition denoted by *a is taller than b* would incorrectly turn out to be false. Klein's objection could be handled by assuming that gradable adjectives denote functions into the set of real numbers between 0 and 1 *exclusive* (the open interval

[10] I will return to a more detailed discussion of the ordering characteristics of measure functions when I discuss the monotonicity properties of gradable adjectives in chapter 3.

(0,1)) such that for all x and y in the domain of φ, $\varphi(x) = \varphi(y)$ just in case $x = y$ in φ-ness.

Given this assumption, a fuzzy logic analysis and a measure function analysis are indeed fundamentally the same, except for one important and empirically significant difference: the dimensional feature of scales. The crucial effect of the dimensional value is to distinguish one scale from another, a distinction that provides the basis for the explanation of incommensurability (see section 1.3.3.1 in chapter 1). In a fuzzy logic analysis, all gradable adjectives denote functions from individuals to (0,1); as a result, this analysis would incorrectly predict that all adjectives should be commensurable, a prediction that is not supported by the facts.[11]

Finally, the hypothesis that the meaning of a proposition constructed out of a gradable adjective should be characterized in terms of a reference value, a standard

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[11]At the same time, the mechanics of the fuzzy logic analysis may provide the basis for a formal analysis of *metalinguistic comparison*, a phenomenon exemplified by (i).

(i) Bob is more "vertically challenged" than "short".

As noted by McCawley (1988:673) (see also Klein 1991), a comparative like (i) does not compare degree to which Bob is vertically challenged with the degree to which he is short, but rather the degree to which it is appropriate to *describe* Bob as vertically challenged with the degree to which it is appropriate to describe him as short. An important characteristic of metalinguistic comparisons is that they may be constructed out of otherwise incommensurable adjectives (see chapter 1, footnote 9), which suggests that the fuzzy logic approach may provide a good foundation upon which to build an analysis of these constructions, as well as a basis for explaining how an interpretation is constructed for constructions whose standard interpretations are anomalous. These are not issues that I will attempt to address here, however.

value, and a degree relation has its roots in Russell's (1905) analysis of the comparative construction as a relation between two definite descriptions (see fn. 4), and it is similar to the generalized quantifier analyses of comparatives discussed in chapter 1 (e.g., Moltmann 1992a; see also Postal 1974, Cresswell 1976, and Williams 1977). For example, the interpretation of a sentence like (55) in a generalized quantifier analysis is (56) (see the discussion in chapter 1, section 1.4.5 for details).

(55) Pluto is colder than Neptune.

(56) $more(\lambda d.cold(Neptune,d))(\lambda d.cold(Pluto,d))$

The truth of (56) is dependent on whether the arguments of the comparative operator (which are derived by abstracting over the degree variable introduced by the adjective) satisfy the relation introduced by *more*–proper inclusion. (56) is true just in case the set of degrees to which Pluto is cold properly includes the set of degrees to which Neptune is cold.

The analysis developed in the previous section is similar in that the comparative morpheme defines a relation between two expressions–the standard value (the degree to which Pluto is cold) and the reference value (the degree to which Neptune is cold)–but it differs crucially in the semantic analysis of the comparative morpheme. Instead of combining with two property-denoting expressions, as in (56), the comparative morpheme combines directly with a gradable adjective and a standard-denoting expression to generate the property in (57), which, when applied to the subject, derives the proposition in (58).

(57) $\lambda x[cold(x) > cold(Neptune)]$

(58) $cold(Pluto) > cold(Neptune)$

The logical representation in (58) differs from (56) in two crucial respects. First, since gradable adjectives are analyzed as measure functions, it implements the hypothesis that the reference and standard values are primary constituents of the proposition denoted by (55) more directly than the generalized quantifier analysis, which achieves this result only by abstracting over the degree variable introduced by the adjective. Second, and most importantly, the degree morpheme has no quantificational force. As a result, it does not make incorrect predictions about the scopal properties of comparatives and other degree constructions.

2.2 The Extended Projection of A

The analysis of degree constructions developed in the previous section claimed that a degree morpheme combines directly with a gradable adjective and a standard-denoting expression to create a property of individuals, which is then applied to the subject. In subsequent sections, I will go through the compositional semantic analysis of the syntactic structures in which degree morphemes appear in some detail, focusing on absolute and comparative constructions. Before I do this, however, I will lay out my general assumptions about the syntax of degree constructions.

Following Abney 1987, I assume that adjectives, like nouns and verbs, project extended functional structure (see also Corver 1990, 1997, Grimshaw 1991).

Specifically, I assume that the extended projection of A is headed by a degree morpheme, i.e., a member of {*ø, er/more, less, as, so, too, enough, how, this, that*} (where *ø* is the phonologically null morpheme associated with the absolute construction). I will further assume that the comparative clause–the constituent headed by *than* or *as* in comparatives and equatives, the non-finite clause in a *too/enough* construction, and the finite clause associated with *so*–is selected by Deg° but adjoined to Deg'.[12] (59) illustrates the basic structure of the extended projection

[12] I.e., the comparative clause is a selected adjunct, syntactically on a par with the selected adjuncts of verbs like *word* or *behave*. Nothing in the analysis hinges on this decision, but there is evidence from *wh*-extraction facts in *too/enough* constructions that the comparative clause is an adjunct rather than a complement of Deg° (as suggested in Abney 1987). The contrast between (i) and (ii) illustrates the well-known fact that extraction of a complement out of an adjunct phrase is possible, while extraction of an adjunct out of an adjunct is impossible. (iii) and (iv) show that, in contrast, both arguments and adjuncts can be extracted out of a complement clause.

(i) Who$_i$ did Audrey [$_{VP}$ [$_{VP}$ leave] [to see t_i]]

(ii) *When$_i$ did Audrey [$_{VP}$ [$_{VP}$ leave] [to see her boss t_i]]

(iii) Who$_i$ did Audrey [$_{VP}$ decide [to see t_i]]

(iv) When$_i$ did Audrey [$_{VP}$ decide [to see her boss t_i]]

If the comparative clause were a complement of Deg°, extraction of arguments and adjuncts should be equally acceptable, as in (iii) and (iv). If, on the other hand, the comparative clause is an adjunct, we should see an asymmetry between argument and adjunct extraction, as in (i) and (ii). The following facts show that this is indeed the case: (v) and (vii) show that arguments can be extracted out of the nonfinite clauses introduced by *too* and *enough*, while (vi) and (viii) show that extraction of adjuncts is impossible.

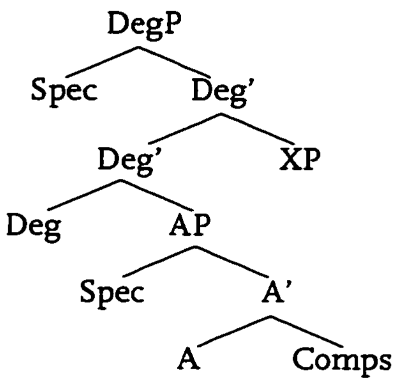
(v) Who$_i$ was Audrey angry enough [to criticize e$_i$]

(vi) *How obnoxiously$_i$ was Audrey angry enough [to criticize her boss e$_i$]

(vii) Which car$_i$ was Tim too scared [to drive e$_i$]

of A, where XP is the constituent that introduces the comparative clause.

(59) *The extended projection of A*



Since degree morphemes are heads, they can impose restrictions on the types of arguments they allow. Thus *more* and *less* can be lexically specified to require XP to be a PP headed by *than*; *as* to require XP to be a PP headed by *as*; and so on for the other degree morphemes.

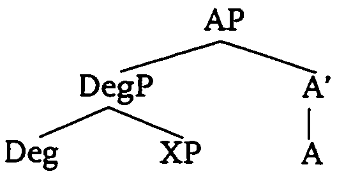
In many respects, (59) reflects a natural approach to the syntax of degree constructions, given the success of similar approaches to nominal and clausal structure (see Grimshaw 1991 for an overview). Other than the work cited above, however, this analysis has not received a great deal of attention.[13] There are at least two reasons for this. The first is the strength of the traditional analysis of the syntax

(viii)*How quickly$_i$ was Tim too scared [to drive the Fiat e_i]

[13] Although see Izvorski 1995 and Larson 1991 for a related approach in which degree constructions are analyzed as DP-shell structures (cf. Larson's 1988b analysis of double object constructions).

of AP, articulated in Bresnan's (1973) seminal work on the syntax of comparatives. The core of Bresnan's analysis, modified slightly here to fit in with more current conceptions of phrase structure, is that degree constructions (which on her analysis consist of degree morphemes and their associated clauses) and measure phrases are base generated as constituents in the specifier of AP (see also Bowers 1970, Selkirk 1970, Jackendoff 1977, Hellan 1981, McCawley 1988, Hazout 1995). The basic structure of degree constructions within this type of analysis is shown in (60) (absolute constructions with measure phrases have essentially the same structure, differing only in the substitution of a measure phrase for DegP).[14]

(60)



A particularly appealing aspect of (60) is that it supports a straightforward compositional semantics of degree constructions in the context of a relational analysis of the interpretation of gradable adjectives: the constituent which occupies the specifier of AP denotes the degree argument of the head of AP. Recall from the

[14] In order to derive the correct surface word order, Bresnan (1973) claims that the complement of Deg°–the comparative clause or PP–must extrapose. This assumption is shared by most syntactic analyses in which degree morphemes are specifies of AP, in order to capture the syntactic subcategorization relation between the various degree morphemes and the clausal or prepositional constituents they are associated with. An exception is the analysis in Jackendoff 1977, in which the comparative clause is base generated in a right-adjoined position.

discussion in section 2.1 that the meaning of a gradable adjective φ in the relational account is (61), where δ_φ is a function from objects to degrees on the scale associated with φ.

(61) $\varphi = \lambda d \lambda x[\delta_\varphi(x) \geq d]$

The interpretation of a structure like (62) is straightforward: the measure phrase provides the degree argument of the adjective, and the sentence has the interpretation in (63), with the truth conditions in (64).

(62) $[_{IP}$ Benny is $[_{AP}$ $[_{DP}$ 4 feet] tall]]]

(63) $\delta_{tall}(Benny) \geq 4\ feet$

(64) $||\delta_{tall}(Benny) \geq 4\ feet|| = 1$ iff the degree to which Benny is tall is at least as great as the degree denoted by *4 feet.*

More complex degree constructions such as the comparative in (65) are interpreted in a similar way. Comparatives (and other degree constructions) quantify over the degree variable introduced by the adjective; assuming that quantificational expressions are subject to an operation of Quantifier Raising (May 1977, 1985), the degree phrase in (65) adjoins to a clausal node at LF, as shown in (66).[15]

[15] Following Bresnan 1973 (see also Hellan 1981, Heim 1985, McCawley 1988, Moltmann 1992a, Hazout 1995, Rullmann 1995, and others), I assume that the degree construction is a constituent at LF (i.e., that the *than*-constituent is extraposed in the PF component or is reconstructed prior to QR). I also assume that the "missing" material in the comparative

(65) Jupiter's atmosphere is more violent than Saturn's atmosphere is.

(66) $[_{IP}$ $[_{DegP}$ more than Saturn's atmosphere is $[_{AP}$ e_i **violent**$]]_i$ $[_{IP}$ Jupiter's atmosphere is $[_{AP}$ e_i violent$]]]$

The interpretation of a structure like (66) can then be formalized either in terms of existential quantification over degrees, as in the degree description analysis discussed in chapter 1, section 1.4, or in terms of the generalized quantifier analysis discussed in chapter 1, section 1.4.6. In the former analysis, the interpretation of (66) is (67), in which the degree construction provides the restriction for an existential quantifier; in the latter analysis, the interpretation of (66) is (68), in which the comparative morpheme is analyzed as a relation between the comparative clause and the main clause.

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clause is recovered through an ellipsis-resolution mechanism whereby missing material is reconstructed under identity with the AP in the matrix clause. In other words, I assume that the resolution of comparative "deletion" in an example like (65) is parallel to the resolution of antecedent-contained deletion (ACD) in an example like (i), which has the Logical Form in (ii) after QR and recovery of the elided material (see May 1985, Larson and May 1988, and Kennedy 1997a for discussion).

(i) Kollberg recognized everyone that Beck did.

(ii) [[everyone that [Op_i Beck did **recognized** e_i]]$_i$ [Kollberg recognized e_i]]

Note in particular that, just as in ACD, recovery of the matrix AP in comparative deletion introduces a A-bar trace. If the comparative clause is an operator-variable construction, as argued in Chomsky 1977, then this trace provides a variable for the operator in the comparative clause to bind, just as recovery of the elided VP in ACD provides a variable for the relative operator to bind. I will return to a more detailed discussion of the syntax of comparative deletion in section 2.4.2 below.

(67) $\exists d[d > \textsc{max}(\lambda d'.violent(Saturn's\ atmosphere,d'))][violent(Jupiter's\ atmosphere,d)]$

(68) $more[\lambda d'.violent(Saturn's\ atmosphere,d')][\lambda d.violent(Jupiter's\ atmosphere,d)]$

The logical representations in (67) and (68) are exactly the same as those used in chapter 1, and can be evaluated as discussed there.

This discussion brings into focus the second explanation for the lack of attention to the extended projection analysis of degree constructions. Although numerous researchers have discussed the semantic analysis of comparatives and other degree constructions within the context of a syntactic analysis along the lines of (60) (see e.g. Hellan 1981, Heim 1985, McCawley 1988, Hazout 1995), there has been virtually no discussion of how extended projection structures such as (59) should be interpreted.[16] An immediate problem is that the syntax of extended projection appears to be inconsistent with a relational analysis of gradable adjectives, given standard assumptions about the syntactic representation of argument structure. Within the syntactic tradition of the Principles and Parameters approach, which is the framework I am assuming here, the basic assumption about the relation between a head and its arguments is that arguments of a lexical head are generated either as complements or specifiers. In (59), however, neither of these relations obtain. Instead, the relation between the lexical head (the adjective) and its argument appears to be reversed: the maximal projection of the adjective is the complement of

[16]Abney (1987) includes some general discussion of how the structure in (59) might be interpreted, but this discussion does not go into the level of detail required for a complete semantic analysis (as Abney himself observes).

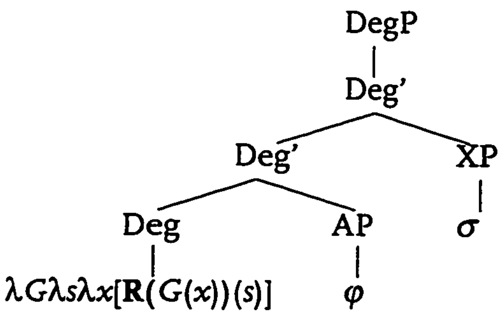
Deg°–the expression which, in a relational analysis, should head one of its arguments.

In fact, it is exactly this relation between the degree morpheme and the adjective phrase that makes the extended projection structure in (59) ideally suited for a compositional semantic analysis of degree constructions in terms of the proposals made in section 2.1. According to these proposals, the interpretation of a gradable adjective φ is a function from objects to degrees on the scale identified by the dimensional parameter of φ, and the interpretation of a degree morpheme is as shown in (69), where the value of the relation **R** is determined by the particular degree morpheme.

(69) $Deg = \lambda G \lambda d \lambda x[\mathbf{R}(G(x))(d)]$

Given these assumptions, the compositional interpretation of the extended projection of a gradable adjective (i.e., DegP) is straightforward. Consider, for example, the structure in (70), where σ denotes the standard value.

(70)



In (70), in which the adjective has a single argument, the denotation of AP is just the denotation of its head: a measure function.[17] Deg° composes with AP to generate a function from standard values to individuals–an expression of the same semantic type as a gradable adjective in the relational account (see the discussion of this point in section 2.1.4). This complex expression combines with the standard-denoting expression, generating a function from individuals to truth values, with the result that DegP denotes a property of individuals, specifically, the property of having a degree of φ-ness that stands in the relation introduced by the degree morpheme to the standard value. The steps in the composition of (70) are shown in (71).

(71) Deg(AP): $\lambda G \lambda d \lambda x[\mathbf{R}(G(x))(d)](\varphi) \Rightarrow \lambda d \lambda x[\mathbf{R}(\varphi(x))(d)]$

Deg'(XP): $\lambda d \lambda x[\mathbf{R}(\varphi(x))(d)](\sigma) \Rightarrow \lambda x[\mathbf{R}(\varphi(x))(\sigma)]$

DegP: $\lambda x[\mathbf{R}(\varphi(x))(\sigma)]$

In the following sections, I will take a closer look at the structure and interpretation of absolute and comparative degree constructions in predicative position. I should point out that my goal here is not to undertake a complete

[17]Many gradable adjectives, for example, *eager* and *quick*, can have internal arguments as well, as in (i-ii).

(i) Beck was eager to finish the investigation.

(ii) Kollberg was quick to poke holes in Larsson's theory.

Note that it is the external argument that is graded in these examples, just as in the simpler examples with a single argument. Assuming that the semantic type of adjectives like *eager* and *quick* (on the interpretations in (i-ii)) is ⟨⟨s,t⟩,⟨e,d⟩⟩, after the internal argument is saturated, the semantic type of AP ⟨e,d⟩: AP denotes a measure function.

syntactic analysis of the full range of degree constructions in English (see Corver 1990, 1997, and Abney 1987 for more detailed discussion of these issues); instead, I will focus on showing how the syntax of extended projection supports a straightforward compositional semantics for comparative and absolute constructions in terms of the proposals in section 2.1.

2.3 Absolute Constructions

2.3.1 Overview

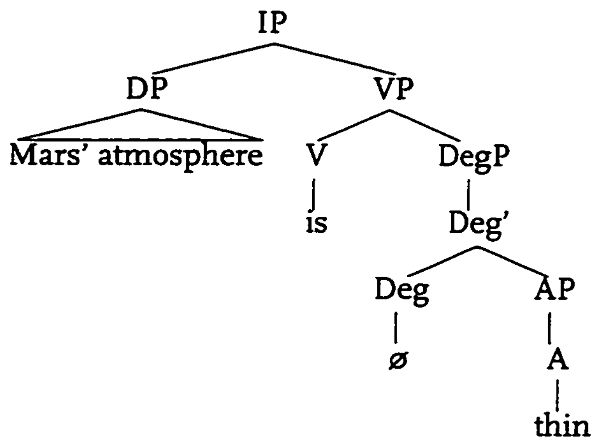
In section 2.1.4, I claimed that gradable adjectives in the absolute form, such as *thin* and *wide* in (72) and (73), should be analyzed as heading degree constructions in which the degree morpheme is phonologically null.

(72) Mars' atmosphere is thin.

(73) The asteroid belt is 50 million miles wide.

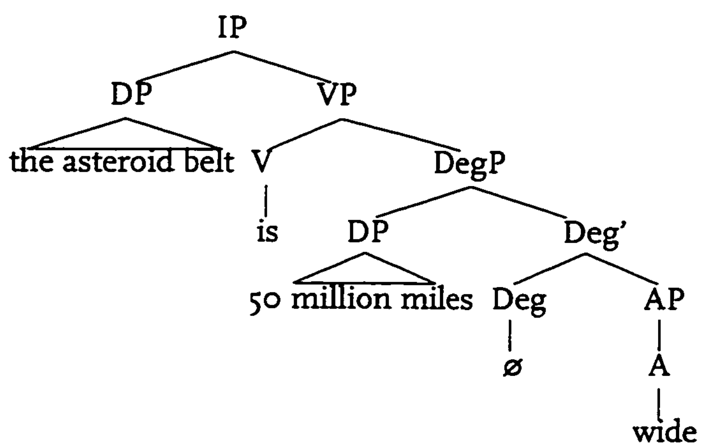
If this is correct, then according to the syntactic assumptions laid out in section 2.2.1, the structure of (72) should be (74).

(74)



Similarly, assuming that the measure phrase *50,000 miles* in an example like (73) is generated in the specifier of DegP (Abney 1987), the syntactic representation of (73) is (75).

(75)



Let us consider first the interpretation of absolute constructions with overt measure phrases, such as (75). Like other degree morphemes, the absolute morpheme should denote an expression of the form in (69), repeated below.

(69) $Deg = \lambda G \lambda d \lambda x[\mathbf{R}(G(x))(d)]$

What needs to be determined is the value of **R**: the relation introduced by the absolute morpheme. Following a tradition of work on gradable adjectives (see Bartsch & Vennemann 1972, Bierwisch 1989, Gawron 1995 and the discussion in chapter 1, section 1.3.1), I will assume that the ordering associated with the absolute is a partial ordering relation.[18] The meaning of the absolute morpheme can then be formalized as in (76) (where ABS is the interpretation of the null morpheme in the logical representation language), and the truth conditions for absolute constructions can be stated as in (77).

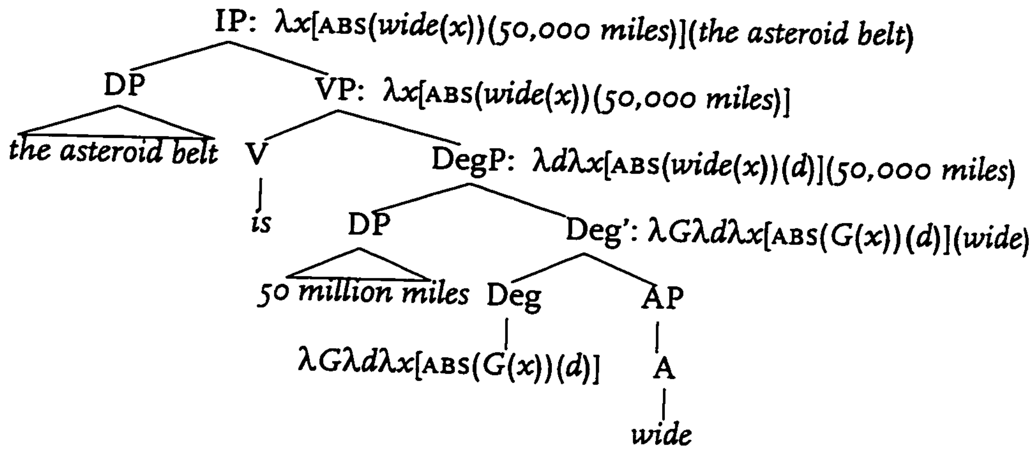
(76) $[_{Deg}\varnothing] = \lambda G \lambda d \lambda x[\mathrm{ABS}(G(x))(d)]$

(77) $||\mathrm{ABS}(d_1)(d_2)|| = 1 \text{ iff } d_1 \geq d_2$

Given these assumptions, the compositional analysis of (75) is as shown in (78) (I assume that measure phrases denote degrees; see Cresswell 1976, Klein 1980, 1991, von Stechow 1984a,b, and Gawron 1995 for discussion).

[18] Nothing hinges on the analysis of the absolute in terms of a partial ordering relation instead of one of equality. If, for example, Carston's (1988) claim that adjectives are ambiguous between an "at least as" and an "exactly" interpretation is correct, the analysis of the absolute presented here can be reworked accordingly. See chapter 1, section 1.4.2 and Horn 1992 for discussion of this issue.

(78)



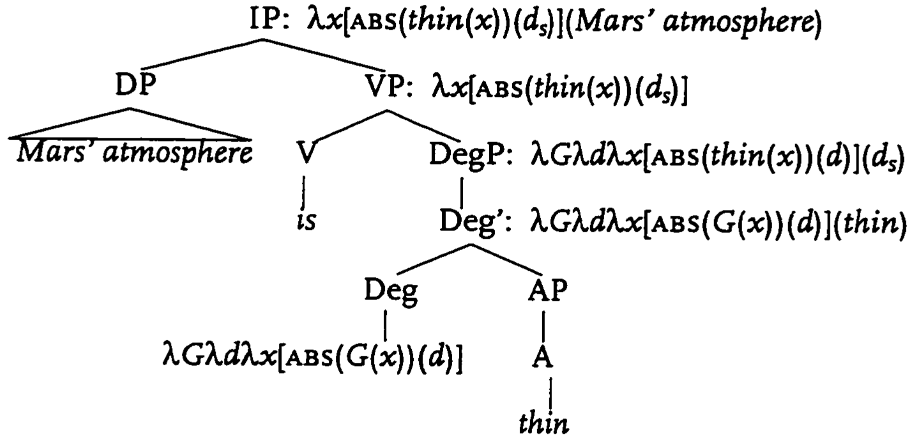
The degree morpheme combines with the gradable adjective, generating a function from degrees to individuals. Saturation of the degree argument by the measure phrase derives a property of individuals which, when applied to the subject, returns the formula in (79) (I am ignoring the contribution of *be* and the tense morphology).

(79) ABS(*wide*(*the asteroid belt*))(*50 million miles*)

According to the truth conditions in (77), (79) is true just in case the degree to which the asteroid belt is wide is at least as great as the degree denoted by the measure phrase 50 *million miles.*

The analysis of absolute adjectives without measure phrases, such as (72), is somewhat more complex, since, as observed in chapter 1, the standard value must be contextually determined, possibly with respect to a particular comparison class. For example, the compositional analysis of a sentence like (72) should reflect the fact that (72) is true just in case the degree to which Mars' atmosphere is thin is at least as great as a standard of thinness for planetary atmospheres. One way to achieve this result is to assume that the value of the standard argument can be set indexically when there is no overt measure phrase (see e.g. Cresswell 1976, von Stechow 1984a, Bierwisch 1989, Lerner and Pinkal 1992, Gawron 1995). Semantic composition is parallel to examples with measure phrases; the difference is that we must introduce a variable to saturate the standard argument, which I have indicated as d_s in (80).

(80)



Since d_s is a free variable, its value must be determined by a function from contexts to degrees. The general form of this function must be such that it assigns a value to a degree based on an appropriate comparison class; in the interpretation of (80), shown in (81), this function should assign to d_s a value of thinness that corresponds to a standard for planetary atmospheres.[19]

[19] It should be noted that it is generally possible to override the context-dependent interpretation of an absolute construction in favor of a "global standard", as observed by Ludlow (1989). For example, a sentence like (i) can clearly be construed as a claim about the size of planets in some very general sense.

(i) No planet is small.

This reading makes the claim that there are no planets that are small in a general sense of

(81) $\textsc{abs}(\mathit{thin}(\mathit{Mars'\ atmosphere}))(d_s)$

2.3.2 Implicit Standards and Comparison Classes

Klein (1980) presents an important argument against an analysis that treats the standard variable as an indexical expression. Klein observes that a general characteristic of indexical expressions is that they cannot change value under VP ellipsis. For example, the second conjunct of (82) can only mean that Mars Pathfinder took pictures of whatever Viking did, not that Mars Pathfinder took pictures of some other thing.

(82) Viking took pictures of it, and Mars Pathfinder did too.

If the standard variable in a formula like (81) is interpreted indexically, as described above, then like the pronoun in (82), its value should remain constant under VP ellipsis. Example (83), from Ludlow 1989, shows that this need not be the case: this sentence asserts that *that elephant* is large for an elephant and *that flea* is large for a flea (i.e., that the degrees to which *that elephant* and *that flea* are large are at least as great as standards of largeness for elephants and fleas, respectively); (83) does not

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smallness, but at the same time, it allows for the existence of small planets (i.e., planets that are small with respect to a comparison class made up of planets and other celestial bodies). One way of accounting for readings of this sort, suggested by Ludlow, is to allow the comparison class to be expanded to include larger portions of the domain of the adjective (and possibly the entire domain).

mean that *that flea* is large for an elephant.

(83) That elephant is large, and that flea is too.

(84) Beck is tall, and his 6 year old daughter is too.

(84) makes a similar point: this sentence can only mean that Beck is tall for a man and his daughter is tall for a 6 year old girl (assuming that Beck is an adult male). What examples like these show is that the value of the standard variable need not remain constant under ellipsis. If the value of the standard variable were set indexically, however, like the pronoun in (82), then we would expect (83) and (84) to have interpretations in which the respective comparison classes do not vary under ellipsis.

In order to construct a solution to this problem, we need to take a closer look at the computation of the standard value. In the discussion of (81) above, I claimed that the value of the standard degree is determined relative to an appropriate comparison class. Klein (1980:13) defines a comparison class as "a subset of the domain of discourse which is picked out relative to a context of use". For example, in a context in which it is known that the individual named *Lana* is a chimp, (85) is understood to mean (86); in other words, the comparison class is the set of chimps.

(85) Lana is intelligent.

(86) Lana is intelligent for a chimp.

(86) illustrates another important fact: the comparison class can be explicitly identified by an indefinite in an adjoined *for*-PP. (87) and (88) make the same point.

(87) Mercury is small for a planet.

(88) Mookie is short for a basketball player.

Taking these examples as a starting point, let us assume that the indefinites in (86)-(88) introduce properties of individuals that are used as the basis for constructing a comparison class; for concreteness, I will refer to such properties as "comparison properties".[20] The hypothesis that a property-denoting expression is used to determine a comparison class is a component of analyses in which the attributive form of a gradable adjective is taken to be basic (see Parsons 1972, Montague 1974, Cresswell 1976, Lerner and Pinkal 1992; cf. Kamp 1975, Klein 1982). In such analyses, what I have called the "comparison property" is supplied by a common noun meaning, e.g. *planet* in (89).

(89) Mercury is a small planet.

[20]The hypothesis that the indefinites in examples like (86)-(88) are property-denoting expressions receives some support from an unusual parallelism between indefinites in absolute *for*-PPs and predicative indefinites: the former show the same agreement patterns as the latter, as illustrated by (i)-(ii).

(i) Mercury and Pluto are small for planets/*a planet.

(ii) Mercury and Pluto are planets/*a planet.

Building on these observations, I will propose that the absolute degree morpheme is ambiguous between the interpretation given above in (76) and repeated below, in which the standard value is introduced by a degree, and the interpretation in (90).

(76) $[_{Deg}\emptyset]_1 = \lambda G \lambda d \lambda x[\text{ABS}(G(x))(d)]$

(90) $[_{Deg}\emptyset]_2 = \lambda G \lambda P \lambda x[\text{ABS}(G(x))(\text{STND}(G)(P))]$

(90) differs from (76) in two crucial ways. First, the second argument of the degree morpheme is a comparison property, rather than a degree, and second, the meaning of the degree morpheme includes a "standard-identification" function, which I have represented as "STND" in (90). This function takes a gradable adjective and a comparison property as arguments and returns the degree on the scale associated with the adjective that represents the appropriate standard value for that property. Although I will not attempt to work out the details of this computation, a fairly straightforward hypothesis suggests itself: assume that STND takes the degrees in the range of G that are related to objects in the extension of P (in some world), and returns the mean (cf. Bartsch and Vennemann 1973). Note that despite the compositional differences between (90) and (76), they are the same in an important respect: since the value of $\text{STND}(G)(P)$ is a degree, the truth conditions for absolutes with implicit standards are exactly the same as those for absolutes with measure phrases; i.e., they are as stated above in (77). (90) thus preserves the general analysis of the absolute construction as a relation between a reference value and a standard value, differing only in incorporating the determination of the standard into the

meaning of the degree morpheme (see von Stechow 1984a for a similar proposal in the context of a relational analysis of gradable adjectives).[21]

The interpretation of examples like (86)-(88) is straightforward: the value of P is supplied by the indefinite in the *for*-clause. Note that since the interpretation of the absolute morpheme in (90) "presaturates" the degree argument, the analysis predicts that measure phrases and comparison properties should be in complementary distribution. (91)-(92), which show that sentences with both a measure phrase and a "*for-indefinite*" phrase are ill-formed, verify this prediction.

(91) *Benny is 4 feet tall for a 10 year old boy.

(92) *The class was 3 hours long for a discussion section.

As it stands, however, this analysis does not yet provide a solution to Klein's objection, because in examples (72) and (85), it is still necessary to supply a value for the

[21] Once the degree morpheme in (90) composes with a gradable adjective φ, the resulting complex expression denotes the relation between properties and individuals shown in (i).

(i) $\lambda P \lambda x[\textsc{abs}(\varphi(x))(\textsc{stnd}(\varphi)(P))]$

(i) is very similar to the analysis of gradable adjectives in Lerner and Pinkal 1992, in which the attributive form is taken to be basic. This is a positive result, since it provides a basis for building a semantics for absolute constructions in their attributive use. Note that the question of whether the attributive form of a gradable adjective is basic disappears in the analysis proposed here, since the meaning of the adjective–a measure function–remains constant regardless of the interpretation of the absolute morpheme.

comparison property. Crucially, we cannot assume that the comparison property is supplied indexically (as in e.g. Lerner and Pinkal 1992), because such an analysis would also make incorrect predictions in the case of VP ellipsis (see Klein 1980:15 for discussion).

The observations made above about the meanings of examples like (72) and (85) suggest a solution to this problem. These examples indicate that when the comparison class is implicit, its value is in some way dependent on the denotation of the subject. More precisely, the comparison class is identified based on some property possessed by the subject that is determined to be relevant in the context of utterance–in (85), the property of being a chimp; in (72), the property of being a planetary atmosphere. This observation provides the starting point for a semantic analysis of absolute constructions with implicit standards that maintains a certain amount of context-dependency, but also explains the ellipsis facts discussed by Klein. Specifically, I will assume that when a comparison property is not explicitly introduced, as in simple absolute constructions like (72) and (85), its value is determined in one of two ways. Either P receives some default value, in which case the degree introduced by the formula $\textsc{stnd}(G)(P)$ is a "global standard" for G (see footnote 19; for psychological evidence that gradable adjectives are associated with global standards, see Rips and Turnbull 1980), or the value of P is determined by a context-dependent function $\mathbf{p}$ that takes an individual as argument and returns a comparison property based on the value of its argument. To account for the observation that the comparison class is determined by property of the subject, I will further assume that the argument of $\mathbf{p}$ is constrained to be identical to the external argument.

Given these assumptions, the interpretation of the degree phrase in (72), repeated below, is the degree property in (93).

(72) Mars' atmosphere is thin.

(93) $\lambda x[\text{ABS}(thin(x))(\text{STND}(thin)(\mathbf{p}(x)))]$

(93) denotes the property of being thin to a degree that is at least as great as a standard of thinness determined on the basis of a contextually salient property of the target of predication. Composition of the property in (93) with the subject derives (94).

(94) $\text{ABS}(thin(Mars'\ atmosphere))(\text{STND}(thin)(\mathbf{p}(Mars'\ atmosphere)))$

Assuming that the value of $\mathbf{p}(Mars'\ atmosphere)$ (the comparison property) is something like "is a planetary atmosphere", the standard value in (94) is the degree on the scale associated with *thin* that identifies a norm of thinness for planetary atmospheres. The crucial difference between (94) and the logical representation in (81) is that the computation of (94) includes resolving an explicit semantic dependency between the standard value and the subject, as specified in (93).

This dependency explains the ellipsis facts observed by Klein. Although the analysis developed here maintains the position that the determination of the standard value is context-dependent, it locates the indexicality in the function **p**, which determines which of the set of properties associated with its argument should be used as the basis for determining the standard value. Crucially, since the argument of **p** is constrained to be identical to the subject of the predication, the domain from which it is chosen must vary in the two conjuncts of an ellipsis construction, even though the actual choice of comparison property is context-dependent. This can be illustrated by reconsidering (84), repeated below.

(84) Beck is tall, and his 6 year old daughter is too.

The logical representation of the verb phrase in the first conjunct in (84) is (95); assuming that VP ellipsis is licensed by identity of logical representations (as in Sag 1976 and Williams 1977), (95) also provides the interpretation of the elided VP.

(95) $\lambda x[\textsc{abs}(tall(x))(\textsc{stnd}(thin)(\mathbf{p}(x)))]$

Since (95) is predicated of two distinct objects in the conjuncts in (84), the actual values of the standards in the two conjuncts will vary as a function of the denotations of the subjects. In the first conjunct, the standard value is determined with respect to an appropriate comparison property for the individual denoted by *Beck*, an adult male; in the second conjunct, the standard value is determined with respect to a comparison property for the individual denoted by *his [Beck's] 6 year old daughter.*[22]

In essence, the analysis claims that absolute constructions in which the comparison property is determined by **p** are reflexive constructions, analogous to verbs with implicit reflexive arguments, such as *bathe*. Like (84), the implicit argument of *bathe* can (and in fact must) have a "sloppy" reading under ellipsis (i.e., its value must vary): (96) has only an interpretation in which Beck's 6 year old daughter bathed herself, not one in which Beck's 6 year old daughter bathed Beck.

(96) Beck bathed, and his 6 year old daughter did too.

This analysis predicts that "strict" interpretations of elliptical conjuncts like (84)–interpretations in which the comparison property in the elided constituent is the same as the comparison property in the antecedent–should be impossible. This seems to be true: as noted above, (84) cannot mean that Beck's daughter is tall for a grown man (assuming that *Beck* is an adult male), although it can be interpreted as a statement that they are both tall with respect to some global standard. In the latter case, however, there is no dependency between the subject and the comparison property, so a sloppy reading is not forced. On the contrary, in this case a strict interpretation is required, which is what we would expect if ellipsis involves identity of logical representations.

[22]I assume that identity of the standard values in examples such as (i) is due to the fact that the subjects in both conjuncts are the same sorts of objects.

(i) Jupiter is large and Saturn is too.

Additional evidence that this analysis is on the right track comes from sentences with quantificational subjects. Consider an example like (97).

(97) Everyone in my family is tall.

(97) can mean that every member of my family is tall with respect to whatever comparison property is appropriate for that individual, i.e., that each child is tall for a child, each man is tall for a man, and each woman is tall for a woman.[23] This interpretation of (97) corresponds to the logical representation in (98).

(98) $every_x[member\text{-}of\text{-}my\text{-}family(x)][\textsc{abs}(tall(x))(\textsc{stnd}(tall)(\mathbf{p}(x)))]$

Since the comparison property must be calculated for each individual that satisfies the restriction of the quantifier, the standard value changes according to the comparison property determined by that individual. If, on the other hand, the standard value were an indexically specified degree, its interpretation should remain constant. This is illustrated by an example like (99), in which the pronoun *her* is interpreted indexically.

(99) Everyone in my family is proud of her.

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[23](97) can also mean that every member of my family is tall with respect to some global standard.

(99) can only mean that everyone in my family is proud of the same person; it cannot mean that everyone in my family is proud of some female individual.

The analysis of implicit comparison classes outlined here is very similar in its basic respects to the one developed in Ludlow 1989, but different in implementation. Ludlow argues that the standard argument in a sentence like (72) is introduced by an operator which moves from its base position in AP to adjoin to the subject, which is then used as the basis for determining the comparison class. Specifically, the comparison class is determined based on the lexical material included in N-bar. On this view, the non-identity of the standards in elliptical contexts follow from the fact that the "standard operator" in the two conjuncts adjoins to different expressions–the subjects of the two clauses–as shown in (100).

(100) [[Op$_i$ that elephant] is large e$_i$] and [[Op$_i$ that flea] is **large e$_i$** too]

There are at least two problems with this type of analysis. The first is strictly syntactic: the analysis requires the standard operator to adjoin to an argument, but this type of adjunction has been claimed to be impossible (see Chomsky 1986). The second problem comes from examples in which the subject is quantificational, such as (97) above. If the standard operator adjoins to the quantificational subject and the lexical material in N-bar determines the comparison class, then the standard value in an example like (97) should be some average based on the combined heights of the members of my family. If this is the case, however, then (97) should be contradictory, because it would always be true that someone in my family is not as tall as the average.

2.4 Comparatives

2.4.1 Initial Observations and Questions

2.4.1.1 Domain of Investigation

The complexity and variety of the class of comparative constructions in English provides a rich domain of syntactic and semantic puzzles, most of which go beyond the scope of this dissertation. As a result, my goal in this section is not to develop a complete semantic (or syntactic) analysis of the comparative, but rather to focus on a few fundamental issues in order to show that the analysis of gradable adjectives and degree constructions proposed in section 2.1 supports a robust account of a core set of facts and also provides a starting point for future work aimed at explaining some of the more complex and problematic puzzles in this domain. To this end, my focus in this section will be on predicative comparatives such as (101)-(103).

(101) The Mars rock called "Barnacle Bill" is as wide as it is tall.

(102) Jupiter is larger than Jones thought it was.

(103) Mars is less distant than Saturn.

I will not discuss attributive comparative constructions, such as (104)-(105) (see e.g. Pinkham 1982, Heim 1985, Lerner and Pinkal 1992, 1995, and Gawron 1995 for relevant discussion), nor will I discuss comparative nominals, such as (106)-(107) (see e.g. Cresswell 1976, Keenan 1987).

(104) Mars has a thinner atmosphere than Venus.

(105) I bought a less powerful telescope than Jaye did.

(106) More stars are visible from the southern hemisphere than the northern hemisphere

(107) There are fewer black holes in the galaxy than there are stars.

Although there is reason to believe that the analysis that I will develop here is extendable to an analysis of these other constructions (see in particular Kennedy and Merchant 1997 for an analysis of attributive comparatives that builds on the proposals in this thesis), it should be observed that attributive and nominal comparatives introduce a number of syntactic and semantic questions that do not arise in the context of predicative comparatives, particularly as regards the role of ellipsis in the derivation of the comparative clause. As a result, in order for the proposals that I will make in this section to be accepted as a general theory of the syntactic and semantic properties of comparatives, they must eventually be evaluated against these other constructions as well, a project that I will leave for future work. My primary goal in this section is to show that the basic approach to the semantic analysis of gradable adjectives and degree constructions that I have developed in this thesis supports a robust analysis of predicative comparatives, and by extension, a foundation upon which to build a general account of the full range of comparative constructions in English.

Within the class of predicative comparatives, I will distinguish three subtypes based on the superficial characteristics of the complement of *than* or *as*–what I have referred to thus far as the "comparative clause". (101)-(103) exemplify these three types, which, following established tradition, I will refer to with the descriptive labels *comparative subdeletion, comparative deletion,* and *phrasal comparatives,* respectively. Comparative subdeletion structures such as (101) are comparatives in which the comparative clause is a constituent that could stand alone as an independent clause (see Grimshaw 1987), but must not contain an overt degree word or measure phrase, as illustrated by (108)-(110).

(108) The Sagan Memorial Station is taller than the Sojurner rover is long.

(109) The Sojurner rover is long.

(110) *The Sagan Memorial Station is taller than the Sojurner rover is very/quite/3 feet long.

Comparative deletion structures are comparatives in which the surface complement of *than* or *as* is a "partial clause": a clausal constituent (as indicated by the presence of verbal inflection) that appears to be "missing" some constituent at least as large as DegP. Comparative deletion is illustrated by (102) above, as well as (111)-(113).

(111) The Mars Pathfinder mission was more successful than anyone thought it would be.

(112) The telescope was less expensive than I expected.

(113) Jones thinks that Jupiter is larger than it is.

Finally, phrasal comparatives are structures in which the surface complement of *than* or *as* is a single, non-clausal constituent, as in (103) and (114)-(117).

(114) The Sagan Memorial Station is taller than the Sojurner rover.

(115) The sun is less massive than a neutron star.

(116) Sunspot activity this year was more intense than ever before.

(117) The atmosphere is thinner over the poles than over the equator.

It should be noted that term "comparative ellipsis" is often used to refer to structures in which the comparative clause is "missing" more material than just DegP (see Gawron 1995 and Hazout 1995 for recent discussion); this label includes both phrasal comparatives and examples of comparative deletion such as (112). The question of whether an ellipsis operation is involved in the derivation of comparatives, and if so, which of the subtypes discussed here are targets of this operation, is one of the questions that this section will address. In order to avoid presupposing the outcome of the discussion, I have chosen the labels "subdeletion", "comparative deletion", and "phrasal comparatives" based on a combination of tradition and their usefulness as descriptive characterizations of the surface forms.

2.4.1.2 Comparative Relations and Degree Descriptions

According to the analysis of gradable adjectives and degree constructions developed in section 2.1, it should be possible to characterize the interpretations of comparative constructions in terms of the general schema for degree morphology in (118).

(118) $Deg = \lambda G \lambda d \lambda x[\mathbf{R}(G(x))(d)]$

Two questions need to be answered: what is the value of **R** for each of the comparative morphemes *er/more*, *less*, and *as*, and how are the standard values derived in each of the three classes of comparatives that I am focusing on here? The answer to the first question is straightforward: *er/more* denotes a total order between two degrees, *less* denotes its inverse, and *as* denotes a partial ordering between degrees.[24] Building on the analysis of the absolute degree morpheme in section 2.3, this claim can be implemented by adopting the interpretations of the comparative morphemes in (119)-(121) and the truth conditions in (122)-(124).

(119) $more/er = \lambda G \lambda d \lambda x[\textsc{more}(G(x))(d)]$

(120) $less = \lambda G \lambda d \lambda x[\textsc{less}(G(x))(d)]$

(121) $as = \lambda G \lambda d \lambda x[\textsc{as}(G(x))(d)]$

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[24] I assume that *as* denotes a partial ordering relation rather than equality based on examples like (i).

(i) Jupiter is as large as Saturn, in fact it's larger than Saturn.

The equality interpretation that equatives typically have can be explained as a scalar implicature. For relevant discussion, see Seuren 1973.

(122) $||\textsc{more}(d_R)(d_S)|| = 1$ iff $d_R > d_S$

(123) $||\textsc{less}(d_R)(d_S)|| = 1$ iff $d_R < d_S$

(124) $||\textsc{as}(d_R)(d_S)|| = 1$ iff $d_R \geq d_S$

This analysis directly implements the proposals from section 2.1: comparative morphemes denote relations between a reference value, derived by applying the gradable adjective that heads the degree construction to the target of predication, and a standard value.

This returns us to the second and more difficult question: how is the standard value derived in each of the three subclasses of predicative comparatives? For subdeletion structures, the answer is straightforward: the comparative clause denotes a description of a degree (see Heim 1985, Izvorski 1995). The basic analysis runs as follows. If the complement of *than* in an example like (108) is a clausal constituent headed by a gradable adjective, then it must contain a degree variable–the standard variable introduced by the absolute morpheme. This variable can be abstracted over to derive an expression that denotes a set of degrees, as shown in (125).

(125) $\lambda d[\textsc{abs}(long(the\ Sojurner\ rover))(d)]$

The logical representation in (125) can be transparently derived from the syntactic representation of (101) if we assume, following e.g. Izvorski 1995 that the comparative clause in a subdeletion structure is a *wh*-construction, in which a null operator moves from the position of the degree variable in DegP to SpecCP (see also Chomsky 1977; but see Grimshaw 1987, and Corver 1991, 1993 for arguments that subdeletion does *not* involve *wh*-movement). On this view, the Logical Form of (108) is (126).

(126) The Sagan Memorial Station is $[_{DegP}$ er $[_{AP}$ tall$]$ $[_{PP}$ than $[_{CP}$ Op$_x$ the Sojurner rover is $[_{DegP}$ e$_x$ ø long$]]]]$

Although I will argue in section 2.4.2 that comparative deletion constructions do involve actual *wh*-movement in the syntax, I will remain agnostic as to whether the operator-variable relation in (126) is the result of actual movement, or whether it is derived in some other way. What is important is that the semantics provides some means of abstracting over the degree variable introduced by the absolute morpheme in (126), in order to derive the logical representation in (125).[25]

The expression in (125) denotes the set of degrees *d* such that the Sojurner rover is at least as long as *d*. Assuming the interpretation of the absolute morpheme adopted in the preceding section, the expression in (125) denotes the set of degrees on a scale ranging from the degree corresponding to the length of the Sojurner

[25]If further research supports the conclusion that subdeletion constructions are syntactically distinct from comparative deletion, as argued by Grimshaw and Corver, this would actually be consistent with, and possibly provide support for, the conclusion that I will draw in sections 2.4.2, that the Logical Forms and compositional interpretation of subdeletion and comparative deletion constructions are not the same. See also Larson 1988:22, which arrives at the same result in the context of a different analysis of comparatives.

rover to the lower end of the scale. In order to derive a definite description of a degree, I will follow von Stechow 1984a in assuming that the expression in (125) is the argument of a covert maximality operator, which has the interpretation in (127) (where D is a (totally ordered) set of degrees; see also Rullmann 1995, and see the discussion of this point in chapter 1, section 1.3.2).

(127) $||\text{MAX}(D)|| = \iota d \in D[\forall d' \in D{:}\ d \geq d']$

Note that the assumption that the comparative clause denotes a maximal degree is necessary even if we reject the semantic analysis of the absolute morpheme in terms of a partial ordering relation, adopting an interpretation in terms of equality instead. Von Stechow 1984a observes that if the comparative clause denotes a simple definite description, then in an example like (128), it should fail to denote, since there is no unique degree *d* such that Sasha can jump *d*-far.

(128) Ede can jump farther than Sasha can.

To account for facts like (128), von Stechow defines the maximality operator in (127), which provides the correct interpretation of the comparative clause: the maximal degree *d* such that Sasha can jump *d*-far.[26]

[26] It should also be noted that von Stechow's analysis of the interpretation of the comparative clause supports an explanation of a number of its important semantic properties, such as the licensing of negative polarity items and anti-additivity. See von Stechow 1984a:70 and Klein 1991:687-8 for discussion.

Given these assumptions, the interpretation of the comparative clause in (108) is (129): the maximal degree *d* such that Barnacle Bill is at least as tall as *d*.

(129) $\text{MAX}(\lambda d[\text{ABS}(\textit{long}(\textit{the Sojurner rover}))(d)])$

This expression can be supplied as the standard argument of the comparative morpheme, giving the property in (130) as the interpretation of DegP in (126).

(130) $\lambda x[\text{MORE}(\textit{tall}(x))(\text{MAX}(\lambda d[\text{ABS}(\textit{tall}(\textit{the Sojurner rover}))(d)]))]$

This property can be applied to the subject, returning (131) as the interpretation of (108).

(131) $\text{MORE}(\textit{tall}(\textit{the Sagan Memorial Station}))(\text{MAX}(\lambda d[\text{ABS}(\textit{tall}(\textit{the Sojurner rover}))(d)]))$

According to the truth conditions for more in (122), (131) is true just in case the degree to which the Sagan Memorial Station is tall exceeds the maximal degree to which the Sojurner rover is long. Given the assumption that *tall* and *long* have the same dimensional parameter–i.e., they map their arguments onto degrees on the same scale (see the discussion of this point in section 2.1.3), this analysis accurately characterizes the meaning of (108).

It should be noted that this analysis of subdeletion also maintains the explanation of incommensurability outlined in section 2.1.3. Consider, for example, an anomalous sentence like (132).

(132) #The space telescope is more expensive than its optics are accurate.

The interpretation of (132) is (133), which is true just in case the degree to which the space telescope is expensive stands in the ">" relation to the maximal degree to which its optics are accurate.

(133) MORE(*expensive*(*the space telescope*))(MAX(λd[ABS(*accurate*(*the space tele's optics*))(d)]))

The problem is that the reference value and the standard value are degrees on different scales: *expensive* and *accurate* project their arguments onto scales with different dimensional parameters, therefore their ranges are disjoint. Since the related degrees in (133) are not objects on the same scale (i.e., are not elements of the same ordered set), the relation introduced by the comparative morpheme is undefined, and the sentence is anomalous.

2.4.1.3 Comparatives and Ellipsis

The preceding discussion indicates that the comparative clause in subdeletion structures can be transparently interpreted as a description of a degree; what remains to be determined is whether the same can be said of comparative deletion constructions and phrasal comparatives. The core question that must be answered is the following: are comparative deletion constructions and phrasal comparatives structurally identical to subdeletion structures at a level of Logical Form, or are the former structurally distinct from the latter? In other words, do the derivations of the two classes of "reduced" comparatives involve some kind of ellipsis resolution, so that the compositional interpretations of the Logical Forms of all three classes of comparatives are essentially the same, or are the compositional interpretations of comparative deletion constructions and phrasal comparatives distinct from the interpretation of subdeletion structures (and possibly from each other)?[27] In sections 2.4.2 and 2.4.3, I will argue that the latter is in fact the case: comparative deletion constructions and phrasal comparatives are structurally distinct from comparative subdeletion at LF, and, as a result, they differ in their compositional interpretations. The primary claims can be summarized as follows. First, "canonical" comparative deletion constructions–examples in which only a DegP is apparently elided from the surface form–do *not* involve any kind of ellipsis; instead, the "missing" degree phrase is actually the trace of a null operator, which is categorically a DegP (cf. Klein 1980, Larson 1988). This syntactic difference has a corresponding effect on the interpretation of the comparative clause: the comparative clause in a

[27] Although the subsequent discussion will assume a framework in which the resolution of ellipsis involves an identity relation between Logical Forms (as in e.g. Fiengo and May 1994), and so is sensitive to syntactic representations, I intend this question to include semantic approaches to ellipsis as well. In particular, I will discuss Gawron's (1995) analysis of comparatives, which adopts Dalrymple, Shieber and Pereira's (1991) Higher Order Unification approach to ellipsis, in section 2.4.3.2.

comparative deletion construction does not denote a description of a degree, as in comparative subdeletion, but rather a function from gradable adjective meanings to degrees. Second, phrasal comparatives in which the surface complement of *than* or *as* is a DP do not have true comparative "clauses" at all, instead, the complement of *than* or *as* is a DP at all stages of the derivation (see Hankamer 1973). These constructions receive a "direct" interpretation, whereby the standard value is derived by applying the gradable adjective meaning to the individual-denoting expression that occurs as the complement of *than* (cf. Heim 1985).

A result of these claims is that it will be necessary to posit three distinct interpretations for the comparative morphemes: one in which the standard value is directly supplied by a degree-denoting expression (for comparative subdeletion), one in which the standard value is derived by supplying the interpretation of the gradable adjective that heads the degree construction as an argument to the standard expression (for comparative deletion), and one in which the standard value is derived by applying the interpretation of the gradable adjective that heads the comparative to the standard expression (for phrasal comparatives). These three interpretations are specified for the morpheme *er/more* in (134)a-c, where Q in (134)b is a function from gradable adjectives to degrees, and y in (134)c is an individual; exactly the same pattern holds for *less* and *as*.

(134) a. $er/more_1 = \lambda G \lambda d \lambda x[\textsc{more}(G(x))(d)]$ (*subdeletion*)

b. $er/more_2 = \lambda G \lambda Q \lambda x[\textsc{more}(G(x))(Q(G))]$ (*comparative deletion*)

c. $er/more_3 = \lambda G \lambda y \lambda x[\textsc{more}(G(x))(G(y))]$ (*phrasal comparatives*)

Although the assumption that the comparative morphemes are ambiguous seems undesirable, it should be noted that the ambiguity does not reflect a truth-conditional difference between the three comparative constructions, only a compositional one. The truth conditions for each of the three subclasses of comparative constructions are as specified above in (122)-(124): they denote relations between a reference value and a standard value; what differs in the three constructions is the way in which the degree that represents the standard value is determined. More importantly, a comparison of comparative deletion and phrasal comparatives with true ellipsis structures provides empirical support for the analysis of comparative morphology outlined in (134). As I will show in the following sections, comparative deletion structures and phrasal comparatives differ from true ellipsis constructions in an important way: the interpretation of the "missing" material in the comparative clause is much more restricted than it should be if the derivations of these constructions actually involved ellipsis. Specifically, the interpretation of the missing material in comparative deletion constructions and phrasal comparatives must come from the adjective that heads the degree construction. This fact is completely unexpected if comparative deletion and phrasal comparatives involve ellipsis, but, it is enforced by the semantic analysis of comparative morphology in (134).

2.4.2 Comparative Deletion

2.4.2.1 Identity and Comparative Deletion

Two syntactic properties in particular characterize comparative deletion structures. First, as noted above, the comparative clause appears to have undergone some kind of ellipsis operation, which targets a constituent at least as large as DegP. Second, as observed by Chomsky (1977), the comparative clause displays characteristics typically associated with *wh*-constructions (see also Bresnan 1975, Grimshaw 1987, and Izvorski 1995). These properties are closely intertwined, as becomes evident when considering the facts discussed by Chomsky as evidence that the comparative clause is a *wh*-construction. Descriptively, whenever the "missing" material in the comparative clause is contained in an extraction island, the sentence is ungrammatical (see Pinkham 1982 and Kennedy and Merchant 1997 for additional relevant discussion). (135)-(142) provide an overview some of the crucial facts.

Wh-islands

(135) Mercury is closer to the sun than I thought it was.

(136) *Mercury is closer to the sun than I wondered whether it was.

(137) *Mercury is closer to the sun than I knew who said it was.

Complex NPs

(138) Hale-Bopp was brighter than Carl claimed it would be.

(139) *Hale-Bopp was brighter than Carl's claim that it would be.

(140) *Hale-Bopp was brighter than a paper that said it would be.

Adjunct islands

(141) The solar flares were more energetic than the aurora borealis was.

(142) *The solar flares were more energetic than we were amazed when the aurora borealis was.

Chomsky concludes from facts like these that the syntactic derivation of the comparative clause involves movement of a phonologically null operator (henceforth the "comparative operator") from some position within the comparative clause. This proposal receives additional support from some dialects of English, which permit an overt *wh*-word in the comparative clause, as shown by (143)-(144).[28]

(143) The flooding was less than what we had thought it would be. [NPR, 1.29.97]

(144) Jupiter is larger than what Saturn is.

On the surface, the syntactic status of the comparative clause as a *wh*-construction appears to fit in naturally with the hypothesis that the interpretation of comparative deletion is completely parallel to that of comparative subdeletion, and that the comparative clause is a type of description. This approach assumes that the

[28] Similar facts can be found in Afrikaans and Hindi, and in some languages, such as Bulgarian, a *wh*-word is obligatory (see Izvorski 1995 for discussion; see Stassen 1985 for a general cross-linguistic survey of comparative constructions).

comparative operator binds a degree variable in the comparative clause, generating an expression which denotes a set of degrees (see e.g. von Stechow 1984a, Moltmann 1992b, Izvorski 1995). In an example like (145), the comparative operator binds a degree variable in the comparative clause, and the whole constituent is interpreted as the lambda expression in (146), which denotes the set of degrees *d* such that Neptune is at least as great as *d*.

(145) Jupiter is more massive than Neptune is.

(146) $\lambda d[\textsc{abs}(\mathit{massive}(\mathit{Neptune})(d))]$

(146) can then be supplied as the argument of the maximality operator, generating a definite description of a degree, exactly as in the analysis of subdeletion discussed in section 2.4.1.2.

In order for this analysis to work, however, it must make the crucial assumption that the derivation of (145) involves some kind of ellipsis operation whereby the missing material in the comparative clause is syntactically represented at LF.[29] In particular, in order for the Logical Form of (145) to map onto the interpretation in (146), it must be the case that the comparative clause in (145) has the structure in (147) (which is structurally parallel to the a subdeletion structure such as (126), discussed in section 2.4.1.2), in which a Degree Phrase headed by the absolute morpheme has been reconstructed.

[29] Or, alternatively, that some kind of semantic ellipsis operation achieves the same result; see Gawron 1995 for such an approach.

(147) Jupiter is $[_{DegP}$ more massive than $[_{CP}$ Op_x Neptune is $[_{DegP}$ e_x ø **massive**]]]

This analysis raises an important and extremely problematic question for the syntactic assumptions that I adopted in section 2.2. If comparative deletion is like other elliptical phenomena in English, then the recovery of elided material at LF should be subject to certain constraints on identity. In particular, the elided material must have a logical representation that is identical to some other constituent in the discourse (Sag 1976, Williams 1977, May 1985, Kitagawa 1991, Fiengo & May 1994, Chung, Ladusaw, and McCloskey 1995; for simplicity, I will assume that ellipsis is licensed by identity of Logical Forms, as in Fiengo and May 1994, although nothing in the following discussion hinges on this assumption); in the case of a comparative deletion structure like (147), the antecedent should be a DegP. The problem for this approach is that the syntactic assumptions adopted in section 2.2 would actually force us to assume that the recovered material in an example like (147), as well as other instances of comparative deletion, *must not be* identical to its antecedent.

To see why, let us consider in more detail the derivation of (145) on the assumption that it involves ellipsis. The first thing to observe is that (145) is an antecedent-contained deletion (ACD) structure. As illustrated by (148), the surface representation of (145), the missing DegP ($DegP_2$) is contained within the DegP that supplies its interpretation ($DegP_1$).

(148) Jupiter is $[_{DegP1}$ more massive than $[_{CP}$ Op Neptune is $[_{DegP2}$ e]]]

Assuming that ACD is resolved by adjoining the constituent that contains the deleted expression to a clausal node outside the antecedent (see May 1985, Larson and May 1987, Fiengo and May 1994, and Kennedy 1997a), the comparative clause in (148) must raise to IP, generating the structure in (149).[30]

(149) $[_{IP}$ $[_{CP}$ Op Neptune is $[_{DegP2}$ e]] $[_{IP}$ Jupiter is $[_{DegP1}$ more massive than e]]]

Even if we allow for the possibility that the PP headed by *than* can be ignored and a degree variable reconstructed in its place (cf. Chung, Ladusaw, and McCloskey 1995), the core problem is that the DegP that supplies the antecedent for the elided phrase ($DegP_1$) is headed by the comparative morpheme *more*. In order to construct a LF that maps onto the correct interpretation of the comparative clause, however, the recovered material must be headed by the null absolute morpheme. To see why, consider what the interpretation of the comparative clause would be if the recovered DegP were headed by the comparative morpheme, as in (150).

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[30]This assumption is compatible with both an analysis of the comparative clause as a definite description as well as an analysis of the comparative clause as a universal quantification structure, as both types of expressions support ACD:

(i) Julio wanted to visit the planet Maureen did.

(ii) Julio wanted to visit every planet Maureen did.

(150) $[_{IP}\ [_{CP}\ Op_x$ Neptune is $[_{DegP2}$ **e_x more massive**]] $[_{IP}$ Jupiter is $[_{DegP1}$ more massive than e]]]

If (150) were the actual LF of (145), then the comparative clause would have the interpretation in (151): it would denote the maximal degree *d* such that Neptune is more massive than *d*.

(151) $\textsc{max}(\lambda d[\textsc{more}(massive(Neptune))(d)])$

This analysis cannot be correct, however, as it gives the wrong truth conditions for the comparative. If (151) were the interpretation of the comparative clause, then in a context in which Jupiter and Neptune were equal in mass, the interpretation of (145), stated in (152), would satisfy the truth conditions for the comparative, restated in (153).

(152) $\textsc{more}(massive(Jupiter))(\textsc{max}(\lambda d[\textsc{more}(massive(Neptune))(d)]))$

(153) $||\textsc{more}(d_R)(d_S)|| = 1$ iff $d_R > d_S$

If Jupiter and Neptune were equally massive, then the degree to which Jupiter is massive would exceed the maximal degree *d* such that Neptune is more massive than *d*. This is clearly the wrong result.[31]

One solution to this problem would be to assume that the identity constraints involved in licensing ellipsis do not distinguish between different degree morphemes. On this view, *more* and *ø* (the null absolute morpheme) would count as identical. There is clear evidence against this hypothesis, however. If it were the case that *more* and *ø* counted as identical, then an example like (154) should permit an interpretation along the lines of (155).

(154) The space telescope was more useful this year, and the gamma ray satellite was, too.

(155) The space telescope was more useful this year, and the gamma ray satellite was useful, too.

Such an interpretation is completely impossible, however; (154) can only have the interpretation in (156), in which the comparative morpheme is retained under ellipsis.

(156) The space telescope was more useful this year, and the gamma ray satellite was more useful, too.

[31] A more general problem, if scales are *dense* linearly ordered sets of points, as I have assumed, is that the comparative clause in (152) would fail to denote, since there would be no maximal degree *d* such that Neptune is more massive than *d*.

The problem of identity in comparative deletion is made even more complex by examples like (157), which has the interpretation paraphrased in (158), in which the antecedent for the missing material is the VP headed by *want*.

(157) Smith wants the novel to be 100 pages longer than her editors do.

(158) Smith wants the novel to be 100 pages longer than her editors want it to be (long).

In order to ensure that the comparative clause maps onto the interpretation paraphrased in (158), (157) must have the Logical Form shown in (159).

(159) $[_{IP}$ $[_{Cp}$ Op_x her editors do $[_{VP}$ **want it to be** $[_{DegP}$ e_x **$\varnothing$ long**]]] $[_{IP}$ Smith $[_{VP}$ wants the novel to be $[_{DegP}$ 100 pages longer than e]]]

The reconstructed material in (159) is clearly not identical to its antecedent, however: not only is the degree morpheme distinct from the degree morpheme in the antecedent, but the measure phrase *100 pages* must be left out of the reconstruction. Again, VP ellipsis facts show that measure phrases cannot be left out in general: (160) has only the interpretation in (161); the reading in (162) is impossible.

(160) Smith's novel will be 300 pages long, and Jones' will be, too.

(161) Smith's novel will be 300 pages long, and Jones' will be 300 pages long, too.

(162) Smith's novel will be 300 pages long, and Jones' will be long, too.

This discussion leads to three possible conclusions: my earlier assumptions about the syntax of degree constructions are incorrect, the constraints on identity in comparative constructions are looser than those for other ellipsis constructions, such as VP ellipsis, or the assumption that the missing DegP in comparative deletion is recovered through ellipsis resolution is incorrect. The discussion so far has shown that the syntax of extended projection supports a straightforward compositional semantics for degree constructions in terms of the semantic analysis of gradable adjectives and degree morphology motivated in section 2.1; as a result, we should be hesitant to reject this syntactic analysis too quickly.[32] Similarly, we should be hesitant to stipulate a relaxation on the constraints on identity typically associated with ellipsis if the sole reason for the stipulation is to account for the problems presented by comparative deletion. This leaves us with the third conclusion, that the analysis of comparative deletion constructions as ellipsis structures is incorrect. In fact, there is independent evidence that comparative deletion differs from true ellipsis constructions–in particular, from VP ellipsis–in an important way. The relevant facts are discussed in the next section.

2.4.2.2 Local Dependencies in Comparative Deletion

A characteristic of VP ellipsis is that an elided verb phrase can typically locate its antecedent from any accessible VP within recent discourse. For example, the elided

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[32]Moreover, Abney (1987) and Corver (1991, 1997) provide a number of independent and compelling syntactic arguments in favor of the extended projection analysis.

VP in the second conjunct of (163) is free to locate its antecedent either locally or non-locally: the second conjunct can have either the interpretation in (164), in which the elided VP receives its interpretation from the VP headed by *read*, or the interpretation in (165), in which the antecedent is the VP headed by *bought*.

(163) Marcus read every book I bought, and I read every book Charles did.
(164) ... I read every book Charles read.
(165) ... I read every book Charles bought.

Consider now (166) and (167), which are structurally parallel in the following respect: both conjuncts in the two examples are "missing" some constituent.

(166) Marcus read every book I did, and I bought every book Charles did.
(167) The table is wider than this rug is, but this rug is longer than the desk is.

The difference is that the two conjuncts in (166) have undergone VP ellipsis, while the two conjuncts in (167) are comparative deletion constructions. If comparative deletion is interpreted in the same way as VP ellipsis, then the missing DegPs in (167) should have the same range of interpretations as the missing VPs in (166). This is true of the first conjuncts: the missing constituents in the first conjuncts of both (166) and (167) receive their interpretations locally: the first conjunct of (166) has the interpretation paraphrased in (168), and the first conjunct of (167) has the interpretation in (169).

(168) Marcus read every book I read....

(169) The table is wider than this rug is wide....

This fact is not surprising: since there is no prior discourse, the local VP and DegP are the only available antecedents.

What is surprising, if comparative deletion involves ellipsis, is that the parallelism between (166) and (167) breaks down when we consider the interpretation of the missing material in the second conjuncts. The second conjunct of (166) is ambiguous: the elided VP can either locate its antecedent locally, from the VP headed by *buy*, resulting in the interpretation paraphrased in (170), or it can find its antecedent in the preceding clause from the VP headed by *read*, giving the interpretation in (171).

(170) ... I bought every book Charles bought.

(171) ... I bought every book Charles read.

In contrast, the second conjunct of (167) is *not* ambiguous: this sentence has only the reading paraphrased in (172), in which the missing DegP receives its interpretation locally, from the DegP headed by *long*; a reading corresponding to (173), in which the missing DegP receives its interpretation from the DegP headed by *wide* in the first conjunct is unavailable.[33]

(172) ... this rug is longer than the desk is long.

(173) ... this rug is longer than the desk is wide.

What these facts indicate is that the interpretation of the missing DegP in a comparative deletion structure, unlike the interpretation of the missing VP in VP ellipsis constructions, exhibits a "local dependency" on the comparative DegP: the interpretation of the missing DegP in the comparative clause is determined by on the interpretation of the comparative DegP. More precisely, the adjective meaning that is used to compute the standard value must be the same as the meaning of the adjective that heads the comparative. This is quite surprising, given the superficial similarity of clausal comparatives to VP ellipsis structures, and completely unexpected if the interpretation of comparative deletion involves some kind of ellipsis resolution.

The facts are complicated by examples like (174), which is identical to (167) except that the comparative in the first conjunct is a subdeletion structure.

(174) The table is longer than this rug is wide, and this rug is longer than the desk is.

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[33]It should be observed that nominal comparative deletion constructions show similar locality effects: (i) has only the interpretation in (ii); the reading in (iii) is unavailable.

(i) Kim bought many peaches, but Sandy bought more apples than Kim did.

(ii) ...Sandy bought more apples than Kim bought apples.

(iii) *...Sandy bought more apples than Kim bought peaches.

Unlike (167), (174) *does* allow a non-local interpretation of the missing DegP in the second conjunct. That is, the second conjunct of (174) is ambiguous between the reading paraphrased in (175) and the one paraphrased in (176).

(175) ... this rug is longer than the desk is long.

(176) ... this rug is longer than the desk is wide.

This interpretive difference between (167) and (174) is extremely puzzling for the following reason. If the interpretation of comparative deletion involves reconstruction of elided material, so that comparative deletion and comparative subdeletion are structurally identical at LF, then the first conjuncts in (167) and (174) should be completely parallel in the relevant respects at LF. But if this is true, why doesn't the second conjunct in (167) display the same ambiguity as the second conjunct in (174)?

2.4.2.3 The Derivation and Interpretation of Comparative Deletion Constructions

The answer to this question, as well as the solution to the problem of identity in comparative ellipsis and justification for assuming that the comparative morpheme can have the interpretation given above in (134)b, is the following: comparative "deletion" does not involve ellipsis at all, and comparative deletion constructions are not structurally parallel to subdeletion structures at LF. Instead, the appearance of ellipsis is due to the fact that the syntactic category of the comparative operator is DegP (see Klein 1980, Larson 1988, and Lerner and Pinkal 1995 for similar analyses, in which the comparative operator is categorically an AP). That is, I claim that the comparative operator does not bind a degree variable inside DegP, as standardly assumed, rather the syntactic variable bound by the comparative operator in the comparative clause is itself a DegP. If this is correct, the Logical Form of (177) is (178), which is identical to its surface representation.

(177) Jupiter is more massive than Neptune is.

(178) Jupiter is more massive than $[_{CP}$ Op$_x$ Neptune is $[_{DegP}$ e$]_x]$

An immediate consequence of this analysis is that the problem of identity in comparative ellipsis disappears. Since no ellipsis is involved in the derivation of (178), there is no need to assume a relaxation of the identity constraints on ellipsis to account for the fact that the comparative morpheme must not be part of the reconstruction (see the discussion of this point in section 2.4.2.1. The problems presented by more complex examples such as (157) (repeated below) are also eliminated.

(157) I want my dissertation to be 100 pages longer than my advisors do.

(157) is problematic for an ellipsis analysis of comparative deletion because it appears to involve two instances of non-identity: in order to generate an appropriate LF for this example, neither the measure phrase nor the comparative morpheme can be included in the reconstructed material. Given the assumption that the comparative

operator is categorically a DegP, however, these problems disappear. The elided VP in the comparative clause is reconstructed under identity with the VP headed by *want*, but instead of copying the matrix DegP, a variable is introduced in its place, as shown in (179).[34]

(179) I [$_{VP}$ want my dissertation to be [$_{DegP1}$ 100 pages longer than [$_{CP}$ Op$_x$ my advisors do [$_{VP}$ **want it to be** [$_{DegP2}$ e]$_x$]]]]

As the discussion of (157) should make clear, I am not claiming that the derivation of comparative deletion constructions *never* involves ellipsis ((157), for example, clearly involves VP ellipsis, since the missing constituent is interpreted as a verb phrase headed by *want*), only that the interpretation of the "missing" DegP in the comparative clause is not constructed on the basis of ellipsis resolution. This

34For simplicity, I assume that the option of replacing DegP$_1$ in (179) with a variable is an instance of *vehicle change*, a relation that establishes identity between a variable and another constituent in a Logical Form (Fiengo and May 1994; see Moltmann 1992a for a slightly different use of vehicle change in the derivation of the comparative clause). Alternatively, one could assume that DegP$_1$ raises to adjoin to the matrix IP (as discussed in section 2.4.2.1). On this view, the LF of (179) is (i), in which case reconstruction of the VP headed by *want* directly introduce a DegP variable.

(i) [$_{IP}$ [$_{DegP}$ 100 pages longer than [$_{CP}$ Op$_x$ my advisors do [$_{VP}$ **want it to be** [$_{DegP}$ e]$_x$]]] [$_{IP}$ I want my dissertation to be [$_{DegP}$ e]$_y$]]

This type of analysis, which essentially describes the derivation of examples like (157) in terms of May's (1985) account of antecedent-contained deletion, is proposed in Larson 1988a in the context of Klein's (1980) semantics for comparatives.

raises two questions. First, how is the interpretation of the "missing" DegP derived? In other words, how do we get from structures like (178) and (179), in which the comparative operator binds a DegP rather than a degree variable, to expressions that introduce a standard value? Second, how does the proposal that the comparative operator is categorically a DegP explain the facts discussed in the previous section? The answer to the second question follows directly from the answer to the first, which requires taking a closer look at the meaning of the comparative operator.

If the comparative operator is categorically a DegP, then its interpretation should be stated in terms of the basic meaning of a Degree Phrase, i.e., its interpretation should be of the same sort as other degree constructions, modulo its status as a syntactic operator. Moreover, in order to derive the correct truth conditions for comparatives, it should be the case that we end up with an interpretation of the comparative clause as a maximal degree. To make the discussion concrete, consider the LF of (177) in (178), which is repeated below.

(178) Jupiter is more massive than $[_{CP}\ Op_x$ Neptune is $[_{DegP}\ e]_x]$

Assuming the comparative operator occupies SpecCP (see Chomsky 1977), it must compose with C-bar. C-bar contains a DegP variable, therefore I will assume that its interpretation is derived by abstracting over DegP, as in (180) (ignoring the contribution of tense morphology and the verb *be*).

(180) $\lambda D[D(\mathit{Neptune})]$

Assuming the interpretation of C-bar to be a function of the sort in (180), the interpretation of the comparative operator can be formalized as in (181): it denotes a function from a C-bar/DegP meaning to a function from gradable adjectives to degrees (cf. Lerner and Pinkal 1995).

(181) $[_{DegP}\ Op] = \lambda P \lambda G(\textsc{max}(\lambda d[P(\lambda x[\textsc{abs}(G(x))(d)])]))$

The proposal can be illustrated by considering the derivation of the interpretation of the comparative clause in (178). The comparative operator takes C-bar as argument, as shown in (182), and the complex expression is transformed into (183) through lambda conversion.

(182) $\lambda P \lambda G(\textsc{max}(\lambda d[P(\lambda x[\textsc{abs}(G(x))(d)])]))(\lambda D[D(Neptune)]) \quad \rightarrow$

$\lambda G(\textsc{max}(\lambda d[\lambda D[D(Neptune)](\lambda x[\textsc{abs}(G(x))(d)])])) \quad \rightarrow$

$\lambda G(\textsc{max}(\lambda d[\lambda x[\textsc{abs}(G(x))(d)](Neptune)]) \quad \rightarrow$

(183) $\lambda G(\textsc{max}(\lambda d[\textsc{abs}(G(Neptune))(d)]))$

Two aspects of the semantics for the comparative operator in (181) and the corresponding interpretation of the comparative clause in (183) are crucial. First, the core meaning of the comparative operator is that of a DegP headed by an absolute morpheme (i.e., it introduces a partial ordering on degrees). In this way, the analysis satisfies the first requirement mentioned above, and moreover reflects the fact that the meaning of the comparative clause in comparative deletion is the same as that of the comparative clause in a subdeletion structure: it denotes a maximal degree. Second, the interpretation of the comparative clause in (183) is semantically "deficient" in an important sense: it does not denote a (maximal) degree; rather, it is a function from a gradable adjective meaning to a degree. In order for the comparative clause to denote a degree, and so introduce the standard value, it must be supplied with a gradable adjective meaning. This result can be achieved if we assume that the comparative morpheme(s) can have the interpretation given above in (134)b, and repeated below.[35]

(134) b. $er/more_2 = \lambda G \lambda Q \lambda x[\textsc{more}(G(x))(Q(G))]$

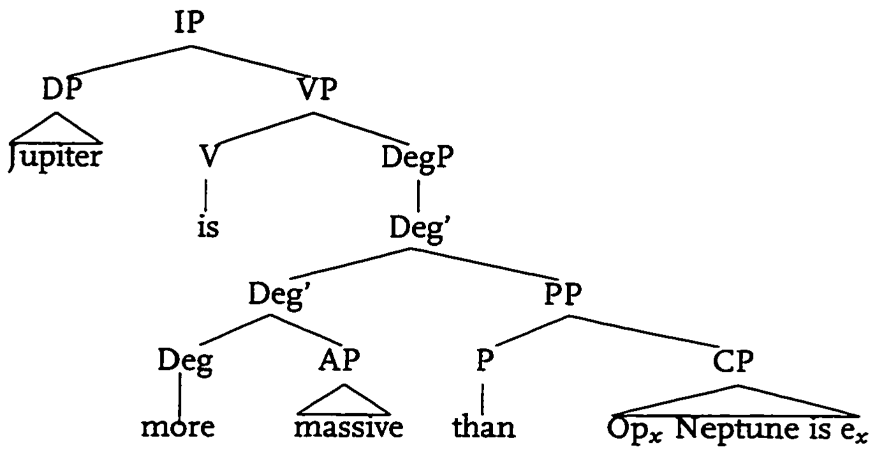
The crucial characteristic of (134)b is that the comparative morpheme supplies the meaning of the gradable adjective that heads the comparative construction as the argument to the comparative clause. This has two consequences: it provides the type of constituent needed to ensure that the standard constituent denotes a degree, and it establishes the "local dependency" observed in the previous section between the adjective that heads the comparative and the "missing" adjective meaning in the comparative clause. I will focus on the latter point in the next section; to see how this analysis derives the correct interpretation of comparative deletion constructions, let us take a closer look at the compositional analysis of (178).

According to the syntactic analysis adopted in section 2.2.1, the structural

[35]See Klein 1980 and Larson 1988 for very similar analyses of comparative deletion within the context of a vague predicate analysis of gradable adjectives.

description of (178) is (184).

(184)



Assuming the interpretation of *er/more* in (134)b, composition proceeds as follows. Deg° combines with AP, generating the expression in (185) as the denotation of the lower Deg'.

(185) $\lambda Q \lambda x[\text{MORE}(massive(x))(Q(massive))]$

Deg' then combines with the comparative clause, generating (186) (ignoring *than*, which I take to denote the identity function; see Larson 1988).

(186) $\lambda x[\text{MORE}(massive(x))(\lambda G(\text{MAX}(\lambda d[\text{ABS}(G(Neptune))(d)]))(massive))]$

The comparative clause needs a gradable adjective as argument; this argument is supplied by the comparative morpheme. Lambda conversion in the standard constituent derives the property shown in (187) as the interpretation of the comparative degree construction in (178): the property of being more massive than the maximal degree d such that Neptune is at least as massive as d.

(187) $\lambda x[\textsc{more}(massive(x))(\textsc{max}(\lambda d[\textsc{abs}(massive(Neptune))(d)]))]$

The final step in the compositional analysis of (184) involves applying the property in (187) to the subject, generating (188).

(188) $\textsc{more}(massive(Jupiter))(\textsc{max}(\lambda d[\textsc{abs}(massive(Neptune))(d)]))$

(188) is true just in case the degree to which Jupiter is massive exceeds the maximal degree d such that Neptune is at least as massive as d, which is exactly what we want.

2.4.2.4 Local Dependencies in Comparative Deletion Revisited

The final piece of the puzzle is to show how the analysis outlined in the previous section provides an explanation for the facts discussed in section 2.4.2.2. The crucial facts are exemplified by the contrast between (189) and (190).

(189) The table is wider than this rug is, but this rug is longer than the desk is.
(190) The table is longer than this rug is wide, and this rug is longer than the desk is.

Recall from the earlier discussion that the second conjunct in (189) is unambiguous, having only the interpretation paraphrased in (191), but the second conjunct in (190) is ambiguous between the reading in (191) and the one in (192).

(191) ... this rug is longer than the desk is long.

(192) ... this rug is longer than the desk is wide.

The puzzle presented by these facts for an ellipsis analysis of comparative deletion stems from the assumption that the Logical Form of the first conjunct in (189) is structurally parallel to the subdeletion structure in the first conjunct of (190). If this were true, and if comparative deletion involved reconstruction of a DegP under identity with some other DegP in recent discourse, then it should be the case that the second conjunct in (189) has the same range of possible interpretations as the second conjunct in (190).[36] The fact that the second conjunct in (189) permits only a "local" interpretation of the missing material in the comparative clause remains a puzzle.

The analysis of comparative deletion outlined in the previous section provides a solution to this puzzle by denying the assumption that the first conjuncts in (189) and (190) are structurally parallel. According to this analysis, the LF of the first conjunct in (189) is (193), in which the comparative operator directly binds a DegP trace.

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[36] Recall that examples of VP ellipsis structurally parallel to (167) *are* ambiguous (see e.g. (163) in section 2.4.2.1).

(193) The table is wider than $[_{CP}\ Op_x$ this rug is $[_{DegP}\ e]_x]$

In contrast, the LF of the first conjunct in (190)–a subdeletion structure–is (194), in which the comparative operator binds a degree variable in DegP.

(194) The table is longer than $[_{CP}\ Op_x$ this rug is $[_{DegP}\ e_x$ wide]]

The crucial structural difference between (193) and (194) is that the former does not contain an occurrence of the adjective *wide*. It follows that even if the surface string in (167) is compatible with a derivation that establishes an elliptical relation between the first and second conjuncts–note that nothing rules out this possibility, a fact that is crucial to the explanation of the ambiguity of (190)–this would not trigger an observable ambiguity. The reason is that the derivation that involves ellipsis and the one that doesn't culminate in structurally identical LFs: in both cases, the LF of the second conjunct in (167) has the structure shown in (195).

(195) ... this rug is longer than $[_{CP}\ Op_x$ the desk is $[_{DegP}\ e]_x]$

According to the semantic analysis outlined in the previous section, the comparative clause in (195) has only one possible interpretation: one in which the adjective that heads the comparative construction (*long*, in (195)) is supplied as argument to the comparative clause, deriving the expression in (196).

(196) $\textsc{max}(\lambda d[\textsc{abs}(\mathit{long}(\mathit{the\ desk}))(d)]))$

(196) denotes the maximal degree d such that the desk is at least as long as d; thus even if the LF in (195) is derived by establishing an ellipsis relation with the DegP in the first conjunct, the only possible interpretation of this structure is the one paraphrased (191).

The crucial difference between (189) and (190)–and the reason for the ambiguity of the latter–concerns the structure of the first conjunct. Unlike the first conjunct in (189), the first conjunct in (190) is an actual subdeletion structure; as a result, the surface string in the second conjunct is compatible with two derivations: one in which the comparative clause is itself a subdeletion structure that has undergone ellipsis under identity with the first conjunct, and one in which the comparative clause is a comparative deletion construction, in which a DegP operator has moved from its base position to SpecCP. In the former case, the LF of the second conjunct of (190) is (197), in which a DegP has been reconstructed under identity with the DegP in the first conjunct; in the latter case, the LF of the second conjunct is (198), in which the comparative operator binds a DegP variable.

(197) ...this rug is longer than $[_{CP}$ Op$_x$ the desk is **$[_{DegP}$ e$_x$ ø wide]]**

(198) ...this rug is longer than $[_{CP}$ Op$_x$ this desk is $[_{DegP}$ e$]_x$]

The structure in (197) maps onto the interpretation in (192), while the structure in (198) has the interpretation in (191); as a result, the second conjunct in (190) is predicted to be ambiguous.

2.4.2.5 Summary

The basic claim of the analysis of comparative deletion that I have presented here is that the "missing" DegP in comparative deletion is not the target of an ellipsis operation, but rather a trace bound by the comparative operator, which is itself categorically a DegP. The interpretation of the comparative operator is such that after it composes with C-bar, the comparative clause denotes a function from gradable adjectives to a (maximal) degree. Assuming that the comparative morpheme *er/more* can have the interpretation in (134)b, the "missing" gradable adjective meaning in the comparative clause is supplied when the clause composes with Deg' (similarly for *less* and *as*). Despite this compositional difference between comparative deletion and comparative subdeletion, the propositions derived in both types of constructions are expressions that fit within the general paradigm for degree constructions proposed in section 2.1.2. Specifically, they have the form in (199): they denote relations between two degrees, a reference value and a standard value.

(199) $\textsc{deg}(d_R)(d_S)$

2.4.3 Phrasal Comparatives

2.4.3.1 Are Phrasal Comparatives Derived from Clausal Sources?

Phrasal comparatives are exemplified by (200)-(202).

(200) Mars is less distant than Saturn.

(201) The asteroid belt is more distant than Mars.

(202) Neptune is as bright as Uranus.

The first question that must be answered in developing an analysis of phrasal comparatives is whether they are derived from a clausal source, i.e., whether examples like (200)-(202) are structurally parallel to either subdeletion or comparative deletion structures at the level of interpretation.

The assumption that phrasal comparatives are derived from a clausal source (see Smith 1961, Lees 1961, Bresnan 1973, Lerner and Pinkal 1995, Hazout 1995) has strong semantic motivation: if comparative morphemes define relations between degrees, as suggested in section 2.1.4, then it is necessary to construct interpretations of sentences like (200)-(202) in which the complement of *than* denotes a degree; in (202), for example, the degree to which Uranus is bright. If the complement of *than* in phrasal comparatives is derived from a clausal source, then the semantic analysis of phrasal comparatives can be subsumed under the semantic analysis of either subdeletion or comparative deletion. The problem is that there is syntactic evidence to indicate that at least some phrasal comparatives are *not* derived from clausal sources. Hankamer 1973 presents an important argument to this effect from extraction facts. Hankamer observes that in constructions like (200)-(202), in which the surface complement of *than* in a phrasal comparative is interpreted as the subject of a "missing" predicate, this constituent can undergo A-bar movement. This is illustrated by (203)-(204).

(203) You finally met somebody you're taller than.

(204) Which planet is Neptune as bright as?

When the complement of *than* contains clausal material, extraction is impossible, however:

(205) *You finally met somebody you're taller than is.

(206) You're taller than Jorge is.

(207) *Which planet is Neptune as bright as is?

(208) Neptune is as bright as Uranus is.

Hankamer notes that the unacceptability of (205) and (207) follows from the well-known fact that the comparative clause is an extraction island. The fact that extraction is possible in the phrasal comparatives (203) and (204) indicates that these constructions do not involve ellipsis: assuming that grammatical constraints–including the calculation of chain well-formedness–are calculated at Logical Form (see Chomsky 1995), then (203) and (204) must not have LFs in which the complement of *than* or *as* is a clausal constituent. If they did, their LFs would be structurally parallel to those of (205) and (207), and so the sentences should be ill-formed.

The claim that the "standard expression" (the overt constituent used to determine the standard value; what I have referred to as the "comparative clause" up to now) can be a nominal expression rather than a clause is also supported by a number of cross-linguistic facts. Many languages, including Latin, Greek, Russian, Serbo-Croatian, and Hungarian, have comparative constructions in which the standard expression is a nominal marked with some designated case morphology (typically an ablative case; see Stassen 1985). Hungarian, for example, has both a prepositional comparative and a case-based comparative, as shown by the examples in (209) and (210).

(209) János magasabb mint Péter.
Janos taller than Peter
'Janos is taller than Peter'

(210) János magasabb Péternél.
Janos taller Peter-ABL
'Janos is taller than Peter'

In all of these languages, however, whenever the complement of *than* is clearly clausal–i.e., when it contains either a remnant of clausal material or a full clause–the comparative must use the prepositional form. It is not surprising, then, that only the case-marking comparatives permit extraction (see Hankamer 1973:184). This is illustrated for Hungarian by the contrast between (211) and (212).

(211) *Mint ki magasabb János?/*Ki magasabb János mint?
Than who taller Janos/Who taller Janos than
'Than whom is Janos taller/Who is Janos taller than'

(212) Kinél magasabb János?

who-ABL taller Janos

'Who is Janos taller than'

The distribution of reflexives provides a second argument against an ellipsis analysis of phrasal comparatives. As noted by Hankamer (1973), a reflexive bound by the subject can introduce the standard expression only in phrasal comparatives, not in clausal comparatives:

(213) No star is brighter than itself.

(214) *No star is brighter than itself is.

The unacceptability of (214) is not surprising: the reflexive is the subject of an embedded finite clause, and so is not bound in its minimal governing category, which incurs a violation of Condition A of the Binding Theory (see Chomsky 1981, 1986). If (213) is actually a reduced clause, then assuming that Condition A must be satisfied at LF (Chomsky 1993, Heycock 1995, etc.), (213) should also be ill-formed. If the constituent headed by *than* has the syntax of a prepositional phrase, however, as in (215), then the reflexive is bound in its minimal governing category, satisfying Condition A.

(215) $[_{IP}$ no star$_i$ is $[_{DegP}$ brighter $[_{PP}$ than $[_{DP}$ itself$_i$]]]]

The conclusion to be drawn from these facts is that at least some phrasal comparatives have syntactic representations in which the complement of *than* is a nominal, rather than clausal constituent. This result raises the following question: if the complement of *than* is an individual-denoting expression (i.e., a DP), and if the semantics of comparative constructions is stated in terms of a relation between degrees, as I have claimed, how is the interpretation of a phrasal comparative derived? In other words, how do we get from an individual to a degree?

Before attempting to develop an answer to this question, I should point out that there is evidence that some phrasal comparatives do in fact have clausal sources. This evidence comes from a contrast between examples like (216) and (217) (cf. Hankamer 1973:180; for additional evidence from Hebrew that some superficially phrasal comparatives are derived from clausal sources, see Hazout 1995).

(216) Max is more eager to meet Susan than Alice.

(217) Who is Max more eager to meet Susan than?

Whereas (216) is ambiguous between the interpretations in (218) and (219), (217) is not: it has only an interpretation corresponding to (219), in which the *wh*-trace binds the argument of *eager*.

(218) Max is more eager to meet Susan than he is eager to meet Alice.

(219) Max is more eager to meet Susan than Alice is eager to meet Susan.

This contrast follows if the non-elliptical structure requires the complement of *than* to have a semantic role parallel to that of the subject. (216) is ambiguous because it can be interpreted either as a simple phrasal construction *or* as an ellipsis construction. In contrast, *wh*-extraction requires the syntactic structure of (217) to be a simple phrasal construction, since a clausal structure would not permit extraction (see (205) and (207) above). What remains to be explained is why the simple phrasal construction requires the argument of *than* to have a semantic role parallel to that of the subject. I will return to this point below.

2.4.3.2 Local Dependencies Phrasal Comparatives

Two solutions to the problem of interpreting phrasal comparatives have been proposed in the literature. The first approach, developed in Gawron 1995, maintains the position that phrasal and clausal comparatives (subdeletion and comparative deletion) have basically the same interpretation–the complement of *than* denotes a description of a degree–but claims that the interpretation of phrasal comparatives is derived through ellipsis resolution in the semantic component, rather than through a reconstruction operation in the syntax.[37] Gawron's analysis adopts the position that phrasal comparatives have the simple syntactic structure in (215), thus maintaining an account of the facts discussed in Hankamer 1973, but derives an interpretation of the complement of *than* as a description of a degree by utilizing the Higher Order

[37] In Gawron's analysis, the comparative clause is actually interpreted as a universal quantification structure, rather than a definite description (of a maximal degree), but this difference is not important to the current discussion.

Unification analysis of ellipsis developed in Dalrymple, Shieber, and Pereira 1991. Within the context of the analysis of gradable adjectives as measure functions, Gawron's proposals can be summarized as follows. The basic interpretation of the standard expression in a simple phrasal comparative is an underspecified relation between an individual and a degree; specifically, the relation is underspecified for a gradable adjective meaning. For example, the logical representation of the complement of *than* in (220), prior to ellipsis resolution, is (221), where **G** is the missing adjective meaning.

(220) The asteroid belt is more distant than Mars.

(221) $\lambda x[\text{MAX}(\lambda d[\text{ABS}(\mathbf{G}(x))(d)])](Mars)$

The problem of finding the standard value boils down to the problem of finding an appropriate function from individuals to degrees, and inserting that function into the logical representation in (221) as the value of **G**. Without going into details, the basic claim of the Higher Order Unification approach is that this function is recovered by abstracting over a parallel element in the main clause. In the case of (220), the parallel element is the subject, and the function that is recovered is the meaning of the adjective *distant*. This function can then be supplied as the value of **G** in (221), deriving (222).

(222) $\text{MAX}(\lambda d[\text{ABS}(distant(Mars))(d)])$

(222) denotes the maximal degree *d* such that the degree to which Mars is distant is at least as great as *d*, which is correctly identifies the standard value for (220).

A strong point of Gawron's analysis is that it provides a means of constructing an appropriate interpretation for the comparative clause using a general ellipsis-resolution mechanism, which is independently required to handle other cases of ellipsis (see Dalrymple, Shieber, and Pereira 1991 for discussion). This also turns out to be a problem for the analysis, however, as phrasal comparatives show exactly the same kind of local dependency between the "missing" adjective meaning in the standard expression and the adjective that heads the comparative DegP that we saw in the case of comparative deletion in section 2.4.2.2. Recall from that discussion that a general characteristic of elliptical constructions is that any constituent of the appropriate semantic type can be recovered as the meaning of an elided constituent. For example, (223) is ambiguous between a reading in which the second conjunct means *I read every book Charles read*, and one in which it means *I read every book Charles bought*.

(223) Marcus read every book I bought, and I read every book Charles did.

The ambiguity of this example shows that the antecedent for the elided verb phrase can either provided by a local antecedent–the VP headed by *read*, or by a more distant one–the VP headed by *bought* in the relative clause of the first conjunct. Although the more local interpretation may be preferred, it is not obligatory.

If the same general mechanisms for recovering elided material are involved in the interpretations of phrasal comparatives, then the second conjunct in an example like (224) should also be ambiguous.

(224) The table is wider than the rug, and the rug is longer than the desk.

(224) is not ambiguous, however. This sentence has only an interpretation in which the length of the rug is asserted to exceed the length of the desk; it does not have a reading in which the length of the rug is asserted to exceed the *width* of the desk.[38] The conclusion to be drawn from this example is that just as we saw with comparative deletion, there is a local dependency between the interpretation of the standard value and the adjective that heads a phrasal comparative. In effect, the standard value must be derived by applying the meaning of the adjective that heads the comparative to the complement of *than*. Without additional stipulations, however, an ellipsis account of the sort proposed by Gawron cannot derive this result.

Before moving on to an alternative analysis, I should point out an interesting difference between phrasal and clausal comparatives: (225), unlike (226) (cf. (174) in section 2.4.2.2), is *not* ambiguous.

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[38]As was the case with nominal comparative deletion, similar facts are observed in phrasal nominal comparatives. (i) has only the interpretation paraphrased in (ii); it cannot be interpreted as in (iii) (cf. fn. 33).

(i) Kim bought many peaches, but Sandy bought more apples than Kim.
(ii) Kim bought many peaches, but Sandy bought more apples than Kim bought apples.
(iii) Kim bought many peaches, but Sandy bought more apples than Kim bought peaches.

(225) The table is longer than the rug is wide, and the rug is longer than the desk.

(226) The table is longer than the rug is wide, and the rug is longer than the desk is.

The ambiguity of (226) was explained in the following way: the second conjunct is structurally ambiguous between an analysis as a subdeletion structure that has undergone VP ellipsis and an analysis as a comparative deletion structure, which does not involve ellipsis. The fact that (225) is unambiguous suggests that it does *not* have an analysis as an ellipsis structure, which creates a puzzle. At the end of section 2.4.3.1, I noted that there is evidence that phrasal comparatives are potentially ambiguous between simple phrasal structures and clausal analyses, which presumably involve ellipsis (see Hankamer 1973, Hazout 1995). If this is true, then it should be possible to analyze (225) as an ellipsis structure. But this would lead us to expect that (225), like (226), should be ambiguous. I will leave this puzzle for future work.

2.4.3.3 A Direct Interpretation of Phrasal Comparatives

The second approach to the problem of phrasal comparatives, developed in Heim 1985, differs from Gawron's in making an explicit distinction between the interpretation of phrasal and clausal comparatives. In Heim's analysis, clausal comparatives–both subdeletion and comparative deletion–have the same analysis: the comparative clause denotes a description of a degree, which is used to compute the standard value.[39] Phrasal comparatives, on the other hand, have a more "direct" interpretation, in which the comparative morpheme takes *three* arguments: the subject, the complement of *than*, and a degree property. In Heim's analysis, which is developed in the context of a relational semantics of gradable adjectives, the interpretation of an example like (220) is (227), which is evaluated with respect to the truth conditions in (228), where a and b are individuals and f is a function from individuals to degrees.

(227) MORE(*the asteroid belt*)(*Mars*)(λx[MAX($\lambda d.distant(x,d)$)])

(228) $||\text{MORE}(a)(b)(f)|| = 1$ iff $f(a) > f(b)$

A positive result of this analysis is that it derives the local dependency between the standard value and the adjective which heads the comparative construction. The same function from individuals to degrees is applied to both of the individual arguments of the comparative morpheme–the adjective that heads the comparative construction–and as a result, no variation is possible.

This approach to the semantics of phrasal comparatives can be straightforwardly implemented in a system in which gradable adjectives denote measure functions by assuming that the comparative morphemes can have the interpretation given above in (134)c, repeated below (again, I focus on the analysis of

39 That is, for Heim, comparative deletion structures are ellipsis constructions that are structurally identical to subdeletion at LF, an analysis that I argued against in the previous section.

er/more for perspicuity, but my remarks hold of *less* and *as* as well).

(134) c. $er/more_3 = \lambda G \lambda y \lambda x[\textsc{more}(G(x))(G(y))]$

The important aspect of (134)c is that the syntactic constituent used to compute the standard value has the semantic type of an individual, and a degree is derived by applying the meaning of the gradable adjective that heads the comparative construction to this individual. This analysis is not only consistent with the syntactic facts of phrasal comparatives observed in this section, it also explains the dependence between the standard value and the adjective which heads the comparative construction. Phrasal comparatives are interpreted by directly applying the adjective meaning both to the subject and to the complement of *than*, explaining the failure of phrasal comparatives to show the kind of variability in interpretation associated with true ellipsis structures.[40]

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[40] This analysis also provides an explanation of the interpretation of structures in which there is no appropriate source for ellipsis. For example, Napoli (1983), citing Williams (see also Heim 1985), points out that metaphorical sentences like (i) have no appropriate source: (i) is interpreted as (ii), but an ellipsis analysis would require it to have the source in (iii).

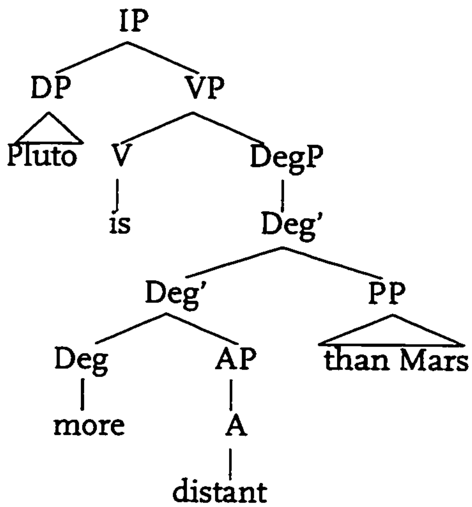
(i) Mary eats faster than a tornado.
(ii) Mary eats faster than a tornado **is fast**
(iii) Mary eats faster than a tornado **eats fast**

Within the analysis proposed here, this problem disappears. The nominal *a tornado* directly provides the standard argument, generating an interpretation for the entire degree construction as in (iv) (which I assume to receive an adverbial interpretation by virtue of its syntactic status as an adjunct).

The semantic analysis of phrasal comparatives outlined here fits together very neatly with the syntactic analysis of the extended projection of the adjective that I adopted in section 2.2. The structural description of a phrasal comparative like (229) is (230), which has the interpretation in (231).

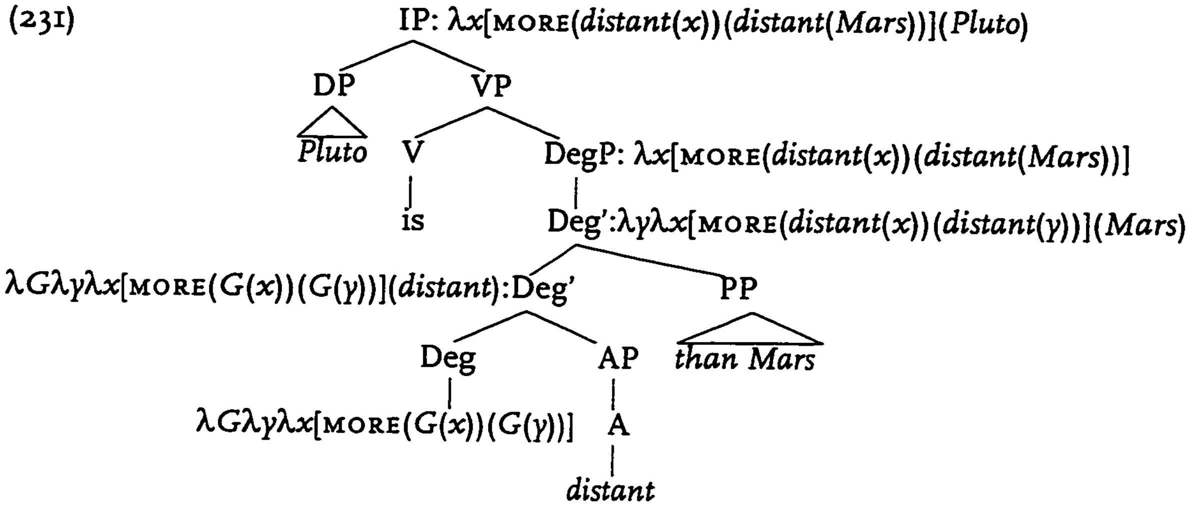
(229) Pluto is more distant than Mars.

(230)



(iv) $\lambda x[\text{MORE}(\textit{fast}(x))(\textit{fast}(\textit{a tornado}))]$

(231)



The comparative morpheme combines with the gradable adjective and applies the adjective to each of its remaining two arguments, which are provided by the nominal argument of *than* and the subject, respectively. The result of the composition in (231) is (232), which has the truth conditions in (233): *Pluto is more distant than Mars* is true just in case the degree to which Pluto is distant exceeds the degree to which Mars is distant.

(232) MORE(*distant*(*Pluto*))(*distant*(*Mars*))

(233) ||MORE(*distant*(*Pluto*))(*distant*(*Mars*))|| = 1 iff
distant(*Pluto*) > *distant*(*Mars*)

An interesting consequence of the syntactic and semantic analyses of phrasal comparatives outlined here is that it explains why the semantic role of the extracted element in examples like (217) must be the same as that of the subject.

(217) Who is Max more eager to meet Susan than?

Since extraction is licensed only if the complement of *than* is a DP, rather than a reduced clause, the comparative is interpreted by applying the AP meaning to the trace of the *wh*-expression. In (217), the meaning of AP is (234) (where *eager to meet Susan* is a function from individuals to degrees), which is the same function that is applied to the subject.

(234) $\lambda z.eager(z, {}^{\wedge}meet(z, Susan))$

As a result, the extracted element and the subject must have the same semantic role.

2.4.3.4 Summary

The syntactic evidence outlined in section 2.3.3.1 clearly shows that in at least some phrasal comparatives, the complement of *than* is a simple phrasal constituent, not a reduced clause. I have demonstrated that the semantic analysis of gradable adjectives as measure functions, combined with the syntax of extended projection, supports a "direct" interpretation of phrasal comparatives similar to the one proposed in Heim 1985. This analysis not only accurately characterizes the truth conditions of phrasal comparatives, it also explains the local dependency between the "missing" adjective meaning in the standard expression and the adjective that heads the comparative clause. Although it was necessary to postulate a compositional difference between phrasal comparatives and their clausal counterparts, the truth conditions of phrasal comparatives are exactly the same as those of subdeletion structures and comparative deletion constructions. Since the complement of *than/as* in a phrasal comparative denotes an individual and the gradable adjective denotes a measure function, semantic composition results in a proposition that expresses a relation between degrees. As a result, the truth conditions of phrasal comparatives follow the general pattern of other degree constructions: they define relations between a reference value and a standard value.

2.4.4 The Phrasal/Clausal Distinction and the Scope of the Standard

A number of researchers have observed semantic differences between phrasal and clausal comparatives (see, for example, McCawley 1967, Napoli 1983, Hoeksema 1983, von Stechow 1984a, as well as Heim 1985). These distinctions are exemplified by the interpretation of phrasal and clausal comparatives in intensional contexts. For example, Napoli (1983) observes that in a context in which the speaker and hearer know that earth is 4.5 billion years old, the galaxy is 6 billion years old, and that Jones believes the Earth to be 4.5 billion years old but has no idea of the age of the galaxy, (235) is felicitous but (236) is not.

(235) Jones thinks the earth is younger than the galaxy is.

(236) Jones thinks the earth is younger than the galaxy.

This type of example is clearly related to those originally discussed by Russell

1905 (see the discussion of scope ambiguities in chapter 1), which show that the comparative clause shows scope ambiguities parallel to definite descriptions in intensional contexts. For example, (237) is ambiguous between the reading paraphrased in (238), in which Jones is mistaken about Jupiter's size, and the one paraphrased in (239), in which he has a contradictory belief about the size of Jupiter.

(237) Jones thinks that Jupiter is larger than it is.

(238) The size that Jupiter actually is is greater than the size Jones thinks it is.

(239) Jones holds the belief that Jupiter exceeds itself in size.

What is important to note is that if the comparative clause in comparative deletion constructions is analyzed as a type of definite description, as claimed in section 2.4.2, then the ambiguity of (237) is expected: like other definite descriptions in intensional contexts, the comparative clause in (237) can have both a *de re* and a *de dicto* interpretation (which correspond to the readings in (238) and (239) respectively). How exactly the readings are derived will depend on the theory of the scope of descriptions; all that is important to note here is that if the comparative clause is a description, then these facts follow (see Russell 1905, Hasegawa 1972, Postal 1974, Horn 1981, Hellan 1981, von Stechow 1984a, Hoeksema 1984, Heim 1985, and Kennedy 1995, 1996b for different approaches to this ambiguity).

An important fact, observed by McCawley (1967), Hellan (1981), Napoli (1983), and Heim (1985), is that phrasal comparatives do not show a similar ambiguity: (240)

has only the interpretation in (239); the *de re* reading in (238) is unavailable.[41]

(240) Jones thinks that Jupiter is larger than itself.

The analyses of phrasal comparatives and comparative deletion constructions developed in the previous sections provides a straightforward explanation of these facts. Although phrasal and clausal comparatives are fundamentally the same–they denote relations between a reference value and a standard value–they also differ in an important way: the standard value in a clausal comparative is a description of a degree, as noted above; the standard value in a phrasal comparative is not (this distinction is also made by Heim (1985)). If standard-denoting expression in a phrasal comparative is not a description of a degree, therefore whatever operations are responsible for the ambiguity of (237) simply don't apply. The facts observed by Napoli (1983), can presumably be explained in the same way.[42]

---

[41]The contrast between (ia-b) and (iia-b) shows that the same facts hold in other intensional contexts.

(i)	a.	If Jupiter were smaller than it is, it might have a solid core.
	b.	If Jupiter were smaller than itself, it might have a solid core.
(ii)	a.	Jones could have been less obnoxious than he was.
	b.	Jones could have been less obnoxious than himself.

[42]Although the facts discussed here might be construed as another argument against an ellipsis analysis of phrasal comparatives (see e.g. Napoli 1983), Heim (1985) points out that these facts do not necessarily provide such an argument, provided that the conditions which license ellipsis are formulated in such a way as to require identity of variables in the elided constituent and antecedent (see Sag 1976). In an example like (240), this will require the world variables in the two constituents to be the same, generating the contradictory interpretation.

2.4.5 Comparatives with Less

An important aspect of the analysis of degree constructions that I have developed in this chapter is that the interpretation of the comparative independent of the interpretation of the absolute. In this sense, the analysis differs from the relational approaches discussed in chapter 1, in which the interpretation of the comparative (qua degree description or generalized quantifier) was stated in terms of the semantics of the absolute form of the adjective (see also the discussion of this point in section 2.1.2). A result of this difference is that the analysis proposed here derives the correct truth conditions for comparatives with *less* without giving up an analysis of the absolute in terms of a partial ordering relation.

Recall from the discussion in chapter 1, section 1.4.2 that an analysis of *less* comparatives in terms of restricted existential quantification fails to accurately characterize the truth conditions of these constructions if the interpretation of the absolute form is stated in terms of a partial ordering relation. Assuming that expressions of the form $\varphi(a,d)$ are true just in case the degree to which a is φ is at least as great as d, the logical representation of a sentence like (241), shown in (242), is satisfied even if Mars Pathfinder was *more* expensive than the space telescope, since it would be true in such a situation that for some d ordered below the degree to which the space telescope was expensive, Mars Pathfinder is *at least* as expensive as d.

(241) Mars Pathfinder was less expensive than the space telescope.

(242) $\exists d[d < \iota d'.expensive(the\ space\ telescope,d')][expensive(Mars\ Pathfinder,d)]$

In contrast, since the analysis of comparatives developed in the preceding sections is not stated in terms of the absolute construction, this problem disappears. The truth conditions for *less* comparatives (as well as those of *more* comparatives, equatives, and the absolute construction) are formulated directly in terms of a relation between two degrees–the reference value and the standard value. Given the truth conditions for *less* and *more* that I have assumed, which are stated below in (243) and (244), the relations denoted by *less* and *more* cannot hold of the same pair of degrees in the same context.

(243) $||\text{LESS}(d_R)(d_S)|| = 1$ iff $d_R < d_S$

(244) $||\text{MORE}(d_R)(d_S)|| = 1$ iff $d_R > d_S$

It follows that (241), which has the logical representation in (245) is true if and only if the degree to which Mars Pathfinder was expensive is ordered below the degree to which the space telescope was expensive on the scale associated with the adjective *expensive*.

(245) $\text{LESS}(expensive(Mars\ Pathfinder))(expensive(the\ space\ telescope))$

2.4.6 Comparative and Absolute

Before concluding this section, a few final words on the difference between comparative and absolute constructions are in order. Although the truth conditions of propositions constructed out of comparative and absolute adjectives are fundamentally the same–they are stated in terms of the same three constituents, a degree relation, a reference value, and a standard value–the semantic differences between the comparative and absolute degree morphemes make an important distinction between these constructions.

What is common to both comparative and absolute degree constructions is that they establish a relation between projection of an object on a scale–specifically, the target of predication–and some other scalar value (the standard). Absolute constructions are more limited in their means of accomplishing this than comparatives, however, because they are constrained to use only degree-denoting expressions (measure phrases) or properties to identify the standard. In contrast, the fundamental characteristic of comparative constructions is that they make it possible to identify the standard value as a function of virtually any object in the discourse, provided that it is the sort of object that can be projected onto the scale associated with a gradable adjective. This difference explains the well-known fact that in typical examples, no entailment relation holds between comparative sentences and the corresponding absolutes. For example, none of the arguments in (246)-(248) are valid.

(246) A white dwarf is brighter than a brown dwarf.

#∴ A white dwarf is bright.

(247) Saturn's gravitational field is less intense than Jupiter's.

#∴ Saturn's gravitational field is (not) intense.

(248) At certain points during its orbit, Pluto is as close to the sun as Neptune.

#∴ Pluto is close to the sun.

In order for arguments such as (246)-(248) to be valid, it would have to be the case that the "constructed" standards introduced by the comparatives *necessarily* stood in some relation to the context-dependent standards associated with the corresponding absolutes. Consider, for example, the interpretations of the premise and conclusion in (248) in (249) and (250). (For simplicity, I will ignore the adverbial constituent in (249) and I will analyze the phrase *close to the sun* as a single adjectival constituent.)

(249) $\textsc{as}(\textit{close-to-the-sun}(\textit{Pluto}))(\textit{close-to-the-sun}(\textit{Neptune}))$

(250) $\textsc{abs}(\textit{close-to-the-sun}(\textit{Pluto}))(\textsc{stnd}(\lambda x.\textit{close-to-the-sun}(x))(\mathbf{p}(\textit{Pluto})))$

(249) and (250) have essentially the same truth conditions: these expressions are true if the first argument of AS/ABS (the reference value) is at least as great as the second argument (the standard value) (see (124) and the truth conditions for the absolute given in (77), section 2.3). In order for (250) to follow from (249), then, it must be the case that the standard value in (249)–the degree to which Neptune is close to the sun–is at least as great as the standard value in (250)–a value on the scale associated with *close-to-the-sun* that is contextually determined based on some

property of *Pluto*. Although it is possible that these two values are related in this way, it is certainly not necessary. As a result, the entailment doesn't go through. Similar arguments apply to (246) and (247).

2.4.7 Summary: Current Results and Future Directions

Building on the syntax of extended projection, this section demonstrated that the analysis of gradable adjectives and degree morphology outlined in section 2.1 supports a straightforward compositional semantics for predicative comparatives that implements one of the main claims of section 2.1: comparative constructions are not quantificational expressions, rather they denote properties of individuals. An important aspect of the analysis is that the interpretations of the three classes of comparatives that I considered–subdeletion structures, comparative deletion constructions, and phrasal comparatives–differ according to the structure and interpretations of the standard expression. In both subdeletion and comparative deletion structures, the standard expression is a clausal constituent (the "comparative clause"), but in the former, the comparative clause is directly interpreted as a description of a degree, while in the latter, the comparative clause denotes a function from gradable adjectives to degree descriptions, and the gradable adjective meaning is supplied by the adjective that heads the comparative construction. In contrast, the standard expression in a phrasal comparative is a DP, and the standard value is derived by applying the measure function introduced by the adjective that heads the comparative DegP to this expression. Although the analysis requires the assumption that the comparative degree morphemes have three distinct interpretations, it was shown to be justified both syntactically, as it provides a direct interpretation for phrasal comparatives, and semantically, as it accounts for the local dependency observed in phrasal comparatives and comparative deletion between the interpretation of the "missing" adjective meaning in the standard expression and the adjective that heads the comparative. More generally, the three interpretations of the comparative morphemes are truth-conditionally equivalent, differing only the derivation of the standard value. As a result, all three classes of comparatives give rise to propositions that have the semantic constituency hypothesized to hold of all degree constructions: they express ordering relations between two degrees, the reference value and the standard value.

A final point should be emphasized. As observed at the outset of this section, in order for the analysis developed here to be accepted as a general account of the semantic and syntactic properties of comparatives, it must be shown that it can be extended to the full range of comparative constructions in English, including attributive AP comparatives and nominal comparatives. Of particular importance is an evaluation of the analysis of comparative deletion with respect to these other types of comparative constructions, in particular, the hypothesis that the missing degree phrase in comparative deletion constructions indicates that the comparative operator is categorically a DegP, rather than the application of an ellipsis operation. Although this hypothesis provided a principled explanation of the semantic and syntactic properties of predicative comparative deletion constructions, whether it generalizes to nominal and attributive comparatives is a question that remains to be answered (though see Kennedy and Merchant 1997 for arguments that this analysis actually provides the basis for an explanation of some otherwise puzzling characteristics of attributive comparatives). What I hope to have demonstrated in this section is that the overall strength of the analysis of gradable adjectives and degree constructions that I have advocated in this thesis makes this a question that is indeed worth pursuing.

2.5 Conclusion

This chapter made two primary claims. First, gradable adjectives should be analyzed not as relational expressions, but rather as functions from objects to degrees. Second, degree morphemes introduce relations between degrees, and degree constructions denote properties of individuals, rather than expressions that quantify over degrees. Building on a syntactic analysis in which gradable adjectives project functional structure headed by a degree morpheme, I demonstrated that these assumptions support a straightforward compositional semantic analysis of a range of degree constructions in English. Crucially, since degrees are not arguments of a gradable adjectives, and degree constructions are not analyzed as quantificational expressions, the fact that they do not participate in scope ambiguities follows.

In a general sense, the semantic analysis outlined in section 2.1 provides support for the extended projection syntactic analysis of degree constructions developed in Abney 1987, Corver 1990, 1997, and Grimshaw 1991. As demonstrated in sections 2.3 and 2.4, the syntactic representations of degree constructions derived within this approach, in which a gradable adjective projects extended functional structure headed by a degree morpheme, can be given a transparent compositional interpretation in which the adjectival head is interpreted as a measure phrase and the degree morpheme as a relation between degrees. The adjective combines with the degree morpheme to generate an expression that denotes a relation between degrees and individuals–an expression of the same semantic type as a gradable adjective on the traditional view. This expression in turn combines with a standard-denoting expression, with the result that DegP denotes a property of individuals. Composition of this property with the subject generates a proposition that manifests the three-part constituency claimed in section 2.1 to be the basic interpretation of degree constructions: a relation between a reference value and a standard value.

A final and very important point to make is that the analysis of gradable adjectives and degree constructions proposed here explains the observation that formed the starting point for this dissertation: the fact that only gradable adjectives appear in degree constructions. One of the basic claims of the analysis of degree constructions developed in this chapter is that degree morphemes denote ordering relations between two degrees. Since one of these degrees (the reference value) is derived by applying the meaning of the adjective that heads the degree construction to the subject, it must be the case that this adjective denotes a function from individuals to degrees (a measure function). If this were not the case, then the relation introduced by the degree morpheme would be undefined, because one of its arguments would be of the wrong semantic type. The conclusion then, is that only expressions that denote measure functions–i.e., only gradable adjectives–can head a degree construction. In order for a non-gradable adjective–which I assume to denote a function from individuals to truth values–to appear in a degree construction, it must be somehow given a gradable interpretation (see the discussion of this point in the introduction).

In essence, this explanation of the distribution of gradable adjectives is of the same type as the one provided by the vague predicate analysis, which claimed that only gradable adjectives (*qua* vague predicates) are of the appropriate semantic type to serve as arguments to degree functions. In a general sense, then, the analysis of gradable adjectives and degree constructions that I have proposed here represents a synthesis of the vague predicate analysis and the traditional scalar analysis of gradable adjectives as relational expressions. Like the vague predicate analysis, gradable adjectives denote functions, and the interpretation of degree constructions involves the semantic composition of the degree morpheme and the gradable adjective. At the same time, by characterizing the core meaning of gradable adjectives in terms of abstract representations of measurement–i.e. a scales and degrees–I have maintained the core assumption of the scalar analysis. This assumption will be examined in more detail in chapter 3, where I will take a closer look at the ontology of scales and degrees.

3 Polar Opposition and the Ontology of Comparison

The objective of this chapter is to demonstrate that degrees should be formalized as intervals on a scale rather than as points, as traditionally assumed. Using cross-polar anomaly as the empirical basis for my claims, I will argue that gradable adjectives denote functions from objects to intervals on a scale, or *extents*, and assume an ontology which distinguishes between two sorts of extents: positive extents and negative extents (as in Seuren 1978, von Stechow 1984b, and Löbner 1990). I characterize the difference between positive and negative adjectives as a sortal one: positive adjectives denote functions from objects to positive extents, and negative adjectives denote functions from objects to negative extents. After setting this analysis into the semantic framework developed in chapter 2, I show that cross-polar anomaly can be explained in the same way as incommensurability: a consequence of the sortal characterization of adjectival polarity is that the ranges of positive and negative adjectives are disjoint; as a result, the comparison relation in examples of cross-polar anomaly is undefined. Section 3.2 continues with an examination of comparison of deviation constructions, which at first glance appear to be counterexamples to the proposals made in section 3.1, but upon closer examination turn out to fit in naturally with the analysis of degree constructions developed in chapter 2. Finally, section 3.3 demonstrates that the algebra of extents, in conjunction with the semantic analysis of gradable adjectives as measure phrases, has the additional positive result of providing the basis for an insightful explanation of the monotonicity properties of gradable adjectives.

3.1 Comparison and Polar Opposition

3.1.1 The Algebra of Degrees

The semantic analysis of gradable adjectives and degree constructions developed in chapter 2 characterized the interpretations of these expressions in terms of abstract *degrees*, or points on a scale. The notion of a degree as a point on a scale goes back at least to Cresswell (1976), who suggests that "[w]hen we make comparisons we have in mind points on a scale" (p. 266). Cresswell builds an algebra of degrees directly from the domain of the adjective; in chapter 2 (see section 2.1.3), I adopted a modified version of this approach, in which scales and degrees are defined abstractly in terms of a linearly ordered set of points and a dimension. Specifically, I defined a *scale* S_δ as a dense, linearly ordered set of points along a dimension δ, and a *degree* as an element of the scale.

Within this sort of ontology, gradable adjectives are traditionally analyzed as two place relations between degrees and individuals. In chapter 2 however, I argued for an alternative approach to the semantics of gradable adjectives in which they are analyzed as measure functions–functions from objects to degrees. Although this approach, as well as the semantics of degree constructions built on top of it, differed from the traditional analysis in a number of important respects, it nevertheless maintained the traditional assumptions about the basic structure of scales and degrees. In the following sections, I will take a closer look at these assumptions, focusing on the representation of adjectival polarity within a degree algebra. In section 3.1.3, I will turn to an examination of cross-polar anomaly, where I will demonstrate that an algebra of degrees that characterizes these objects as points on a scale incorrectly predicts that comparatives constructed out of antonymous pairs of adjectives should be perfectly interpretable.

3.1.2 Degrees and Polar Opposition

As observed in chapter 1 (see section 1.1.4), a characteristic of many (though not all) gradable adjectives is that they come in pairs: *tall* - *short*, *safe* - *dangerous*, *sharp* - *dull*, *bright* - *dim*, etc. In a basic sense, the meanings of the members of such antonymous pairs are fundamentally the same: they apply to the same objects, and they provide the same kind of information about the degree to which an object possess some gradable property. The antonymous adjectives *tall* and *short*, for example, both provide information about an object's height. At the same time, positive and negative adjectives represent different–and in some sense complementary–perspectives on the degree to which an object possesses a gradable property. Intuitively, *tall* measures the height an object has; *short* measures the height an object does not have.

The empirical manifestation of this distinction in perspective can be observed in differences in the interpretations of absolute and comparative constructions with positive and negative adjectives. The basic analysis of the semantics of positive adjectives can be illustrated by considering interpretation of (1). The logical form of (1) is (2), where s_{long} denotes a standard of longness relative to some comparison property appropriate for *The Brothers Karamazov* (e.g., the property of being a

Russian novel).[1]

(1) *The Brothers Karamazov* is long.

(2) ABS(*long*(*BK*))(s_{long})

According to the truth conditions for the absolute construction proposed in chapter 2, (1) is true just in case the degree to which *The Brothers Karamazov* is long is at least as great as the standard value; i.e., if and only if the relation illustrated in (3) holds, where d_{BK} is the degree of *The Brothers K.*'s length.

(3) LENGTH: 0 ———————— s_{long} ———————— d_{BK} ———————— ∞

Absolute constructions with negative adjectives may be analyzed in basically the same way, with one important modification: the relation between the reference value and the standard value must be reversed. This point is illustrated by the analysis of (4).

(4) *The Dream of a Ridiculous Man* is short.

(5) ABS(*short*(*Dream*))(s_{short})

[1]See the discussion of the derivation of implicit standards in chapter 2, section 2.3.2; I use the variable s_{long} rather than the complex expression STND(*long*)(**p**(*The Brothers Karamazov*)) for perspicuity.

The logical representation of (4) is (5), where s_{short} denotes the standard of shortness appropriate for *The Dream of a Ridiculous Man*, which may or may not be the same as the standard of longness in a given context. The crucial difference between (4) and (1) is that in the former, the partial ordering relation associated with the absolute construction must be reversed. Consider, for example, a context in which the standard of longness for Russian novels is 600 pages, and the standard of shortness is 400 pages.[2] What should be the case is that any novel over 600 pages in length counts as long, while any novel *under* 400 pages in length counts as short (see Gawron 1995 for discussion of this issue). Assuming, then, that the ordering relation introduced by ABS is reversed in (5), (4) is true just in case the relation between the reference and standard values illustrated in (6) holds.

(6) LENGTH: 0 ——— d_D ——— s_{short} ——————————— ∞

Comparatives with positive and negative adjectives show exactly the same difference in ordering relations as absolute constructions. Consider, for example, (7), which has the logical representation in (8).

[2] In this context, a novel whose length is between 400 and 600 pages is neither long nor short; in Klein's (1980) terminology, it falls in the "extension gap" on the scale of length. This example points out the fact that antonymous adjectives are, in effect, *contraries*: although an object may be neither long nor short, no object is both long and short. This relation is enforced by a general constraint on the relation between positive and negative standards; see Bierwisch 1989 for discussion.

(7) *The Brothers Karamazov* is longer than *The Idiot.*

(8) MORE(*long*(*BK*))(*long*(*Idiot*))

(8) is true just in case the degree to which *The Brothers Karamazov* is long exceeds the degree to which *The Idiot* is long. In the context illustrated by (9), where d_I denotes the projection of *The Idiot* on a scale of length and d_{BK} indicates *The Brothers Karamazov*'s degree of length, (7) is true.

(9) LENGTH: 0 ———————— d_I ———————— d_{BK} ———————— ∞

Negative comparatives can be analyzed in the same way as their positive counterparts, with the exception that the ordering relation introduced by the degree morpheme must be reversed, as in negative absolute constructions. This is illustrated by (10).

(10) *The Idiot* is shorter than *The Brothers Karamazov.*

(11) MORE(*short*(*Idiot*))(*short*(*BK*))

(10) is true just in case the degree to which *The Idiot* is short is ordered *below* the degree to which *The Brothers Karamazov* is short, as shown in (12).

(12) LENGTH: 0 ———————— d_I ———————— d_{BK} ———————— ∞

Put another way, (10) is true just in case the degree to which *The Idiot* is short exceeds the degree to which *The Brothers Karamazov* is short, assuming that the definition of "exceeds" for degrees of shortness is the inverse of the definition of "exceeds" for degrees of longness.

The relational differences between positive and negative adjectives illustrated by these examples suggest a means of formally representing adjectival polarity within the algebra of degrees outlined in section 3.1.1. As noted above, the members of a positive and negative pair of gradable adjectives not only apply to the same objects (i.e., share the same domain), they also provide the same basic information about the objects to which they apply: they measure the degree to which an object possesses some gradable property. Another way of stating this observation is that positive and negative pairs of adjectives measure objects according to the same dimension. The crucial difference between positive and negative adjectives, illustrated by the examples discussed above, is that the measurements they return permit complementary orderings on their domains. This was most clearly shown by the comparatives in (7) and (10): when *The Brothers Karamazov* "exceeds" *The Idiot* with respect to longness, *The Idiot* "exceeds" *The Brothers Karamazov* with respect to shortness.

The analysis of gradable adjectives as measure functions supports a formal representation of adjectival polarity which captures the intuitions about polar adjectives outlined here. The claim that gradable adjectives denote measure functions is a claim about their semantic type: they denote functions from objects to degrees. Put another way, the range of a gradable adjective is a scale. Since scales are defined as a linearly ordered set of degrees along some dimension (which corresponds to a gradable property such as *length* or *density*), we can capture the intuition that positive and negative pairs of adjectives measure objects according to the same dimension by assuming that they define identical mappings from the objects in their domains to points on a shared scale. To make this idea more precise, I will assume the general principle in (13) (cf. Rullmann 1995).

(13) For any scale S_δ along dimension δ, for any antonymous pair of gradable adjectives φ_{pos} and φ_{neg} with dimensional parameter δ, and for any object x in the domain of φ_{pos} and φ_{neg}: $\varphi_{pos}(x) = \varphi_{neg}(x)$.

The crucial difference between φ_{pos} and φ_{neg}–what I referred to as a difference in perspective–is that they impose opposite orderings on their domains. This difference can be represented in terms of an ordering distinction between the ranges of φ_{pos} and φ_{neg}. Specifically, I will assume that the range of the positive is the set of degrees on the scale under the basic ordering provided by the scale ("<"), while the range of the negative the set of degrees on the scale under the *reverse* ordering (">"). On this view, a negative adjective is the *dual* of its positive counterpart (cf. Cresswell 1976, Gawron 1995, Sánchez-Valencia 1995, Rullmann 1995).

The claim underlying this representation of adjectival polarity is that positive and negative pairs of adjectives map the objects in their domains to degrees on the same basic scale, but their ranges are differentiated by virtue of being associated with opposite ordering relations. Since there is a one-to-one mapping between the range of φ_{pos} and the range of φ_{neg} (the identity function), however, the two sets are isomorphic. In other words, for any scale S, the set of positive degrees on S and the set of negative degrees on S contain the same objects. This has a very important empirical result: it explains the validity of statements like (14), a minimal requirement of any theory of the semantics of polar adjectives and comparatives.

(14) *The Brothers Karamazov* is longer than *The Idiot* if and only if *The Idiot* is shorter than *The Brothers Karamazov*.

If positive and negative adjectives define identical mappings from objects in their domains to degrees on a scale, but differ the ordering they induce, then assuming that the comparative (and absolute) morphemes "inherit" the ordering associated with the adjective that heads the degree construction, it follows that the coordinated propositions in (14) (i.e., (7) and (10)), are true in the same situations: whenever the degree of *The Brothers K*'s length exceeds the degree of *The Idiot*'s length.[3]

3.1.3 Cross-polar Anomaly

Sentences such as (15)-(18), which exemplify the phenomenon that I referred to in chapter 1 as "cross-polar anomaly", present an interesting puzzle for the algebra of

[3]If a negative adjective is the dual of its positive counterpart, then the validity of (14) follows from the Duality Principle: if a statement φ is true in all orders of type T (partial order, total order, etc.), then its dual is also true in all orders of type T (see Landman 1991:88).

degrees discussed in the previous two sections, in which degrees are represented as points on a scale.[4]

(15) #*The Brothers Karamazov* is longer than *The Idiot* is short.

(16) #*The Idiot* is shorter than *The Brothers Karamazov* is long.

(17) #Mars is closer than Pluto is distant.

(18) #A brown dwarf is dimmer than a blue giant is bright.

These examples indicate that comparatives constructed out of a positive and negative pair of adjectives are semantically anomalous. Crucially, (15)-(18) contrast with examples of comparative subdeletion involving adjectives of the same polarity, such as (19)-(20).[5]

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[4]The anomaly of sentences like (15)-(18) was first observed by Hale (1970), who notes the contrast between (i) and (ii).

(i) The table is longer than it is wide.
(ii) #The table is longer than it is short.

See also Bierwisch 1989 for a discussion of similar facts in German.

[5]Recall from the discussion in chapter 1 that examples of cross-polar anomaly also contrast with superficially similar sentences like (i-ii), which I described as examples of "comparison of deviation".

(i) *The Brothers Karamazov* is as long as *The Dream of a Ridiculous Man* is short.
(ii) A brown dwarf is more dim than a blue giant is bright.

I will return to a detailed discussion of comparison of deviation in section 3.2.

(19) Carmen's Cadillac is wider than Mike's Fiat is long.

(20) Fortunately, the ficus was shorter than the ceiling was low, so we were able to get it into the room.

The puzzle of cross-polar anomaly is that the very same assumptions which provided an intuitive characterization of adjectival polarity, as well as an explanation of the validity of (14), make the wrong predictions in the case of cross-polar anomaly.

Examples of cross-polar anomaly are structurally instances of comparative subdeletion, therefore, assuming the analysis of subdeletion structures presented in section 2.4.1.2 of chapter 2, the logical representation of (15) is (21).

(21) $\text{MORE}(\mathit{long}(\mathit{The\ Brothers\ K}))(\text{MAX}(\lambda d[\text{ABS}(\mathit{short}(\mathit{The\ Idiot}))(d)]))$

The standard value in (21) is the degree introduced by the comparative clause: the maximal degree *d* such that *The Idiot* is at least as short as *d*. According to the analysis of adjectival polarity outlined in section 3.1.2, the adjectives *long* and *short* define the same mapping from the objects in their domains to points on a scale of length. It follows that degrees of *longness* and *shortness* are the same objects, therefore the comparative clause in (21) should pick out not only the maximal degree in the range of *short* that represents *The Idiot*'s length, but also the maximal degree in the range of *long* that represents *The Idiot*'s length, since these two degrees are in fact the same objects. That is, even though the orderings on the ranges of *long* and *short* are distinct, since degrees of longness and degrees of shortness are the same objects, the equivalence in (22) holds.

(22) $\textsc{max}(\lambda d[\textsc{abs}(short(The\ Idiot))(d)]) = \textsc{max}(\lambda d[\textsc{abs}(long(The\ Idiot))(d)])$

If this is the case, however, then (15) should not only be interpretable, it should be logically equivalent to (7) and (10).[6] This is clearly the wrong result.

What is important to observe is that this result is not dependent on the choice of the specific adjectives *long* and *short*, it holds for any positive-negative pair. Since positive and negative degrees denote the same objects, any equivalence relation of the form in (22) holds, with the result that the ordering relations schematized in (23) and (24) should be defined, where DEG is an ordering relation on degrees and d_{pos} and d_{neg} are positive and negative degrees on the same scale.

(23) $\textsc{deg}(d_{pos})(d_{neg})$

(24) $\textsc{deg}(d_{neg})(d_{pos})$

Simply put, there is no property of an algebra of degrees which explains the anomaly of comparatives constructed out of positive and negative pairs of adjectives. This leads to the following conclusion: either the assumption that positive and negative degrees are the same objects is incorrect, or the assumption that positive and negative adjectives share the same scale is false. Since the latter (or some equivalent

[6]The same argument can be made in the case of examples such as (16), in which the matrix adjective is negative and the adjective in the comparative clause is positive.

assumption) is required to explain the validity of statements like (14) (cf. Rullmann 1995), it must be the case that the former needs to be rethought.[7]

3.1.4 On the Unavailability of an Incommensurability Explanation

Before I present an alternative characterization of degrees, I should address what at first glance appears to be a possible explanation of cross-polar anomaly within the algebra of degrees outlined here. This explanation rejects the claim that positive and negative pairs of adjectives share the same scale, and explains the anomaly of examples like (15)-(18) in terms of incommensurability. On this view, (15)-(18) are

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[7]It should be observed that the problem of cross-polar anomaly for a degree algebra is not a consequence of the semantic analysis of comparatives and gradable adjectives that I adopted in chapter 2. The same problems arise in an approach which assumes a relational semantics for gradable adjectives and analyzes comparatives in terms of restricted quantification over degrees, such as the one discussed in chapter 1. Consider, for example, the analysis of (i) within this type of approach.

(i) #Carmen is taller than Mike is short.

(ii) $\exists d[d > \iota d'.short(Mike,d')][tall(Carmen,d)]$

According to (ii), (i) is true just in case there is a degree which exceeds the maximum degree of Mike's shortness, and Carmen is that tall. This means that (i) should be true in the situation represented in (iii), since d_M denotes both the degree to which Mike is short and the degree to which Mike is tall.

(iii) HEIGHT: 0 ———————— d_M ———————— d_C ———————— ∞

See Kennedy 1997b for more detailed discussion of the problem of cross-polar anomaly for within the context of a relational analysis of gradable adjectives.

anomalous for the same reason that (25)-(26) are: the two adjectives in the subdeletion construction are associated with different scales.

(25) #Mike is taller than Carmen is clever.

(26) #*The Idiot* is more tragic than my copy of *The Brothers Karamazov* is heavy.

The explanation of the anomaly of examples like (25) and (26) developed in chapter 2 builds on the semantic analysis of subdeletion outlined above. According to these proposals, the logical representation of an example like (25) is (27).

(27) $\textsc{more}(tall(Mike))(\textsc{max}(\lambda d[\textsc{abs}(clever(Carmen))(d)]))$

The standard value introduced by the comparative clause in (27) is the maximal degree *d* such that Carmen is at least as clever as *d*, therefore, in order to evaluate the truth of (27), an ordering must be established between this degree and the degree to which Mike is tall. The adjectives *tall* and *clever* map their arguments onto different scales, however, so the ordering relation introduced by the comparative is undefined for these two degrees, resulting in semantic anomaly.

Although I will ultimately construct an explanation of cross-polar anomaly in these terms, this type of explanation does not appear to be available within the traditional degree algebra. The explanation of the incommensurability of examples like (25) and (26) presupposes that the scales associated with the adjectives *clever* and *tall* are distinct (i.e., they are associated with different dimensional parameters; see the discussion in chapter 1, section 1.1.3). This is crucial to the explanation, because when the adjectives in a subdeletion structure map their arguments to points on the same scale, comparison is possible, as shown by the examples discussed above.

In order for an incommensurability explanation of cross-polar anomaly to go through, then, it must be demonstrated that for any for antonymous pair of adjectives, there is no mapping between objects in the range of the positive adjective and objects in the range of the negative. If such a mapping can be defined, then examples like (15)-(18) should be amenable to the same sort of analysis as (19) and (20). The problem is that it must be the case that a mapping between e.g. degrees of tallness and degrees of shortness can be defined, otherwise the validity of (14) would remain unexplained (see Rullmann 1995 for additional discussion of this point). The incommensurability explanation fails because any algebra of degrees which explains the validity of constructions like (14)–which is a minimal requirement of descriptive adequacy–should also permit a mapping between positive and negative degrees, with the consequence that examples of cross-polar anomaly should be fully interpretable.

Although it fails to explain cross-polar anomaly, the proposal that positive and negative adjectives are incommensurable contains an interesting hypothesis: that degrees of tallness and degrees of shortness are different sorts of objects, with the consequence that the range of a positive adjective is *disjoint* from the range of its negative counterpart. If this were the case, then cross-polar anomaly could be explained in the same terms as incommensurability: it would be impossible to evaluate the relation introduced by the comparative morpheme. Without an ad hoc stipulation to this effect, however, there is no way to build the necessary sortal difference between positive and negative degrees into a degree algebra: if corresponding positive and negative degrees on the same scale denote the same objects, then they are sortally indistinguishable from one another. In the following section, I will develop an alternative algebra of degrees in which positive and negative degrees are analyzed as distinct objects, and I will show that this distinction not only provides an insightful representation of adjectival polarity and an account of the validity of statements like (14), it also provides the basis for an explanation of cross-polar anomaly.

3.1.5 The Algebra of Extents

In order to develop a solution to the problem of cross-polar anomaly, I will adopt an ontology of comparison in which the projection of an object on a scale is represented not as a discrete point, but rather as an *interval*, which I will refer to as an *extent* (cf. Seuren 1978, 1984, von Stechow 1984b, Bierwisch 1989, Löbner 1990). In terms of the analysis of gradable adjectives developed here, the basic claim remains the same: every gradable adjective denotes a function from objects to scalar values, and scales are differentiated through association with a dimension. The difference is in the structure of the scalar values–what I have referred to up to now as "degrees". Whereas the algebra of degrees outlined in section 3.1.2 represents scalar values as a discrete points, the extent algebra that I will formalize below represents degrees as intervals. As I will demonstrate, this modification provides the basis for an analysis of adjectival polarity which both predicts the validity of statements like (14) above *and* supports an explanation of cross-polar anomaly.

In terms of basic structure, the notion of a scale can be formalized as above. Specifically, let a *scale* S_δ be a dense, linearly ordered set of points along a dimension δ which may have a minimal element but has no maximal element.[8] Since a scale is defined as a sets of points, an *extent* on a scale can be defined as a nonempty, convex subset of the scale, i.e. a subset of S_δ with the following property: $\forall p_1,p_2 \in E \forall p_3 \in S_\delta[p_1 < p_3 < p_2 \rightarrow p_3 \in E]$ (cf. Landman 1991:110; this is simply the definition of an interval for a linearly ordered set of points). Finally, I will define a *proper extent* on a scale S_δ as a nonempty, convex proper subset of S_δ. The distinction between extents and proper extents not crucial, rather it is made primarily to simplify the definitions of positive and negative extents presented below, and to avoid the question of what sort of extent the scale itself is.

These definitions provide the basis for a semantic analysis of gradable adjectives as functions from individuals to extents that has essentially the same properties as the degree-based analysis assumed up to now. In order to build a foundation for an alternative theory of adjectival polarity, I will make a further distinction between two sorts of extents–*positive extents* and *negative extents*–which are defined in (28) and (29).

(28) A *positive extent* on a scale is a proper extent which ranges from the lower end of the scale to some positive point.

[8]Although it seems appropriate to assume that the scales associated with dimensional adjectives like *long* and *wide* have a minimal element, it is not obvious that the same holds of adjectives like *beautiful* and *creative*. Since this point does not affect the basic claims to be made below, I have left the question of whether scales have a minimal element open.

(29) A *negative extent* on a scale is a proper extent which ranges from some positive point to the upper end of the scale.

To make things more precise, assume that for any object a which can be ordered according to some dimension δ, there is a function **d** from a to a unique point on the scale S_δ.[9] Let the positive extent of a on S_δ ($\text{POS}_\delta(a)$) be as defined in (30), and let the negative extent of a on S_δ ($\text{NEG}_\delta(a)$) be as defined in (31).

(30) $\text{POS}_\delta(a) = \{p \in S_\delta \mid p \leq \mathbf{d}(a)\}$

(31) $\text{NEG}_\delta(a) = \{p \in S_\delta \mid \mathbf{d}(a) \leq p\}$.

According to the definitions in (30) and (31), the positive and negative projections of an object on a scale are (join) complementary. This is illustrated by (32), which shows the positive and negative extents of an object a on the scale S_δ.

(32) S_δ: 0 ———— $\text{POS}_\delta(a)$ ————•———— $\text{NEG}_\delta(a)$ ————→ ∞

Given these background assumptions, we can now construct a formal analysis of adjectival polarity in terms of an algebra of extents. In section 3.1.2, I noted the following distinction between antonymous pairs of adjectives: although the members of a positive and negative pair of adjectives measure objects according to the same dimension, they represent complementary perspectives on the projection of an

[9] This point corresponds to a degree in the traditional algebra.

object onto scale. For example, the sentences *Carmen is tall* and *Mike is short* both provide information about the height of Carmen and Mike, respectively, but the information is qualitatively different in each case: the positive adjective *tall* conveys information about the height an object has, while the negative adjective *short* conveys information about the height an object does not have (cf. von Stechow 1984b:196).

The distinction between positive and negative extents provided by the algebra of extents–specifically, the complementarity illustrated in (32)–provides a means of representing adjectival polarity in a way that captures these intuitions. Specifically, I will claim that positive adjectives denote functions from objects to positive extents, and negative adjectives denote functions from objects to negative extents. Put another way, I am claiming that adjectival polarity is a *sortal* distinction between positive and negative adjectives. All gradable adjectives denote functions from objects to extents, but the set of such functions can be sorted according to their range: positive adjectives denote gradable properties whose range is the set of positive extents on a scale S; negative adjectives denote gradable properties whose range is the set of negative extents on S. A consequence of this approach is that although antonymous pairs of positive and negative adjectives define mappings from objects in their domains to the same scale, the positive projection of an object on a scale is distinct from the negative projection of that object on the same scale.

This distinction represents the fundamental difference between this approach to adjectival polarity and the one provided by the degree algebra outlined in section 3.1.2: in the former, but not the latter, the ranges of a positive and negative pair of adjectives are *disjoint*. As observed in section 3.1.2, because degrees are defined as points on a scale, there is no way to differentiate positive and negative degrees. If gradable adjectives denote functions from objects to points on a scale, then for any object *a* and any pair of positive and negative adjectives φ_{pos} and φ_{neg}, $\varphi_{pos}(a)$ and $\varphi_{neg}(a)$ denote the same object. In contrast, extents have additional structure, namely the intervals extending to the relevant end of the scale. As a result, positive and negative extents are distinct objects, and for any object *a* and any pair of positive and negative adjectives φ_{pos} and φ_{neg}, $\varphi_{pos}(a) \neq \varphi_{neg}(a)$. Put another way, positive and negative extents are different *sorts* of objects, distinguished in terms of perspective. A consequence of this distinction is that, for any scale S, the set of positive extents on S and the set of negative extents on S are disjoint subsets of the total set of extents on S. This aspect of the extent algebra provides the foundation for the explanation of cross-polar anomaly that I will present in section 3.1.7.

The ontological assumptions that I have outlined here have their roots in the work of Seuren (1978) (see also Seuren 1984), who analyzes gradable adjectives as relations between individuals and extents and makes a distinction between positive and negative extents along the lines of the one proposed in (28) and (29); this approach is also adopted in von Stechow 1984b and Löbner 1990.[10] The important contribution that the work reported here makes to this line of research is that it introduces a strong empirical argument–the phenomenon of cross-polar anomaly–for formalizing scalar values in terms of intervals and, in particular, for

[10]Bierwisch (1989) also formalizes scalar values as intervals, rather than points, but Bierwisch's system does not make the distinction between positive and negative extents advocated here.

using the sortal distinction between positive and negative extents as the basis for a theory of adjectival polarity (see also the discussion of the distribution of measure phrases in section 3.1.8). Before I go through the explanation of cross-polar anomaly, however, I will show how the algebra of extents provides an explanation for the different relational characteristics of positive and negative adjectives observed in section 3.1.2, and how it accounts for the validity of statements like (14).

3.1.6 Extents and Polar Opposition

The formal representation of adjectival polarity proposed in the previous section has an important consequence: it derives the relational difference between positive and negative pairs of gradable adjectives, eliminating the need to assume that the comparative and absolute degree morphemes "inherit" their ordering relations from the adjectives they combine with. Instead, we can adopt a uniform set of truth conditions for degree morphemes as in (33)-(36), where the ordering relations on extents $\{>,<,\geq\}$ are defined in a standard Boolean fashion, as in (37)-(39).

(33) $||\textsc{abs}(e_R)(e_S)|| = 1$ iff $e_R \geq e_S$

(34) $||\textsc{more}(e_R)(e_S)|| = 1$ iff $e_R > e_S$

(35) $||\textsc{less}(e_R)(e_S)|| = 1$ iff $e_R < e_S$

(36) $||\textsc{as}(e_R)(e_S)|| = 1$ iff $e_R \geq e_S$

(37) $[e_1 > e_2]$ iff $[e_1 \cap e_2 = e_2 \;\&\; e_1 \neq e_2]$

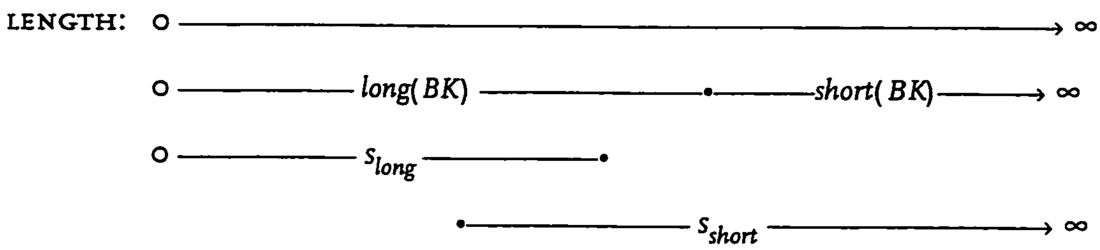
(38) $[e_1 < e_2]$ iff $[e_1 \cap e_2 = e_1 \;\&\; e_1 \neq e_2]$

(39) $[e_1 \geq e_2]$ iff $[e_1 \cap e_2 = e_2]$

Consider, for example, the analysis of positive and negative absolute constructions, such as (40) and (41), in the context illustrated by (42), where *long*(BK) denotes the positive extent of *The Brothers Karamazov* on the scale of length, *short*(BK) denotes its negative extent, and s_{long} and s_{short} denote standards of longness and shortness (for e.g. Russian novels) respectively.[11]

(40) *The Brothers Karamazov* is long.

(41) *The Brothers Karamazov* is short.

(42)


The logical representations of (40) and (41) are (43) and (44) respectively.

(43) ABS(*long*(BK))(s_{long})

(44) ABS(*short*(BK))(s_{short})

---

[11]As above, I assume that s_{long} and s_{short} are derived as a function of the meaning of the adjective and a contextually determined comparison property, as described in chapter 2, section 2.3.

According to the truth conditions for the absolute in (33), (40) is true just in case the extent to which *The Brothers Karamazov* is long is at least as great as the standard value. In the context in (42), (40) is true, because $long(BK) \geq s_{long}$ holds.

The negative absolute in (41) can be analyzed in exactly the same way: it is true just in case the extent to which *The Brothers Karamazov* is short is at least as great as the standard of shortness. (43) is false in the context illustrated by (42), because $short(BK) \geq s_{short}$ does not hold. What is important to observe is that the same ordering relation is used to calculate the truth of both the positive and negative absolute constructions. This contrasts with the analysis of this sentence in the algebra of degrees discussed in section 3.1.2, which required the ordering relation associated with the absolute to be reversed for negative adjectives.

The analysis of positive and negative comparatives is similar. Consider, for example, (45) and (46) in the context represented by (47), where *long*(BK) and *short*(BK) are as defined above, and *long*(*Idiot*) and *short*(*Idiot*) represent the positive and negative extents of *The Idiot*'s length, respectively.

(45) *The Brothers Karamazov* is longer than *The Idiot*.

(46) *The Idiot* is shorter than *The Brothers Karamazov*.

(47) LENGTH: $0 \longrightarrow \infty$

0 —— *long*(BK) ——•—— *short*(BK) $\longrightarrow \infty$

0 —— *long*(*Idiot*) ——•—— *short*(*Idiot*) $\longrightarrow \infty$

The logical representation of (45) is (48).

(48) $\text{MORE}(long(BK))(long(Idiot))$

According to the truth conditions for the comparative in (34), (45) is true just in case $long(BK) > long(Idiot)$, i.e., just in case the positive projection of *The Brothers Karamazov* on the scale of length exceeds the positive projection of *The Idiot* on the scale of length. These conditions are met in the context represented by (47), so (45) is true. Again, there is no need to assume a change in the ordering relation associated with the comparative: the structure of extents is such that the same relation can be used to characterize the truth conditions of both positive and negative comparatives.

The negative comparative (46) is treated in the same way. The logical form of (46) is (49).

(49) $\text{MORE}(short(Idiot))(short(BK))$

(46) is true just in case $short(Idiot) > short(BK)$ holds, i.e., just in case the negative projection of *The Idiot* on the scale of length exceeds the negative projection of *The Brothers Karamazov* on the scale of length. This relation also holds in (47), so (46) is true.

This discussion of (45) and (46) illustrate another important aspect of the analysis, namely that it explains the validity of constructions like (50).

(50) *The Idiot* is shorter than *The Brothers Karamazov* iff *The Brothers Karamazov* is

longer than *The Idiot.*

(50) can be paraphrased in the following way: "the extent to which *The Idiot* is short exceeds the extent to which *The Brothers Karamazov* is short if and only if the extent to which *The Brothers Karamazov* is long exceeds the extent to which *The Idiot* is long". More generally, statements like (50) can be viewed as substitution instances of (51), where φ_{pos} and φ_{neg} are antonymous gradable adjectives.

(51) $\varphi_{pos}(a) > \varphi_{pos}(b)$ iff $\varphi_{neg}(b) > \varphi_{neg}(a)$

The validity of (51) follows from the claim that the positive and negative projections of an object on a scale are join complementary. In section 3.1.4, I claimed that the positive and negative projections of an object onto a scale along dimension δ, $\text{POS}_\delta(a)$ and $\text{NEG}_\delta(a)$, correspond to (30) and (31), repeated below, where **d** is a function from an object to a point on the scale.

(30) $\text{POS}_\delta(a) = \{p \in S_\delta \mid p \leq \mathbf{d}(a)\}$

(31) $\text{NEG}_\delta(a) = \{p \in S_\delta \mid \mathbf{d}(a) \leq p\}$

From these definitions, we can define the complements of positive and negative extents as follows:

(52) $-\text{NEG}_\delta(x) = \text{POS}_\delta(x) - \{\mathbf{d}(x)\}$

(53) $-\text{POS}_{\delta}(x) = \text{NEG}_{\delta}(x) - \{\mathrm{d}(x)\}$

Returning to (51), since the result of applying φ_{pos} and φ_{neg} to an object is a positive or negative extents on the scale shared by φ_{pos} and φ_{neg}, we can rewrite (51) as the more general statement in (54), and use the equivalences in (52) and (53) to prove its validity.

(54) $\text{POS}_{\delta}(a) > \text{POS}_{\delta}(b)$ iff $\text{NEG}_{\delta}(b) > \text{NEG}_{\delta}(a)$

If $\text{POS}_{\delta}(a) > \text{POS}_{\delta}(b)$, then $\text{POS}_{\delta}(a) - \{d(a)\} > \text{POS}_{\delta}(b) - \{d(b)\}$, since $d(a)$ and $d(b)$ are the maximal elements of $\text{POS}(a)$ and $\text{POS}(b)$, respectively. It follows that $-\text{NEG}_{\delta}(a) > -\text{NEG}_{\delta}(b)$, by substitution, and finally that $\text{NEG}_{\delta}(b) > \text{NEG}_{\delta}(a)$, by contraposition. The other direction of the biconditional can be proved in exactly the same way.

3.1.7 Cross-Polar Anomaly Revisited

We are now in a position to explain cross-polar anomaly. Recall that in section 3.1.3 I investigated the possibility of an explanation of this anomaly within a degree algebra in terms of incommensurability. The basic idea behind this type of explanation is that degrees of e.g. *tallness* and *shortness*, like degrees of e.g. *tallness* and *cleverness*, should be analyzed as distinct objects in different ordered sets. If this were the case, then the relation introduced by the comparative morpheme would be undefined, and cross-polar anomaly could be explained in the same way as incommensurability. I observed that this explanation is unavailable if degrees are defined as points on a scale, because the algebra of degrees does not make a distinction between positive and negative degrees: for any scale, the set of positive degrees and the set of negative degrees are isomorphic. As a result, any expression which is a substitution instance of (23) or (24) (repeated below), which schematically represent the interpretation of examples of cross-polar anomaly, should be perfectly interpretable.

(23) $\text{DEG}(d_{pos})(d_{neg})$

(24) $\text{DEG}(d_{neg})(d_{pos})$

In contrast, the algebra of extents makes a structural distinction between positive and negative extents: positive and negative extents are different sorts of objects, which represent complementary perspectives on the projection of an object on a scale. This distinction was used to characterize adjectival polarity as a sortal distinction: positive adjectives denote functions from objects to positive extents; negative adjectives denote functions from objects to negative extents. The crucial consequence of these assumptions is that the range of a positive adjective is disjoint from the range of its negative counterpart. If the sets of positive and negative extents are disjoint, then any expression that is a substitution instance of (55) or (56), where DEG is an ordering on extents and e_{pos} and e_{pos} are positive and negative extents, will fail to return a truth value, since the ordering relation introduced by DEG will be undefined.

(55) $\text{DEG}(e_{pos})(e_{neg})$

(56) $\text{DEG}(e_{pos})(e_{neg})$

The end result is that within the algebra of extents, cross-polar anomaly can be explained in the same terms as incommensurability: the degree relation introduced by the comparative morpheme is undefined for the compared extents.

For illustration, consider an example like (57), which has the logical representation in (58).

(57) #*The Brothers Karamazov* is longer than *The Dream of a Ridiculous Man* is short.

(58) $\text{MORE}(long(The\ Brothers\ K))(\text{MAX}(\lambda e[\text{ABS}(short(The\ Dream\ of\ a\ Ridiculous\ Man))(e)]))$

The denotation of the comparative clause in (58) is the maximal extent *e* such that *The Dream of a Ridiculous Man* is at least as short as *e*, which is a negative extent. The reference value, however, is derived by applying the adjective *long* to the denotation of *The Brothers K*, returning the positive extent of *The Brothers K*'s length. Since positive and negative extents come from disjoint sets, the relation introduced by MORE is undefined for its arguments, and the structure is anomalous.

The same explanation applies to sentences in which the polar adjectives are reversed, such as (59).

(59) #*The Dream of a Ridiculous Man* is shorter than *The Brothers Karamazov* is

long.

(60) MORE(*short*(*The Dream of a Ridiculous Man*))(MAX(λ*e*[ABS(*long*(*The Brothers K*))(*e*)]))

In this example, the standard value is a positive extent–the maximal extent *e* such that *The Brothers Karamazov* is at least as long as *e*–and the reference value is a negative extent–the negative projection of *The Dream of a Ridiculous Man* on a scale of length. Again, the arguments supplied to the comparative morpheme come from disjoint sets, so the comparison relation is undefined, and the structure is anomalous.

It should be observed that the analysis of cross-polar anomaly that I have outlined here makes a more general prediction: if subdeletion structures are interpreted by directly supplying the denotation of the comparative clause as the standard value, then any instance of comparative subdeletion in which the adjective in the main clause is of different polarity from the adjective in the *than*-clause should be anomalous, not just examples involving antonymous pairs such as (15)-(18). The following minimal pairs verify this prediction.

(61) Unfortunately, the ficus turned out to be taller than the ceiling was high.

(62) #Unfortunately, the ficus turned out to be taller than the ceiling was low.

(63) Luckily, the ficus turned out to be shorter than the doorway was low.

(64) #Luckily, the ficus turned out to be shorter than the doorway was high.

The logical representation of the comparative in (62) is (65).

(65) MORE(*tall*(*the ficus*)(MAX(λe[ABS(*low*(*the ceiling*))(*e*)]))

(62) is anomalous for the same reason as the examples discussed above: the degrees introduced by the arguments of MORE are not members of the same ordered set, therefore the comparative relation is undefined. Cross-polar anomaly is thus a more general phenomenon than the original facts suggest: it does not require that the two adjectives in the comparative are members of a specific positive-negative pair, only that they are of different polarity. Indeed, the analysis proposed here predicts that this should be the case.

To summarize, the explanation of cross-polar anomaly outlined here is available because the algebra of extents permits a sortal distinction between positive and negative extents to be made at a very basic, structural level. More importantly, the fact that this anomaly is observed in the first place provides support for the hypothesis that "degrees" should be characterized as intervals on a scale, rather than as points on a scale. If adjectival polarity is represented as a sortal distinction between positive and negative adjectives, and if positive and negative extents are distinct objects, then we predict that comparatives constructed out of polar opposites should be anomalous. That is, any formula which is a substitution instance of (55) and (56) should fail to return a truth value, because the relation introduced by DEG will be undefined. Ultimately, the crucial component of the analysis is the distinction between positive and negative extents provided by the extent algebra, as similar results can be derived using alternative approaches to the semantics of comparatives. For example, in Kennedy 1997b I assume a relational semantics for gradable adjectives and a quantificational analysis of comparatives, and I present an account of cross-polar which is very similar to the one proposed here. The end result, then, is that the phenomenon of cross-polar anomaly provides a compelling empirical argument for formalizing "degrees" as intervals on a scale–i.e., as extents–rather than as points on a scale, and for adopting the sortal characterization of adjectival polarity described in this section (and advocated in Seuren 1978, 1984, von Stechow 1984b, and Löbner 1990).

3.1.8 The Distribution of Measure Phrases

As observed by von Stechow (1984b), the algebra of extents also provides an explanation for the contrast between examples like (66) and (67).

(66) My Cadillac is 8 feet long.

(67) #My Fiat is 5 feet short.

If we assume that measure phrases denote bounded extents (see the discussion of comparison of deviation in section 3.2), and that dimensional adjectives such as *long, tall*, and *wide* are associated with scales with a minimal element, then this contrast can be explained in the same way as cross-polar anomaly: the ordering relation introduced by the absolute morpheme is undefined in (67) but not in (66).

The explanation runs as follows. If the scale of length has a minimal element, then according to the definitions of scales and positive and negative extents in section 3.1.5, positive extents on the scale of length are bounded but negative extents on the scale of length are not (because scales have no maximal element). It follows that the objects in the range of *long* are the sort of extents that can be referred to by a measure phrase, but objects in the range of *short* are not. It follows that the logical representation of (66), shown in (68), is interpretable, because the partial ordering between the positive extent of *my Cadillac*'s longness and the extent denoted by *8 feet* is defined.

(68) ABS(*long*(*my Cadillac*))(*8 feet*)

In contrast, since the negative extent of *my Fiat*'s shortness and the bounded extent denoted by *4 feet* are objects in disjoint sets, the ordering introduced by the absolute in the logical representation of (67), shown below in (69), is not defined.

(69) ABS(*short*(*my Fiat*))(*5 feet*)

Because the ordering relation in (69) is undefined, (67) is correctly predicted to be anomalous.

If this analysis is correct, then it suggests an explanation for the fact that while (67) is anomalous, (70) is not.

(70) My fiat is shorter than 8 feet.

Structurally, (70) is a phrasal comparative. Given the analysis of phrasal comparatives presented in chapter 2, the logical representation of (70) should be (71).

(71) MORE(*short*(*my Fiat*))(*short*(*5 feet*))

The crucial difference between (71) and (69) is that the standard value in the latter is provided directly by the measure phrase, while the standard value in the former is derived by applying the adjective *short* to the measure phrase. If it can be shown that the result of this operation is the negative extent that ranges from the point on the scale corresponding to *5 feet* to the upper end of the scale, then we will have an explanation for this contrast. I will leave this as a point for future investigation.

3.1.9 Positives that Look Like Negatives

Chris Barker (personal communication) observes that sentences like (72)-(74) appear to be counterexamples to the claim that comparatives formed out of positive and negative pairs of adjectives are anomalous.

(72) Your C is sharper than your D is flat.

(73) My watch is faster than your watch is slow.

(74) She was earlier than I was late.

If the adjectives in (72)-(74) are actual positive-negative pairs, then the analysis outlined in the previous sections incorrectly predicts that these sentences should be anomalous. There are at least three reasons to believe that the adjectives in (72)-(74) are not positive-negative pairs, however, but rather pairs of *positive* adjectives. If this is true, then they are comparable not to examples of cross-polar anomaly, but rather to typical examples of comparative subdeletion (such as (19) and (20) above), and so are not counterexamples to the claims made in this section.

The first argument involves interpretation. (72)-(74) are nonanomalous only if the adjectives are interpreted in such a way as to measure the divergence from some common point of reference–a "pure tone" in (72), the "actual time" in (73), and "on time" in (74). This is particularly clear in the case of (73), which can only mean that the extent to which my watch is faster than the actual time is greater than the extent to which your watch is slower than the actual time. (73) *cannot* be used to make the claim that my watch is more temporally advanced than yours, which would be true in a situation in which both of our watches were slow. An interpretation of (73) along these lines is anomalous in the same way that (75) is:

(75) #My car is faster than your car is slow.

The second argument comes from the distribution of overt measure phrases. A characteristic of negative adjectives is that they cannot be modified by overt measure phrases (see section 3.1.8):

(76) #Mr. Reich is 5 feet short.

(77) #Maureen was driving 14 mph slow.

Both of the adjectives in each of (72)-(74) permit measure phrases, however, when they are interpreted in the way described above, so that they measure divergence from a reference point. (78)-(80) illustrate this point.

(78) Your C is *30 Hz* flat/sharp.

(79) My watch is *10 minutes* fast/slow.

(80) She was *an hour* early/late.

The third argument makes use of the observation that statements whose logical forms are substitution instances of (51), repeated below, are valid for any positive-negative pair of adjectives.

(51) $\varphi_{pos}(a) > \varphi_{pos}(b)$ iff $\varphi_{neg}(b) > \varphi_{neg}(a)$

If *flat-sharp, fast-slow,* and *early-late,* are actual positive-negative pairs, then (81)-(83) should be valid.

(81) Your A is sharper than your D iff your D is flatter than your A.

(82) My watch is faster than yours iff yours is slower than mine.

(83) She was earlier than I was iff I was later than she was.

These statements are not valid, however, on the relevant interpretation. Although (83), for example, is valid if *late* and *early* describe the relative temporal ordering of two individuals (with respect to some event), it is not valid if the adjectives describe deviation from some reference point indicating "on time". On the latter interpretation, the first conjunct would be true in a context in which we were both early, but she was earlier than I was, while the second conjunct would be false, because neither of us was late. This latter interpretation is the one the adjectives must have in (74), however: if they are interpreted so that (83) valid, (74) is anomalous.

The data discussed here support the conclusion that both members of the adjective pairs in (72)-(74) are positive: adjectives like *sharp* and *flat* (as well as *fast-slow* and *early-late*, on the relevant interpretations), which measure divergence from some reference point (for example, the point at which a tone is neither sharp nor flat), not only project their arguments onto the same scale, they define the same *sorts* of projections onto a scale.[12]" If the adjectives in (72)-(74) are sortally the same, as the facts indicate, then these sentences do not represent counterexamples to the analysis developed in this section.

[12]A number of other interesting questions must be left for future work. Two in particular should be addressed. First, are the characteristics of the pairs in (72)-(74) true of all adjectives which do not make reference to a standard in the absolute form? For example, the truth value of *that note is sharp* is not dependent on context of utterance in the way that the truth value of *that note is loud* is: the former is true as long as the projection of *that note* on a scale of "pitch" is non-null. Second, how should the ambiguity of an adjective like *slow*, which has both a "true" negative interpretation (as in (75)) and an interpretation in terms of divergence from a reference point (as in (73)), be accounted for?

3.1.10 Summary

The extent approach to the semantics of gradable adjectives consists of two principal claims. First, gradable adjectives denote relations between individuals and extents. An extent is defined as an interval on a scale, and a structural distinction is made between two sorts of extents: positive extents and negative extents. Second, positive and negative adjectives are distinguished by the sort of their extent arguments: positive adjectives denote relations between individuals and positive extents; negative adjectives denote relations between individuals and negative extents.

The discussion so far has shown this analysis to have several interesting results. It explains the validity of statements like (14), satisfying the minimal requirement of descriptive adequacy, and in addition, it provides a uniform account of the semantics of positive and negative adjectives in both the absolute and comparative forms. Most importantly, it provides a principled explanation of cross-polar anomaly within a general analysis of incommensurability.

3.2 Comparison of deviation

3.2.1 The Semantic Characteristics of Comparison of Deviation

As noted in chapter 1, any analysis of cross-polar anomaly must also account for the existence of comparatives involving positive and negative pairs of adjectives which are superficially similar to examples of cross-polar anomaly but are not anomalous. (84)-(87) exemplify sentences of this type, which I referred to as "comparison of deviation" constructions.

(84) William is as tall as Robert is short.

(85) Francis is as reticent as Hilary is long-winded.

(86) San Francisco Bay is more shallow than Monterey Bay is deep.

(87) The Tenderloin is more dirty than Pacific Heights is clean.

Comparison of deviation and cross-polar anomaly are linked in the following way: an explanation of cross-polar anomaly must not have the consequence that comparison of deviation sentences are predicted to be ungrammatical; similarly, it should not be the case that an account of comparison of deviation permits non-anomalous interpretations of cross-polar anomaly.[13]

In chapter 1 (section 1.1.4.3), I noted three important characteristics distinguish the former from the latter. The first difference involves basic

[13] Recall from the discussion in chapter 1, section 1.23, that this was a problem for the vague predicate analysis.

interpretation. Unlike standard comparative constructions, which compare the projections of two objects onto a scale, comparison of deviation constructions compare the extents to which two objects differ from a relevant standard value. This is most clearly illustrated by the equative construction (84). (84) can only mean that the extent to which William exceeds some standard of tallness is (relatively) the same as the extent to which Robert exceeds some standard of shortness; (84) *cannot* mean that William and Robert are equal in height. This interpretation should be contrasted with that of a more typical example of equative subdeletion, such as (88), in which it is asserted that the height and width of the doorway are the same.

(88) The doorway is as tall as it is wide.

The comparatives in (86) and (87) have similar interpretations. (86), for example, means that the extent to which the Tenderloin exceeds a standard of dirtiness is greater than the extent to which Pacific Heights exceeds a standard of cleanliness.

That these sentences have only interpretations of this sort is made clear by the second difference between them and standard comparative constructions. Whereas standard comparatives do not entail that the property predicated of the compared objects is true in the absolute sense, comparison of deviation constructions do carry this entailment. For example, (84) entails that William is tall and that Robert is short, but (88) entails neither that the doorway is tall nor that it is wide: this sentence could be truthfully used to describe a one foot by one foot opening. Similarly, while (86) entails that San Francisco Bay is shallow and Monterey Bay is deep, (89) does not, though this information is conveyed as a cancelable implicature, as shown by (90).

(89) San Francisco Bay is shallower than Monterey Bay.

(90) San Francisco Bay is shallower than Monterey Bay, though they're both fairly deep.

In contrast, denying that San Francisco Bay is shallow after an utterance of (86) is contradictory:

(91) San Francisco Bay is more shallow than Monterey Bay is deep. #San Francisco Bay isn't shallow, though.

Finally, comparison of deviation interpretations do not license morphological incorporation of the adjective and the comparative morpheme. (86) and (87) contrast with (92) and (93), respectively, which are instances of cross-polar anomaly.

(92) #San Francisco Bay is shallower than Monterey Bay is deep.

(93) #The Tenderloin is dirtier than Pacific Heights is clean.

On the surface, comparison of deviation constructions appear to be problematic for the analysis of cross-polar anomaly developed in section 3.1, which predicted that any comparative constructed out of a positive and negative pair of adjectives should trigger incommensurability. On closer inspection, however, comparison of deviation constructions like (84)-(87) actually provide interesting *support* for the analysis of cross-polar anomaly. Consider, for example, the interpretation of (84). What is crucial to observe is that this sentence does not simply *permit* the type of interpretation discussed above, in the compared objects are the extents to which the compared individuals exceed appropriate standards of tallness and shortness, (84) has *only* this type of interpretation. In particular, (84) *cannot* mean that the compared individuals are (at least) equal in height. This latter reading, which would correspond to the standard interpretation of the equative construction, is correctly ruled out by the analysis of cross-polar anomaly developed above.

To see why, consider the logical representation of (84) on this interpretation:

(94) $\textsc{as}(tall(William))(\textsc{max}(\lambda e[\textsc{abs}(short(Robert))(e)]))$

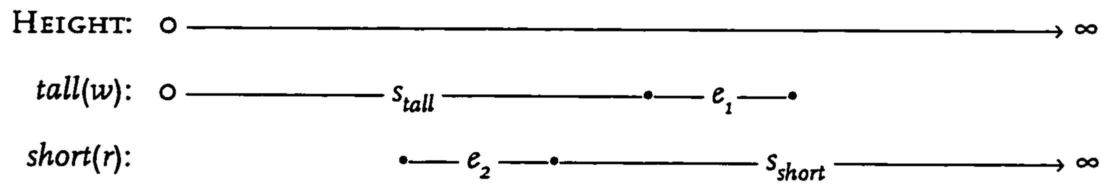
Assuming the truth conditions for the equative given in section 3.1.6, the interpretation of (84) represented by (94) is ruled out as an instance of cross-polar anomaly: the arguments of AS are not elements of the same ordered set, so the partial ordering relation introduced by the degree morpheme is undefined. A similar case can be made for (85). The puzzle that remains to be solved is how the comparison of deviation interpretation arises in the first place. I will address this question in the next section.

3.2.2 Differential Extents and Comparison of Deviation

As noted above, the basic interpretation of comparison of deviation constructions do not involve comparison between "absolute" extents (where an absolute extent is the projection of some object onto a scale), but rather comparison between the extents to which two objects each exceed an appropriate standard. Consider, for example, (84), repeated below, in a context in which the positive projection of William on a scale of height is *tall*(w) and the negative projection of Robert on a scale of height is *short*(r), as shown in (95).

(84) William is as tall as Robert is short.

(95)



If the standards of tallness and shortness in this context are s_{tall} and s_{short}, respectively, then *tall*(w) = $e_1 \bullet s_{tall}$, and *short*(r) = $e_2 \bullet s_{short}$, where "•" is a concatenation operation on extents, defined in terms of set difference as in (96).[14]

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[14] Some kind of concatenation operation on extents is independently required to interpret "differential" comparatives like (i) and (ii) (see von Stechow 1984a, Hellan 1981).

(i) William is 2 feet taller than Robert.

(ii) San Francisco Bay is over 150 fathoms shallower than Monterey Bay.

(96) $e_d \cdot e = \iota e'[e' - e = e_d]$

If absolute extents can be partitioned as in (95), then e_1 denotes the difference between *tall*(w) and s_{tall}, and e_2 denotes the difference between *short*(r) and s_{short}. That is, e_1 and e_2 represent the extents to which Bradley and Reich exceed standards of tallness and shortness, respectively.

I would like to suggest that comparison of deviation involves comparison of such "differential extents". Specifically, the comparison of deviation interpretation of (84) involves a relation between e_1 and e_2 in (95). Building on the standard interpretation of the equative, the comparison of deviation interpretation of (84) can be characterized as in (97):

(97) $||(84)|| = 1$ iff $e_1 \geq e_2$, where $e_1 \cdot s_{tall} = tall(w)$ and $e_2 \cdot s_{short} = short(r)$.

Note that in order to evaluate the ordering relation in (97), it must be the case that there is a mapping between e_1 and e_2 and two extents that share an endpoint, e.g. e'_1 *and* e'_2, respectively, in(98).

(98) HEIGHT: 0 ————————————————→ ∞

•— e'_1 —•

•— e'_2 —•

Intuitively, a sentence like (i) asserts that the extent to which William is tall exceeds the extent to which Robert is tall by the amount denoted by *2 feet*.

This could be accomplished in the following way. In addition to the set of positive and negative extents on a scale S_δ, we can define a set of *bounded* extents: the set of bounded proper intervals on the scale.[15] Assuming that an explicit theory of measurement can be overlaid onto the theory of scales (see Klein 1991 for some promising initial proposals in this direction), we can make the natural assumption that all bounded extents of equal measurement are equivalent (i.e., we can group bounded extents into equivalence classes based on their measurements). If this is the case, then e_1 and e_2 in (95) are equivalent to e'_1 and e'_2 in (98) respectively, and it follows that if $e'_1 \geq e'_2$, then $e_1 \geq e_2$.

In order for the general approach to comparison of deviation outlined here to

[15]This assumption entails that for any scale with a minimal element, the set of positive extents is a subset of the set of bounded extents. If the hypothesis that measure phrases denote bounded extents is correct (see section 3.1.8), we make the following prediction: only positive adjectives that map their arguments onto scales with a minimal element will permit measure phrases, since only in these cases will the corresponding positive extents be bounded. This prediction appears to be borne out by well-known contrasts like (i) and (ii), assuming that the scale associated with *warm* (a scale along a dimension of "temperature") has no lower bound.

(i) #It's 50 degrees warm today.
(ii) The kitchen is 50 degrees warmer than the basement.

The importance of (ii) is its acceptability indicates that a standard of measurement is defined for the scale onto which *warm* maps its arguments, thus the unacceptability of (i) cannot be due to an absence of such a standard (as could be argued for an adjective like *beautiful*, for example). Even though there may be an actual lower bound on the temperature of objects in the universe, it seems reasonable to assume that the scale onto which the adjective *warm* maps its argument does not have a lower bound, given the fact that a sentence such as *Absolute zero is warmer than nothing* is perfectly interpretable.

go through, however, it must be shown that comparison of differential extents in examples involving positive and negative adjectives (such as (84)-(87)) does not result in incommensurability. That is, it must be shown that differential extents are sortally the same, regardless of whether they are subintervals of positive extents or subintervals of negative extents, so that the comparison relation is defined in examples like (84)-(87). In fact, this result follows from the definition of extent concatenation in (96). Two initial conditions are important. First, since we are only interested in cases in which $e_d \bullet e$ is the argument of a gradable predicate, it must be the case that e' is either positive or negative, therefore e' must be a proper extent. Second, e and e' must be extents of the same sort: both positive or both negative. This follows from the definition of an extent as a convex subset of a totally ordered set of points: if e.g. e and e' were of opposite polarity, then the value of $e' - e$, which equals $-(e' \cap e)$, would not be convex, and therefore not an extent.

Assuming these initial conditions, two questions must be answered: what is the sort of e_d when e is positive, and what is the sort of e_d when e is negative? In the case in which e is positive, e_d must be a bounded extent (i.e., a proper subset of $S - e$), otherwise e' would not satisfy the condition that it be a proper extent. When e is negative, e_d again must be bounded in order to ensure that e' is a proper extent. The conclusion is that a differential extent is bounded when concatenated with either a positive or a negative extent, a fact which I interpret as indicating that differential extents are (structurally) of the same sort.[16] This is consistent with the hypothesis mentioned above that all differential extents are elements of the set of bounded extents on a scale. If all differential extents are members of the same set of bounded extents, and assuming that mappings of the sort defined above can be determined, it should be possible to establish an ordering relation between any two differential extents. Therefore the comparison relation associated with comparison of deviation constructions should be defined.

To summarize the discussion so far, I have suggested that comparison of deviation involves a relation between differential extents, rather than a relation between absolute extents, as in standard comparative/equative interpretations. Comparison of deviation is possible in contexts in which standard comparison triggers incommensurability because differential extents are sortally the same, regardless of the sort of the extent with which they are concatenated. A positive result of this analysis is that it explains why comparison of deviation interpretations have the entailments they do. Focusing on (84), if $tall(b) = e_1 \bullet s_{tall}$, then $tall(b) \geq s_{tall}$. According to the semantics of the absolute adopted in chapter 2, it follows that the statement *William is tall* is true. More generally, if the differential extents which are compared in comparison of deviation constructions denote the difference between

[16]Evidence in support of this conclusion is provided by examples like (i) and (ii), which show that differential extents can measure differences between compared positive extents and differences between compared negative extents (cf. the anomaly of measure phrases with negative absolute adjectives, discussed in section 3.1.8).

(i) The plane was 5 kilometers higher than the helicopter.

(ii) The helicopter was 5 kilometers lower than the plane.

the absolute extent of an object and an extent which denotes an appropriate standard, then the truth conditions for the absolute are independently satisfied.[17]

Before concluding this section, it should be observed that comparison of

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[17]A final question remains unanswered: what is the difference in compositional semantics between standard comparative constructions and comparison of deviation constructions? Although this is a question that I will have to leave for future work, a consideration of degree modifiers such as *very*, *fairly* and *quite* suggests an initially promising answer to this question. Like comparison of deviation constructions, degree modifiers also involve comparison of extents which measure the difference between the absolute projection of an object on a scale and a standard value. Consider, for example, a sentence like (i).

(i) William is very tall.

The meaning of (i) can be accurately and intuitively paraphrased as in (ii).

(ii) The extent to which William exceeds a standard of tallness is large.

That (i) has such a meaning is supported by its entailments: (i) clearly entails that William is tall (the same can be said of e.g., *William is fairly tall*, *William is quite tall*). Note as well that the negation of (i) does not entail that William is *not* tall, only that the extent to which he exceeds a standard of tallness is *not* large. That is, the negation of (i) is consistent with a situation in which William is short, or one in which he's just not very tall, as shown by (iii)-(iv).

(iii) William is tall, but he's not very tall.
(iv) William is not very tall; in fact, he's quite short.

Given the similarity in meaning between degree modifiers and comparison of deviation constructions, a plausible hypothesis is that comparison of deviation indicates that the comparative morphemes *more*, *less*, and *as* have, in addition to their standard interpretations as comparative degree morphemes, interpretations as degree modifiers like *very* and *fairly*, and it is the latter interpretation that is involved in comparison of deviation constructions.

deviation is not unique to comparatives involving polar opposites; it represents a possible interpretation of subdeletion structures in general, as shown by (99).

(99) The Bay Bridge is as long as the Empire State Building is tall.

(99) is ambiguous between a standard equative interpretation, in which it is asserted that the length of the Bay Bridge equals the height of the Empire State Building (which is false), and a comparison of deviation interpretation, in which the two objects are asserted to deviate to a (relatively) equal extent from the appropriate standards of longness and tallness (which is true). This ambiguity is predicted by the analysis of comparison of deviation that I have outlined here. Nothing about the analysis restricts it to examples involving positive and negative pairs of adjectives. As a result, in examples which do not involve adjectives of opposite polarity, such as (99), it should not only be possible to construct a comparison of deviation interpretation, it should also be possible to construct an interpretation in terms of the standard meaning of the equative morpheme.[18]

[18] Note that a comparative version of (99) also permits a comparison of deviation interpretation if incorporation does not occur:

(i) The Bay Bridge is more long than the Empire State Building is tall.

3.2.3 Summary

The analysis of comparison of deviation proposed here claims that comparison of deviation constructions differ from standard comparatives in that they involve comparison of differential extents, rather than comparison of the absolute projections of two objects on a scale. Differential extents measure the difference between the absolute projection of an object and a standard value, and as a result, the truth conditions for the absolute are satisfied whenever the truth conditions for the comparison of deviation construction are satisfied. Crucially, since all differential extents are sortally the same, and so elements of the same ordered set (the set of bounded extents), the comparison relation introduced by comparison of deviation constructions is defined, and the sentences do not trigger cross-polar anomaly.

3.3 The Logical Polarity of Gradable Adjectives

3.3.1 The Monotonicity Properties of Polar Adjectives

In chapter 1 (section 1.1.4.1), I observed that negative polarity item licensing and entailment patterns indicate that positive adjectives generate monotone decreasing contexts, while negative adjectives generate monotone increasing contexts (see Seuren 1978, Ladusaw 1979, Linebarger 1980, Sánchez-Valencia 1996). (100)-(107) review the crucial data.

(100) It is difficult/*easy for him to admit that he has *ever* been wrong.

(101) It would be foolish/*clever of her to *even bother to lift a finger* to help.

(102) It is strange/*typical that *any* of those papers were accepted.

(103) It's lame/*cool that you *even* have to talk to *any* of these people *at all.*

(104) It's dangerous to drive in Rome. ⇒ It's dangerous to drive fast in Rome.

(105) It's safe to drive in Des Moines. ⇐ It's safe to drive fast in Des Moines.

(106) It's strange to see Frances playing electric guitar. ⇒ It's strange to see Frances playing electric guitar poorly.

(107) It's common to see Frances playing electric guitar. ⇐ It's common to see Frances playing electric guitar poorly.

Monotonicity properties represent one of several factors which have traditionally been used to classify gradable adjectives according to their "logical polarity" (in the sense of H. Klein 1996): adjectives which license negative polarity items and downward entailments in clausal complements, such as *difficult* and *strange*, are classified as negative, while adjectives which do not license negative polarity items but do permit upward inferences, such as *easy* and *common*, are classified as positive (see Seuren 1978 for early discussion of this issue). The goal of this section is to show that the monotonicity properties of polar adjectives follow directly from the theory of polarity developed in section 3.1, in which polar adjectives are sorted according to their range: positive adjectives denote functions from individuals to positive extents; negative adjectives denote functions from individuals to negative extents.

3.3.2 Degrees and Monotonicity

Recall from the discussion in section 3.1 that logical polarity (in the sense discussed above) is represented in a degree algebra as a distinction in the range of gradable adjectives. As defined above, a scale S_δ is a linearly ordered set of degrees along some dimension. If we assume that a positive adjective preserves the order on S_δ, while a negative one reverses it, then for any scale S_δ and any pair of positive and negative adjectives associated with S_δ, the set of degrees associated with the positive D_{pos} and the set of degrees associated with the negative D_{neg} stand in the dual relation. D_{pos} and D_{neg} are differentiated by ordering, but their membership is the same. Moreover, since there is a one-to-one mapping between the two sets (the identity function), D_{pos} and D_{neg} are isomorphic. A positive result of this analysis is that it predicts that statements like (108) are valid.

(108) *The Dream of a Ridiculous Man* is shorter than *The Brothers Karamazov* if and only if *The Brothers Karamazov* is longer than *The Dream of a Ridiculous Man.*

Degrees of longness and shortness are the same objects, therefore, given the difference in the ordering relations associated with positive and negative adjectives, the two conjuncts in (108) are true in exactly the same situations.

This representation of logical polarity has an additional positive result: it entails that negative adjectives are monotone decreasing. To see why, consider an arbitrary case of ordering along a dimension, for example, *safety*. If b is safer than a, then the relation in (109) holds.

(109) $a <_{safety} b$

If the ordering relation associated with a negative adjectives is the dual of the relation associated with its positive counterpart, then given the analysis of gradable adjectives as functions that map individuals to degrees, whenever (110) holds, (111) also holds.

(110) $safe(a) < safe(b)$

(111) $dangerous(b) < dangerous(a)$

Given the definitions in (112), it follows that positive adjectives denote monotone increasing functions and negative adjectives denote monotone decreasing functions.

(112) a. A function f is *monotone increasing* iff: $a < b \rightarrow f(a) < f(b)$

b. A function f is *monotone decreasing* iff: $a < b \rightarrow f(b) < f(a)$

Although this is a positive result, it must be acknowledged that the monotonicity of negative adjectives does not follow from an independent aspect of the algebra of degrees. Rather, it is a definitional property of negative adjectives: that negative adjectives are scale reversing is assumed in order to construct a semantics which correctly accounts for the interpretations of positive and negative adjectives in the absolute and comparative forms. Nothing about the system itself requires negatives to be monotone decreasing; rather, it is the data which force this assumption. An alternative situation would be one in which independently motivated characteristics of the ontology have the additional consequence that negative adjectives are scale reversing. The discussion of cross-polar anomaly in section 3.1 demonstrated that the distinction between positive and negative extents provided by an extent algebra *is* independently motivated, as it supports an explanation of cross-polar anomaly (something the algebra of degrees fails to do). In the following section, I will show that this distinction has the additional positive result of deriving the monotonicity properties of gradable adjectives.

3.3.3 Extents and Monotonicity

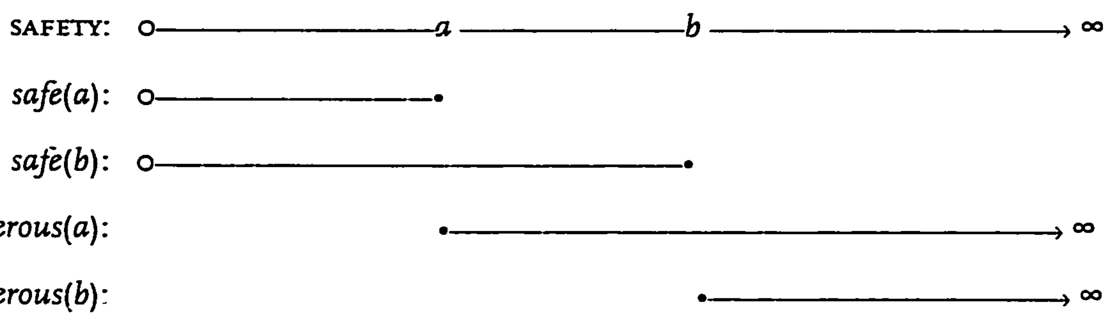
The conclusion of section 3.1 was that scalar values ("degrees") should be formalized in terms of intervals of a scale, as originally proposed by Seuren (1978) (see also von Stechow 1984b and Löbner 1990), and polar opposition should be represented as a sortal distinction between positive and negative adjectives: positive adjectives denote functions whose range is the set of positive extents E_{pos}; negative adjectives denote functions whose range is the set of negative extents E_{neg}. In addition to supporting a principled explanation of cross-polar anomaly, this sortal characterization of adjectival polarity has the positive consequence of entailing that positive adjectives are monotone increasing functions and negative adjectives are monotone decreasing functions.

Consider again the case of an ordering along a dimension of *safety*, in which an object a is ordered below an object b, as in (113)

(113) $a <_{safety} b$

When the relation between *a* and *b* shown in (113) holds, then the values of *safe*(*a*) and *safe*(*b*), and *dangerous*(*a*) and *dangerous*(*b*) (i.e., the positive and negative extents of *a* and *b* on the scale of safety) are as shown in (114).

(114)



Assuming a standard Boolean ordering on extents as in (115), whenever (114) holds, the relations in (116) and (117) also obtain.

(115) $[e < e']$ iff $[e \cap e' = e$ and $e \neq e']$

(116) *safe*(*a*) < *safe*(*b*)

(117) *dangerous*(*b*) < *dangerous*(*a*)

The positive adjective *safe* preserves the ordering on *a* and *b*, but the negative adjective *dangerous* reverses it. Therefore *safe* is monotone increasing, and *dangerous* is monotone decreasing. This result does not follow from some property of *safe* and *dangerous*; rather it is a general consequence of the hypothesis that logical polarity is represented as a sortal distinction between gradable adjectives. What distinguishes this result from the one obtained in the degree approach is that it follows directly from the algebra of extents, not from prior assumptions about implicit ordering relations associated with the adjectives *safe* and *dangerous*.[19]

3.3.4 Summary

Taking differences in monotonicity properties of gradable adjectives as a starting point, this section considered two alternative representations of logical polarity. The degree analysis makes the assumption that negative adjectives are scale reversing at a basic level; rather than explaining why negative adjectives are monotone decreasing, it defines them as such. The extent approach, on the other hand, derives the monotonicity properties of polar adjectives from the sortal distinction between positive and negative adjectives provided by the algebra of extents. This approach is independently motivated because, unlike the degree algebra, it supports an explanation of cross-polar anomaly.

It is worth noting that the proposals I have made here do not *predict* whether an adjective is going to be positive or negative–nor are they intended to. The goal is rather to present a formal representation of adjectival polarity which accounts for the logical properties of gradable adjectives in as robust and explanatorily adequate a way as possible. The facts I have considered in this paper show that a formal system in which polarity is represented as a sortal distinction between gradable adjectives achieves this goal.

[19]If the nominal determiners *many* and *few* are analyzed as positive and negative gradable predicates, respectively (Klein 1980, see also Sapir 1944), then it should be possible to explain their monotonicity properties in the same way.

3.4 Conclusion

The puzzle which formed the starting point for this chapter was the anomaly of comparatives formed of positive and negative pairs of adjectives. Observing that this anomaly is unexplained if degrees are analyzed as points on a scale, I claimed that degrees should instead be formalized as intervals on a scale, or *extents*, and I made a structural distinction between two sorts of extents: positive extents, which range from the lower end of the scale to some positive point, and negative extents, which range from some point to the upper end of the scale. Adjectival polarity was then characterized as a sortal distinction between positive and negative adjectives: positive adjectives denote functions from objects to positive extents; negative adjectives denote functions from objects to negative extents. This approach not only supported a principled analysis of cross-polar anomaly, it also explained the different relational characteristics of positive and negative adjectives, and provided the basis for an explanation of the interpretation of comparison of deviation constructions. Finally, the algebra of extents and the sortal characterization of adjectival polarity has the additional positive result of entailing that positive adjectives denote monotone increasing functions and negative adjectives denote monotone decreasing functions.

Conclusion

The primary claim of this dissertation is that the meaning of a gradable adjective should be characterized in terms of an abstract representation of measurement, or *scale*. Building on the hypothesis that the semantic function of a gradable adjective is to project an object onto a scale, I argued that gradable adjectives should be analyzed as *measure functions*–functions from objects to scalar values or *degrees*–as in Bartsch and Vennemann 1972. This analysis directly encodes a basic and distinguishing semantic characteristic of gradable adjectives: the fact that they support a partial ordering on their domains. Since gradable adjectives define mappings between objects in their domain and values on a scale, and since scalar values are totally ordered along a dimension (a property that permits grading), gradable adjectives support a partial ordering on the objects in their domains according to the amount or extent to which those objects possess some gradable property.

The conclusion that the meaning of gradable adjectives must be characterized in terms of scales and degrees was arrived at by considering a number of facts (including incommensurability, cross-polar anomaly, the distribution of measure phrases, and the interpretation of comparison of deviation constructions) that receive a natural explanation only if scales are introduced into the ontology and the interpretation of gradable adjectives is characterized in terms of such abstract objects. However, a number of facts called into question the traditional scalar analysis of gradable adjectives as relations between objects and degrees. In particular, a component of this analysis–the assumption that comparative constructions quantify over degrees–failed to explain the limited scopal properties of comparatives. These facts were accounted for by reanalyzing gradable adjectives as measure functions and degree constructions as properties of individuals, removing the relational component and the degree argument from the meaning of the adjective and incorporating these constituents into the meaning of degree morphology.

A central claim of this analysis is that all propositions in which the main predication is a degree construction headed by a gradable adjective can be analyzed in terms of three semantic constituents: a *degree relation*, introduced by a degree morpheme, a *reference value*, derived by applying the function denoted by the adjective to the target of predication, and a *standard value*. Focusing on comparative and absolute degree constructions, in which the standard value is a degree and the degree morphology introduces a partial ordering relation, I showed that this approach supports a straightforward compositional semantics for a syntactic analysis of degree constructions in which a gradable adjective projects extended functional structure headed by degree morphology, as in Abney 1987, Corver 1990, 1997, and Grimshaw 1991. An important question that remains to be addressed is whether the approach can be extended to other degree constructions, such as *how A* questions and anaphoric *this/that A* constructions, as well as *too*, *enough*, and *so...that* constructions in which the degree morpheme introduces a causal relation and the "standard value" is not a degree, but rather a proposition.

Finally, I addressed the question of the ontology of scales and degrees in more detail, using the phenomenon of cross-polar anomaly as the empirical basis for the investigation. Observing that this anomaly is unexplained if degrees are formalized as points on a scale, I argued that degrees should instead be characterized as intervals on a scale, or *extents* (as originally proposed in Seuren 1978), and that a structural distinction should be made between two sorts of extents: positive extents, which range from the lower end of the scale to some positive point, and negative extents, which range from some point to the upper end of the scale. This distinction was used as the foundation for a sortal characterization of adjectival polarity, in which positive adjectives are analyzed as functions from objects to positive extents and negative adjectives are analyzed as functions from objects to negative extents. This approach was shown not only to support a principled analysis of cross-polar anomaly, but also to explain the different ordering properties of positive and negative adjectives in both the comparative and absolute forms, and to provide the tools necessary for an explanation of the interpretation of comparison of deviation constructions. Finally, the sortal characterization of adjectival polarity made within the algebra of extents was shown to provide the basis for an explanation of the monotonicity properties of polar adjectives.

Bibliography

Abney, S. 1987. *The English Noun Phrase in its Sentential Aspect.* Doctoral dissertation, Massachusetts Institute of Technology, Cambridge, Mass.

Atlas, J. 1984. Comparative adjectives and adverbials of degree: An introduction to radically radical pragmatics. *Linguistics & Philosophy* 7: 347-377.

Bartsch, R. and T. Vennemann. 1972. *Semantic Structures: A Study in the Relation between Syntax and Semantics.* Frankfurt: Athenäum Verlag.

Barwise, J. and R. Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4.2:159-219.

van Benthem, J. 1983. *The Logic of Time.* Dordrecht: Riedel.

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

Bowers, J. 1970. Adjectives and adverbs in English. Ms. distributed by the Indiana University Linguistics Club, Indiana University, Bloomington, Ind.

Bresnan, J. 1973. Syntax of the comparative clause construction in English. *Linguistic Inquiry* 4.3:275-343.

Bresnan, J. 1975. Comparative deletion and constraints on transformations. *Linguistic Analysis* 1:25-74.

Bresnan, J. 1979. *Theory of Complementation in English Syntax.* New York: Garland.

Carden, C. 1977. Comparatives and factives. *Linguistic Inquiry* 9:586-590.

Carston, R. 1988. Implicature, explicature, and truth-theoretic semantics. In Kempson, R. (ed.), *Mental Representations: The Interface between Language and Reality.* London?: Cambridge University Press. 155-181.

Chomsky, N. 1965. *Aspects of the Theory of Syntax.* Cambridge: MIT Press.

Chomsky, N. 1977. On wh-movement. In P. Culicover, T. Wasow, and A. Akmajian (eds.), *Formal Syntax.* New York: Academic Press.

Chomsky, N. 1981. *Lectures on Government and Binding.* Place published.

Chomsky, N. 1986. *Barriers.* Cambridge: MIT Press.

Chomsky, N. 1995. *The Minimalist Program.* Cambridge: MIT Press.

Chung, S., W. Ladusaw, and J. McCloskey. 1995. Sluicing and logical form. *Natural Language Semantics* 3:239-282.

Corver, N. 1990. *The Syntax of Left Branch Constructions*. Doctoral dissertation, Tilburg University.

Corver, N. 1993. A note on subcomparatives. *Linguistic Inquiry* 24.4:773-781.

Corver, N. 1997. *Much*-support as a last resort. *Linguistic Inquiry* 28.1:119-164.

Cresswell, M. J. 1976. The semantics of degree. In B. Partee (ed.), *Montague Grammar.* New York: Academic Press.

Cresswell, M. J. 1984. Comments on von Stechow. *Journal of Semantics* 3:79-81.

Dalrymple, M., S. Shieber, and F. Pereira. 1991. Ellipsis and Higher Order Unification. *Linguistics and Philosophy* 14:399-452.

Farkas, D. 1981. Quantifier scope and syntactic islands. *Papers from the seventeenth regional meeting of the Chicago Linguistics Society*. Chicago: University of Chicago.

Farkas, D. 1993. Modal anchoring and NP scope. Linguistics Research Center Report LRC-93-08. University of California, Santa Cruz.

Farkas, D. 1994. An indexical theory of scope. To appear in Logic and Language 5.

Fauconnier, G. 1975. Polarity and the scale principle. *CLS* 11:188-199.

Fiengo, R. and R. May. 1994. *Indices and Identity*. Cambridge: MIT Press.

Fodor, J. and I. Sag. 1981. Referential and quantificational indefinites. *Linguistics & Philosophy* 5:355-398.

Gawron, J-M 1995. Comparatives, superlatives, and resolution. *Linguistics & Philosophy* 18:333-380.

Giannakidou, Anastasia 1997. *The Landscape of Polarity Items*. Doctoral dissertation, University of Groningen.

Grimshaw, J. 1987. Subdeletion. *Linguistic Inquiry* 18.4:659-669.

Grimshaw, J. 1991. Extended projection. Ms., Brandeis University.

Guéron, J. and R. May. 1984. Extraposition and Logical Form. *Linguistic Inquiry* 15.1:1-31.

Hale, A. 1970. Conditions on English comparative clause pairings. In Jacobs, R. and P. Rosenbaum (eds.) *Readings in English transformational grammar*. Washington: Georgetown University Press.

Hammann, C. 1991. Adjectives. In von Stechow, A. & D. Wünderlich (eds.) *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*. Berlin: Walter de Gruyter.

Hammann, C., J. Nerbonne, and R. Pietsch. 1980. On the semantics of comparison. *Linguistiche Berichte* 67:1-22.

Hankamer, J. 1973. Why there are two than's in English. *CLS* 9.

Hankamer, J. and I. Sag. 1976. Deep and surface anaphora. *Linguistic Inquiry* 7.3:391-426.

Hasegawa, K. 1972. Transformations and semantic interpretation. *Linguistic Inquiry* 3:141-159.

Hazout, I. 1995. Comparative ellipsis and Logical Form. *Natural Language and Linguistic Theory* 13:1-37.

Heim, I. 1985. Notes on comparatives and related matters. Ms., University of Texas, Austin.

Hellan, L. 1984. Notes on some issues raised by von Stechow. *Journal of Semantics* 3:83-92.

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

Hendrick, R. 1978. The Phrase Structure of Adjectives and Comparatives. *Linguistic Analysis* 4.3:255-299.

Hendriks, P. 1995. *Comparatives and Categorial Grammar*. Doctoral dissertation, University of Groningen.

Heycock, C. 1995. Asymmetries in reconstruction. *Linguistic Inquiry* 26.4:547-570.

Hobbs, J., W. Croft, T. Davies, D. Edwards, and K. Laws. 1988. The TACITUS Commonsense Knowlege Base. Ms., Artificial Intelligence Center, SRI International.

Hoeksema, J. 1983. Negative polarity and the comparative. *Natural Language and Linguistic Theory* 1:403-434.

Hoeksema, J. 1984. To be continued: The story of the comparative. *Journal of Semantics* 3:93-107.

Horn, L. 1981. A pragmatic approach to certain ambiguities. *Linguistics & Philosophy* 4:321-358.

Horn, L. 1989. *A Natural History of Negation.* Chicago: University of Chicago Press.

Horn, L. 1992. The said and the unsaid. In *SALT 2.*

Huddleston, R. 1967. More on the English comparative. *Journal of Linguistics* 3:91-102.

Huddleston, R. 1971. A comparative tautology. *Linguistic Inquiry* 2:252-254.

Izvorski, R. 1994. A DP-shell for comparatives. *Proceedings of CONSOLE 3,* University of Venice.

Izvorski, R. 1995. A solution to the subcomparative paradox. In *The Proceedings of WCCFL 14,* University of Southern California.

Jackendoff, R. 1977. *X-bar Syntax.* Cambridge: MIT Press.

Kamp, H. 1975. Two theories of Adjectives. In Keenan, E. (ed.) *Formal Semantics of Natural Language.* Cambridge: Cambridge University Press, 123-155.

Kaplan, D. 1979. On the logic of demonstratives. *Journal of Philosophical Logic* 8:81-98.

Karttunen, L. 1971. Implicative verbs. *Language* 47.2:340-358.

Keenan, E. 1987. Multiply-headed noun phrases. *Linguistic Inquiry* 18.3:481-490.

Keenan, E. and J. Stavi. 1986. A semantic characterization of natural language determiners. *Linguistics and Philosophy* 9:253-326.

Kennedy, C. 1997a. Antecedent contained deletion and the syntax of quantification. *Linguistic Inquiry* 28.4.

Kennedy, C. 1997b. Comparison and polar opposition. In *SALT 7.* Ithaca: Cornell University Linguistics Publications.

Kennedy, C. 1997c. On the quantificational force of the comparative clause. Paper presented at ESCOL '97, 21-23 November, Yale University.

Kennedy, C. 1996a. On the monotonicity of polar adjectives. Paper presented at the Perspectives on Negation workshop, 24-26 August, Rijksuniversiteit Groningen, the Netherlands.

Kennedy, C. 1996b. An indexical account of certain ambiguities. In , Przezdziecki, M. and L. Whalen (eds.), *Proceedings of ESCOL '95*. Ithaca: Cornell Linguistics Club.

Kennedy, C. 1995. Comparatives, indices, and scope. In Gabriele, L. and R. Westmoreland (eds.). *Proceedings of FLSM VI*. Bloomington: Indiana University Linguistics Club.

Kennedy, C. and J. Merchant. 1997. Attributive comparatives and bound ellipsis. Linguistics Research Center report LRC-97-03, University of California, Santa Cruz.

Kitagawa, Y. 1991. Copying identity. *Natural Language and Linguistic Theory* 9:497-536.

Klein, E. 1991. Comparatives. In von Stechow, A. & D. Wunderlich (eds.) *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*. Berlin: Walter de Gruyter.

Klein, E. 1982. The interpretation of adjectival comparatives. *Journal of Linguistics* 18:113-136.

Klein, E. 1980. A semantics for positive and comparative adjectives. *Linguistics & Philosophy* 4.1:1-45.

Klein, H. 1996. Polarity sensitivity and collocational restrictions of adverbs of degree.

Paper presented at the Perspectives on Negation workshop, 24-26 August, Rijksuniversiteit Groningen.

Kuno, S. 1981. The syntax of comparative clauses. *CLS* 17.

Ladusaw, W. 1979. *Polarity as Inherent Scope Relations.* Ph.D. dissertation, University of Texas, Austin.

Ladusaw, W. 1986. Principles of semantic filtering. In Dalrymple, Mary,... (eds.), *Papers from the 5th Western Conference on Formal Linguistics.* Stanford: Stanford Linguistics Association. 129-141.

Lakoff, G. 1972. Hedges: A study in meaning criteria and the logic of fuzzy concepts. *CLS 8.* 183-228.

Lakoff, G. 1973. Fuzzy grammar and the performance/competence terminology game. *CLS* 9. 271-291.

Lakoff, R. 1970. Another non-source for comparatives. *Linguistic Inquiry* 1:181-194.

Landman, F. 1991. *Structures for semantics.* Dordrecht: Kluwer.

Larson, R. 1987. "Missing Prepositions" and the Analysis of English Free Relative Clauses. *Linguistic Inquiry* 18.2:239-266.

Larson, R. 1988a. Scope and comparatives. *Linguistics & Philosophy* 11:1-26.

Larson, R. 1988b. On the double object construction. *Linguistic Inquiry* 19:583-609.

Larson, R. 1990. Extraction and multiple selection in PP. *The Linguistic Review* 7:169-182.

Larson, R. 1991. The projection of DP and DegP structure. Handout for talk given at the CUNY Linguistics Colloquium.

Lees, R. 1961. Grammatical analysis of the English comparative construction. *Word*

17.2:171-185.

Lerner, J-Y. and M. Pinkal. 1995. Comparative ellipsis and variable binding. Computerlinguistik an der Universität des Saarlandes Report No. 64. Also in *The Proceedings of SALT 5*.

Lerner, J-Y. and M. Pinkal. 1992. Comparatives and nested quantification. Computerlinguistik an der Universität des Saarlandes Report No. 21.

Lewis, D. 1973a. Causation. *Journal of Philosophy* 70:556-567.

Lewis, D. 1973b. Counterfactuals and comparative possibility. *Journal of Philosophical Logic* 2:418-446.

Lewis, D. 1970. General semantics. *Synthese* 22:18-27.

Linebarger, M. 1980. *The Grammar of Negative Polarity*. Ph.D. dissertation, MIT.

Löbner, S. 1990. *Wahr neben Falsch: Duale Operatoren als die Quantoren natürlicher Sprache.* Tübingen: Niemeyer.

Ludlow, P. 1989. Implicit comparison classes. *Linguistics & Philosophy* 12:519-533.

Manaster-Ramer, A. 1978. Comparatives and factives. *Linguistic Inquiry* 9.2:308-310.

May, R. 1985. *Logical Form.* Cambridge: MIT Press.

McCawley, J. 1994. Comparative conditional constructions in Mandarin and Cantonese. In *In Honor of William S-Y. Wang: Interdisciplinary Studies on Language and Language Change.* Pyramid Press.

McCawley, J. 1988. *The syntactic phenomena of English.* Chicago: University of Chicago Press.

McConnell-Ginet, S. 1973. *Comparative Constructions in English: A Syntactic and Semantic Analysis.* Doctoral dissertation, University of Rochester.

Moltmann, F. 1992a. *Coordination and Comparatives.* Ph.D. dissertation, MIT.

Moltmann, F. 1992b. The empty element in comparatives. NELS 23.

Mok, S-S. 1994. The comparative marker GWO in Cantonese. Ms., University of California, San Diego.

Montague, R. 1974. *Formal Philosophy.* New Haven: Yale University Press.

Napoli, D. 1983. Comparative Ellipsis: A Phrase Structure Analysis. *Linguistic Inquiry* 14.4:675-694.

Parsons, T. 1972. Some problems concerning the logic of grammatical modifiers. In Davidson, D. and Harman, G. (eds.), *Semantics of Natural Language.* Dordrecht: Reidel. 127-141.

Partee, B. 1995. Quantificational structures and compositionality. In Bach, E., E. Jelinek, A. Kratzer, and B. H. Partee (eds.), *Quantification in Natural Languages*, 541-601. Dordrecht: Kluwer.

Pesetsky, D. 1985. Morphology and Logical Form. *Linguistic Inquiry* 16.2:193-246.

Pilch, H. 1965. Comparative constructions in English. *Language* 41.1:37-58.

Pinkham, J. 1982. *The Formation of Comparative Clauses in French and English.* Doctoral dissertation, Indiana University.

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

Pustejovsky, J. & B. Boguraev. 1993. Lexical knowledge representation and natural language processing. *Artificial Intelligence* 63:193-223.

Rips, L. and W. Turnbull. 1980. How big is big? Relative and absolute properties in memory. *Cognition* 8:145-174.

Rullmann, H. 1995. *Maximality in the Semantics of WH-Constructions.* Ph.D.

dissertation, UMass., Amherst.

Rullmann, H. 1994. The ambiguity of comparatives with *less*. In Fuller, Janet, Ho Han, and David Parkison (eds.), *Proceedings of ESCOL 1994*. Ithaca: DMLL Publications.

Rullmann, H. 1993. Scope ambiguities in *how-many* questions. Ms., University of Massachusetts, Amherst.

Rusiecki, J. 1985. *Adjectives and Comparison in English: A Semantic Study*. London: Longman.

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

Ryan, K. 1983. *A Grammar of the English Comparative*. Doctoral dissertation, University of Minnesota.

Sadock, J. 1981. Almost. In Cole, P. (ed.) *Radical Pragmatics*. New York: Academic Press, 257-271.

Sag, I. 1976. *Deletion and logical form*. Doctoral dissertation, MIT, Cambridge, Mass.

Sánchez-Valencia, V. 1994. Polarity, predicates, and monotonicity. Ms., University of Groningen.

Sapir, E. 1944. Grading: A study in semantics. *Philosophy of Science* 11:93-116.

Selkirk, L. 1970. On the determiner systems of noun phrases and adjective phrases. Ms., Massachusetts Institute of Technology.

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

Seuren, P.A.M. 1978. The structure and selection of positive and negative gradable adjectives. In Farkas, D., W. Jacobson & K Todrys (eds.), *Papers from the Parasession on the Lexicon, CLS 14*, University of Chicago. 336-346.

Seuren, P.A.M. 1973. The comparative. In F. Kiefer & N. Ruwet (eds.), *Generative Grammar in Europe.* Dordrecht: Riedel.

Siegel, M. 1994. Such: Binding and the pro-adjective. *Linguistics & Philosophy* xx:481-497.

Siegel, M. 1980. *Capturing the Adjective.* New York: Garland.

Smith, C. 1961. A class of complex modifiers in English. *Language* 37:342-365.

Stalnaker, R. 1968. A theory of conditionals. In N. Rescher (ed.), *Studies in Logical Theory*. Oxford: Blackwell.

Stassen, L. 1985. *Comparison and Universal Grammar.* Oxford: Basil Blackwell.

Stassen, L. 1984. The comparative compared. *Journal of Semantics* 3:143-182.

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

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

Williams, E. 1977. Discourse and logical form. *Linguistic Inquiry* 8.1:101-139.

Wunderlich, D. 1970. Vergleischssätze. Ms., Berlin Technische Universität.

Zadeh, L.A. 1971. Quantitative fuzzy semantics. *Information Sciences* 3. 159-176.

Zwicky, A. 1969. A note on becoming. *CLS 6.*

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