1. The Semantic Characteristics of Gradable Adjectives

Gradable adjectives are inherently vague; for example, the sentence: "The Mars Pathfinder mission is expensive." In one context, it may be judged true, but in another, it may be judged false. Sentences containing adjectives are inherently vague.

1.1 Vagueness

The Mars Pathfinder mission is expensive.

In one context, and false in another.

Sentences containing adjectives are inherently vague:

(1) The Mars Pathfinder mission is expensive.

In a context in which the discussion includes all objects that have some cost associated with them, this sentence would 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 the sentence would be judged false, since the cost of sending a spacecraft to Mars is minimal.

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, the problem of resolving the vagueness of gradable adjectives can be approached in two main ways: the vague predicate analysis and the scalar analysis. The vague predicate analysis builds on the hypothesis that gradable adjectives denote partial functions from individuals to truth values. The scalar analysis, on the other hand, builds on the hypothesis that gradable adjectives denote relations between objects and abstract measures, or degrees, and degree constructions are analyzed as expressions which quantify over degrees.

The goal of this section is to introduce several additional empirical domains that provide important insight into the semantic characteristics of gradable adjectives.
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 a 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 \( \phi \) 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 \( \phi \) is true, and for objects ordered towards the lower end, \( x \) is \( \phi \) is false.

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. Specifically, 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 \( \phi \), \( x \) is \( \phi \) 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.

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".

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In this context, (5) 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 (5) 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 \[ x \textit{ is } \phi \] 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 \textit{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.

This would be an unacceptable result: there is a clear intuition that if the basic ordering on the domain of \textit{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. Additionally, a comparison on a comparison class must preserve the initial ordering on the domain of the adjective. Therefore, in order to make this problem go away (e.g., to make the ordering on the Mars Pathfinder mission fall at the upper end of the ordered set), we must impose a condition on the comparison class that guarantees that it preserves the ordering on the domain of \textit{expensive}.

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 2001), provides a means of answering the question \( \text{does } x \textit{ count as } \phi \textit{ in c?} \) by constructing an abstract representation of measurement and defining the interpretation of a gradable adjective in terms of this representation. This abstract representation, or \textit{scale}, can be construed as a set of points ordered by a relation \( \leq \), where each point represents a measure or \textit{degree} of \( \phi \)-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 \textit{expensive}, repeated below as (7).

[Note: The text continues with further discussion of the analysis of gradable adjectives, including the introduction of scales and the ordering of their domains.]
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

\[ x \text{ is } \phi \]

is taken to mean

\[ x \text{ is at least as } \phi \text{ as } d \]

where \( d \) is a degree on the scale associated with \( \phi \) that identifies a "standard" of \( \phi \)-ness. Intuitively, a standard-denoting degree is a value that provides a means of separating those objects for which the statement \( x \text{ is } \phi \) is true from those objects for which \( x \text{ is } \phi \) 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 contextually relevant comparison class (see Cresswell 1976, von Stechow 1984a, and, in particular, Bierwisch 1989 for discussion).

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 \( d_{\text{std}} \) as shown in (9).

(9)

\[
\text{expensive : } d_{\text{Pathfinder}} : : d_{\text{Shuttle}} : : d_{\text{Moon}} : : d_{\text{People to Mars}}
\]

In this context, (8) is true, because \( d_{\text{Pathfinder}} \)—the degree to which the Pathfinder mission is expensive—is ordered below \( d_{\text{std}} \). In an alternative context, however, in which the comparison class were such that the standard value were to shift to a point below \( d_{\text{Pathfinder}} \), (8) would be false. What the scalar analysis gains—relative to the two approaches to vague sentences discussed here—is the independence of the ordering on the domain of the adjective from the ordering on the scale of expensiveness. Therefore, an alternative approach to the interpretation of vague sentences like (1) involves the characterization of gradable adjectives as relational expressions.
One way to approach the problem of indeterminacy would be to assume that it is a
residue to other issues (e.g., "measuring", the same individual multiple times) and then to
recognize that, with respect to some issues (e.g., health care, depression), the effect of
the comparison classes in the first account, 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 analyses outlined here differ in a fundamental way.
Specifically, they make very different claims about the relation between the meaning of
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 a basis for the construction of a comparison class that preserves the
ordering on the domain. In contrast, the scalar analysis derives the ordering on the
domain 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
typical 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. For example, consider the following set of 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 (11). A particular individual might be considered
smart in the role of, for example, a political advisor, but decidedly not smart when it
comes to matters of social behavior and discretion. As a result, the truth of each of these
sentences is fundamentally different from that of a typical vague sentence. The

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.
However, these operations presuppose that the ordering associated with the
adjective is determinate, since it is with respect to this ordering that the
ultimate judgment is made. For many adjectives, however, the ordering is not
determinate, and the resolution of vagueness in these cases is more
complex. Some adjectives have a natural ordering on their domain, while others do not.

1.2 Interpreting and the Dimensional Parameter

In such cases, the resolution of vagueness involves the introduction of a new sense of
the adjective that is consistent with the ordering associated with the
adjective. For example, consider the adjective "smart". In the context of
politics, "smart" might refer to someone who is able to make difficult decisions
under pressure. In the context of social behavior, "smart" might refer to someone who
can handle difficult social situations. In order to resolve the vagueness of
sentences like (10), it is necessary to introduce a new sense of "smart"
that is consistent with the ordering associated with the
adjective in each context.
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.

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 calculating the costs of the different missions.

(13) Richard is smarter than George.
(14) The Mars Pathfinder mission was less expensive than the Viking missions.

The interpretation of smart is somewhat similar to that of other non-linear adjectives like poor. In contrast, (19) can be evaluated simply by calculating the costs of the different missions. In this sentence, smart is not the adjective that determines the truth value of the sentence; the sense in which smart is used is left unspecified. Instead, the sentence is true or false depending on which of the two possible orderings on the domain of smart that are relevant to the interpretation of the sentence is chosen. Thus, (13) can be true or false depending on whether (i) or (ii) is chosen.
The dimensionality of these sentences is due to a mismatch of dimensions. Interpreting adjectives as being determined by different dimensions allows us to understand how they can differ even when their domains are the same. This is particularly evident in sentences like (10):

(10) My copy of The Brothers Karamazov is heavier than my copy of The Idiot.

This sentence is anomalous because it involves a comparison between two different dimensions: the weight of the book and the age of the book. The fact that these dimensions can be compared indicates that the adjectives “heavy” and “old” are associated with different dimensions. If we assume that these dimensions are incommensurable, then we can make sense of the fact that the sentence is anomalous. This is because the comparison between two different dimensions cannot be made without reference to a common standard of comparison. In this case, the common standard of comparison is the dimension of weight, which allows us to compare the weights of the two copies of the book.

Other examples of incommensurability involve adjectives that are associated with different dimensions. For example, the adjectives “tall” and “smart” are associated with different dimensions: height and intelligence, respectively. This means that we cannot compare these adjectives directly, even though they have the same domain. The fact that these adjectives are incommensurable means that we cannot make sense of the fact that they can differ even when their domains are the same. This is because the comparison between two different dimensions cannot be made without reference to a common standard of comparison. In this case, the common standard of comparison is the dimension of height, which allows us to compare the heights of people.

In conclusion, 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.
Most boats are longer than they are wide.

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".

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).

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 approaches to the problem of incommensurability differ in their analyses of the same phenomenon. (24)-(29) show the difference in clausal complements of the adjective.

(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.

Although the comparatives in these examples are constructed out of different adjectives, there is no evidence for interpreting them as comparisons of incommensurable properties. (20)-(21) cannot be compared in this way, and neither can (17)-(18). However, (21)-(22) cannot be interpreted as a comparison of incommensurable properties, since the comparison involves the adjectives "tall" and "taller," which are gradable adjectives. A plausible explanation for this generalization is that 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 approaches to the problem of incommensurability differ in their analyses of the same phenomenon.
It's sad that you have to talk to any of these people at all. *It's great that you have to talk to any of these people at all.

It would be foolish of her to even bother to help. *It would be clever of her to even bother to help.

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

It's dangerous to drive in Rome. $\Rightarrow$ It's dangerous to drive fast in Rome.

It's safe to drive in Des Moines. $\Leftarrow$ It's safe to drive fast in Des Moines.

It's strange to see Frances playing electric guitar. $\Rightarrow$ It's strange to see Frances playing electric guitar poorly.

It's common to see Frances playing electric guitar. $\Leftarrow$ 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.

Venus is brighter than Mars if and only if Mars is dimmer than Venus.

Driving in Rome is more dangerous than driving in Los Angeles if and only if driving...

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 properties that are connected to the way in which the ordering on their domains is introduced. In section 1.1.3, positive and negative adjectives are associated with different interpretations. In section 1.1.4.2, cross-polar anomaly is a topic of discussion. Similarly, (40)-(45) show that negative adjectives have downward entailments in clausal complements.

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. 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 inverse ordering relations, while positive adjectives generate monotone increasing contexts, and negative adjectives generate monotone decreasing contexts. The conclusion to be drawn from these facts is that negative adjectives are associated with inverse ordering relations, while positive adjectives are associated with monotone increasing contexts. 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 expression of polarity in adjectives like fast and dirty affect the entailment relations of parts of adjectives like fast and dirty? The important questions are: how is the logical property of adjectives discussed above, that of negative polarity, a part of the entailment relations of parts of adjectives like fast and dirty? The important questions are: how is the logical property of adjectives discussed above, that of negative polarity, a part of the entailment relations of parts of adjectives like fast and dirty? The important questions are: how is the logical property of adjectives discussed above, that of negative polarity, a part of the entailment relations of parts of adjectives like fast and dirty? The important questions are: how is the logical property of adjectives discussed above, that of negative polarity, a part of the entailment relations of parts of adjectives like fast and dirty? The important questions are: how is the logical property of adjectives discussed above, that of negative polarity, a part of the entailment relations of parts of adjectives like fast and dirty? The important questions are: how is the logical property of adjectives discussed above, that of negative polarity, a part of the entailment relations of parts of adjectives like fast and dirty?
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—and (37) if positive and negative adjectives have different dimensional parameters, then this assumption that provides the basis for an explanation of the validity of examples like (34) and (35) is no longer available. In any case, to explain the intuition behind (40), one would need to assume that cross-polar anomaly is a kind of incommensurability. 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 positive and negative adjectives have different dimensional parameters.

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 positive and negative adjectives have different dimensional parameters. In section 1.3 and in more detail in chapter 3, I will show that a possible causal of scalar analogies of gradable adjectives is that comparison of deviation is not defined for the compared degrees. Chapter 3 will show that a possible causal of scalar analogies of gradable adjectives is that comparison of deviation is not defined for the compared degrees.
cannot mean that Robert and William are equal in height. 11

(42) The extent to which William exceeds some standard of tallness.  

1.1.5 Summary

This section provided an overview of the empirical domain that a theory of the semantics of gradable adjectives must explain, and gave an informal introduction to two approaches to these issues: the vague predicate analysis and the scalar analysis that the interpretation of gradable adjectives should be formalized in terms of. The vague predicate analysis analyzes the interpretation 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, the vague predicate analysis is more general in that it can account for the interpretation of gradable adjectives in terms of partial functions, whereas the scalar analysis is more specific in that it characterizes the interpretation of gradable adjectives in terms of abstract representations of measurement. 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.

27 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.

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.

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 of magnitude. In the following sections, I will examine the basic assumptions of this approach in detail. In section 1.2.2, I will briefly discuss the versions articulated in Klein 1980, 1982, and show that only a subset of both accounts for the inferences associated with sentences like (47). The inferences presented by comparison of deviation must be handled in a different way.

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

28 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.

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.

1.2.1 Overview

As observed in section 1.1.1, the vague predicate analysis starts from the assumption that the interpretation of gradable adjectives is determined by the comparison of the compared objects to a fixed standard. This section provided an overview of the empirical domain that a theory of the semantics of gradable adjectives and degree constructions must explain, and gave an informal introduction 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 of magnitude. 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, and finally how it explains the interpretation of absolute forms of degree constructions. Finally, I will discuss several problems with the analysis of comparatives. 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 they're both quite easy.

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

1.2.2 Comparison of Deviation

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 subset of both accounts for both accounts for the inferences associated with sentences like (47).

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

(48) It's more difficult to surf Maverick's than it is to surf Steamer Lane, though they're both quite easy.
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 \( \phi \) 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 \( \text{pos}_c(\phi) \), which contains objects above some point in the ordering (objects that are definitely \( \phi \) in \( c \)), (ii) a negative extension \( \text{neg}_c(\phi) \), which contains objects below some point in the ordering (objects that are definitely not \( \phi \) in \( c \)), and (iii) an extension gap \( \text{gap}_c(\phi) \), which contains objects that fall within an "indeterminate middle", i.e., objects for which it is unclear whether they are or are not \( \phi \) in \( c \). The net effect of these assumptions is that the truth conditions of a sentence of the form \( x \text{ is } \phi \) in a context \( c \) can be defined as in (49) (where \( \phi(x) \) is the logical representation of "\( x \text{ is } \phi \)"").

\[
\text{(49) i. } \phi(x) || c = 1 \text{ iff } x \text{ is in the positive extension of } \phi \text{ at } c,
\]

\[
\text{ii. } \phi(x) || c = 0 \text{ iff } x \text{ is in the negative extension of } \phi \text{ at } c,
\]

\[
\text{iii. } \phi(x) || c \text{ is undefined otherwise.}
\]

As noted 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 a 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 of (50) depends only on the position of Bill in this smaller set. If the entire domain of discourse were taken into consideration when evaluating the truth of (50), the result would be different, since Bill would fall in the negative extension of tall in this case. The information of a proposition with a gradable adjective is functionally dependent on the information of its comparison class.
The analysis of comparative constructions within the vague predicate analysis builds on the

1.2.2 Comparatives

The Consistency Postulate is another important assumption which guarantees the domain of the
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comparison of some comparison class in context c falls in the positive extension of a
A degree function is a partial function from the domain of a gradable adjective to a partially ordered set $\mathbb{D}$ 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 complete function $\phi$ is the set of degree functions; cf. Klein 1982:126).15

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

$$(61)\text{Jupiter is larger than Saturn (is).}$$

For two objects $a,b$ in the domain of a gradable adjective $\tau$ is the domain of discussion, and $D$ is the set of degree functions; Klein 1982:105.

Once we have degree functions, the Consistency Postulate can be restated more formally as in (63) (where $\phi$ is the set of degree functions), $D$ is the domain of discourse, and $C$ is the set of gradable adjective meanings. $\phi$ is a partially ordered set $\mathbb{D}$. 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 interpretations of the domain of a gradable adjective are fully determined. 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 interpretations of the domain of a gradable adjective are fully determined. 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 interpretations of the domain of a gradable adjective are fully determined. 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 interpretations of the domain of a gradable adjective are fully determined.

$$\begin{align*}
\text{Deg} & \in C, \\
GrAdj & \in D, \\
\text{Consistency Postulate} & = (63)
\end{align*}$$

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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 interpretations of the domain of a gradable adjective are fully determined.
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) \(D_{\text{large}} = \{\text{Pluto, Mercury, Mars, Venus/Earth, Neptune, Uranus, Saturn, Jupiter}\}\)

(68) \(\text{pos}_{d}(\text{large}) = \{\text{Jupiter}\}\)
\(\text{neg}_{d}(\text{large}) = \{\text{Pluto, Mercury, Mars, Venus/Earth, Neptune, Uranus, Saturn}\}\)

Since the possible values of the function \(d\) must satisfy Consistency Postulate, partitionings such as (69) are impossible, and we derive the desired conclusion: namely that Jupiter is larger than Saturn is.

(69) \(\text{pos}_{d}(\text{large}) = \{\text{Uranus, Saturn}\}\)
\(\text{neg}_{d}(\text{large}) = \{\text{Pluto, Mercury, Mars, Venus/Earth, Neptune, Jupiter}\}\)

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).

\(\forall d [ (d(\text{large}))(\text{Venus}) \rightarrow (d(\text{large}))(\text{the earth})] \)

(70) 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

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) \(\exists d [ (d(\text{fast}))(\text{my Volvo}) \& \neg (d(\text{fast}))(\text{Jason’s Honda})] \)

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

(73) \(\text{pos}_{d}(\text{fast}) = \{\text{my Volvo, my old Dodge, ..., Ken’s Jaguar, Jorge's Morgan, Kari's Dodge}\}\)
\(\text{neg}_{d}(\text{fast}) = \{\text{..., Rachel's scooter, Jason's Honda, ...}\}\)

It does not follow, however, that this partitioning is the one derived contextually (relative to 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 true, according to the analysis of the construction.

(74) \(\text{pos}_{d}(\text{fast}) = \{\text{my Volvo, my old Dodge, ..., Ken’s Jaguar, Jorge's Morgan, Kari's Dodge}\}\)
\(\text{neg}_{d}(\text{fast}) = \{\text{..., Rachel's scooter, Jason’s Honda, ...}\}\)

A positive result of this analysis is that it accounts for the fact that (i) and (ii) are logically equivalent (see Klein 1980).

(i) Mars is not as large as Jupiter.

(ii) Jupiter is larger than Mars.
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. 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.

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 a general account of the monotonous properties of polarity.

Although Klein (1990) 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 that the domains of antonymous pairs are distinguished by their orderings: one is the inverse of the other. A positive result of this assumption is that it explains why sentences like (77) are valid. A positive result of this assumption is that it explains why sentences like (77) are valid. A positive result of this assumption is that it explains why sentences like (77) are valid. A positive result of this assumption is that it explains why sentences like (77) are valid.
Consider, for example, the case of (82), which has the logical representation in (84).

\[
\exists d \left[ (d(\text{happy})) (\text{Mona}) \land \neg (d(\text{sad})) (\text{Jude}) \right]
\]

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

\[D_{\text{happy}} = \{x, y, \text{Jude}, z, \text{Mona}\}\]

\[D_{\text{sad}} = \{\text{Mona}, z, \text{Jude}, y, x\}\]

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 \(\text{happy}\) and \(\text{sad}\) shown in (87).

\[\text{pos}_d(\text{happy}) = \{\text{Jude}, z, \text{Mona}\}\]

\[\text{neg}_d(\text{happy}) = \{x, y\}\]

\[\text{pos}_d(\text{sad}) = \{y, x\}\]

\[\text{neg}_d(\text{sad}) = \{\text{Mona}, z, \text{Jude}\}\]

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 approach to comparatives developed in section 1.1.4.3.1 observed that they have two

somewhat different

comparisons of deviation constructions such as (88) and (89), though their effects are

The problems posed by cross-polar constructions clearly are a worry for a vague predicate approach to

1.2.3.2 Comparison of Deviation

negative adjectives is possible in certain circumstances.

negatives adjectives are impossible in certain circumstances, and

comparisons addressed in the next section show that comparison between positive and negative adjectives within the vague predicate approach that describes this construction. Moreover, negative pairs of adjectives is impossible, but there is no aspect of the approach to

M\[\exists d \left[ (d(\text{happy})) (\text{Mona}) \land \neg (d(\text{sad})) (\text{Jude}) \right]
\]

consider the case of (82), which has the logical representation in (84).
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—rather 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 specified in (91) and (92) and that 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).

\[
\begin{align*}
\text{happy} & = \{x, y, z, \text{Mona}, \text{Jude}\} \\
\text{sad} & = \{z, \text{Jude}, y, \text{Mona}, x\}
\end{align*}
\]

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: (95) is false, since Mona appears in the positive extension of happy and Jude appears in the negative extension of sad, while (97) is false, since Jude appears in the negative extension of sad but (96) is true, which is a rough paraphrase of what (98) means. 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 the comparison of deviation construction (89) in this context.

\[
\begin{align*}
\text{happy} & = \{x, y, z, \text{Mona}, \text{Jude}\} \\
\text{sad} & = \{z, \text{Jude}, y, \text{Mona}, x\}
\end{align*}
\]

Similarly, (96) is false, because Jude falls in the negative extension of sad and (98) is true.

\[
\begin{align*}
\text{happy} & = \{x, y, z, \text{Mona}, \text{Jude}\} \\
\text{sad} & = \{z, \text{Jude}, y, \text{Mona}, x\}
\end{align*}
\]
The problem for the vague predicate analysis is that it does not provide a means of explaining incommensurability in these cases. To see why, first consider the analysis of a

\[ (102) \text{Mona is more happy than Jude is sad, but Jude is happier than Mona.} \]

In section 1.2.3.3, I used the contrast between examples like (103)-(104) and (105) as the basis for the descriptive generalization in (106).

\[ (106) \text{A comparative construction is semantically well-formed only if the compared adjectives have the same dimensional parameter.} \]

Although this approach to incommensurability seems reasonable, it should nevertheless be the case that the actual constraint underlying the descriptive generalization is sensitive to the linguistic properties of gradable adjectives and the comparative construction. That is, the explanation for 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).

\[ (107) \text{My copy of } The \text{ Brothers Karamazov } \text{ is higher on a scale of heaviness than my copy of } The \text{ Idiot.} \]

In section 1.2.4, I used the contrast between examples like (107)- (109) as the basis for the descriptive generalization in (106).

\[ (109) \text{Our Norfolk Island Pine is as tall as its branches are long.} \]

\[ (107) \text{My copy of } The \text{ Brothers Karamazov } \text{ is heavier than my copy of } The \text{ Idiot.} \]

\[ (107) \text{My copy of } The \text{ Brothers Karamazov } \text{ is higher on a scale of heaviness than my copy of } The \text{ Idiot.} \]

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\[ (107) \text{My copy of } The \text{ Brothers Karamazov } \text{ is heavier than my copy of } The \text{ Idiot.} \]

\[ (107) \text{My copy of } The \text{ Brothers Karamazov } \text{ is higher on a scale of heaviness than my copy of } The \text{ Idiot.} \]
The tree is taller than the ceiling is high.

According to \((109)\), \((108)\) is true just in case there is a function \(d\) that introduces a partitioning on the domain of \(\text{tall}\) so that \(\text{the tree is tall}\) is true, and also introduces a partitioning on the domain of \(\text{high}\) so that \(\text{the ceiling is high}\) 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 \(\text{tall}\) and \(\text{high}\) 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 domain of \(\text{heavy}\) is \((110)\), while the ordering on the domain of \(\text{old}\) is \((111)\).

\[
(110) \quad D_{\text{heavy}} = \{\text{Crime and Punishment, The Devils, The Idiot, The Brothers Karamazov}\}
\]

\[
(111) \quad D_{\text{old}} = \{\text{The Idiot, The Devils, The Brothers Karamazov, Crime and Punishment}\}
\]

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

\[
(112) \quad \exists d [ (d(\text{heavy})) (\text{The Brothers Karamazov}) \& \neg (d(\text{old})) (\text{The Idiot})]
\]

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 \(d\) such that the highest-ranked object in each set falls in the positive extension and the rest are in the negative extension? Therefore it is not enough to show that \(d\) is actually unavailable—this would have the result that \((104)\) is false, rather than the desired result that the sentence is anomalous. Indeed, one way to derive this result is to consider any copies of Dostoevski's novels, and the ordering on the domain of \(\text{happy}\) is to include only my copies of Dostoevski's novels, and the ordering on the domain of \(\text{happy}\) is.

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 domain of \(\text{happy}\) is.

\[
(109) \quad 109(6) \text{ (The Idiot, The Devils, The Brothers Karamazov, Crime and Punishment)}
\]

The tree is taller than the ceiling is high. 21 "Subdeletion" structures are those of the form \(x \text{ is more } A \text{ than } A\), where \(A\) are lexically distinct (cf. Bresnan 1973, 1975, Grimshaw 1987, Corver 1990, 1993, Izvorski 1995).
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 function comparisons even if the domains of the adjectives are the same. Ideally, then, the anomaly of examples like (104) should follow from the semantics of gradable adjectives and the comparative construction, not from a general stipulation over comparative functions, and the assumption that comparative functions (and other comparative constructions in terms of comparative functions) are part of the analysis of comparative construction (Klein 1980:27-28). We should not only be non-mandatory, it should be obligatory and inapplicable to other comparative functions. The anomaly of adherence to the requirement is the result of adherence to a requirement that cannot apply to other comparative functions. However, a result it does not support in explanation of the well-known fact that negative adjectives such as three feet short do not permit measure phrases:

(117) #Mona is three feet short.

Assuming that all third short are extensional equivalents, the result follows from the analysis of the comparative with the opposite semantics of gradable adjectives and the comparative construction. The anomaly of adherence to the requirement is the result of adherence to a requirement that cannot apply to other comparative constructions.
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 function expects 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 adjectives, but differ in their assumptions about how the ordering is derived. In the vague predicate analysis, the ordering is a priori, while in the scalar analysis, it is derived from the underlying measurement.

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 examples and their implications for the theory of meaning and logical form. The reader is referred to Cresswell (1976:266) for a detailed treatment of the scalar analysis of gradable adjectives.

1.3.1 Degree Arguments

Cresswell (1976:266) suggests that "when 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 points and objects 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, density, etc., and provides a measure of the object with respect to that property.
Once scales and degrees are introduced into the ontology, it becomes possible to
differentiate one scale from another.22

22

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

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.

Within a framework in which gradable adjectives are analyzed as relational
expressions, the logical representation of a sentence of the form

\[ x \text{ is } \phi \]

can be stated as in (121), which has the truth conditions in (122), where

\[ \delta_{\phi}(x) \]

is a function that maps objects to the scale associated with \( \phi \).

Stated informally, \( x \text{ is } \phi \) is true just in case the projection of \( x \) on the scale associated with
\( \phi \) (i.e., the degree to which \( x \) is \( \phi \)) 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

\[ x \text{ is } \phi \] (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 \( x \text{ is } \phi \) is true from those elements for which
\( x \text{ is } \phi \) is false in some context.

For illustration of this idea, consider an example like (123), which has the logical
representation in (124), where

\[ \text{ds} \]

is the degree argument of \( \text{long} \) and denotes a contextually determined standard of “longness”.

\[ \text{long}(\text{BK,ds}(\text{long})) \]

According to the truth conditions in (122), (123) is true if and only if \( \delta_{\text{long}}(\text{BK}) \geq \text{ds}(\text{long}) \) holds,

\[ (123) \]

\[ (124) \]

\[ \text{long} \]

\[ \text{BK} \]

\[ \text{ds} \]

\[ \text{long} \]

\[ (122) \]

\[ (121) \]

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.

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.
Some facts to be expected when Venus has ever been d-bright.

Assume a general constraint that prohibits a context in which the standard of tallness is the same as the standard of shortness. That is, we must have a general constraint that the standard of shortness cannot exceed the standard of tallness. That is, we must have

$$\exists d \text{ such that } d > d_c$$

where

$$\forall x \forall d (x < d \rightarrow \neg \phi(x,d))$$

$$\forall x \forall d (x > d \rightarrow \phi(x,d))$$

$$\forall x \forall d (x \in \text{comparison class})$$

The context-dependency of a sentence of the form (125) is determined, and assume following Bierwisch 1989 that the standard value is determined contextually, relative to a particular comparison class. As observed in section 1.1.1, this hypothesis forms the basic explanation of vagueness in a scalar analysis of gradable adjectives. For example, in (126) the scalar analysis is parallel to

$$\phi(x,d) \equiv (\phi(x,d_c) \lor \phi(x,d'))$$

$$\phi(x,d')$$

The logical representation of a typical comparative like (125) is (126).

$$\phi(x,d) \equiv (\phi(x,d_c) \lor \phi(x,d'))$$

$$\phi(x,d')$$

Given the truth conditions for the absolute construction presented in section 1.3.1, a comparative clause is a form of a quantifier that denotes a maximal degree and is specified by a contextual parameter.

$$\exists x \exists d (x > d \rightarrow \phi(x,d))$$

$$\exists x \exists d (x < d \rightarrow \neg \phi(x,d))$$

$$\exists x \exists d (x \in \text{comparison class})$$

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Given the truth conditions for the absolute construction presented in section 1.3.1, a comparative clause is a form of a quantifier that denotes a maximal degree and is specified by a contextual parameter.

$$\exists x \exists d (x > d \rightarrow \phi(x,d))$$

$$\exists x \exists d (x < d \rightarrow \neg \phi(x,d))$$

$$\exists x \exists d (x \in \text{comparison class})$$

The context-dependency of a sentence of the form (125) is determined, and assume following Bierwisch 1989 that the standard value is determined contextually, relative to a particular comparison class. As observed in section 1.1.1, this hypothesis forms the basic explanation of vagueness in a scalar analysis of gradable adjectives. For example, in (126) the scalar analysis is parallel to

$$\phi(x,d) \equiv (\phi(x,d_c) \lor \phi(x,d'))$$

$$\phi(x,d')$$

The logical representation of a typical comparative like (125) is (126).

$$\phi(x,d) \equiv (\phi(x,d_c) \lor \phi(x,d'))$$

$$\phi(x,d')$$

Given the truth conditions for the absolute construction presented in section 1.3.1, a comparative clause is a form of a quantifier that denotes a maximal degree and is specified by a contextual parameter.
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).

\[
\text{max}(D) = \{ d \in D \mid \forall d' \in D: d \geq d' \}
\]

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) \( \exists d \left[ d > \text{max}(\lambda d'. \text{long}(\text{Idiot}, d')) \right] \left[ \text{long}(\text{BK}, d) \right] \)

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 \( dBK \) denotes the degree of *The Brothers K.*'s length, (128) is true.

(130) length:

\[ 0 \quad \cdots \quad d_I \quad \cdots \quad dBK \quad \cdots \quad \infty \]

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 a judgment on a scale. Since the truth conditions of the comparative construction are established by a standard value, since the truth conditions of the comparative construction are not determined by the difference between the projections of two objects on a scale, it does not make an absolute judgment on a scale. The comparative construction is therefore a *relative* construction.

5.3.3 Solutions to the Problems for the Vague Predicate Analyses

(19) Then, where \( p \) denotes the degree of *The Idiot*’s length and \( dBK \) denotes the degree of *The Brothers K.*’s length, (128) is true iff there is a degree such that \( dBK \) exceeds the maximal degree of *The Brothers K.*’s length.

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

(17) Logical Representation in (128)

For an illustration of the basic approach consider the analysis of (128), which has the form

\[
[p \geq dBK \wedge \forall d \in D: d \leq d_I \rightarrow d > dBK] \rightarrow (d_I \geq dBK)
\]

(16) According to (129), (128) is true iff there is a degree such that \( dBK \) exceeds the maximal degree of *The Brothers K.*’s length. According to (129), (128) is true iff there is a degree such that \( dBK \) exceeds the maximal degree of *The Brothers K.*’s length.

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

(14) The phrase *longer than* is longer.
1.3.3 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 1.3.1, 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 of degrees ordered along dimension $\phi$ is different from a scale of degrees ordered along dimension $\psi$. 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) $\exists d \left[ d > \max (\lambda d'. \text{old}(\text{my copy of The Idiot}), d') \right] \left[ \text{heavy}(\text{my copy of The Brothers K}) \right]$

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 $\delta_{\text{heavy}}$ is a function from objects to the scale associated with *heavy*.

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

Since the ordering relation introduced by the comparative construction 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, since the ordering relation introduced by the comparative construction 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 degree of age is defined as the degree to which my copy of *The Idiot* is old, and it is the only degree of age that satisfies the restriction imposed by the comparative.

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 that 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 avoids 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.
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 the nuclear scope. The assumption that the meaning of a gradable adjective is defined in relation to the expression of incommensurability, the explanation of cross-polar anomaly

1.4.2 Cross-Polar Anomaly

Section 1.1.2 explains that incommensurability is a property of gradable adjectives and comparatives, rather than a general conceptual property. The 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 nuclear scope. 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 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.

Finally, it should be noted that the analysis of incommensurability outlined above is applicable to cases where a comparative introduces a degree on the same scale as the one associated with the adjective in the nuclear scope. This is determined by the scalar association between the adjective and the comparative. In general terms, incommensurability is predicted to arise whenever a comparative introduces a degree on the same scale as the one associated with the adjective in the nuclear scope.
Venus is brighter than Mars is dim.

The Dream of a Ridiculous Man is shorter than The Brothers Karamazov.

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 in 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).

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.

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

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

∃d [d > max(λd'. 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 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.

As a result, the comparative restricts the degree argument of the positive adjective bright to be a negative degree. Since height is negatively quantified by the comparative clause, the comparative restricts the degree argument of the positive adjective bright to be a negative degree.

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).

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

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).

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 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, is the question of how the scalar analogies succeed in meeting this requirement. I will present an overview of how the scalar analogies succeed in meeting this requirement was unable to address either of these goals. Although it does succeed in explaining cross-polar anomaly, it does not succeed in explaining comparison of deviation constructions. It does not account for their entailment, nor does it account for their interpretation. For comparison of comparison of deviation constructions, it is not clear how the scalar analogies succeed in explaining the entailment of (145), nor does it explain the entailment of the measure phrase in an example like (146).

The challenge faced by an analysis of comparison of deviation is that of developing a scalar analogy that is able to account for both the entailment and the interpretation of comparison of deviation.

The challenge faced by an analysis of comparison of deviation is the question of how the scalar analogies succeed in meeting this requirement. I will present an overview of how the scalar analogies succeed in explaining comparison of deviation constructions. It does not account for their entailment, nor does it account for their interpretation. For comparison of comparison of deviation constructions, it is not clear how the scalar analogies succeed in explaining the entailment of (145), nor does it explain the entailment of the measure phrase in an example like (146).

1.3.4.4 Comparison of Deviation

For a similar explanation of these facts, reference is made to the comparative construction

(147) The authors of the measure phrase reference is provided by the measure phrase reference.

1.3.4.4 Comparison of Deviation

For a similar explanation of these facts, reference is made to the comparative construction

(148) The authors of the measure phrase reference is provided by the measure phrase reference.
Hellan 1981 and von Stechow 1984a, appear to verify this prediction.

Red stars are typically 5000 degrees cooler than blue stars.

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).

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 projection of an object on a scale and an appropriate standard-denoting degree. Building on the 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 denote the difference between the projection of an object on a scale and an appropriate standard-denoting degree. This explains the unacceptability of (144), which asserts that Galileo was 6 inches shorter than Copernicus.

It can be shown that the above analysis satisfies the requirements of the above discussion.

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. An important explanation why comparison of deviation constructions are nonnatural: second, this analysis provides the comparison of deviation constructions are satisfied. For example, the truth condition for absolute comparison (145) is correct if it defines the entailment properties of comparison of deviation constructions, whereas standard comparatives quantify over degrees that represent the projection of an object on a scale, and if differential degrees that represent the differences between the projection of an object on a scale and an appropriate standard-denoting degree. This explains the unacceptability of (144), which asserts that Galileo was 6 inches shorter than Copernicus.

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

Galileo was 6 inches taller than Copernicus.

Copernicus was 6 inches taller than Galileo.

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null
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.

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

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

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

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 brother’s tallness, Max is at least as tall as \( d \). 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 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 degree. If (156) were a possible interpretation of (154), the sentence could be true in a situation in which Max’s brother is taller than Max, regardless of whether the nuclear scope of the comparative is narrow or wide.

One response to this problem is that the wide scope reading of the comparative is a tautology: assuming there is no maximal degree of any kind, it is always true that some degree which satisfies the restriction \( d \) will also satisfy the nuclear scope of the comparative – 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) Max didn't see a recent supernova in the Hercules Cluster because it was obscured by cosmic dust.

The sentence in (154) is ambiguous, as illustrated by the following diagram.

\[
\begin{array}{c}
\text{Max's height} \\
\downarrow \\
\text{Max} \\
\downarrow \\
\text{Height:} \\
0 \\
\vdots \\
\text{Max's brother} \\
\downarrow \\
\text{Brother's height} \\
\downarrow \\
\text{Degree} \\
\downarrow \\
\infty
\end{array}
\]

On the reading of (154) in (155), the sentence is true if there is a degree which exceeds the degree of Max’s brother’s height, and it is not the case that Max is at least as tall as that degree. This is an accurate characterization of the interpretation of (154). On the wide scope reading in (156), the sentence is true if there is a degree which exceeds the degree of Max’s brother’s height, and it is not the case that Max is at least as tall as that degree.
We were amazed that the Hale-Bopp comet was as bright as it was. 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.

There is no context that supports a reading of (154) with the truth conditions in (156): this 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. For example, (159) correctly captures the interpretation of (162): for every x such that x is a planet, for every y such that y is a book, x reads a book that is larger than Earth's moon.

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) ∃y [book-on-adjectives(y)] [∀x [student-in-semantics-1(x)] [read(x,y)]]

(161) ∀x [student-in-semantics-1(x)] [∃y [book-on-adjectives(y)] [read(x,y)]]

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

The problem with this sort of explanation is that there is reason to believe that it is too weak. If comparatives participate in scope ambiguities, then (162) should have the two readings.

(162) Every planet in the solar system is larger than Earth's moon.
some degree
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 the factual interpretation of a sentence such as \( y \) is \( z \)-short is one in which

\[ \text{B}: \] In 5 feet tall; in fact, I'm over 5 feet tall.

Although the factual interpretation of a sentence such as \( y \) is \( z \)-short is one in which

\[ \text{B}: \] In 5 feet tall; in fact, I'm over 5 feet tall.

If the absolute form is interpreted in this way, however, it presents a serious problem for the analysis of comparatives with \( \text{less} \). Specifically, an analysis of \( \text{less} \) comparatives in terms of existential quantification ends up with the wrong truth conditions.

Consider, for example, (167), which has the logical representation in (168).

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

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

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). The problem disappears (this point is made in Rullmann 1995) if the absolute form of the comparative is interpreted with respect to a relation of

\[ \rho, \xi \text{ and } \xi \text{ are at least as great as } \rho \]

because there is a larger \( \rho \) that satisfies the conditions imposed by (168): \( \rho \) is exceeded by the degree of the black hole and \( \rho \) does not exceed the density of the red giant. (167) would be true.

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because there is a larger \( \rho \) that satisfies the conditions imposed by (168): \( \rho \) is exceeded by the degree of the black hole and \( \rho \) does not exceed the density of the red giant. (167) would be true.
That red giant is less dense than the black hole it’s orbiting; in fact, it’s denser than the black hole. 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.

### 1.4.3 Intensional Contexts

Although the discussion in the previous section suggested 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).

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

(175) \[ \exists d \left[ (\lambda d'.\text{large}(\text{moon},d')) > \text{max} \right] \left[ \text{think}(\text{Max},^\text{large}(\text{moon},d)) \right] \]

(176) \[ \text{think}(\text{Max},^\exists d \left[ (\lambda d'.\text{large}(\text{moon},d')) > \text{max} \right] \left[ \text{large}(\text{moon},d) \right]) \]

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 the comparatives are quantificational. However, this is expected because (172) is ambiguous between the two readings.

We thus arrive at a paradox: in order to construct an analysis of comparatives with less that correctly captures the truth conditions of comparatives, it must also stipulate that the existential force introduced by the comparative has narrow scope with respect to distributive quantifiers.
If Jones had been taller than he was, he would have been decapitated by the flying saucer.

It 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 (where Jones is not decapitated), 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 "⇒" indicates counterfactuality (cf. Lewis 1973a, Stalnaker 1968).

$$\phi \Rightarrow \psi \mid w = 1 \text{ iff (i) there are no possible worlds in which } \phi \text{ or (ii) there is a world } w' \text{ in which } \phi \text{ and } \psi \text{ are true and } w' \text{ is closer to } w \text{ than any world in which } \phi \text{ holds but } \psi \text{ does not.}$$

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

$$\exists d \left[ d > \max (\lambda d'. \text{tall}(\text{Jones}, d')) \right] \left[ \text{tall}(\text{Jones}, d) \Rightarrow \text{decapitate}(\text{flying saucer, Jones}) \right]$$

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.

<table>
<thead>
<tr>
<th>World</th>
<th>Jones' height</th>
<th>Jones' decapitated</th>
</tr>
</thead>
<tbody>
<tr>
<td>$w_0$</td>
<td>5' 4&quot;</td>
<td>yes</td>
</tr>
<tr>
<td>$w_1$</td>
<td>5' 3&quot;</td>
<td>no</td>
</tr>
<tr>
<td>$w_2$</td>
<td>5' 2&quot;</td>
<td>no</td>
</tr>
<tr>
<td>$w_3$</td>
<td>5' 1&quot;</td>
<td>no</td>
</tr>
<tr>
<td>$w_4$</td>
<td>5' 0&quot;</td>
<td>yes</td>
</tr>
</tbody>
</table>

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 (181) 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.

Accoding to von Stechow, the actual logical representation of the non-trivial interpretation of (177) is as in (181), in which the comparative clause (max (\lambda d'. \text{tall}(\text{Jones}, d')))) has scoped out of the conditional, but the quantifier introduced by the comparative remains within the conditional. In the representation in (179), the non-trivial interpretation of (177) is assigned the logical representation

$$\forall \phi \exists d \left[ d > \max (\lambda d'. \text{tall}(\text{Jones}, d')) \right] \left[ \text{tall}(\text{Jones}, d) \Rightarrow \text{decapitate}(\text{flying saucer, Jones}) \right]$$

Unlike (179), (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 (177), (181) is false in the context illustrated by (180).
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 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 similar accounts). On this view, comparatives do not introduce a degree, but rather denote relations between sets of degrees. The basic form of the analysis is as follows. Assume that degree morphemes such as more/more, and less/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 \( \phi \) and \( \psi \) correspond to the comparative clause and main clause respectively, and denote sets of degrees.

\[
\text{more}(\phi)(\psi) \iff \phi \subset \psi
\]

(182)

For an illustration of this 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)

\[
\text{more}(\lambda d. \text{thick}(\lambda d. \text{Titan's atmosphere}, d)))(\lambda d. \text{thick}(\lambda d. \text{Jupiter's atmosphere}, d))
\]

According to (184), (182) is true just in case the set of degrees which makes Titan's atmosphere d-thick true is properly included by the set of degrees which makes Jupiter's atmosphere d-thick true.
(184) \(\phi(a,d)\) = 1 if \(\delta\phi(d) \geq d\), where \(\delta\phi\) 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 that 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 comparative interpretation (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 d-thick; this is the set of degrees which are ordered above the degree of Jupiter's atmosphere's thickness. Because of the ordering of the scale, it will never be the case that the set of degrees ordered below the degree of thickness of Titan's atmosphere is a proper subset of the set of degrees which are ordered below the degree of thickness of Jupiter's atmosphere on a scale of which are ordered above the degree of thickness of Titan's atmosphere. Therefore, the formula in (188) is false just in case the set of degrees which are ordered above the degree of thickness of Titan's atmosphere is a proper subset of the set of degrees which are ordered above the degree of thickness of Jupiter's atmosphere.

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:

\[ D(\phi) \equiv D(\phi \cap \psi) \]

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) \(\phi \subset \psi\) \(\equiv\) \(\phi \subset (\phi \cap \psi)\)

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) \(\phi \cup \psi\) = 1 \(\equiv\) \(\phi \supset \psi\)

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

(192) \[ D(\phi) \equiv D(\phi \cup \psi) \]

The second problem with the analysis of comparatives as generalized quantifiers is a problem associated with the analysis of comparatives with less. An immediate positive result of this analysis is that it avoids problems associated with the analysis of comparatives with less in section 1.4.1. The second problem with the analysis of comparatives as generalized quantifiers is a problem associated with the analysis of comparatives with less. An immediate positive result of this analysis is that it avoids problems associated with the analysis of comparatives with less in section 1.4.1.
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 interpretation of more, then the interpretation of less must be as in (194), in which case less is nonconservative.

\((194)\) \(\text{less} (\phi)(\psi) \equiv \phi \subset \psi\) iff \(\phi \subset \psi\) implies \(\phi \subset \psi\) and \(\psi \subset \phi\).

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 section 2.4, but which avoids some of the problems of natural language conservativity.

The primary conclusion of this chapter is that gradable adjectives should be analyzed in terms of abstract representations of measurement, i.e., scales and degrees. The 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.

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