ABSTRACT

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Determining the semantic content of sentences, and uncovering regularities between linguistic form and meaning, requires attending to both morphological and syntactic properties of a language with an eye to the notional categories that the various pieces of form express. In this dissertation, I investigate the morphosyntactic devices that English speakers (and speakers of other languages) can use to talk about comparisons between things: comparative sentences with, in English, *more... than*, *as... as*, *too*, *enough*, and others. I argue that a core component of all of these constructions is a unitary element expressing the concept of measurement.

The theory that I develop departs from the standard degree-theoretic analysis of the semantics of comparatives in three crucial respects: first, gradable adjectives do not (partially or wholly) denote measure functions; second, degrees are introduced compositionally; and three, the introduction of degrees arises uniformly from the semantics of the expression *much*. These ideas mark a return to the classic morphosyntactic analysis of comparatives found in Bresnan (1973), while incorporating and extending semantic insights of Schwarzschild (2002, 2006). Of major interest is how the dimensions for comparison observed across the panoply of comparative

constructions vary, and these are analyzed as a consequence of what is measured (individuals, events, states, etc.), rather than which expressions invoke the measurement.

This shift in perspective leads to the observation of a number of regularities in the mapping between form and meaning that could not otherwise have been seen. First, the notion of measurement expressed across comparative constructions is familiar from some explications of that concept in measurement theory (e.g. Berka 1983). Second, the distinction between gradable and non-gradable adjectives is formally on a par with that between mass and count nouns, and between atelic and telic verb phrases. Third, comparatives are perceived to be acceptable if the domain for measurement is structured, and to be anamolous otherwise. Finally, elaborations of grammatical form reflexively affect which dimensions for comparison are available to interpretation.

MEASURING PREDICATES

by

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Chapter 1: Introduction & overview

This dissertation is about measurement in natural language, in particular as it is expressed in sentences with *more*, *as*, *too* and *enough*, and others. Canonical examples of comparative sentences contain adjectives like *tall* and *intelligent*, as in (1). Adjectives like these are said to be 'gradable' since their application is not an all-or-nothing affair: for an individual to have the property expressed by a gradable adjective is for the individual to have it *to an extent* or *to a degree*. Words expressing properties like these are prototypical elements of comparative sentences.

(1) a. Al is tall**er**/**more** intelligent than Bill is.

b. Al is **as** tall/intelligent as Bill is.

c. Al is **too** tall/intelligent to date Bill.

d. Al is tall/intelligent **enough** to date Bill.

e. **How** tall/intelligent is Al?

f. Al is **that**/**so** tall/intelligent.

On one major theory of the semantics of comparatives, *tall* and *intelligent* are analyzed as expressing relations between individuals and **degrees**, themselves understood as representations of measures along various dimensions (e.g., height, intelligence). Comparative morphemes like *as*, *too*, etc., on such accounts, express **relations** between degrees: we can say that one degree is greater than (1a) or (at least) equal to another (1b), one can be excessive (1c) or sufficient for some state of affairs (1d). Degrees can also be inquired about (1e) and demonstrated (1f).

A 'degree predicate' on this view is one that maps individuals to **scales**, which are understood to be total orders on sets of various sorts of degrees: *tall* associates individuals with degrees in an ordering on degrees-of-height, and *intelligent* with an ordering on degrees-of-intelligence. I outline the motivations and details of the degree-theoretic analysis of gradable adjectives (GAs[1]) and extend it to adverbs in Chapter 2, contrasting it with prominent alternative, vagueness-based approaches.

Degree-based analyses have been applied most widely to canonical cases like the sentences in (1); however, my major interest will be in its extension to non-canonical cases such as comparatives with nouns (2) and verbs (3). Such sentences show the same range of degree-relational interpretations (greater-than, excessive-for, etc.), but differ in that the comparative morphemes appear either morphologically different (in the case of *more*) or somewhat at a distance from the nouns or verbs targeted for comparison (e.g. *as much soup*).

(2) a. Al ate **more** soup than Bill did.

b. Al ate **as much** soup as Bill did.

c. Al ate **too much** soup to feel comfortable.

d. Al ate **enough** soup to feel comfortable.

[1] I often use 'GA' as a label for both gradable adjectives and gradable adverbs.

e. **How much** soup did Al eat?

f. Al ate **that/so much** soup.

(3) a. Al ran **more** than Bill did.

b. Al ran **as much** as Bill did.

c. Al ran **too much** to feel refreshed now.

d. Al ran **enough** to feel refreshed now.

e. **How much** did Al run?

f. Al ran **that/so much**.

These differences suggest one widely-adopted hypothesis, namely that nouns and verbs interact compositionally with comparative morphemes in a fundamentally different way than do GAs. On such accounts, instead of expressing relations between individuals and degrees, they express **properties**, and degrees are introduced in (2) and (3) by an expression like *much*.[2] Indeed, such an expression must appear between comparative morphemes and the noun or verb, contrast (2)-(3) with (4)-(5). Furthermore, if both GAs and *much* introduce degrees, this can help explain why GAs cannot "double up" with *much*, contrast (1) with (6).

(4) a. * Al ate **as** soup as Bill did.

b. * Al ate **too** soup to feel comfortable.

(5) a. * Al **as** ran as Bill did.

b. * Al **too** ran to feel refreshed now.

[2]It is traditionally thought that *more* in (2a) and (3a) has two parts underlyingly, *much* and *-er* (Bresnan 1973).

(6) a. * Al is **as much** tall/intelligent as Bill is.

b. * Al is **too much** tall/intelligent to date Bill.

In Chapter 3, I discuss the strongest semantic evidence I know of for maintaining this distinction between GAs (degree-theoretic relations), on the one hand, and nouns and verbs (properties) on the other. The major data pertains to a "monotonicity constraint" (Schwarzschild 2002, 2006, Nakanishi 2007) on the interpretation of comparatives with nouns and verbs that is not obviously evidenced by GA comparatives. In brief, a restriction to monotonic measures explains the fact that while the same "stuff"—portions of soup in (7a,b), running in (8a,b)—is measured, only dimensions that respect part-whole relations are available to nominal and verbal comparatives. For example, larger portions of soup have greater measures by volume or weight than do smaller portions, which is not generally the case with measures by temperature. To express comparisons along non-monotonic dimensions, a GA like *hot* (7b) or *quickly* (8b) must be used.

(7) a. Al bought **as much soup** as Bill did. *temp, volume, weight

b. Al bought **as hot (of) soup** as Bill did. temp, *volume, *weight

(8) a. Al **ran as much** as Bill did. *speed, time, distance

b. Al **ran as quickly** as Bill did. speed, *time, *distance

The differences between the (a) and (b) pairs in (7) and (8) can be explained by positing that *much* is **neutral** with respect to a range of degree predicates, but that it is interestingly constrained: it is limited to expressing mappings that are **homomorphic** (or, structure-preserving) on the measured domain, e.g. the part-whole structures of ⟦*coffee*⟧ and ⟦*run*⟧. In contrast, GAs like *hot* and *quickly* lexically incorporate specific degree predicates—ones that need not (and often do not) preserve such structure.

Nevertheless, that the semantics of *much* is variable but constrained in these ways raises the question of whether that expression couldn't introduce degrees in GA comparatives as well. I argue for precisely this re-envisioning of the standard degree-theoretic analysis in Chapter 4. The argument is based, in part, on a classic syntactic account in which an expression like *much* is, overtly or covertly, present in all comparatives, whether adjectival, nominal, or verbal (Bresnan 1973; cf. Corver 1997). Coupled with the semantic analysis of GAs as expressing properties of states (Landman 2000, Fults 2006), I suggest that their extensions are measurable in the same sense as those of *coffee* and *run* are. Building on a distinction drawn by Champollion (2010), I posit that even GA comparatives involve monotonic mappings to degrees.

Thus, this dissertation is an attempt to depart fairly radically from the usual understanding of the logical form of comparative constructions. Instead of hard-wiring the semantics of degree into the interpretations of GAs, it is uniformly introduced compositionally by *much*. This, I argue, is the only way degrees may be elaborated upon by comparative morphemes like *more*, *as*, *too*, and others.

Defending this view, Chapters 5 and 6 address potential challenges to the idea that the semantics is so uniform in this domain.

Chapter 5 discusses grammatical effects on the dimensions that are available for measurement in a comparative. In (9), the presence or absence of the plural morpheme radically changes which dimensions for measurement are available for comparison: where (9a) is intuitively judged true where measures by volume or weight are understood, (9b) is only intuitively judged true if the **number** of coffees Al drank exceeds the number of coffees Bill drank (Bale & Barner 2009, Barner et al. 2009). I show that parallel facts obtain in the verbal and adjectival domains, once the effects of grammatical aspect and word order are taken into consideration.

(9) a. Al drank **more coffee** than Bill did. vol, weight, *number

b. Al drank **more coffees** than Bill did. *vol, *weight, number

These effects are, I argue, a consequence of the semantics of *much*: it is uniquely sensitive to grammatical manipulations like that displayed in (9) and others that I explore in Chapter 5. On the theory I propose, the dimensions for measurement that are possible in a given construction are determined in large part by the nature of **what is measured**—e.g., individuals, events, or states of different sorts. When *much* measures **pluralities** of individuals or events, only measurement by number is possible. This chapter also addresses the idea that such interpretations arise due to the presence of the morpheme *many*, and argues that *many* is not a distinct lexical primitive but rather a suppletive form of *much*.

Chapter 6 examines claims that *more* in English is systematically ambiguous between an expression with a 'direct', 'indirect' (e.g. Bale 2006, 2008[3]), 'metalinguis-

[3]Unlike the other authors noted in the text, Bale does not claim that *more* is ambiguous. He derives the apparent differences between 'direct' and 'indirect' comparatives by manipulating how

tic' (e.g. Giannakidou & Stavrou 2009, Morzycki 2011), and 'deviation' semantics (e.g. Bartsch & Vennemann 1972, Kennedy 1999). In each of these cases, a distinct analysis of (non-decomposed) *more* has been developed to account for the differences in interpretation that are there detected.

(10) a. Al is **taller** than Bill is **(wide)**. 'direct'

b. Esme is **more intelligent** than Einstein is **clever**. 'indirect'

c. Your problems are **more financial** than **legal**. 'metalinguistic'

d. Team A is **more legitimate** than Team B is **fraudulent**. 'deviation'

I begin that chapter by imagining that there are two classes of comparatives: 'commensurating', those expressing a comparison of two measures along a common dimension, and 'categorizing', those that express a comparison roughly along the lines of how apt a given predication is. I then suggest that each of the proposed types in (10) can be assimilated to one or the other of these classes. After reviewing proposals for 'metalinguistic' comparatives as candidates for the analysis of the categorizing comparatives, I present an alternative in which the same *much* and *-er* are used for both varieties—in effect, that there is one type of comparative construction in English. To derive the differences in interpretation between these apparent types, I combine a version of the morphosyntactic analysis of 'metalinguistic' comparatives by Embick (2007) with semantic-pragmatic elements of Davis et al. (2008). Just as with plural comparisons, the properties of categorizing comparatives are derived based on how the semantics of *much* interacts with the domain

scales are constructed; I discuss this theory in detail in Chapter 4.

for measurement—in this case, credence states of the speaker.

Concluding in Chapter 7, I address a number of questions raised by the proposed theory. First, I consider how it could extend to the explanation of other phenomena where lexical measure functions have been hypothesized (e.g., verbal 'degree achievements'; Dowty 1979, Hay et al. 1999, Kennedy & Levin 2008, and Husband 2012). Next, I consider the question of how proposals about cross-linguistic variation fit in: it has been claimed (in different respects by Beck et al. 2010, and Bochnak 2013) that languages vary with respect to whether and to what extent they employ a degree-based semantics. On the account I offer, this can perhaps be understood as the presence/absence of an expression with the semantics of *much*.

Closing the thesis, I consider the question of why it is that English should 'package' the semantics of comparison and measurement into distinct pieces, *much* and e.g. *-er*. If the interpretation of *-er*, *as*, *too* and *enough*, etc., require a predicate to introduce measures, why not do it themselves? After all, this is how some other languages appear to do it, at least on the surface (e.g. Spanish has the univocal form *más*: *más alto* 'taller', *más cerveza* 'more beer'). These questions are especially pertinent in light of recent decompositional approaches to negative antonyms and *less* (Büring 2007, Heim 2006, 2008). There, I discuss a possibility familiar from Distributed Morphology and, earlier, Generative Semantics, namely that semantic primitives must correspond one-to-one with syntactic primitives.

Chapter 2: The standard theory

This chapter presents distributional and interpretive data on comparative constructions based on the comparative morphemes *more/-er*, *as*, *too*, *enough*, *-est*, etc., when they occur with adjectives and adverbs. While I introduce the so-called 'positive' construction (e.g. *Al is tall*) and its standard semantics, I do not discuss it again until almost the end of Chapter 4. The major reason for this delay is that this construction has properties that markedly distinguish it from the comparatives that I otherwise focus on here.

On the degree-theoretic analysis of gradable adjectives (GAs), they express relations between individuals and degrees on a scale. Comparative morphemes express relations between such degrees. This analysis has been fruitfully applied to a range of data, some of which is presented below; primary here is the generalization that GAs are directly interpretable with comparative morphemes, while non-gradable adjectives are not. More precisely, comparative constructions are environments in which an adjective *must* be read as expressing a gradable, rather than an absolute property.

I first outline the motivating data and technology the theory employs for GA comparatives, and show how it may be straightforwardly extended to comparatives with gradable adverbs. This allows me to set up an interplay between event- and degree-based semantics that will be useful when I turn to comparatives with verbs in Chapter 3. Note that, while the present discussion will include illustrative contrasts between GA and nominal/verbal comparatives, I do not discuss the latter directly until the next chapter.

2.1. Basic data

In this section, I introduce the major data that contemporary degree-theoretic approaches are concerned with. The vast majority of the literature on comparative constructions has focused on adjectives, however, I suggest, its machinery easily extends to comparatives with adverbs. The major contrast introduced is between how the lexical semantics of gradable (*tall*, *intelligent*, and *fast*, *loudly*) and non-gradable adjectives and adverbs (*wooden*, *pregnant*, and *twice*, *hourly*) interact with that of comparative morphemes.

2.1.1. Adjectives

Gradable adjectives in English are those that appear with *-er* and *as* without any apparent mediation. Intuitively, (11a)-(11b) express that Al's height/intelligence exceeds that of Bill, whereas (11c)-(11d) express that Al's height/intelligence meets or exceeds that of Bill.[1]

(11) a. Al is **taller** than Bill is. COMPARATIVE

[1] See Schwarzschild 2008 and references therein for discussion of = versus ≥ in the semantics of equatives.

b. Al is **more intelligent** than Bill is.

c. Al is **as tall** as Bill is. EQUATIVE

d. Al is **as intelligent** as Bill is.

This dissertation mainly discusses sentences like those in (11), although the same remarks will apply to sentences like those in (12), mutatis mutandis. (12a)-(12b) express that Al's height/intelligence is excessive, (12c)-(12d) express that Al's height/intelligence is sufficient, and (12e)-(12f) express that Al's height/intelligence is of the highest extent with respect to a given context.

(12) a. Al is **too tall** to get on this ride. EXCESSIVE

b. Al is **too intelligent** to date Bill.

c. Al is **tall enough** to get on this ride. ASSETIVE[2]

d. Al is **intelligent enough** to solve this puzzle.

e. Al is **the tallest girl** in her class. SUPERLATIVE

f. Al is **the most intelligent girl** in her class.

GAs appear to represent a distinguished class in this respect. Observe that substituting for a noun like *coffee* in such contexts is ungrammatical, (13). Nouns, as opposed to adjectives, do not meet the syntactic criteria for combination with comparative words. Substituting a non-gradable adjective like *wooden* (14) seems grammatical, but these sentences are perceived as a kind of category error: a piece

[2]The constructions with *enough* have gone long enough without their own label. This term was coined by J. Foulks (p.c.), in response to my request for naming ideas during a talk at Stony Brook University on April 4th, 2014. He cites the OED etymology for inspiration: *asset*, n., "Legal Anglo-Norman *as(s)etz* from Old French *asez* (modern *assez* = *enough*), ultimately from Latin *ad* to + *satis* enough, sufficiency".

of wood seems just to *be* wooden, the question of what it would be for one piece to be determinately "more wooden" than another is wanting.[3]

(13) a. * That is **coffee-er** than this is.

b. * That is **as coffee** as this is.

(14) a. ? This piece of wood is **more wooden** than that piece.

b. ? This piece of wood is **as wooden** as that piece.

GAs also appear bare in copular constructions, and modified by *very*. (15) intuitively express that Al's height/intelligence exceeds some standard measure along the relevant dimensions, and (16), roughly, that it is an exceptional exceeding of such standards.

(15) a. Al is **tall**. BARE OCCURRENCE

b. Al is **intelligent**.

(16) a. Al is **very tall**. VERY+ADJ

b. Al is **very intelligent**.

Again to contrast, nouns like *coffee* and non-gradable adjectives like *wooden* do not appear to appeal to standards in the copular construction in the same way, (17): some demonstrated thing just is (or is not) coffee, or is (or is not) wooden,

[3] It is of no small interest that the comparative construction encourages us to consider adjectives normally thought to denote absolute properties 'as though' they denote gradable properties, a consideration that is more or less difficult depending on the adjective in question. Throughout the dissertation, I talk as though gradability is a property of lexical items, although it is more likely a property of the concepts we 'most naturally' associate with *some* lexical items. Nonetheless, the intuitive contrast between *tall* and *wooden* should be clear; we have stable intuitions about when the taller-than relation is true of a pair of entities, but we do not appear to know this about the putative more-wooden-than relation. The same caution will be necessary when I turn to adverbs below, as well as the (fraught) mass-count distinction in Chapter 3.

regardless of the context. With *very*, the same ungrammaticality (18a) or sense of category error (18b) is evident.

(17) a. That is **coffee**.

b. That piece of furniture is **wooden**.

(18) a. * That coffee is **very coffee**.

b. ? That piece of furniture is **very wooden**.

In sum, gradable adjectives are a distinct class in that they appear to combine directly with comparative morphemes (distinguishing them syntactically from e.g. nouns) and that they are interpretable there (distinguishing them semantically from non-gradable adjectives). The next section discusses the properties of a parallel class of expressions in the verbal domain: gradable adverbs.

2.1.2. Adverbs

There are adverbs that pattern much like gradable adjectives, both with respect to their distribution and interpretation. (19a)-(19b) express that Al's speed/loudness exceeds that of Bill, whereas (19c)-(19d) express that Al's speed/loudness meets that of Bill.

(19) a. Al ran **faster** than Bill did. COMPARATIVE

b. Al talked **more loudly** than Bill did.

c. Al ran **as fast** as Bill did. EQUATIVE

d. Al talked **as loudly** as Bill did.

Similarly, (20a)-(20b) express that Al's speed/loudness is excessive, (20c)-(20d) express that Al's speed/loudness is sufficient for a given state of affairs, and (20e)-(20f) express that Al's speed/loudness is of the highest extent in a given context.

(20) a. Al ran **too fast** to get caught. EXCESSIVE

b. Al talked **too loudly** to be understood.

c. Al ran **fast enough** to catch him. ASSETIVE

d. Al talked **loudly enough** to be heard.

e. Al ran **the fastest** of the group. SUPERLATIVE

f. Al talked **the most loudly** of the group.

In addition to acting as the pivot for these comparative morphemes, gradable adverbs appear bare modifying verbs (21), and modified by *very* (22).

(21) a. Al ran **fast**. bare occurrence

b. Al talked **loudly**.

(22) a. Al ran **very fast**. VERY+ADV

b. Al talked **very loudly**.

Gradable adverbs are distinguished from verbs syntactically, and from non-gradable adverbs semantically. Parallel to what we have seen with nouns and non-gradable adjectives, verbs like *run* are ungrammatical combined with *-er* (23a) and *very* (23b). Adverbs like *hourly* seem to represent a similar sort of category mistake as *wooden* in this environment (24); normally, we think of work as being hourly or not being hourly, and thus attempting to grade the notion with *more* or *very* does not immediately lend itself to a determinate thought.[4]

(23) a. * Al **ran-er** than Bill did.

b. * Al **very ran**.

(24) a. ? Al works **more hourly** than Bill does.

b. ? Al works **very hourly**.

In sum, gradable adverbs, like their nominal counterparts gradable adjectives, are distinguished in that they too appear to combine directly with comparative morphemes (distinguishing them from verbs) and in that sentences containing them seem to have definite truth conditions (unlike non-gradable adverbs).

The next section introduces the formal apparatus that I use to characterize the semantics of comparatives in this dissertation; and, following that, I show how it is applied in the standard analysis of comparatives with GAs.

2.2. Degrees and scales

The differences in distribution and interpretation between GAs, on the one hand, and non-gradable adjectives, non-gradable adverbs, nouns, and verbs, on the other, is standardly modeled by appealing to *degrees* and *scales* associated with the denotations of GAs to the exclusion of the others. This section reviews some of the motivations of such an appeal, and then introduces the formal properties of degree

[4]The intended sense of *work hourly* here is to work 'by the hour' or 'for an hour at a time' as opposed to 'full time' (*daily*, *monthly*, *yearly*).

scales.[5] The following section provides the compositional details for comparatives with adjectives and adverbs on what I will refer to as the standard theory.

2.2.1. Why degrees?

Degree-based analyses of GAs contrast primarily with vagueness-based analyses. **Degree-based approaches** may be found in various forms in Bartsch & Vennemann (1972), Seuren (1973), Cresswell (1976), Hellan (1981), von Stechow 1984, Bierwisch (1989), Heim (1985, 2000), Kennedy (1999, 2001b), and Bale (2006, 2008), among others. **Vagueness-based approaches** may be found in Wheeler (1972), Klein (1980, 1982, 1991), Larson (1988b), and Burnett (2012), among others.

On the degree analysis, a GA like *tall* expresses a relation between individuals and degrees (primarily Cresswell 1976, von Stechow von Stechow 1984, Heim 1985, 2000), or, a function from individuals to degrees (primarily Bartsch & Venneman 1972, Kennedy 1999, Bale 2006, 2008). The relevant degrees are, as we will see, objects of a particular sort ordered on a 'scale' associated with the GA. On this approach, comparisons between individuals are represented linguistically as comparisons between degrees. In contrast, on vagueness-based approaches, a GA like *tall* denotes a vague property that is precisified relative to contexts and comparison classes. There, comparisons between individuals are made by establishing that

[5] This discussion will be couched in a point-based system, where degrees are primitive entities. A major alternative understands degrees as intervals, which can be understood as (convex) sets of degrees. Since the major argument of this thesis is how degrees are introduced into the compositional semantics, this choice will not affect anything I have to say, as far as I can see. See Kennedy 2001b (citing Seuren 1984, von Stechow 1984), Schwarzschild & Wilkinson 2002, Büring 2007, Heim 2008 for relevant discussion.

there is a context and comparison class in which one individual falls into the positive extension of *tall*, and the other falls into its anti-extension.

The crucial difference between the two kinds of approaches is that degree-based approaches refer to ordered ‘measurements’ in the semantics of comparatives, a notion that will be important for this dissertation, whereas vagueness-based approaches do not. Presently, I discuss what work this appeal does apart from what I will use it to do.

Kennedy (1999) emphasizes ‘(in)commensurable’ comparisons (25) and ‘cross-polar anomalies’ (26) as phenomena that support degree-based approaches. On that style of account, comparatives are interpretable just in case the degrees to be compared are ordered with respect to one another. If two GAs in a comparative relate to degrees from disjoint sets (as those associated with, e.g., *tall* and *punctual* intuitively will be), then such comparisons are predicted to be semantically anomalous. Because vagueness-based approaches do not refer to ordered measurements, it is more difficult on such accounts to explain why tallness and punctualness are, intuitively, incomparable.

(25) ? Al is **taller** than Bill is **punctual**.

The same kind of reasoning is available to the degree-theorist to explain the oddity of sentences like (26), where the compared GAs stand in an antonymy relationship. On Kennedy’s (1999, 2001c) account, such data can be explained by positing that comparative morphemes cannot establish an ordering between ‘positive’ and ‘negative’ degrees. Positive degrees are there conceived of as intervals that begin at the bottom of a scale and extend up to a point, whereas negative degrees begin at a non-zero point and extend to infinity; such do not stand in a subset relationship as required by interval-based theories of comparative constructions. On vagueness-based approaches, *tall* and *short* are just (vague) predicates, and there is seemingly no reason why (26) shouldn't be perfectly interpretable.

(26) ? Al is **taller** than Bill is **short**.

Kennedy also discusses measure phrase constructions (27a) and 'comparisons of deviation' (27b) in support of degree-based approaches. There, *6 feet* is analyzed as denoting a degree on the scale associated with *tall*. The intuitive interpretation of (27b) can, Kennedy writes, be easily paraphrased in ways that refer to scale calculations like *deviation from some standard degree*, e.g.: (27b) is predicted to be judged true just in case the degree to which Team A exceeds the standard for legitimacy in the context is greater than the degree to which Team B exceeds the standard for fraudulent in the context. Sentences like these ones play a fairly minor role in this dissertation; however, I discuss measure phrase constructions in Chapter 4 and comparisons of deviation in Chapter 6.

(27) a. Al is **6 feet tall**.

b. Team A is **more legitimate** than Team B is **fraudulent**.

Bale emphasizes comparatives like (28a) as phenomena in support of degree-based approaches. (28a) is most naturally interpreted as a direct comparison of Al's width and height (and is hence, for most individuals, probably false). However, the fact that (28a) can be judged false while (28b) can be judged true is a problem for vagueness-based accounts like that of Klein (1980). For Klein, comparisons proceed via existential quantification over 'delineators' like *very*: a sentence like (28a) is predicted to be judged true just in case a paraphrase like the following is true: *there is a delineator that applies to 'wide' which is true of Al that does not apply to 'tall' that is true of Al.* Such accounts predict that any context in which a sentence like (28b) is judged true, a sentence like (28a) will be judged true as well, contrary to fact.

(28) a. Al is **wider** than he is **tall**.

b. Al is **very wide** but he is not **very tall**.

Appeal to degrees and the scales that order them are thus argued to provide a rich enough ontology to model interpretable and anomalous comparatives, and which vagueness-based approaches find less natural. Following Kennedy and Bale, I assume that the evidence in support of degree-based approaches to the semantics of comparatives is good, and henceforth its appropriateness for the present project.

The question that I address in this dissertation is how measurements, modeled as degrees, are introduced into the compositional semantics of comparatives.

2.2.2. Scales

The degree-theoretic, relational analysis of comparatives was first formalized in Bartsch & Vennemann (1972) and Cresswell (1976). On Cresswell's account, degrees are ordered pairs, $\langle d_{\succ_x}, \succ_x \rangle$, where $d_{\succ_x}$ represents a measurement value in the domain of the ordering $\succ_x$.[6] More contemporaneously, such orderings are called *scales*. Seuren (1973) provides earlier discussion in terms of 'extents', wherein the role played is formally distinct: the interpretations of comparative morphemes do not express relations between the extents, as they do on modern accounts. Rather, Seuren analyzes a comparative like *Al is taller than Bill* in terms paraphrasable as *there is an extent to which Al is tall and Bill is not tall to that extent*.[7]

Contemporary degree-based analyses of gradable adjectives hold that GAs are lexically associated with total orderings on degrees. Total orders are relations with particular properties: they are reflexive, transitive, anti-symmetric, and connected relations.

These relations are, in set-theoretic terms, just sets of ordered pairs. We refer to the elements occurring in those pairs as the domain D_R for the relation R, and I notate the structure as a whole $\langle D_R, R\rangle$. A relation can have some or none of the properties *reflexivity*, *transitivity*, *symmetry*, *antisymmetry*, and *connectivity*. I briefly walk through each of these properties, and give intuitive examples of relations that have them.

Reflexivity is the property a relation has just in case each element in its domain is paired with itself in the relation, (29). The relation "be self-identical to" is reflexive: each individual is indeed self-identical to themselves. The relation "be a sibling of" is not reflexive: no individual is one's own sibling.

(29) A relation R is **reflexive** iff for all $x \in D_R$, $\langle x, x\rangle \in R$.

[6] I use $\succcurlyeq$and $\preccurlyeq$ instead of $\geq$ and $\leq$ so as not to suggest that *numbers* are ordered by this relation.

[7] Schwarzschild 2008 discusses Seuren's 'A-not-A' analysis in the modern context; see also Kennedy to-appear and Beck 2011 for overviews of the area.

A relation is transitive just in case, if an individual x bears the relation to individual y, and in turn y bears the relation to individual z, then x must also bear the relation to z, (30). The relation "be a compatriot of" is transitive: for example, if Al is Betty's compatriot, and Betty is Carla's compatriot, then Al is Carla's compatriot, too.

(30) A relation R is **transitive** iff for all $x, y, z \in D_R$,
if $\langle x, y \rangle \in R$ and $\langle y, z \rangle \in R$, then $\langle x, z \rangle \in R$.

Symmetric relations are those for which it doesn't matter what order the individuals in the pair occur in, (31). If x bears the relation to y, then y also bears the relation to x. The relation "be a sister of" is symmetric, so is "cousin of". The relation "mother of" is not symmetric, since if Al is Betty's mother, it is not the case that Betty is Al's mother.

(31) A relation R is **symmetric** iff for all $x, y \in D_R$,
if $\langle x, y \rangle \in R$ then $\langle y, x \rangle \in R$.

Rather, "mother of" is asymmetric (32), as is "father of", "grandparent of", etc. Note that any relation that is asymmetric cannot be reflexive.

(32) A relation R is **asymmetric** iff for all $x, y \in D_R$,
if $\langle x, y \rangle \in R$ then it is not the case that $\langle y, x \rangle \in R$.

Anti-symmetry (33) differs from asymmetry in that anti-symmetric relations allow for individuals to be related to themselves. The relation $\geq$ on the natural numbers $\mathbb{N}$ is anti-symmetric: for any numbers n, $m \in \mathbb{N}$, if $n \geq m$ and $m \geq n$, then $m = n$.

(33) A relation R is **anti-symmetric** iff for all $x, y \in D_R$,

if $\langle x, y\rangle \in R$ and $\langle y, x\rangle \in R$, then $x = y$.

Lastly, relations may be connected, (34). $\geq$ is connected: for any numbers n, m, it is the case that either $n \geq m$ or $m \geq n$.

(34) A relation R is **connected** iff for all $x, y \in D_R$,

either $\langle x, y\rangle \in R$ or $\langle y, x\rangle \in R$.

Now we can see why it is said that e.g. *tall*, associates with a total ordering on degrees, where the relevant degrees are understood as measures of heights. First, a total order is defined as in (35).

(35) A **total order** is a binary relation that is reflexive, anti-symmetric, transitive, and connected.

Consider the relation "be at least as much height as", or H. Clearly, anyone's height is at least as much as their height, so H is reflexive. Moreover, any two heights are such that, if the first is as at least as great as the second, and the second is as great as the first, then the two heights are equal; so H is anti-symmetric. Similarly, if one height is at least as great as a second, and the second is at least as great as a third, then the first is at least as great as the third; so, H is transitive. Finally, for any two heights, either one bears H to the other or vice versa; so, H is connected.

The notion of a scale in linguistic semantics is an encoding of relations like this. Thus, scales are defined as in (36).

(36) A **scale** S is a structure, $\langle D_{\succcurlyeq^{Deg}}, \succcurlyeq^{Deg}\rangle$, where $D_{\succcurlyeq^{Deg}}$ is a set of degrees (i.e., entities of type d) and $\succcurlyeq^{Deg}$ is a total order on $D_{\succcurlyeq^{Deg}}$.

I leave it to the reader to verify that relations like "is at least as much speed as", where speeds are represented by degrees, meet the definition of a scale, as well.

2.3. Formal preliminaries

I now outline the standard framework for interpretation in semantics generally, and that of degree-based approaches to comparatives more specifically.

2.3.1. Framework

I assume a framework in which the semantic values of expressions are type-theoretic objects, i.e. basic entities or n-place functions. In this framework, functions are named by λ-terms with the basic shape in (37). Here, ζ represents the function's **argument**, ϕ its **domain condition**, and γ its **value description**. Functions may have more than one argument ζ, ζ', etc.; each of these arguments is called by its own λ. Domain conditions specify what types of things the function ranges over. Value descriptions represent the range of the function, given an argument ζ of the appropriate type.

(37) **Schema for λ-terms**

$\lambda\zeta : \phi \,.\, \gamma$

I assume a model theory with at least the subdomains of entities in (38). Proper names like *Al* and *Bill* are interpreted as entities of type e, elements of domain D_e. Verbs like *run* denote (the characteristic functions of) sets of events of type D_v. Degrees are entities in D_d.[8] The two truth values comprise the domain D_t. Complex types like that in (38v) indicate functions from one particular type to another; I do not represent the domains of all possible functions that are believed relevant in linguistics.

(38) **Domains in the model**

i. $D_e = \{x : x \text{ is an individual}\}$

ii. $D_v = \{e : e \text{ is an event}\}$

iii. $D_d = \{d : d \text{ is a degree}\}$

iv. $D_t = \{\top, \bot\}$

v. $D_{\langle e,t\rangle} = \{f : f \text{ is a function from } D_e \text{ to } D_t\}$

The denotations of expressions are given by the interpretation function, notated $[\![\cdot]\!]$, relative to the assignment function A that assigns values to variables; I omit reference to A unless it is explicitly pertinent. Expressions are semantically composed via the standard set of rules laid out in Heim & Kratzer (1998) in (39)-(42), unless otherwise noted. In that text, many of the rules are stated explicitly

[8] I noted above that on Cresswell's approach 'degrees' were properly understood as ordered pairs, of a degree value and the ordering it occurs in.

over the domain of individuals, D_e. To allow the rules to apply to eventive denotations as well, I use the variable name η to indicate neutrality with respect to the primitive types e and v.

(39) *Terminal Nodes (TN)*

If σ is a terminal node, $[\![\sigma]\!]$ is specified in the lexicon.

(40) *Functional Application (FA)*

If σ is a branching node, $\{\beta, \gamma\}$ is the set of σ's daughters, and $[\![\beta]\!]$ is a function whose domain contains $[\![\gamma]\!]$, then $[\![\sigma]\!] = [\![\beta]\!]([\![\gamma]\!])$.

(41) *λ-conversion (λc)*

For some value description ϕ, type τ and entity $y \in D_\tau$,

a formula like $[\lambda x : x \in D_\tau.\phi(x)](y)$ rewrites as $\phi(y)$.

(42) *Predicate Modification (PM)*

If σ is a branching node, $\{\beta, \gamma\}$ the set of σ's daughters, and $[\![\beta]\!]$ and $[\![\gamma]\!]$ are both in $D_{\langle \eta,t\rangle}$, then:

$[\![\sigma]\!] = \lambda x : x \in D_\eta.[\![\beta]\!](x)$ & $[\![\gamma]\!](x)$

(43) *Predicate Abstraction (PA)*[9]

If σ is a branching node, $\{\beta, \gamma\}$ the set of σ's daughters, and γ is an operator bearing index i, then:

$[\![\sigma]\!]^A = \lambda x : x \in D_\eta.\ [\![\beta]\!]^{A:Ai \to x}$

[9] The use of 'operator' in this rule definition refers to syncategorematic nodes in trees labeled OP with a subscripted index. OP is to be interpreted as a syncategorematic element, just like '$\exists x$' is interpreted in the standard semantics for predicate logic. In the present system, its only function is to trigger the PA rule for interpreting its sister as an A-variant, and appears in this dissertation in *than/as*-clauses (see below).

(44) <u>*Indexed Expression Rule (IR)*</u>[10]

If σ is an expression bearing index i, then $[\![\sigma_i]\!]^A = A(i)$.

In addition to these rules, I posit two more, both of which are required for the neodavidsonian analysis of verbal denotations that I will assume. Davidson (1967; Filip 2011 cites Ramsey 1927 for precedence) proposed to augment the traditional analysis of verbs (see Table 2.1) with an event argument.[11] Shortly afterwards, Castañeda proposed that the denotations of the subject and object expressions could be linked to the verb meaning via thematic predicates (1967; see also discussion in Fillmore 1970, Bach 1981, 1986, Carlson 1984, Taylor 1985, Dowty 1989, Krifka 1989, 1992, Parsons 1990, and Landman 2000). Schein (1993) further proposed that thematic conjuncts should be explicit in the logical syntax (see also Pietroski 2005, 2011, Landman 2000, and Champollion 2010 for defense of this position). Kratzer (2000) argues that, while separation of the Agent role is well-motivated, there is not yet convincing evidence for a separation hypothesis for internal arguments (see also Marantz 1984, Pylkkänen 2002).[12] Since I do not address the question of total thematic separation, I assume with Kratzer that, while the Agent role is introduced separately, object denotations combine with the verb denotation directly.

Kratzer (1996) suggests that the Agent role is introduced by a v head in the syntax (here, 'little-v'; see Chomsky 1995 a.o.) and a special rule called Event

[10] I use 'Indexed Expression' rather than e.g. 'Traces and pronouns', as it is more general; this level of generality becomes pertinent in Chapter 5.

[11] Higginbotham 1985, 2000 offers a yet more radical approach, in which every V, N, A, and P have a davidsonian argument.

[12] Schein 2003, 2011 has offered further arguments for separation of Theme; see also Williams 2008, 2009, Laterza 2011, and others.

Table 2.1: Possible verb and sentence logical forms for Al kicked Bill, with initial proponents and the hypothesized status of thematic conjuncts.

verb	**sentence**	**proposed by**	**thematic roles**
$\lambda y \lambda x.\textsc{kick}(x, y)$	$\textsc{kick}(\text{Al}, \text{Bill})$	traditional	-
$\lambda y \lambda x \lambda e.\textsc{kick}(e, x, y)$	$\exists e[\textsc{kick}(e, \text{Al}, \text{Bill})]$	Davidson 1967	-
$\lambda y \lambda x \lambda e.\textsc{kick}(e)$ & $\exists e[\text{Agent}(e, x)$ & $\text{Patient}(e, y)$	$\exists e[\textsc{kick}(e)$ & $\text{Agent}(e, x)$ & $\text{Patient}(e, y)]$	Castañeda 1967	lexical
$\lambda e.\textsc{kick}(e)$	$\exists e[\textsc{kick}(e)$ & $\text{Agent}(e, x)$ & $\text{Patient}(e, y)]$	Schein 1993	total separation
$\lambda y \lambda e.\textsc{kick}(e, y)$	$\exists e[\text{Agent}(e, \text{Al})$ & $\textsc{kick}(e, \text{Bill})]$	Kratzer 1996	separation of Agent

Identification, given in (45).[13]

(45) *Event Identification (EI)*

If σ is a branching node, $\{\beta, \gamma\}$ the set of σ's daughters, and $[\![\beta]\!]$ is in $D_{\langle e,\langle v,t\rangle\rangle}$ and $[\![\gamma]\!]$ is in $D_{\langle v,t\rangle}$, then:

$[\![\sigma]\!] = \lambda x : x \in D_e \lambda e : e \in D_v.[\![\beta]\!](e)(x)$ & $[\![\gamma]\!](e)$.

It is standard on event-based analyses to assume a default rule of existential closure that applies at the top of a clause if that clause denotes a predicate of events. In a more articulated theory of the left periphery, the function of binding verb phrase event variables is performed by Aspect (see Kratzer 1998, Ferreira 2005 and Hacquard 2006 for discussion and references). In derivations, I mark this step with $\exists$.

Finally, I adopt the notational conveniences in (46). Given adherence to these, I generally omit reference to domain conditions, unless they become necessary for clarity.

[13] Alternatives to this mode of introducing Agent include type-shifting (Landman 2000, Champollion 2010) or encoding the thematic relation as part of the interpretation of a silent head in the syntax (Lin 2001, Schein 2003, Borer 2005c, Bowers 2010, Lohndal 2011).

(46) **Notational conveniences**

i. $x, y, z...$ range over elements of D_e.

ii. $e, e', e''...$ range over elements of D_v.

iii. $d, d', d''...$ range over elements of D_d.

iv. $\alpha, \alpha', \alpha'', ...$ are neutral with respect to D_e and D_v.

2.3.2. Composition: adjectives I

I assume the degree-theoretic analysis of gradable adjectives proposed by Bartsch & Vennemann (1972), Kennedy (1999), Bale (2008), a.o., in which they are represented as **measure functions** of type $\langle e, d \rangle$. A prominent alternative represents them as relations between individuals and degrees, type $\langle d, \langle e, t \rangle \rangle$ (Cresswell 1976, Heim 2000, Bhatt & Pancheva 2004, a.o.). At the end of this chapter, I provide a sketch of the differences between these proposals for completeness.

The denotations of gradable adjectives from this perspective are as in (47): they are functions from individuals x to degrees d, d a representation of the measure of Al's height or her intelligence.[14]

(47) **Gradable adjectives (standard)**

i. $[\![\text{tall}]\!] = \lambda x.\textsc{tall}(x)$ $\langle e, d \rangle$

ii. $[\![\text{intelligent}]\!] = \lambda x.\textsc{intelligent}(x)$

[14]One may wish to put very explicit domain conditions in the λ-terms given in (47). Perhaps along the lines of Cresswell's lexical specification for $[\![\textit{tall}]\!]$: "[its] domain contains only physical objects", and further, here, "$>$ is the relation whose field is the set of all v such that v is a spatial distance, and $\langle v_1, v_2 \rangle \in >$ iff v_1 is a greater distance than v_2, and u is the distance between a's extremities..., and... this distance will typically be vertical" (1976:267). I return to the question about the particular status of degrees and ordering relations specifically in Chapter 4.

The ranges of such functions are elements of scales associated with the GAs. For instance, the scale associated with $[\![tall]\!]$ can be represented as in (48i), and the scale associated with $[\![intelligent]\!]$ can be represented as in (48ii), building on the formulation given in Kennedy & McNally (2005).

(48) i. $\langle D_{\succcurlyeq_{length}}, \succcurlyeq_{length} \rangle$

ii. $\langle D_{\succcurlyeq_{intelligence}}, \succcurlyeq_{intelligence} \rangle$

In this case, the two adjectives associate with different scales: the sets of degrees that they order are disjoint. For instance, the domain of a length scale D_{length} consists in degrees representing length measures, and $D_{intelligence}$ in degrees representing intelligence measures. These degrees may be such that it is sensible to say, of some $d \in D_{tall}$, that it equals 6 feet, or of some $d \in D_{intelligent}$, that it equals 120 IQ points. The '$\succcurlyeq$'s, of course, are total orderings over the respective sorts of degrees. Other pairs of adjectives may associate with the same scale: for example, the domain of the scale of length can be the range of the mapping denoted by $[\![tall]\!]$ and $[\![wide]\!]$, just the mappings themselves will usually differ (see Kennedy 1999, 2001b).

In contrast, non-gradable adjectives like *wooden* are assigned denotations like that in (49): they are functions from individuals x to truth values t. These denotations do not involve reference to scales.

(49) **Non-gradable adjectives**

$[\![\text{wooden}]\!] = \lambda x.\text{WOODEN}(x)$ $\langle e, t \rangle$

The denotations of the comparative morphemes *-er* and *as* are given with the type of gradable adjectives in mind, (50): each combines with their respective comparative clauses (headed by *than* or *as*, of type d; more on this below) then with an expression of measure function type $\langle e, d\rangle$ to deliver a property of individuals (type $\langle e, t\rangle$). As is standard, I assume that $\succ$ and $\succcurlyeq$ in (50) are polymorphic, i.e., they do not express any particular ordering relation, but take on a particular value based on the grammatical context—in particular, that of the scale from which d and $g(x)$ are drawn. I return to this in Chapter 4.

(50) **Comparative morphemes** *(first version)*

i. $[\![\text{-er/more}]\!] = \lambda g \lambda d \lambda x. g(x) \succ d$ $\quad \langle\langle e, d\rangle, \langle d, \langle e, t\rangle\rangle\rangle$

ii. $[\![\text{as}]\!] = \lambda d \lambda g \lambda x. g(x) \succcurlyeq d$

Bare occurrences of GAs, e.g. *Al is tall*, do not seem to mean 'Al has some degree of height', but rather, that she has some significant degree of height. On this theory, such readings are posited to be the result of combining the GA with a covert expression that introduces a context-sensitive 'standard' degree on the scale associated with *tall* (Bartsch & Venneman 1972, Cresswell 1976, and many since). Its (simplified) semantics are as in (51).[15] Thus, the interpretation of a sentence like *Al is tall* will be represented along the lines of *Al is (at least) as tall as the standard for tallness.*

[15] The simplification is that I have omitted reference to the 'comparison property' P discussed in Kennedy 1999. P is said to be filled by a *for*-phrase when present (e.g. *Al is tall for a jockey*) and otherwise provided by context.

i. $[\![\textsc{pos}]\!] = \lambda g \lambda P \lambda x.\textsc{abs}(G(x))(\textsc{standard}(G)(P)]$

(51) **Positive morpheme**

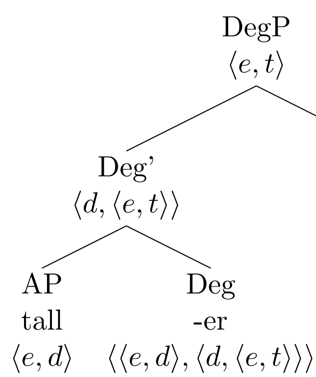
$[\![\text{POS}]\!] = \lambda g \lambda x . g(x) \succcurlyeq \textsc{standard}(g)$

The given denotations of *-er* and *as* require that *than*/*as* map their complement clauses of type $\langle d, t\rangle$ to the greatest element in those sets, which I will formalize with the ι operator in (52) (Heim 1985; cf. von Stechow 1984 and Rullmann 1995 for a formulation using MAX[16,17]). Putting the pieces together, the (simplified) structure with the types of the various elements for an *-er* comparative is as in (53).

(52) **<u>than</u>/<u>as</u> heads**

$[\![\text{than/as}]\!] = \lambda D . \iota d [D(d)]$ $\langle\langle d, t\rangle, d\rangle$

(53)



Turning to the internals of *than*/*as* clauses, Chomsky (1977) argues (building on observations by Bresnan 1973) that they display evidence suggestive of *wh*-movement; this is now generally assumed to be the syntactic counterpart of a λ-abstraction over degrees (Izvorski 1995, Kennedy 1999, Bhatt & Pancheva 2004,

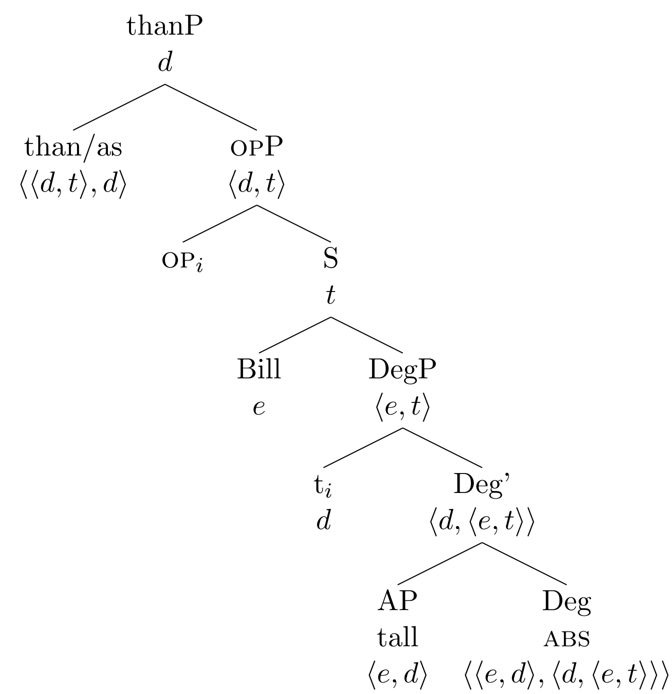
[16] The MAX operator is more appropriate for comparatives in modal contexts, as in *Al can jump higher than Bill can.* That is, if Bill can jump 6 feet high, he can also jump 5 feet high, etc. Thus, there is no unique degree d such that Bill can jump d-high. MAX is then defined in terms of ι (Heim 2000) and with reference to a degree scale:

i. $\textsc{max}(D) = \iota d[D(d) \ \& \ \forall d'[D(d') \Rightarrow d' \preccurlyeq d]]$

[17] See Schwarzschild & Wilkinson 2002 for problems with ι and MAX in a point-based system, when interpreting quantificational noun phrases in the *than*-clause.

a.o.; though cf. Grimshaw 1987, Corver 1993). On this view, the internal structure of the *than/as*-clause is as in (54), ignoring the (uninterpreted) copular verb, and using category labels of convenience. The function of OP$_i$, raised to the higher position, is to trigger the rule of Predicate Abstraction (PA).[18] Following Kennedy (1999) and Bale (2008), the degree-trace is related to the GA *tall* (elided in the matrix clause) via a morpheme called ABS.[19]

(54) **than-clauses**



ABS has a semantics identical to *as*, or to POS without the standard degree; it is interpreted as in (55). Kennedy (1999) suggests that, without such a morpheme, the identity conditions on ellipsis for *than*-clauses such as occurs in *Al is taller than Bill is (tall)* in (54) would not be licensed.

(55) **Absolute morpheme (Kennedy)** *(first version)*

$[\![\text{ABS}]\!] = \lambda g \lambda d \lambda x.g(x) \succcurlyeq d$ $\langle\langle e,d\rangle,\langle d,\langle e,t\rangle\rangle\rangle$

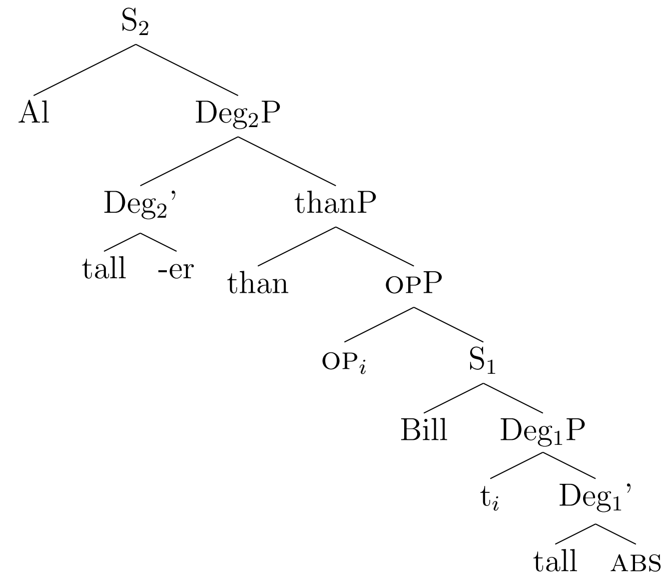
[18]Kennedy 1999, 1998 ultimately rejects the analysis of constructions like *Al as taller than Bill* (as opposed to *Al is taller than Bill is wide*) as involving ellipsis in the *than*-clause; I revisit his alternative analysis in Chapter 3.

[19]Note that OP is syncategorematic; it does not have a type. See footnote 9.

Again ignoring the copular verb, (11a), repeated here as (56), has the structure in (57). The labels for the maximal projections are not theoretically important here, and, for the most part throughout, are merely provided for reference.

(56) Al is **taller** than Bill is.

(57)



The interpretation of this structure is composed as in (58), with the compositional steps indicated on the right-hand side. I give this and all subsequent derivations in a bottom-up fashion. Note that, throughout the dissertation, I omit reference to the rule Terminal Nodes (TN). The result of the derivation in (58) is that an utterance of (56) is predicted to be judged true just in case the degree representing Al's height exceeds that representing Bill's height.

(58)

i.	$[\![\mathrm{Deg_1'}]\!]^A = \lambda d \lambda x.\textsc{tall}(x) \succcurlyeq d$	FA
ii.	$[\![\mathrm{Deg_1P}]\!]^A = \lambda x.\textsc{tall}(x) \succcurlyeq A(i)$	(i),IR,FA
iii.	$[\![\mathrm{S_1}]\!]^A = \top$ iff $\textsc{tall}(\mathrm{Bill}) \succcurlyeq A(i)$	(ii),FA
iv.	$[\![\textsc{op}\mathrm{P}]\!]^{A:Ai \to d} = \lambda d.\textsc{tall}(\mathrm{Bill}) \succcurlyeq d$	(iii),PA
v.	$[\![\mathrm{thanP}]\!]^A = \iota d[\textsc{tall}(\mathrm{Bill}) \succcurlyeq d]$	(iv),FA
vi.	$[\![\mathrm{Deg_2'}]\!]^A = \lambda d' \lambda y.\textsc{tall}(y) \succ d'$	FA

vii. $[\![\text{Deg}_2\text{P}]\!]^A = \lambda y.\textsc{tall}(y) \succ \iota d[\textsc{tall}(\text{Bill}) \succcurlyeq d]$ (v),(vi),FA

viii. $[\![\text{S}_2]\!]^A = \top$ iff $\textsc{tall}(\text{Al}) \succ \iota d[\textsc{tall}(\text{Bill}) \succcurlyeq d]$ (vii),FA

In light of this derivation, we can see why non-gradable adjectives and nouns are predicted to be judged anomalous in comparatives: attempting to combine *-er* or ABS with $[\![$*wooden*$]\!]$ would result in a type mismatch (cf. $[\![\text{Deg}_2\text{'}]\!]$ in (58vi)).

Before turning to the composition of comparatives with gradable adverbs, a brief digression into a comparison of the measure function analysis adopted here, and theanalysis of GAs as denoting 'individual-degree relations'. I show that either choice comes with benefits and drawbacks.

2.3.3. Comparison with the relational analysis

The earlier degree-theoretic approach to GAs analyzes e.g. *tall* as a **measure function** type, $\langle e, d\rangle$ (cf. Bartsch & Vennemann 1972, Kennedy 1999, Bale 2008, a.o.). The later alternative analyzes it as of **individual-degree relation** type, $\langle d, \langle e, t\rangle\rangle$ (Cresswell 1976, Heim 1985, 2000, von Stechow 1984, Bhatt & Pancheva 2004, a.o.). The differences between the accounts start with the (surface) word order of comparatives, and in how applicable they are in the analysis of apparent scope interaction phenomena.

The measure function analysis in (59i) differs from the individual-degree relation analysis in (59ii) in that the latter introduces a λ-abstract over degrees, those that a measure function maps individuals to. The individual-degree relation analysis, in effect, **properly contains** the measure function analysis. That is to say, the function TALL embedded in (59ii) is identical to that in (59i): both map individuals to their (unique) heights. By introducing '$\succcurlyeq$', one is able to quantify over all of the degrees on the relevant scale that are ordered below the individual's height.

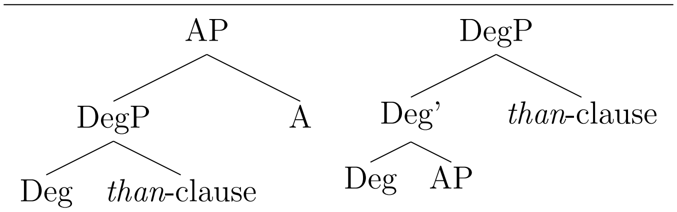
(59) i. $[\![\text{tall}_{mf}]\!] = \lambda x.\textsc{tall}(x)$ $\langle e, d\rangle$

ii. $[\![\text{tall}_{idr}]\!] = \lambda d \lambda x.\textsc{tall}(x) \succcurlyeq d$ $\langle d, \langle e, t \rangle \rangle$

The two analyses are often paired with different assumptions about the syntax of degree phrases, although they are in principle independent. The first relevant distinction concerns whether a comparative morpheme like *-er* or *as* first combines with the *than* or *as* clause, or first with the adjective. Bhatt & Pancheva (2004) contrast the **classical constituency analysis** (citing Chomsky 1965, Selkirk 1970, Bresnan 1973, and Heim 2000), and the **non-classical constituency analysis** (citing Abney 1987, Larson 1988a, Corver 1990, 1993, and Kennedy 1999, 2002). The classical constituency is typically paired with the semantics in (59ii), while the non-classical is typically paired with (59i). I return to the "independence" remark shortly.

Table 2.2: The classical and non-classical analyses of DegP constituency.

Classical	**Non-classical**



They are also usually paired with different assumptions about the interpretation of the comparative morpheme, e.g. *-er* in (60). The denotation in (60i) combines with a measure function-denoting expression, then with the interpretation of the *than*-clause (type $\langle d \rangle$). That in (60ii) combines with a function of type $\langle d, t \rangle$, the interpretation of the *than*-clause on this account, and that of the matrix clause.

(60) i. $[\![\text{-er}_{mf}]\!] = \lambda g \lambda d \lambda x.g(x) \succ d$ $\langle \langle e, d \rangle, \langle d, \langle e, t \rangle \rangle \rangle$

ii. $[\![\text{-er}_{idr}]\!] = \lambda D \lambda D'.max(D') \succ max(D)$ $\langle \langle d, t \rangle, \langle d, t \rangle \rangle$

Creating the matrix clause $\langle d, t \rangle$ predicate marks the second important distinction: whether expressions like *-er* or *as* undergo Quantifier Raising (QR; Lakoff

1970, May 1977, Heim & Kratzer 1998) in the matrix clause. Kennedy (1999) shows that, unlike existentially quantified noun phrases (e.g. *a recent supernova*) and distributive quantifiers (e.g. *every student in Semantics 1*), comparative morphemes do not show scope ambiguities with respect to negation. He concludes that there is not sufficient evidence for treating them as scopally mobile expressions.

Heim (2000) argues that the facts may be more subtle than Kennedy supposes. She offers examples like those in (61a) and (61b) (crediting Stateva 2000 for the latter). The sentence in (61a) can be understood as expressing that the relevant paper is not allowed to be longer than 15 pages (so it could be less than 15 pages long), or that the shortest it's allowed to be is 15 pages (so it is allowed to be 15 pages or longer). A similar pair of readings are possible for (61b): on one reading, the paper is not allowed to be longer than 10 pages, and on another, it is equivalent to "the paper is not required to be as long as that" (Heim 2000:10).[20]

(61) Context: The draft of the paper is 10 pages long.

  a. The paper is required to be exactly 5 pages longer than that.

  b. The paper is required to be less long than that.

As Heim points out, such ambiguities are expected if the comparative morpheme is able to take scope under or above the intensional verb *require*. That can be made possible by positing that expressions like *-er* can QR: if there are landing sites both below and above the matrix verb, then these expressions can take scope accordingly.

Considering scope issues, the QR approach would appear to overgenerate (it predicts scopal ambiguities that are not observed; Kennedy 1999) while the non-QR approach would appear to undergenerate (it predicts no scopal ambiguities, which appear to have been observed, depending on how the explanation of the facts in (61)

[20]See also Heim 2006, 2008 for discussion of *less* and negative adjectives like *short* in such contexts. I discuss antonymy and *less* briefly in Chapter 7.

ultimately works out). Separately from this question, since this dissertation does not deal with matters of scope, choosing between a QR and non-QR approach will have little effect.

With respect to constituency, each analysis succeeds in some places and not in others. The QR approach to *-er* is incompatible with the non-classical constituency analysis; by favoring the non-classical analysis, it does not need to posit a rule of obligatory extraposition (Bresnan 1973) to explain the necessary linear distance between *-er* and the *than*-clause, contrast (62a) and (62b). Establishing the semantic relationship between those two expressions can be captured by a rule of covert late merger (Bhatt & Pancheva 2004; though see Grosu & Horvath 2006 and Larson & Wellwood under review for critical discussion).

(62) a. Al is **more** intelligent **than Bill is**.

b. * Al is **more than Bill is** intelligent.

In contrast, the measure function approach is compatible with either constituency analysis; the denotation for *-er* on this approach can be given with the degree argument first or second, as maintained so far here. Regardless of that choice, the measure function-based analysis of GAs in concert with the interpretation it posits for *-er* will have to posit obligatory extraposition in some cases. Consider the comparative in (63) with an attributive (i.e., prenominal) adjective. If the *than*-clause is to be even the second argument of *-er*, it must be local to that expression at some stage of the derivation; however, on the surface, it is dislocated to the right of the noun.[21,22]

[21] Alternatives are possible; Alrenga et al. 2012 QRs the *than*-clause, Larson & Wellwood under review offer an account in which the *than*-clause is always base generated at a distance.

[22] R. Schwarzschild (p.c.) points out that it is more standard to say that *-er* combines with *hot coffee*, motivated by the fact that (i) is odd, because it entails (ii) (he notes that Chomsky 1965:234, fn.36 cites Brandon Qualls for this point). The contrasting data point is that, with *more* and *clever* postposed with respect to the nominal (iii), the same implication does not obtain.

i. I've never met a more clever man than Mary.

(63) Al drank **hotter coffee** than Bill did.

i. [[[hot -er] **thanP**] coffee] base generation

ii. [[[hot -er] coffee] **thanP**] surface order

Finally, there is a further difference between the two accounts, regarding whether they posit an additional morpheme, i.e. the one Kennedy calls ABS, in the *than*-clause. On the individual-degree relation analysis, the covert *wh*-operator feeds a degree-interpreted trace to the GA directly. Since the measure function analysis fails to syntactically-represent degree variable that can be abstracted over by the null operator in such clauses, some other expression must introduce it. As noted above, it is likely that this expression can be motivated based on ellipsis licensing considerations.

At the level of sentential complexity that will be involved in this dissertation, the two accounts are effectively interchangeable. To see this, consider a derivation of the sentence in (65) on the individual-degree relation analysis.

(64) Al is **taller** than Bill is.

(64) has the structure in (65) on e.g. Bhatt & Pancheva's (2004) theory. There are two important features that differentiate this representation from that we saw in the preceding section: (i) there is no ABS in the *than*-clause, (ii) the *than* head is uninterpreted, and (iii) *-er* has raised from its position in the matrix clause, leaving an index i that is interpreted as a trigger for Predicate Abstraction.[23]

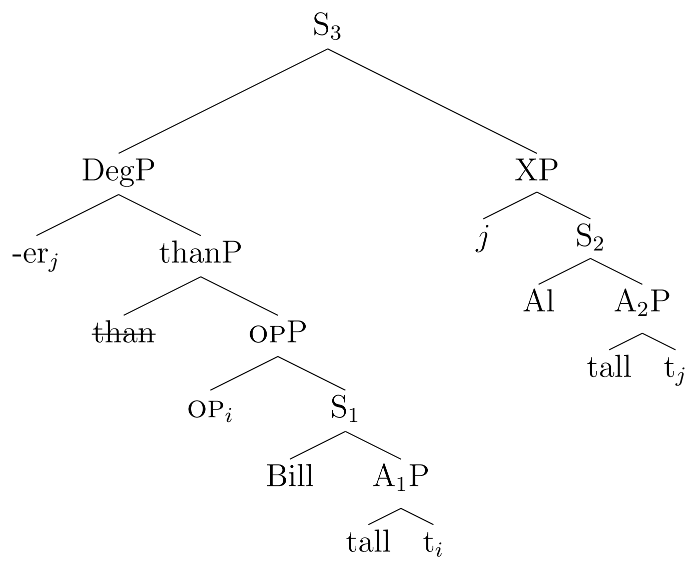
ii. Mary is a man.

iii. I've never met a man more clever than Mary.

The present text places *-er* directly next to the GA uniformly, so that they may semantically combine without issue given the assumptions laid out in this chapter: only this will guarantee a comparison by temperature for *hotter coffee*, excluding unattested readings e.g. by volume; see Chapter 3. This raises the question of the entailment from (i) to (ii), which I am not able to resolve here.

[23] Note that, with this representation, an OP-less index triggers the rule of Predicate Abstraction. Apart from this example, the text sticks with the OPERATOR interpretation of that rule.

(65)



The interpretation is derived as in (66). The result is that an utterance of a sentence like (65) is predicted to be judged true just in case the greatest degree to which Al is tall is greater than the greatest degree to which Bill is tall; i.e., just in case the degree representing Al's height is greater than that representing Bill's height. By design, in such simple cases the two accounts are truth-conditionally equivalent.

(66)
i. $[\![\mathrm{A_1P}]\!]^A = \lambda x.\textsc{tall}(x) \succcurlyeq d$ FA

ii. $[\![\mathrm{S_1}]\!]^A = \top$ iff $\textsc{tall}(\mathrm{Bill}) \succcurlyeq A(i)$ (i),FA

iii. $[\![\textsc{op}\mathrm{P}]\!]^{A:Ai\to d} = \lambda d.\textsc{tall}(\mathrm{Bill}) \succcurlyeq d$ (ii),PA

iv. $[\![\mathrm{DegP}]\!]^A = \lambda D.\max(D) \succ \max(\lambda d.\textsc{tall}(\mathrm{Bill}) \succcurlyeq d)$ (iii),FA

v. $[\![\mathrm{A_2P}]\!]^A = \lambda x.\textsc{tall}(x) \succcurlyeq A(j)$ FA

vi. $[\![\mathrm{S_2P}]\!]^A = \top$ iff $\textsc{tall}(x) \succcurlyeq A(j)$ (vi),FA

vii. $[\![\mathrm{XP}]\!]^{A:Aj\to d'} = \lambda d'.\textsc{tall}(\mathrm{Al}) \succcurlyeq d'$ (vii),PA

viii. $[\![\mathrm{S_3}]\!]^A = \top$ iff $\max(\lambda d'.\textsc{tall}(\mathrm{Al}) \succcurlyeq d') \succ \max(\lambda d.\textsc{tall}(\mathrm{Bill}) \succcurlyeq d)$

Despite this, there are non-trivial differences between the two approaches. In terms of appeal to distinct lexical primitives, the individual-degree relation approach posits less. In terms of interpreting the morphemes that are present in the sentence, the measure function approach interprets more. The accounts make different predictions when it comes to matters of scope and word order. The explanation of these phenomena are, however, neither settled, nor will they play a role in this dissertation. Consequently, I continue to make use of the measure function analysis. My major reason for this choice is aesthetic: it keeps the syntactic structures that I interpret closer to the surface syntax. Moreover, since this analysis is typically paired with the non-classical constituency analysis, I assume that syntax as well.

In the next section, I introduce my assumptions about the denotations of verbs and their arguments. This will lead us to see how the standard theory as I have drawn it can be extended to comparatives with gradable adverbs and with attributive adjectives.

2.3.4. Composition: adverbs

The derivation of adverbial comparatives is parallel to that of comparatives with gradable adjectives once certain assumptions are made about the denotations of verbs. As stated above, I assume the neodavidsonian framework for verbs, in which they denote predicates of events. However, for simplicity, I do not assume total separation, in which the denotations of subjects and objects are related to the verb meaning separately.

One advantage of incorporating the neodavidsonian framework is that it allows the interpretation of comparative morphemes to remain relatively unchanged from their adjectival occurrences. They require only the generalization in (67), in which the individual arguments labeled x in (50) have been replaced with α to indicate neutrality with respect to individuals and events. ABS is similarly generalized, (68).

(67) **Comparative morphemes** *(final version)*

i. $[\![\text{-er/more}]\!] = \lambda g \lambda d \lambda \alpha . g(\alpha) \succ d$

ii. $[\![\text{as}]\!] = \lambda d \lambda g \lambda \alpha . g(\alpha) \succcurlyeq d$

(68) **Absolute morpheme** *(final version)*

$[\![\text{ABS}]\!] = \lambda g \lambda d \lambda \alpha . g(\alpha) \succcurlyeq d$

Gradable adverbs are assigned the denotations in (69). Like gradable adjectives, they denote functions whose range is (some subset of) the domain of degrees D_d, the only difference is that they take event arguments of type v.[24]

(69) **Gradable adverbs ('standard')**

i. $[\![\text{fast}]\!] = \lambda e.\text{FAST}(e)$ $\langle v, d \rangle$

ii. $[\![\text{loudly}]\!] = \lambda e.\text{LOUDLY}(e)$

The ranges of these functions are elements of the scales associated with the GAs, as before. For instance, the scale associated with $[\![\textit{fast}]\!]$ can be represented as in (70i), and the scale associated with $[\![\textit{loudly}]\!]$ can be represented as in (70ii). D_{speed} consists in degrees representing measures of speed, and D_{loudly} in degrees representing measures of loudness. These degrees are such that it is sensible to say, of some $d \in D_{speed}$, that it is *6 mph*, or of some $d \in D_{loudness}$, that it *88 dB*. The '$\succcurlyeq$'s are total orderings over the respective sorts of degrees.

(70) i. $\langle D_{\succcurlyeq_{speed}}, \succcurlyeq_{speed} \rangle$

ii. $\langle D_{\succcurlyeq_{loudness}}, \succcurlyeq_{loudness} \rangle$

In contrast, non-gradable adverbs like *hourly* are assigned denotations like those in (71): they are functions from events e to truth values. Their denotations do not reference scales.

(71) **Non-gradable adverbs**

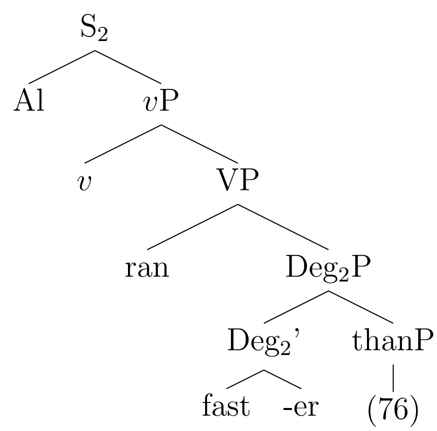
$[\![\text{hourly}]\!] = \lambda e.\text{HOURLY}(e)$ $\langle v, t \rangle$

[24] The semantics of adverbs is potentially much more complex; see relevant discussion in Taylor 1977a, Ernst 1984, 2000, Tenny & Pustejovsky 2000, Piñón 2005, and Rawlins 2013. However, as I focus only on gradability in this dissertation, I adopt the given minimal representations.

Thus, I assume that the (simplified) syntax in (73) underlies the matrix clause of the adverbial comparative in (19a), repeated here as (72). The v head projected between the verb and the subject relates events with their Agents (Marantz 1984, Chomsky 1995, Kratzer 1996, Pylkkänen 2002, a.o.), and interpreted here as in (74).

(72) Al ran **faster** than Bill did.

(73)



(74) **little-**v

$[\![v]\!] = \lambda x \lambda e.\text{Agent}(e)(x)$

The interpretation of (73) is derived as in (75), ignoring tense, and abbreviating the contribution of the *than* clause using δ.

(75)
i. $[\![\text{Deg}_2\text{'}]\!] = \lambda d' \lambda e'.\textsc{fast}(e') \succ d'$ — FA

ii. $[\![\text{Deg}_2\text{P}]\!] = \lambda e'.\textsc{fast}(e') \succ \delta$ — (i),FA

iii. $[\![\text{VP}]\!] = \lambda e'.\textsc{run}(e')\ \&\ \textsc{fast}(e') \succ \delta$ — (ii),PM

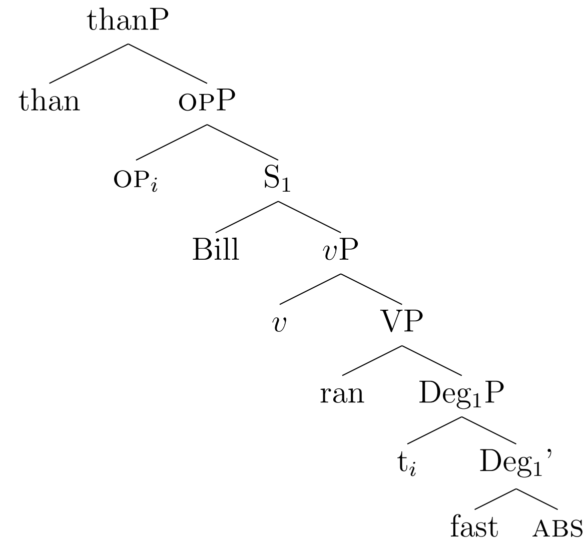
iv. $[\![v\text{P}]\!] = \lambda x \lambda e'.\text{Agent}(e')(x)\ \&\ \textsc{run}(e')\ \&\ \textsc{fast}(e') \succ \delta$ — (iii),EI

v. $[\![\text{S}_2]\!] = \lambda e'.\text{Agent}(e')(\text{Al})\ \&\ \textsc{run}(e')\ \&\ \textsc{fast}(e') \succ \delta$ — (iv),FA

vi. $= \top$ iff $\exists e'[\text{Agent}(e')(\text{Al})\ \&\ \textsc{run}(e')\ \&\ \textsc{fast}(e') \succ \delta$ — (v),$\exists$

The structure of the *than*-clause of (73) is as in (76), and its interpretation is derived as in (75), again ignoring tense.

(76)



(77) i. $[\![\text{Deg}_1\text{'}]\!]^A = \lambda d \lambda e.\textsc{fast}(e) \succcurlyeq d$ FA

ii. $[\![\text{Deg}_1\text{P}]\!]^A = \lambda e.\textsc{fast}(e) \succcurlyeq A(i)$ (i),IR,FA

iii. $[\![\text{VP}]\!]^A = \lambda e.\textsc{run}(e)\ \&\ \textsc{fast}(e) \succcurlyeq A(i)$ (ii),PM

iv. $[\![v\text{P}]\!]^A = \lambda x \lambda e.\text{Agent}(e)(x)\ \&\ \textsc{run}(e)\ \&\ \textsc{fast}(e) \succcurlyeq A(i)$ (iii),EI

v. $[\![\text{S}_1]\!]^A = \lambda e.\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ \textsc{fast}(e) \succcurlyeq A(i)$ (iv),FI

vi. $= \top$ iff $\exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ \textsc{fast}(e) \succcurlyeq A(i)]$ (v),$\exists$

vii. $[\![\textsc{op}\text{P}]\!]^{A:Ai \to d} = \lambda d.\exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ \textsc{fast}(e) \succcurlyeq d]$ (vi),PA

viii. $[\![\text{thanP}]\!]^A = \iota d[\exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ \textsc{fast}(e) \succcurlyeq d]]$ (vii),FA

Putting the two together, the result is as in (78). This logical form encodes the prediction that an utterance of (73) will be judged true just in case there is an event of Al running, the speed-measure of which is greater than the speed-measure of Bill's running. This accords with intuition.[25]

(78) $[\![\text{Al ran } \textbf{faster} \text{ than Bill did}]\!]^A =$

$$\top \text{ iff } \exists e'[\text{Agent}(e')(\text{Al})\ \&\ \textsc{run}(e')\ \&\ \textsc{fast}(e') \succ$$

[25]There is some question that the condition in (78) (and ones below) may be too weak. Without maximizing on the events picked out by the matrix clause, (78) might be predicted to be judged true in a context where, for only a very small portion of the (relevant) event under discussion, did John run faster than Bill, etc. Ultimately, one may want to include reference to a maximization function of perfective aspect (see e.g.Filip 2008; Filip & Rothstein 2005).

$$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \ \& \ \textsc{run}(e) \ \& \ \textsc{fast}(e) \succcurlyeq d]]]$$

Deriving the interpretation of comparatives with gradable adverbs differs from those with gradable adjectives so far in that they combine conjunctively with the predicate denoting the events they measure. However, there is a construction where it appears that gradable adjectives so combine as well: attributive adjectival constructions. To sketch their structure and interpretation, I first need to establish how mass and plural nouns combine with verbs.

2.4. Verbs and objects

The question of how mass and plural nouns are interpreted is not a trivial or easy one. Above, I discussed the general approach adopted here for how objects combine with verbs: namely, by function application. I assumed that the Agent role of a verbal predicate like *run* is introduced by the v head in combination with the rule of Event Identification (and see Chapter 4 for an extension to stative predicates), while maintaining the non-separation analysis of internal arguments. The goal of this section will be to establish a good foundation for the interpretation of sentences like that in (79), where the internal argument is an apparently bare mass or plural noun.

(79) Al drank **hotter coffee/s** than Bill did.

To set up the issue, consider the hypothesized interpretation of the transitive verb *drink* in (80): it expresses a relation between drinking events e involving individual y (the patient of the drinking event).

(80) **Transitive verb**

$[\![\text{drink}]\!] = \lambda y \lambda e.\textsc{drink}(e)(y)$

Table 2.3: Different options for linking bare plurals and mass nouns to verbs depending on basic denotative type (referring or predicative).

mass or bare plural interpretation	**major proponents**
referring expressions, type e	
kinds	Parsons 1970, Carlson 1977
mode: type shift	Chierchia 1998b, 2010
fusions	Higginbotham 1994
predicates, type $\langle e, t \rangle$	
properties	Cartwright 1975, Pelletier 1974
mode: covert indefinite determiner	Gillon 1992
mode: existential closure	
by the verb	van Geenhoven 1996, McNally 1995
by type shift	Krifka 2003 (building on Partee 1987)

Now consider *drink* in the context of the sentences in (81a) and (81b). There are a number of traditional ways of analyzing the definite description in (81a), all of which, even when combined with the event analysis, will ultimately deliver something of type e to saturate the y variable of *drink* in (80). (81a) may be paraphrased as *there is some definite quantity of coffee/s that Al drank*. (81b) is not definite in the same way, seemingly paraphrasable as *there is some quantity of coffee/s that Al drank*.

(81) a. Al **drank the coffee/coffees** (that I prepared for him).

b. Al **drank coffee/coffees** (all day yesterday).

But then what about the analysis of the mass noun/bare plural occurrences like those in (81b)? An array of semantic options are presented in Table 2.3, arranged by the basic contrast between whether they are, lexically, referring expressions of type e, or whether they denote predicates of type $\langle e, t \rangle$.

For the purposes of this dissertation, *coffee* must be of predicative type before it is of type e. That is, in (79), the measure function denoted by *hot* needs access to *what is* coffee in the context, not merely the (abstract) kind coffee. This prevents me from adopting Chierchia's (1998, 2010) kind-based theory (building on, but departing from Carlson 1977). On Chierchia's theory, instances of the kind can be made accessible once the verb combines with the kind-denoting expression, via the rule of Derived Kind Predication. This rule applies in case a verb is looking for an entity of type e but receives a kind of type k instead.[26]

Krifka (2003) argues that we needn't decide, once and for all, whether bare plurals and mass nouns are covert indefinites/quantifiers or kind-denoting terms. He hypothesizes that they just denote properties of type $\langle e, t\rangle$, and employs type-shifters to lift them to the appropriate type (indefinite/quantificational or kind-denoting) as required by the linguistic context. For present purposes, the relevant type shift is Partee's $\exists$ (82). On the Krifkean view, the noun starts out life as type $\langle e, t\rangle$, but in existential contexts is lifted to take the verb (of type $\langle e, t\rangle$) as an argument, simultaneously binding its own individual variable. Such a solution is elegant, but it has not yet been extended to the context of event semantics.

(82) *Partee's $\exists$ type-shift*

If a noun phrase denotes a formula like $[\lambda x : x \in D_e.X(x)]$ of type $\langle e, t\rangle$, it may be rewritten as:

$\lambda P : P \in D_{\langle e,t\rangle}.\exists y[X(y)\ \&\ P(y)]$.

Alternatively, Cartwright (1975), Link (1983), Higginbotham (1994), and Landman (2000) offer different forms of 'fusion' or 'sum' operators that combine with a predicate, just in case that predicate denotes in a (partially ordered) set. These operators share that they return the least upper bound, or supremum of such sets. However, such approaches don't straightforwardly work in non-generic contexts, such as the case of *hotter coffee than Bill drank*. If the coffee that Al drank and the coffee that Bill drank are both represented as "the sum/fusion of coffee in the context", then they should have drunk (i) the same coffee and (ii) all the coffee,

[26]There is a further question, namely how Derived Kind Predication applies in the case of the event analysis. I am not sure if this framework has been extended in that direction.

which is going to be false for most utterances, contrary to intuitions.

The remaining option is the silent determiner approach, and this is what I will adopt. There are (at least) two ways this silent determiner could be interpreted: as a quantifier equivalent to the denotation of *some* (i.e., undergoing QR from its base position, leaving a trace of type e that can act as the internal argument of the verb) or as a choice function (i.e., a choice of an entity of type e from the extension of a predicate of type $\langle e, t\rangle$). I believe that either of these will get the meaning right, though I will opt for a choice function-like interpretation.

In (83), I use the character ϵ to suggest Hilbert's (1921[1922]) operator. ϵ is the indefinite counterpart of ι, the definite description operator, which differs in that it doesn't presuppose uniqueness of the entity chosen in a context of utterance.[27] More along the lines suggested by Hintikka (1974), and followed up in discourse representation theories (Kamp 1981, Heim 1982), 'ϵx' prefixed to an expression of type $\langle e, t\rangle$ over x is a term of type e. $\epsilon x[P(x)]$ is read as '*some* x such that $P(x)$', with $\epsilon x[\textsc{coffee}(x)]$ read as 'some x such that x is a portion of coffee', and abbreviated 'some portion of coffee x'.[28]

(83) **little-e**

$[\![e]\!] = \lambda P \in D_{\langle e,t\rangle}.\epsilon x[P(x)]$ type $\langle\langle e, t\rangle, e\rangle$

Apart from the modifications that may be required to accommodate measure functions and events, linking the interpretation of mass and bare plural arguments to verbs can in principle be carried out in any of the ways discussed in this section.

[27] The formulation in the text is like that of Bierwisch 1989, for whom ϵ is understood as equivalent to an existential quantifier. According to von Heusinger 1997, Schröter 1956 proposed the interpretation of Hilbert's ϵ as a choice function, and Asser 1957 formulated this in detail; Slater 1988 argued that the interpretation of Hilbert's ϵ as an **indefinite** as opposed to **definite** operator is misguided. Von Heusinger 1997 uses ϵ for a definitely-interpreted choice function operator, and η for the indefinitely-interpreted. In all other respects, my discussion follows that of von Heusinger 1997.

[28] Note, in what follows I abstract away from two problems: that of empty domains, and the issues that motivate a quantificational analysis of *some*, e.g. negation: If Al says *Bill drank some coffee* and Sue says *That is false*, Sue is committed to Bill's having drunk **no** coffee. Thanks to A. Williams (p.c.) for clarifying these points.

Adopting the last approach in terms of an operator like ϵ requires the fewest modifications to the original formulation to be suitable for present purposes. With these pieces in place, we can see one way of deriving the interpretation of comparative constructions with attributive adjectives.

2.4.1. Composition: attributive adjectives

While the syntax of comparatives with attributive adjectives has been investigated to some extent (Kennedy 2000, and references therein), less has been said about their semantics. However, I believe that they can be easily accommodated within the present system, given the assumptions just laid out about how verbs and objects compose. The relevant example from the beginning of the preceding section is reproduced in (84). It expresses a comparison between the temperature of the coffee Al drank with the temperature of the coffee Bill drank.

(84) Al drank **hotter coffee** than Bill did.

I assume with the predicate analysis of mass nouns that *coffee* denotes a predicate of type $\langle e, t \rangle$, as in (85). For now, I continue to assume that *hot* denotes a measure function of type $\langle e, d \rangle$.

(85) $[\![\text{coffee}]\!] = \lambda x.\textsc{coffee}(x)$ type $\langle e, t \rangle$

As discussed above, the surface syntax of sentences like (84) belies an underlying structure wherein the *than*-clause is actually base generated next to *hotter*. Let's assume that this underlying structure is what is compositionally interpreted (though see fn. 22 for important discussion).[29] Thus, I posit the underlying syntax

[29] Bresnan 1973 has a structure like that reported in the text, as noted above; she posits obligatory extraposition of *than* and *as* clauses universally. See also the discussion in Heim 2000. If the underlying syntax were in fact primarily (as opposed to derivatively) like that in (i), the semantics given in Alrenga et al. 2012 and Larson & Wellwood under review can accommodate such structures, while that in the text cannot, without modification.

i. [[[hot -er] coffee] thanP]

of the matrix clause of (84) is as in (86), and derive its interpretation as in (87), abbreviating the interpretation of the *than*-clause as δ, and ignoring tense as usual.

(86)

$$[_{\text{S}_2\text{P}}\ \text{Al}\ [_{v_2\text{P}}\ v\ [_{\text{V}_2\text{P}}\ \text{drank}\ [_{e_2\text{P}}\ e\ [_{\text{N}_2\text{P}}\ \text{coffee}\ [_{\text{Deg}_2\text{P}}\ [_{\text{Deg}_2\text{'}}\ \text{hot}\ \text{-er}]\ [_{\text{thanP}}\ (88)]]]]]]]$$

(87)

i. $[\![\text{Deg}_2\text{'}]\!] = \lambda d \lambda x.\textsc{hot}(x) \succ d$ — FA

ii. $[\![\text{Deg}_2\text{P}]\!] = \lambda x.\textsc{hot}(x) \succ \delta$ — (i),FA

iii. $[\![\text{N}_2\text{P}]\!] = \lambda x.\textsc{coffee}(x)\ \&\ \textsc{hot}(x) \succ \delta$ — (ii),PM

iv. $[\![e_2\text{P}]\!] = \epsilon x[\textsc{coffee}(x)\ \&\ \textsc{hot}(x) \succ \delta]$ — (iii),FA

v. $[\![\text{V}_2\text{P}]\!] = \lambda e.\textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ \textsc{hot}(x) \succ \delta])$ — (iv),FA

vi. $[\![v_2\text{P}]\!] = \lambda x \lambda e.\text{Agent}(e)(x)\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ \textsc{hot}(x) \succ \delta])$ — (v),EI

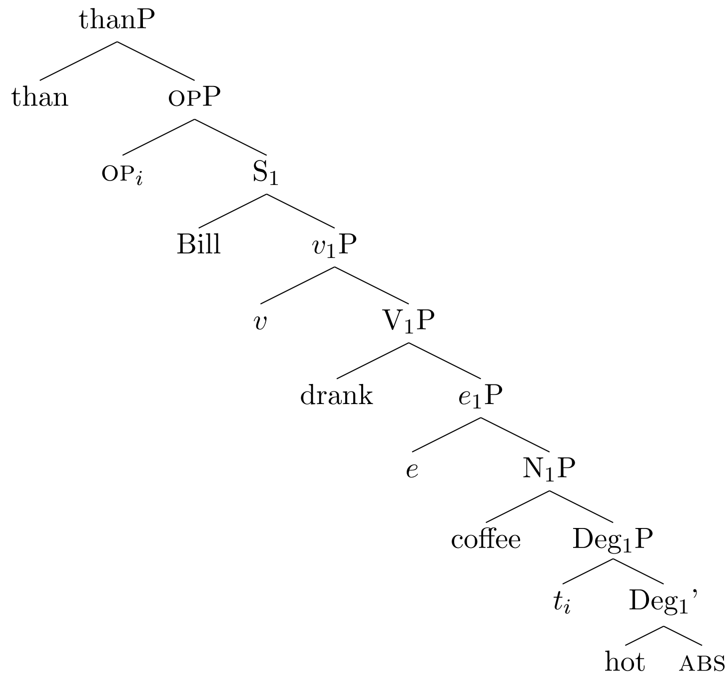
vii. $[\![\text{S}_2\text{P}]\!] = \lambda e.\text{Agent}(e)(\text{Al})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ \textsc{hot}(x) \succ \delta])$ — (vi),FA

viii. $= \top$ iff $\exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ \textsc{hot}(x) \succ \delta])]$ — (vii),$\exists$

Noteworthy in this derivation is that *hotter*$_\delta$ combines with *coffee* via Predicate Modification. In comparative constructions with copular adjectives, the measurand (i.e., the denotation of a subject like *Al*) combines with the measure function via Functional Application. The interpretation derived in (87viii) is an existential statement about drinking events involving some quantity of coffee whose temperature-measure is greater than δ, and whose Agent is Al.

The structure of the *than*-clause that I assume is as in (88), and its corresponding interpretation derived in (89). The interpretation in (89j) is a definite description over degrees of temperature, those representing coffee that Bill drank.

(88)



(89) a. $[\![\text{Deg}_1\text{'}]\!]^A = \lambda d \lambda x'.\textsc{hot}(x') \succcurlyeq d$ FA

b. $[\![\text{Deg}_1\text{P}]\!]^A = \lambda x'.\textsc{hot}(x') \succcurlyeq A(i)$ (i),IR,FA

c. $[\![\text{N}_1\text{P}]\!]^A = \lambda x'.\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq A(i)$ (ii),PM

d. $[\![\text{s}_1\text{P}]\!]^A = \epsilon x'[\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq A(i)]$ (iii),FA

e. $[\![\text{V}_1\text{P}]\!]^A = \lambda e'.\textsc{drink}(e')(\epsilon x'[\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq A(i)])$ (iv),FA

f. $[\![v_1\text{P}]\!]^A = \lambda y' \lambda e'.\text{Agent}(e')(y') \ \& \ \textsc{drink}(e')(\epsilon x'[\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq A(i)])$
(v),EI

g. $[\![\text{S}_1]\!]^A =$
$\lambda e'.\text{Agent}(e')(\text{Bill}) \ \& \ \textsc{drink}(e')(\epsilon x'[\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq A(i)])$ (vi),FA

h. $=$
$\top$ iff $\exists e'[\text{Agent}(e')(\text{Bill}) \ \& \ \textsc{drink}(e')(\epsilon x'[\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq A(i)])]$ (vii),$\exists$

i. $[\![\textsc{op}\text{P}]\!]^{A:Ai \to d} =$
$\lambda d.\exists e[\text{Agent}(e')(\text{Bill}) \ \& \ \textsc{drink}(e')(\epsilon x'[\textsc{coffee}(x') \ \& \ \textsc{hot}(x') \succcurlyeq d])]$ (viii),PA

j. $[\![\text{thanP}]\!]^{A} =$

$$\iota d[\exists e'[\text{Agent}(e')(\text{Bill}) \;\&\; \textsc{drink}(e')(\epsilon x'[\textsc{coffee}(x') \;\&\; \textsc{hot}(x') \succcurlyeq d])] \quad \text{(xi),FA}$$

Putting the two together, the result is as in (90). This logical form encodes the prediction that an utterance of (84) will be judged true in a context just in case Al was the agent of a drinking event involving coffee whose temperature-measure was greater than that of the coffee involved in a drinking event by Bill.

(90) $[\![$Al drank **hotter coffee** than Bill did$]\!] = \top$ iff

$$\exists e'[\text{Agent}(e')(\text{Al}) \;\&\; \textsc{drink}(e')(\epsilon x[\textsc{coffee}(x) \;\&\; \textsc{hot}(x) \succ$$
$$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \;\&\; \textsc{drink}(e)(\epsilon x'[\textsc{coffee}(x') \;\&\; \textsc{hot}(x') \succcurlyeq d])]])]$$

2.5. Taking stock

The derivation of comparatives with adjectives and adverbs are perfectly parallel, once certain assumptions are made about the interpretations of verb phrases. GAs are uniformly assigned the type $\langle \eta, d \rangle$, where η is used to indicate neutrality between entities in D_e and D_v. Gradable adjectives take the entity denoted by the subject of a copular predication as an argument, or combine conjunctively with noun phrases in attributive adjectival comparatives, measuring those entities along various dimensions. Gradable adverbs combine conjunctively with (the characteristic function of) a set of events, once the Agent role is separated, measuring those events along various dimensions.

The theory outlined in this chapter represents an extension of the standard theory in one of its manifestations (i.e., the measure function analysis), though it was shown how to intertranslate this version with its alternatives. The theory accounts for interpretable comparatives by assigning a measure function-type to GAs, and a measure function-taking-type to comparative morphemes. Anomalous comparatives are accounted for by a type mismatch between the type of comparative morphemes and that of non-gradable adjectives and adverbs. Those expressions denote simple properties of individuals or events.

What we have not yet seen so far is comparative constructions like *more coffee* and *run more*, where there does not appear to be a GA mediating the relationship between the comparative morpheme and the noun or verb. Normally, it is said that such constructions contain an expression, *much*, that has the semantics of a GA, whether it is pronounced or not (e.g., contrast *more coffee* and *as much coffee*). If this expression contributes a measure function in comparatives with nouns and verbs, then, expressions of such categories are non-gradable, simpliciter. They denote measurands, not measurers.

In the next chapter, I explore the interpretation of comparatives with nouns and verbs, further extending the theory developed in this chapter to account for them. I show that such constructions have surprising properties that render them, at least superficially, quite different from comparatives with GAs.

Chapter 3: Nominal and verbal comparatives

On the standard account, mass nouns like *coffee* and atelic verbs like *sleep* do not denote measure functions (or individual-degree relations). This hypothesis finds support in the morphosyntactic asymmetry evidenced between the comparative constructions in (91) and those in (92): with *coffee* and *run*, the expression *much* appears, while with *tall* and *fast*, it cannot. A natural hypothesis to account for such data is that *much* itself denotes a measure function of some sort. This chapter[1] offers an account of *much* along these lines.

(91) a. Al drank **as much coffee** as Bill did.

b. Al **ran as much** as Bill did.

(92) a. * Al is **as much tall** as Bill is.

b. * Al ran **as much fast** as Bill did.

As we will see, however, the interpretation of *much* is interestingly different from that of GAs: it routinely invokes *variable* measure functions, so long as the measured domain meets certain conditions.

I first discuss the interpretation of nominal and verbal comparatives, offering an account of their semantics that combines ideas from the standard theory with an explicit account of the conditions on the interpretation of *much*. I conclude with a discussion of the wider distribution of *much* in English, and alternative proposals for its semantics. This will provide a nice segue into the reevaluation of the standard

[1] Developing ideas found in Wellwood et al. 2012 and Wellwood 2012a.

theory that follows in Chapter 4.

3.1. Basic data

This section introduces the basic properties of comparative constructions with nouns and verbs. I emphasize their distribution and interpretation, detailing in particular the relevance of the mass/count and telicity distinctions in comparative constructions: only mass or atelic expressions are compatible with the semantics of comparative morphemes. Following this discussion, I posit that this pattern is the result of how *much* interacts with the denotational domains of such expressions.

3.1.1. Noun phrases

Unlike gradable adjectives, nouns in English appear with *-er* and *as* only via the mediation of *much*.[2] Intuitively, (93a)-(93b) express that the amount of coffee Al drank/rock she found strictly exceeds that of Bill's coffee/rock, and (93c)-(93d) express that Al's amount meets or exceeds Bill's amount.

(93) a. Al drank **more coffee** than Bill did. COMPARATIVE

b. Al found **more rock** than Bill did.

c. Al drank **as much coffee** as Bill did. EQUATIVE

d. Al found **as much rock** as Bill did.

As before, I present the other comparative constructions, although they will not be addressed in detail here; the points I make will extend to these cases.

(94) a. Al drank **too much coffee** to be ready to sleep. EXCESSIVE

b. Al found **too much rock** to carry home.

[2] Again, *more* is assumed to be *much*+*-er* (Bresnan 1973); Chapter 4 breaks this assumption down.

c. Al drank **enough coffee** to stay awake. ASSETIVE

d. Al found **enough rock** to be able to share.

e. Al drank **the most coffee** of any of the students. SUPERLATIVE

f. Al found **the most rock** of any of the girls.

Such is the behavior of mass nouns like *coffee* and *rock*. This behavior contrasts with that of nouns like *idea* and *traffic cone*. While it is intuitively clear that *more/as much idea* in (95a)-(95b) could in principle express something about 'an idea of greater profundity', such readings are not available. This is not just a problem with abstract nouns, as (95c)-(95d) serve to illustrate: these examples are sensical only to the extent that *traffic cone* can be understood as denoting a kind of stuff. It appears at first blush that this is a similar distinction to that between gradable and non-gradable adjectives: some expressions are perfectly natural and interpretable in the comparative, while others are odd, and coercive at best. The comparative disallows characteristically 'count' noun interpretations as it disallows characteristically 'absolute' adjective interpretations.

(95) a. ? Al has **more idea** than Bill does.

b. ? Al has **as much idea** as Bill does.

c. ? This street has **more traffic cone** than that one does.

d. ? This street has **as much traffic cone** as that one does.

Importantly, count nouns like *idea* and *traffic cone* are perfectly natural in nominal comparative constructions if they are plural-marked, (96). I discuss such cases in detail in Chapter 5.

(96) a. Al has **more ideas** than Bill does.

b. This street has **more traffic cones** than that one does.

Semantically, what appears to distinguish (interpretable) nominal comparative constructions from GA comparative constructions is the existence of what has been dubbed a **monotonicity constraint** on their interpretation.

Schwarzschild (2002, 2006) identified this constraint in his consideration of a wide variety of constructions, among which are *much* with a partitive NP (97a) and the excessive (*too much*) with mass nouns (97b).[3] He observed two major patterns: (i) such constructions allow for **variable** dimensions for measurement, and (ii) this variability is interestingly **constrained**. For example, (97a) and (97b) can express comparisons of amounts of coffee weight or by volume, but neither can express comparisons by temperature.

(97) a. Al didn't buy **much of our coffee**.

b. Al bought **too much coffee**.

Schwarzschild suggests that part of the meaning of the nominals in (97a)-(97b) is a contextually-determined measure function, selected from among just those whose dimensions for measurement respect the part-whole structure of e.g. $[\![$*coffee*$]\!]$ (Cartwright 1975, Link 1983, Chierchia 1998a, among many others, discuss the relevance of part-whole relations in the nominal domain in detail). I will first discuss the work captured by this appeal to ontology in the semantics of mass and count nouns, and then return to Schwarzschild's monotonicity generalization.

A popular way of capturing the felt difference between mass and count nouns is by positing structural differences in their domains of application. Mass nouns tend to show **cumulative reference**: if $[\![$*coffee*$]\!]$ applies to two portions of matter, then it also applies to the mereological sum of those portions, (98a).[4] In contrast, (singularly-interpreted) count nouns tend to show **quantized reference**: if $[\![$*a cup*$]\!]$

[3]He mainly focuses on pseudopartitives (*20 ounces of water*) and attributive measure phrase constructions (*20 degree water*), which I do not discuss here.

[4]They also tend to show the property of *divisiveness/homogeneity*, e.g. if $[\![$*coffee*$]\!]$ applies to a portion of stuff, it also applies to a proper part of that stuff. See Zucchi & White 2001 for critical discussion, including counterexamples like *twig*, *sequence*, etc.

applies to a given object, it fails to apply to any of its (relevant) proper parts, (99a).[5] Expressions displaying cumulative reference are thus often modeled as having a domain structured by the part-of relation, while those displaying quantized reference are said to lack such structure.

(98) **Nominal cumulativity**

a. $\top$ If this is *coffee* and that is *coffee*, their sum is *coffee*.

b. $\bot$ If this is *a cup*, and that is *a cup*, their sum is *a cup*.

(99) **Nominal quantization**

a. $\bot$ If this is *water*, then no proper subpart of it is *water*.

b. $\top$ If this is *a cup*, then no proper subpart of it is *a cup*.

Now, a given measure function μ is "monotonic" in Schwarzschild's sense just in case, for any two things that are (properly) ordered in a part-of relation, their measurements are similarly ordered. Krifka (1989) discusses similar patterns in terms of a restriction to "extensive" measure functions; Higginbotham (1994) gives a semantics (for e.g., *Much water spilled*) with appeal to additive measure functions. Nakanishi's (2007) discussion of measurement in the nominal and verbal domains in Japanese follows Schwarzschild's formulation, as I will here,[6] although reference to binary *relations* or *operations* will ultimately be important for how we formalize measurement in semantics (see Klein 1991 for extensive discussion).

Schwarzschild's monotonicity condition can be stated as in (100). For reasons that will become clear below, I state monotonicity relative to the domain of an ordering, rather than to a predicate. Observe that the relation that must be preserved

[5]Crucially, for these tests it is imperative that nouns be presented in a mass or count *context*, since otherwise coercive effects intrude on the judgments. Also, there is always an idealization made for quantization, e.g. we have to imagine a "normal" cup, since a cup made out of cups would fail quantization.

[6]Champollion 2010 offers an alternative account of Schwarzschild's generalizations in terms of his Stratified Reference theory.

here is the strict ordering, $\prec$: if we required only that $\preccurlyeq$ was preserved, mappings from $[\![coffee]\!]$ to degrees of temperature would be incorrectly permitted (e.g., for two portions of coffee, a and b, it may be that $a \preccurlyeq b$ and $a \neq b$, while nonetheless $\textsc{temperature}(a) = \textsc{temperature}(b)$).[7]

(100) **Monotonicity** *(first version)*

A measure function $\mu : D_{\preccurlyeq^{Part}} \mapsto D_{\leq^{Deg}}$ is **monotonic** iff:

for all $x, y \in D_{\preccurlyeq^{Part}}$, if $x \prec^{Part} y$, then $\mu(x) \prec^{Deg} \mu(y)$.

To see what this restriction amounts to, consider a portion of coffee, a, and two of its proper subparts, a', a''. All of a, a' and a'' necessarily measure some degree e.g. of volume, weight, and temperature, but only degrees of volume or weight can be invoked by (101). Importantly, the sum a necessarily measures a *greater* degree of volume or weight than that of the parts a' and a''; they (normally) have the *same* degree of temperature. The temperature dimension thus represents non-monotonic measurement on such a domain.

(101) a. Al has **more coffee** than Bill does. *temp, vol

b. Al has **as much coffee** as Bill does. *temp, vol

To express a comparison of portions of coffee along a dimension like temperature, one must use a GA like *hot* as in (102).

(102) a. Al has **hotter coffee** than Bill does. temp, *vol

b. Al has **as hot (of) coffee** as Bill does. temp, *vol

Part of the meaning of nominal comparative constructions is something that ensures only monotonic dimensions for measurement are available for a given comparison. This generalization can be naturally captured on accounts that appeal to

[7] Nakanishi (2007), citing an anonymous reviewer of her paper, notes a further requirement for conditions like (100) to be sufficient, namely that there *be* two distinct elements that are so ordered.

mereological structure in the domain of application for expressions like *coffee*: this provides just the structures that monotonicity can be stated over. Furthermore, nominal comparatives (at least those we have seen so far) are not compatible with singularly-interpreted count nouns, whose domains are often understood to lack such structure.

Ultimately, I will propose that these properties (the naturalness of mass nouns in comparatives, the unnaturalness of count nouns here) are the result of the interpretation of *much*. After discussing what I will suggest are analogous patterns in the verbal domain, I formalize the mereological interpretation of mass and count nouns, which sets us up for a formalization of the interpretation of *much*.

3.1.2. Verb phrases

It has often been argued that the distinction between atelic and telic verb phrases closely parallels that between mass and count nouns (Mourelatos 1978, Hoepelman & Rohrer 1980, Bach 1986, Krifka 1989, Rothstein 2004, Borer 2005a, a.o.).[8] **Telic** verb phrases like *run to the park* or *eat two apples* include information about the termination of their expressed events: namely, when the runner has arrived at the park, or when the two apples are eaten. In contrast, **atelic** verb phrases like *run in the park* or *eat apples* do not include information about their events' termination. As we will see, this distinction affects how measurement and comparison are understood in the verbal domain.

The semantic difference between the two types of verb phrases can be seen in how they are interpreted in the context of temporal modifiers. With *run in the park* or *eat apples* as in (103), the modifier can be used to express that an event of a certain type occurred over the course of 5 minutes, and says nothing about

[8] See Ryle 1949, Kenny 1963, Vendler 1957, Verkuyl 1972, Mourelatos 1978, Dowty 1979, Parsons 1990, Filip 2004, 2011 for discussion of telicity. Borer 1998, 2005b, Ritter & Rosen 1998, Ramchand 1997, 2003, van Hout 2000, and Kratzer 2004 discuss structural factors in determining telicity.

whether that duration marks completion of the event. In contrast, with *run to the park* or *eat two apples*, such an interpretation is odd: (104) rather seem to express that an event of a certain type **iterated** over the course of 5 minutes, with pauses in between the (completed) events. Atelic event descriptions show the interpretive pattern in (103) and telic event descriptions that in (104).

(103) a. Al **ran in the park** for 5 minutes.

b. Al **ate apples** for 5 minutes.

(104) a. ? Al **ran to the park** for 5 minutes.

b. ? Al **ate two apples** for 5 minutes.

In contrast, a modifier like *in 5 minutes* combined with telic verb phrases as in (105) can express that an event of a certain sort lasted the course of 5 minutes. The corresponding examples with atelic verb phrases are odd, (106).

(105) a. Al **ran to the park** in 5 minutes.

b. Al **ate two apples** in 5 minutes.

(106) a. ? Al **ran in the park** in 5 minutes.

b. ? Al **ate apples** in 5 minutes.

Atelic verb phrases appear with *-er* and *as* along with an expression like *much*. (107a)-(107b) express that the amount Al ran/slept strictly exceeds that of Bill, and (107c)-(107d) express that Al's amount meets or exceeds Bill's amount.

(107) a. Al **ran more** than Bill did. COMPARATIVE

b. Al **slept more** than Bill did.

c. Al **ran as much** as Bill did. EQUATIVE

d. Al **slept as much** as Bill did.

The other comparative constructions are similar, as can be seen in (108).

(108) a. Al **ran too much** to feel refreshed. EXCESSIVE

b. Al **slept too much** to feel refreshed.

c. Al **ran enough** to feel refreshed. ASSETIVE

d. Al **slept enough** to feel refreshed.

e. Al **ran the most** of the team. SUPERLATIVE

f. Al **slept the most** of her family members.

Telic verb phrases, however, pattern differently. While (107)-(108) can express comparisons of measures between single events, those in (109) cannot. Conceptually, one could imagine (109a)-(109b) to express something about e.g. how long the ceremony lasted, or the students' GPAs, yet such readings are not available. The sentences in (109) are only interpretable if they are conceived in terms of comparisons of numbers of events, which is odd given what we normally think about events like graduating high school and eating one's first cupcake.

(109) a. ? Al **graduated high school more** than Bill did.

b. ? Al **graduated high school as much** as Bill did.

c. ? Al **ate her first cupcake more** than Bill did.

d. ? Al **ate her first cupcake as much** as Bill did.

Some suggestive evidence as to what might underly the variety of 'coercive' interpretations of sentences like those in (109) is provided by languages that have a richer system of aspectual morphology than English. With perfective aspect, an atelic verb phrase like *play* is perfectly acceptable in the comparative in Bulgarian, and is interpreted as a comparison of amounts of playing-activity. In contrast, forming the verbal comparative with a perfective-marked telic verb phrase is ungrammatical, (111); i.e., such sentences have no interpretation.[9]

[9]The Bulgarian data is reported in Wellwood et al. 2012.

(110) **Perfective atelic (Bulgarian)**

Minalata sedmica Ivan **igra** **poveče** ot Maria.
last week Ivan play-PFV.PAST more from Maria

'Last week, Ivan played more than Maria.'

(111) **Perfective telic (Bulgarian)**

*Minalata sedmica Ivan **izkaĉi** **vrâh Musala poveče** ot Maria.
last week Ivan climb-PFV.PAST top Musala more from Maria

'Last week, Ivan climbed Musala more than Maria.'

In Bulgarian, perfective-marking on a telic verb phrase indicates that the (bounded) event it expresses is relevantly **singular** (or at least, non-plural). Importantly, telic verb phrases with imperfective morphology are grammatical in verbal comparatives in Bulgarian, (112), and the result interpreted as a comparison of numbers of events. Ferreira (2005) has argued that such interpretations of imperfective-marked verb phrases indicate that the verb phrase is covertly plural-marked; I pick up on this idea in Chapter 5.

(112) **Imperfective telic (Bulgarian)**

V onezi dni Ivan izkaĉvasê vrâh Musala poveče ot Maria.
in those days Ivan climb-IMPF.PAST top Musala more from Maria

'In those days, Ivan climbed Musala more than Maria.'

For present purposes, my interest is in the fact that singularly-interpreted verb phrases are uninterpretable in the verbal comparative. In English, I showed this by contrasting comparatives over atelic verb phrases like *run in the park*, with those comparing 'once-only', telic verb phrases like *eat one's first cupcake.* In languages like Bulgarian, the effect of telicity on the verbal comparative was seen most starkly by manipulating perfective morphology: here, atelic verb phrases are acceptable, and interpreted as comparisons of amounts of the given events, and telic verb phrases are unacceptable.

Just as the felt difference between mass and count nouns is often encoded as a difference in their domains of application, so have researchers tended to locate the felt difference between atelic and telic predicates here—the major difference being that verbal predicates range over events (entities of type v) as opposed to individuals (type e; Taylor 1977b, Mourelatos 1978, Hoepelman & Rohrer 1980, Bach 1986, Link 1987, Krifka 1989, Landman 2000, Rothstein 2004, Borer 2005a, a.o.). Indeed, like mass nouns, atelic predicates tend to show cumulative reference: if $[\![$*eat apples*$]\!]$ applies to two stretches of an event, it also applies to the sum of those stretches, (113a).[10] In contrast, (singularly-interpreted) telic predicates tend to show quantized reference: if $[\![$*eat two apples*$]\!]$ applies to a given event, it fails to apply to any of its (relevant) subparts, (114). In light of this, atelic verb phrases are analyzed as predicates whose domains are structured by the part-of relation on events, while the domains of telic predicates lack such structure.

(113) **Verbal cumulativity**

a. $\top$ If this is *eat apples* and that is *eat apples*, their sum is *eat apples.*

b. $\bot$ If this is *eat two apples* and that is *eat two apples*, their sum is *eat two apples.*

(114) **Verbal quantization**

a. $\bot$ If this *eat apples*, then no proper subpart of it is *eat apples.*

b. $\top$ If this is *eat two apples*, then no proper subpart of it is *eat two apples.*

In light of these parallels, the interpretative properties of licit verbal comparatives is perhaps more interesting: that is, they manifest their own version of Schwarzschild's monotonicity restriction. Recall that, in the nominal domain, only

[10] It is difficult to show this pattern just with verb phrases like *run in the park* and *run to the park*, because of the difficulty of controlling for aspectual intepretation in English. In Spanish, for example, the same points about cumulativity and quantization hold if we use such descriptions with perfective aspect (S. Lago, p.c.).

dimensions for measurement that tracked part-whole relations on the extension of a noun like *coffee* were permitted for comparison: *more coffee* can express comparisons by volume or weight, but not by temperature. Larger portions of coffee have larger measures along monotonic dimensions, this is not necessarily or even likely so when they are measured along non-monotonic dimensions.

To see monotonicity in the event domain, consider a stretch of some running event, e, and two of its proper subparts, e' and e''. All of e, e', and e'' necessarily measure some degree by e.g. temporal duration, spatial distance, and speed, yet the sentences in (115) invoke only measures by duration or distance (Nakanishi 2007, Wellwood et al. 2012). Along such dimensions, the sum e necessarily measures a greater degree by temporal duration or distance than that of the parts e' and e''; however, arbitrary subparts of a running event may measure the same, a lesser, or even a greater degree of speed. The speed dimension thus represents a non-monotonic dimension on events.[11]

(115) a. Al **ran more** than Bill did. *speed, dur

b. Al **ran as much** as Bill did. *speed, dur

To express a comparison of stretches of an event along the speed dimension, one must use an adverb like *fast*, as in (116).

(116) a. Al **ran faster** than Bill did. speed, *dur

b. Al **ran as fast** as Bill did. speed, *dur

Monotonicity in the verbal domain means that, for any two events that are (properly) ordered in a part-of relation, their measurements are similarly ordered. We can thus generalize the statement of the monotonicity condition so that it is **neutral** with respect to the type of (at least) individuals and events.

[11]Importantly, with atelic *play* in the Bulgarian sentence in (110), the comparison expressed can only be by temporal duration. It can't be interpreted as a comparison by e.g. energy expended.

(117) **Monotonicity** *(final version)*

A measure function $\mu : D_{\preccurlyeq^{Part}} \mapsto D_{\leq^{Deg}}$ is **monotonic** iff:

for all $\alpha, \beta \in D_{\preccurlyeq^{Part}}$, if $\alpha \prec^{Part} \beta$, then $\mu(\alpha) \prec^{Deg} \mu(\beta)$.

The data discussed in this section suggest that part of the meaning of (verbal) *more* is something ensuring that only monotonic dimensions for measurement are available for comparison. Furthermore, verbal comparatives are not compatible with singularly-interpreted telic VPs. This can be seen, for example, with non-repeatable predicates like *graduate high school* in (109) in English. After formalizing the mereology-based analysis of atelic and telic verb phrases, I give a semantics for *much* in §3.3 that captures these patterns.

3.2. Formal preliminaries

This section formalizes the referential properties of noun and verb phrases that I will assume in this dissertation. Mereology-based approaches are designed to capture the fact that the domains of some nominal and verbal predicates are cumulative, while others are quantized. Meanwhile, I will suggest that *much* combines only with cumulative predicates. Here, cumulativity is modeled by appeal to structures called join semi-lattices, and quantization by appeal to a lack of such structures.

3.2.1. Operations

The major distinction to be encoded is that some expressions are most naturally interpreted as cumulative (*coffee*), and others as quantized (*idea*). A popular approach to modeling these interpretations is to posit that the domains of cumulative predicates have the structure of a **join semi-lattices** (and atomic or anti-atomic subsets thereof) whereas the domains of quantized predicates have no such structure.[12]

Join semi-lattices are, in set-theoretic terms, just *operations* (functions that map ordered pairs of entities to entities) with certain properties. The elements so paired are members of $D_\circ$ for an operation $\circ$, and the structure as a whole is notated $\langle D_\circ, \circ \rangle$.

An operation can have some or none of the properties *idempotence*, *commutativity*, *associativity*, and *closure*, among others. I briefly review each of these properties, giving intuitive examples where possible for illustration.

Idempotence is the property an operation has just in case each element x in its domain is such that $\langle x, x \rangle$ is mapped to x, (118). The operation MAX on a pair of numbers is idempotent, since for any n, $\text{MAX}(n, n) = n$. The operation $+$ on the domain of natural numbers $\mathbb{N}$ is not idempotent—a counter-example is: $1 + 1 \neq 1$.

(118) An operation $\circ$ is **idempotent** iff for all $x \in D_\circ$, $x \circ x = x$.

An operation is commutative just in case switching the order of the elements in the input pair fails to affect the value under the operation, (119). $+$ is commutative, since for every $n, m \in \mathbb{N}$, $m+n = n+m$. The operation $-$ on the domain of integers $\mathbb{I}$ is not commutative: a counter-example is $1 - 2 \neq 2 - 1$.

(119) An operation $\circ$ is **commutative** iff for all $x, y \in D_\circ$, $x \circ y = y \circ x$.

Associative operations are those for which application of the same operator in the first or second position of the input pair results in the same output, (120). $+$ is associative, since for all $m, n, p \in \mathbb{N}$, $m + (n + p) = (m + n) + p$. $-$ is not associative: a counter-example is $5 - (3 - 2) \neq 5 - (3 - 2)$.

(120) An operation $\circ$ is **associative** iff for all $x, y, z \in D_\circ$, $x \circ (y \circ z) = (x \circ y) \circ z$.

Finally, an operation can have the closure property: for any two elements

[12] This section owes a great debt to Gillon in prep.

in the domain of the operation, the pair of those elements has a value under the operation, (121). $+$ and $-$ are both closed on $\mathbb{N}$ and $\mathbb{I}$.

(121) A structure $\langle D_\circ, \circ\rangle$ is **closed** iff for all $x, y \in D_\circ$, there is a $z \in D_\circ$ such that $x \circ y = z$.

Now we can see how to encode the domain of application for *coffee* as forming a **join semi-lattice**. Join semi-lattices are operations that are idempotent, commutative, associative, and closed; such operations are often notated $\vee$, and called 'join'. Intuitively, join can be understood in terms of mereological summation (see esp. Simons 1987), often notated $\oplus$. $\vee$ on a set of portions of coffee is idempotent: taking a portion of coffee x with itself gives you no more, no less than x. It is commutative, since x taken together with an arbitrary portion of coffee y is the same whether x or y is taken first. It is also associative, by the same reasoning. And finally, it is closed, since one can take any two portions of coffee together to get their sum, which is itself a portion of coffee.

(122) A structure $\langle D_\vee, \vee\rangle$ is a **join semi-lattice** iff it is idempotent, commutative, associative, and closed.

This is how I will model cumulative reference. Previously, we talked about the denotations of expressions like *coffee* in terms of the part-of relation. Part-of relations are binary orders that are reflexive, antisymmetric, and transitive.[13] In fact, any domain that is so ordered defines a join semi-lattice, given the equivalence in (123). To see this, consider the two relevant cases: for any portions of coffee a and b, if $a \prec b$ then $a \vee b = b$, and if $a = b$ then $a \vee b = b$, and vice versa.

(123) **Equivalence between $\preccurlyeq$ and $\vee$**

For all $x, y \in D_{\preccurlyeq^{Part}}$, $x \preccurlyeq^{Part} y$ iff $x \vee y = y$.

[13]Part-of structures differ from the scale structures discussed in Chapter 2 only in that part-of relations are not **connected**. An equivalence ordering on a part-of structure **is** connected, however.

3.2.2. Nominal reference

We can use the notions just introduced to formalize the felt difference between mass and count noun denotations, in a manner consistent with the appeal to part-whole structures in their domains of application.[14] Mass nouns like *coffee* denote in domains with the structure of an **anti-atomic join semi lattice** and (singularly-interpreted) count nouns denote in domains of (unstructured) atomic entities.

An entity is *atomic* if, in a given domain (here, just the domain of individuals D_e) has no proper parts in the same domain, (124).

(124) **Atomicity** *(first version)*

For all $x \in D_e$, x is an **atom** iff there is no $y \in D_e$ such that $y \prec^{Part} x$.

A noun like *idea* is most naturally understood as applying to atomic entities. Thus, quantization of a predicate like this one can be modeled by appeal to a domain containing only atoms, (125). From this perspective, any entity satisfying $[\![$*traffic cone*$]\!]$ has no proper parts that also satisfy that predicate.

(125) **Quantization** *(first version)*

A predicate P is **quantized** iff for all $x \in D_P$, x is an atom.

The question of mass noun denotations is more subtle, turning essentially on whether they denote in domains that have atomic parts, (126). Here, $x \preccurlyeq^{Part} y$ is read as 'x is a subpart of y'. **Atomic join semi-lattices** are join semi-lattices that have minimal parts that are also atoms, (127).

(126) **Atomic parthood** *(first version)*

For all $x, y \in D_e$, x is an **atomic part** of y iff $x \preccurlyeq^{Part} y$ and x is an atom.

(127) **Atomic join semi-lattice** *(first version)*

A predicate P denotes an **atomic join semi-lattice** iff:

[14] This section owes a great debt to Champollion 2010 and Gillon 2012.

for all $x \in D_P$, there is a $y \in D_P$ such that y is an atomic part of x.

Anti-atomic join semi-lattices are join semi-lattices that do not have minimal parts, let alone atoms, (128). For any x in such lattices, there is always some y that is a proper subpart of x.

(128) **Anti-atomic join semi-lattice** *(first version)*

A predicate P denotes an **anti-atomic join semi-lattice** iff:

for all $x \in D_P$, there is a $y \in D_P$ such that $y \prec^{Part} x$.

The **anti-atomic theory** of mass nouns holds that all mass nouns denote anti-atomic join semi-lattices (Ter Meulen 1981, Link 1983, Roeper 1983, Bunt 1985, Lønning 1987, Landman 1989, Eschenbach 1992, Ojeda 1993, Higginbotham 1994, a.o.). The **atomic theory** holds that all mass nouns denote atomic join semi-lattices (Chierchia 1998a, 2010).[15] The **neutral theory** holds that mass nouns are **neutral** with respect to atomicity (Gillon 1992, Fox & Grodzinsky 1998, Fox 2000, Nicolas 2002, 2008, Bale & Barner 2009, Pelletier 1974).

As Gillon (2012) discusses, both the anti-atomic theory and the atomic theory arguably make incorrect predictions. Consider that 'mass noun' is a distributional label: it applies to those nouns that appear with *much* (as opposed to *many*), that are awkward with the plural morpheme, show singular subject-verb agreement, etc. The anti-atomic theory expects no mass noun to behave as if it has atoms in its denotation, whereas the atomic theory expects mass nouns to behave as though they do. The neutral theory expects mass nouns to sometimes behave as though they have atoms, and sometimes not.

The atomic theory has difficulty with nouns like *food*, which do not behave as though they have atoms, while the anti-atomic theory has a problem with nouns like *furniture*, which behave as though they do. First, observe that, by the traditional

[15] There are subtleties to Chierchia's account with respect to the 'vagueness' of the atoms, but we can set these aside.

distributional tests, e.g. (129), *food* and *furniture* are mass nouns.

(129) a. Al doesn't have **much food/furniture/?traffic cone** in his house.

b. Al wishes he had **?foods/?furnitures/traffic cones**.

However, $[\![$*food*$]\!]$ patterns as anti-atomic: all (relevant) parts of some food count as food. If $[\![$*food*$]\!]$ was atomic, we should be able to detect the atoms in its domain of application. Moreover, $[\![$*furniture*$]\!]$ patterns as atomic: while a chair counts as furniture, e.g., the legs of that chair do not. If $[\![$*furniture*$]\!]$ was anti-atomic, prima facie we should **not** be able to detect atoms. On the neutral theory, mass nouns are underspecified for atomicity, and so can capture the fact that the syntactic distribution in (129) does not determine the kind of join semi-lattice a given mass noun denotes.

What mass nouns like *furniture* and *food* do share is cumulativity. Two portions of food count as food, as does the sum of those portions; two chairs individually count as furniture, as do two chairs together. Therefore, we can define a cumulative predicate as one that denotes a join semi-lattice, (130).

(130) **Cumulativity**

A predicate P is **cumulative** iff P denotes a join semi-lattice.

Further restrictions on mass noun reference can, as on the neutral theory, be determined by the kind of noun it is. A substance mass noun like *coffee* denotes an anti-atomic join semi-lattice, while a superordinate mass noun like *furniture* denotes an atomic join semi-lattice. The important thing is that, on mereology-based approaches, a count noun like *traffic cone* fails to denote a semi-lattice, atomic or otherwise. It denotes only a set of atoms.

3.2.3. Verbal reference

We have seen that eventive verbal descriptions show a distinction that can be seen as parallel to the mass/count distinction, that between atelic and telic verb phrases. I briefly show how we can use the formalism just developed to model this parallel.

The relevant notion for distinguishing atelic from telic VPs is that which we used to distinguish mass from count noun phrases, namely, atomicity. Thus, we can give a generalized version of this property as in (131), where η is used to indicate neutrality with respect to types e and v.

(131) **Atomicity** *(final version)*

For all $\alpha \in D_\eta$, x is an **atom** iff there is no $\alpha' \in D_\eta$ such that $\alpha' \prec^{Part} \alpha$.

We have seen that telic VPs like *eat one's first cupcake* are not cumulative. Rather, they are quantized. The generalized version of that property can be given as in (132). From this perspective, any event satisfying *eat one's first cupcake* has no proper parts that also count as instances of *eat one's first cupcake*.

(132) **Quantization** *(final version)*

A predicate P is **quantized** iff for all $\alpha \in D_P$, α is an atom.

Correlatively, atelic verb phrases like *run* have the cumulativity property. Thus, by the scheme laid out here, they are posited to denote join semi-lattices. Parallel to the question for mass nouns, the question for these predicates is whether being an atelic verb phrase entails denoting an atomic or anti-atomic semi-lattice.

I conjecture that the neutral theory applies here as it did in the nominal domain. Some evidence supporting this is the contrast between verb phrases appearing with adverbial *much*. Atelic verb phrases like *run* and *bounce* are fine here, whereas telic verb phrases like *find a unicorn* are awkward (133), as we would expect if they are parallel to count nouns (cf. Bach 1986). However, while $[\![run]\!]$ patterns as anti-atomic (i.e., all parts of a running count as running), $[\![bounce]\!]$ patterns as atomic: while a single bounce counts as a bouncing, the parts of that bounce do not.

(133) Al **didn't run/bounce/?find a unicorn much** last night.

An instance of wiggling is a back and forth motion, as an instance of bouncing is a bodily motion upwards and back down; half of a single one of these motions would not count as an instance of the predicate.[16] In contrast, *run* and *sleep* have no discernable atomic parts. The differences in their interpretation can readily be seen when they combine with *for*-adverbials: while *wiggle* and *bounce* are interpreted **iteratively** (i.e., as expressing a series of back-and-forth, or up-and-down motions), *run* and *sleep* are interpreted **duratively**.

(134) a. Al **wiggled/bounced for an hour**.

b. Al **ran/slept for an hour**.

Such considerations suggest that, within the class of atelic VPs, there are expressions that denote anti-atomic join semi-lattices, and expressions that denote atomic join semi-lattices. Given this, we can generalize the earlier definitions of atomicity to include event predicates, as in (135)-(137).

(135) **Atomic parthood** *(final version)*

For all $\alpha, \alpha' \in D_\eta$, α is an **atomic part** of α' iff $\alpha' \preccurlyeq^{Part} \alpha$ and α is an atom.

(136) **Atomic join semi-lattice** *(final version)*

A predicate P denotes an **atomic join semi-lattice** iff:

for all $\alpha \in D_P$, there is a $\alpha' \in D_P$ such that α' is an atomic part of α.

[16] I am using semelfactive telic phrases here because they seem most like the verbal equivalent to *furniture* nouns, involving multiple, discrete objects (or rather, in this case, events).

(137) **Anti-atomic join semi-lattice** *(final version)*

A predicate P denotes an **anti-atomic join semi-lattice** iff:

for all $\alpha \in D_P$, there is a $\alpha' \in D_P$ such that $\alpha' \prec^{Part} \alpha$.

3.3. Measuring individuals and events

I have suggested that nominal and verbal comparative constructions are interpretable just in case the nouns or verb phrases that form the basis for comparison have cumulative reference. The previous section modeled cumulative predicates as those that denote join semi-lattices, and quantized (i.e., non-cumulative) predicates as those which are atomic. In this section, I present a compositional semantics that captures both the variability and constraints observed for comparatives, tying it to the interpretation of *much*.

Any analysis in this domain must capture that measurement in nominal and verbal comparatives is monotonic: i.e., only permitting dimensions for comparison that respect strict part-whole relations on the extension of the nominal or verbal predicate. Yet, this mapping is not determinate: indeed, TEMPERATURE is not available with *more coffee*, but VOLUME and WEIGHT are; and SPEED is not available with *run more*, but TEMPORAL DURATION and SPATIAL DISTANCE are. Given this, I must first address the question of what sort of indeterminacy *much* represents.

3.3.1. What kind of indeterminacy?

In the framework adopted in this dissertation, the semantic value of an expression like *coffee* is a **function**: applied to some entity, it has a determinate output, e.g. applied to some x of type e, $[\![coffee]\!]$ returns a truth value of type t. On the degree-theoretic analysis, GAs like *tall* are functions of a slightly different sort:

given an x, they return a degree of type d.[17] However, *much* is not determinate in the usual manner of functions. Cartwright (1975) demonstrated this indeterminacy already with examples like (138).

(138) There is **more water than sand** in these buckets **by volume**,
but **more sand than water by weight**.

If *much* introduces introduces measure functions in comparatives, as I and others have hypothesized it does, the question is: what sort of indeterminacy does it involve? I explore three types, the similarities and differences amongst which are explicated most lucidly by Gillon (2004), and ask how comparatives fair with respect to the same tests.[18]

Prima facie, the felt relatedness of the various senses of 'measure' invoked in comparatives speaks against an ambiguity hypothesis. Classic examples of lexical **ambiguity** involve sequences of sounds that associate with multiple, unrelated senses. In (139), the sounds of 'pen' are used to refer both a kind of writing implement and to a kind of animal enclosure.

(139) I lost my **pen** (with blue ink) in the **pen** (where I keep my pigs).

With respect to the tests presented below, **deixis** patterns much like ambiguity. Deixis typically involves pronominal expressions like *him* in (140), which require context to fix the intended referent.

(140) I saw **him** (the man you met yesterday).

Polysemy is similar to ambiguity in involving a sequence of sounds associated with more than one sense, yet differs in that there is a felt relatedness between those

[17] Some GAs are not so clear-cut. Kennedy & McNally 2010 diagnose ambiguity for *red* (i.e., in uses for talking about area versus intensity), yet there are perhaps further distinctions (see Chapter 4).

[18] V. Hacquard and A. Williams, p.c., contributed immensely to the discussion in the remainder of this section. Many of the examples are based on theirs, or on A. Williams' lecture notes.

senses: France, conceived of as a geographical region, can have the property of being hexagonal, (141a). Conceived of as a political entity, it can have the property of being a republic, (141b). These are distinct, while intuitively related, senses of the word.

(141) a. **France** (the geographical region) is hexagonal.

b. **France** (the polis) is a republic.

Generality is similar to polysemy, but applies to expressions that are neutral with respect to one or more specific senses, for instance *teacher* in (142). To be a teacher, one must teach some or other specific subject; however, the term itself is neutral with respect to the varieties of subject one might teach.

(142) Al is a **teacher** (of physics, or of math, or of linguistics, or...).

Broadly, tests for varieties of indeterminacy distinguish at least two main groups: ambiguity and deixis, on the one hand, and generality/polysemy on the other. I present just three of them (see others in Gillon 2004).

The first test is **distribution over conjuncts**. Sentences with ambiguous expressions do not allow for a single instance of the expression to simultaneously involve two of its senses, (143). Similarly, the entities referred to by deictic expressions cannot simultaneously involve distinct referents, (144).

(143) * Al and Bill both like **pens**;

that is, Al likes writing implements, and Bill likes places to keep pigs.

(144) * Al and Bill both like **her**; that is, Al likes Susie, and Bill likes Mary.

In contrast, polysemous and general expressions allow for just this kind of mixing and matching. It is possible to express that Al and Bill like different aspects of France using the first sentence in (145). Similarly, it is possible to express that

Al and Bill like teachers that cover different subjects in their classes with the first sentence in (146).[19]

(145) Al and Bill both like **France**;

that is, Al likes its governance structure, and Bill likes its shape.

(146) Al and Bill both like **teachers**;

that is, Al likes the physics teacher, and Bill likes the linguistics teacher.

To investigate how comparatives fare with respect to this test, consider this context (due to A. Williams, p.c.). Suppose that Al does landscaping, and Bill ships freight. Susie does both. Al's primary concern is covering space, and he has a large volume of pumice (a light and porous rock). Bill's primary concern is not sinking his ship, and he has a small volume of iron ore (a heavy and dense rock). Susie has medium amounts of both. This situation can be summarized as: Al's rock measures greater than Susie's rock by volume, but not by weight, and Bill's beats Susie's by weight, but not by volume. The question is: can (147) be true in such a context? My own judgment leans towards 'yes'; I have equally heard both 'yes' and 'no' from informants with about the same level of confidence.

(147) $^{?}$ Al and Bill both have **more rock** than Susie.

The **absurd denials** test checks whether it is required that a speaker have a particular sense of an expression in mind. Making an assertion with 'pen', followed by a claim of ignorance about which sense was intended is infelicitous, (148a).[20] It

[19] Tests by **pronominalization** cut the space similarly; consider the contrasts in (i)-(iv).

i. * My **pen**$_{writing\ implement}$ has blue ink, and **it**$_{the\ place\ I\ keep\ my\ pigs}$ is large.

ii. * I like **him**$_{Thiago\ Silva}$ because **he**$_{Neymar\ Jr}$ is handsome.

iii. **France**$_{geographical\ region}$ is hexagonal, and **it**$_{polis}$ is a republic.

iv. Al became a **teacher**$_{of\ physics}$, and **that**$_{become\ a\ teacher,\ e.g.\ of\ math}$ is what Bill wants to do.

[20] With quotative stress on *pen*, this probably improves.

seems crashingly bad to use a pronoun and then claim not to know the intended referent, (148b). However, it is fine to be familiar with France without knowing the shape of its geographical region, (148c), and to know that Al is a teacher without knowing which subject he teaches, (148d).

(148) a. ? I know Al has a **pen**,
but I don't know if it's a writing implement or an animal enclosure.

b. ? I know **him**, but I don't know who we are talking about.

c. I know **France**, but I don't know what shape it is.

d. I know Al is a **teacher**, but I don't know if he teaches physics.

Like the generality and polysemy examples, it seems fine to know that one individual has a greater measure of rock than another individual, without knowing which measure makes the comparison true, (149). If this judgment is robust, as I suspect it is, this speaks to an analysis of *much* in terms of generality or polysemy.

(149) ? I know that Al has **more rock** than Sue,
but I don't know if it's by weight or by volume.

Negation differentiates the same groupings. With 'pen', it is possible to assert of an entity that it is a writing implement but not a place to put pigs, using 'pen' twice without explicit elaboration, (150a). Similarly, with 'him', it is possible to pick out one of two possible antecedents to avoid contradiction, (150b). However, it is not possible to use 'France' to pick out the polis sense in one sentence, and the geographical region sense in a continuation, (150c). Finally, one cannot assert that an individual is not a teacher with the intention of asserting that they fail to teach a certain subject, (150d).

(150) a. My prize $\textbf{pen}_{\textit{writing implement}}$ is not a $\textbf{pen}_{\textit{place to put pigs}}$.

b. Al and Bill are both annoying. I really hate $\textbf{him}_{Al}$, but I don't hate Bill.

c. * **France**$_{polis}$ doesn't have a shape,

though as a matter of fact **France**$_{geographical\ region}$ is hexagonal.

d. * Al is not a **teacher**$_{of\ math}$, though in fact he teaches physics.

Consider now the comparative with respect to this last test, (151). Suppose Al has more pumice than Bill has iron ore by volume, yet the weight of the pumice is far less than the weight of the iron ore. In such a context, asserting denial of a true comparison by weight in the first sentence, is it fine to continue by asserting a true comparison by volume, (151)? Judgments are again mixed here.

(151) ? Al doesn't have **more**$_{by\ weight}$ rock than Bill does,

though in fact Al's rock takes up ten times as much space.

As noted, the results of the tests are mixed. Schwarzschild (2006) and Solt (to appear) suggest an index-based account for how measure functions are introduced in nominal comparatives, without quite spelling out the details. However, appealing to indices would suggest that *much* is a type of deictical or pronominal element. Indeed, this type of analysis is more consistent with widely-adopted techniques in the formal semantics literature. Yet, in certain cases, the tests seem to suggest the opposite conclusion; however, analysis of generality and polysemy have been far less worked out in formal semantics.

Here are what I understand the options to look like, in (152), where again η indicates neutrality with respect to individuals e and events v.

(152) a. **Index-based account of <u>much</u>**

$[\![\text{much}_\mu]\!]^A = A(\mu)$ type $\langle \eta, d \rangle$

b. **Polysemy-based account of <u>much</u>**

$[\![\text{much}]\!]^A = \lambda\alpha.\mu(\alpha)$ type $\langle \eta, d \rangle$

a. μ is a **metavariable**; or

b. μ is a **polymorphic function** (?)

On the index-based account, *much* has an index μ that is assigned to a particular measure function by the assignment function A. Here, μ (or μ', μ'', etc.) is a privileged variable name used to range only over functions of type $\langle \eta, d \rangle$. This is straightforward technically, while potentially conceptually odd given that the interpretation of *more* isn't exactly sensitive to the same tests as other pronominal expressions. Another difference is that a pronoun like *he* can potentially have a greater range of values than *much*.

Only a polysemy-based account, there are downsides to either version of its implementation. If μ is a metavariable, we need to now to know what an assignment function for the metalanguage looks like. Standardly, we assign entities in the model/world to variables directly; there is no infrastructure for an interpretation like this. On the other hand, if μ is a polymorphic function (i.e., it has a specific interpretation depending on the nature of its α argument), then expressions like *coffee* will themselves have to be analyzed as ambiguous. This seems unreasonable. Yet, if such expressions are not ambiguous, then there aren't two 'different things' that could lead a (even polymorphic) **function** to have two different measure functions as outputs.

Precisely the way in which *much* is indeterminate remains a delicate matter that I will not pretend to settle here. Given the difficulties just noted, however, for ease of implementation I will provide an index-based account of its semantics.

3.3.2. The proposal

I retain the interpretations of morphemes like *-er* and *as* from Chapter 2 as in (153). In light of the preceding discussion, I give an interpretation for *much* as in (154).[21] In (154), μ is an object language-level variable over functions of the

[21] My formulation builds on developments primarily in Schwarzschild 2002, 2006, Nakanishi 2007, and Wellwood et al. 2012, and Wellwood 2012a. I discuss alternative proposals in the next section. Wellwood 2012a in particular is much like the present approach, but differs in two ways: (i) $[\![\textit{much}]\!]$

measure function type, taking its value from the assignment function A.

(153) **Comparative morphemes**

i. $[\![\text{-er}]\!] = \lambda g \lambda d \lambda \alpha . g(\alpha) \succ d$ $\langle\langle\eta, d\rangle, \langle d, \langle\eta, t\rangle\rangle$

ii. $[\![\text{as}]\!] = \lambda g \lambda d \lambda \alpha . g(\alpha) \succcurlyeq d$

(154) **Interpretation of <u>much</u>** *(with restrictions)*

$[\![\text{much}_\mu]\!]^A = A(\mu)$ $\langle\eta, d\rangle$

Some examples are given in (155), for some assignment A.

(155) a. $A(\mu) = \text{VOLUME}$

b. $A(\mu') = \text{TEMPERATURE}$

c. $A(\mu'') = \text{TEMPORAL-DURATION}$

To capture the restrictions we've seen on nominal and verbal comparatives, $A(\mu)$, in any context and for any assignment A, must be restricted in the following ways: (i) the measured domain must be **structured**; (ii) the mapping to degrees must be **homomorphic**; and finally, (iii) the mapping must be **monotonic**. I discuss each of these properties in turn.

First, requiring that an α predicated of by $A(\mu)$ be structured amounts to the claim that α is in the domain of an ordering, $D_{\succcurlyeq\alpha}$. This ensures that (relevantly singular) count nouns and telic verb phrases are uninterpretable in the comparative; that is, if the domain of any expression is an unstructured, atomic subset of D_η, it is not measurable.

Requiring that the mapping is homomorphic ensures that the mapping to degrees preserves the structure of the measured domain. Homomorphic functions can be defined relative to binary relations or operations: that is, for any binary orders $\preccurlyeq_R$ and $\preccurlyeq_S$, (156), or, for any two join semi-lattices $\vee_M$ and $\vee_N$, (157).

has a $\langle d, \langle e, t\rangle\rangle$ interpretation, and (ii) it is not relativized to the assignment function A.

(156) A function $h : D_{\preccurlyeq_R} \mapsto D_{\preccurlyeq_S}$ is a **relational homomorphism** iff:

for all $\alpha, \beta \in D_{\preccurlyeq_R}$, $\alpha \preccurlyeq_R \beta$ if and only if $h(\alpha) \preccurlyeq_S h(\beta)$.

(157) A function $h : D_{\vee_M} \mapsto D_{\vee_N}$ is an **operational homomorphism** iff:

for all $\alpha, \beta \in D_{\vee_M}$, $h(\alpha \vee_M \beta) = h(\alpha) \vee_N h(\beta)$.

Finally, requiring that the mapping be monotonic is just a restatement of Schwarzschild's condition: not only must $A(\mu)$ preserve structure, it must preserve part-whole structure non-trivially. This captures the fact that VOLUME, WEIGHT and TEMPORAL DURATION, DISTANCE are permissible for the measure of $[\![$*coffee*$]\!]$ and $[\![$*run*$]\!]$, respectively, but TEMPERATURE and SPEED are not. Monotonicity is repeated in (158).

(158) A measure function $\mu : D_{\preccurlyeq^{Part}} \mapsto D_{\leq^{Deg}}$ is **monotonic** iff:

for all $\alpha, \beta \in D_{\preccurlyeq^{Part}}$, if $\alpha \prec^{Part} \beta$, then $\mu(\alpha) \prec^{Deg} \mu(\beta)$.

There is one further factor that must be made explicit. The value of μ understood in a given context of use depends not only on how entities are ordered, but what sort of entity they are. For example, *more coffee* cannot express a measure by (i) TEMPERATURE, or (ii) TEMPORAL DURATION. (i) is ruled out by the monotonicity condition, above. I submit that (ii) is ruled out because the relevant measure function, TEMPORAL-DURATION, is a function from events to degrees, (159i); entities that $[\![$*coffee*$]\!]$ is true of are not in the domain of such functions. Similarly, *run (in the park) more* cannot express measures by (i) SPEED, or (ii) VOLUME. (i) is ruled out by monotonicity; as above, I submit that (ii) is ruled out because VOLUME does not have events in its domain, (159ii). This seems intuitively correct.

(159) i. TEMPORAL-DURATION : $D_v \mapsto D_d$

ii. VOLUME : $D_e \mapsto D_d$

I turn next to the compositional details.

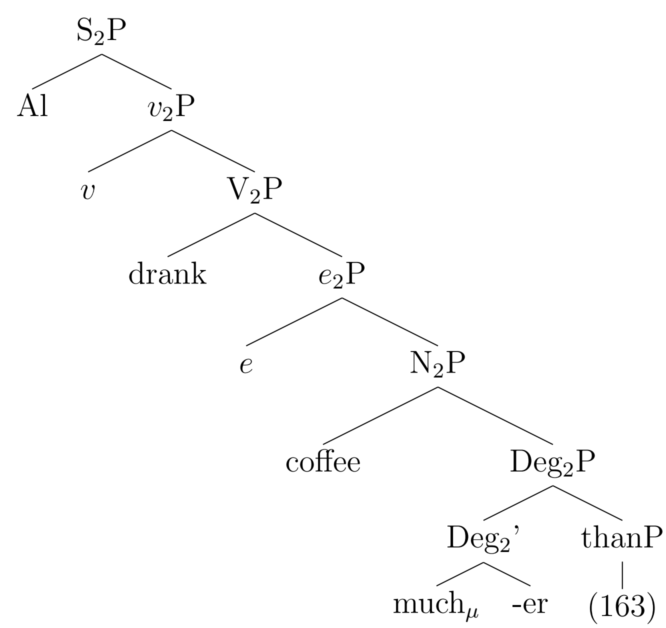
3.3.3. Composition: nouns

Comparatives with nouns are, at a surface-structural level, just like those with attributive adjectival constructions. The only difference with respect to the interpretation of those constructions that I posited in Chapter 2 is that *much* appears in the place of e.g. *hot*. This section presents the composition with *much*, and discusses how the result differs interpretively.

Consider the nominal comparative in (160), which I posit has the (simplified) structure in (163).

(160) Al drank **more coffee** than Bill did.

(161)



The composition of (161) is as in (162), with the *than*-clause abbreviated as δ. The result is an existential statement about events e of which Al was the agent, where e is a drinking of a quantity of coffee whose assigned measure is greater than δ.

(162) i. $\llbracket \text{Deg}_2\text{'} \rrbracket^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succ d$ IR,FA

ii. $\llbracket \text{Deg}_2\text{P} \rrbracket^A = \lambda \alpha . A(\mu)(\alpha) \succ \delta$ (i),FA

iii. $\llbracket \text{N}_2\text{P} \rrbracket^A = \lambda y . \textsc{coffee}(y) \;\&\; A(\mu)(y) \succ \delta$ (ii),PM

iv. $[\![e_2\mathrm{P}]\!]^A = \epsilon y[\textsc{coffee}(y) \ \& \ A(\mu)(y) \succ \iota\delta]$ (iii),FA

v. $[\![\mathrm{V}_2\mathrm{P}]\!]^A = \lambda e'.\textsc{drink}(e')(\epsilon y[\textsc{coffee}(y) \ \& \ A(\mu)(y) \succ \delta])$ (iv),FA

vi. $[\![v_2\mathrm{P}]\!]^A =$

$\lambda y \lambda e'.\mathrm{Agent}(e')(y) \ \& \ \textsc{drink}(e')(\epsilon y[\textsc{coffee}(y) \ \& \ A(\mu)(y) \succ \delta])$ (v),EI

vii. $[\![\mathrm{S}_2\mathrm{P}]\!]^A =$

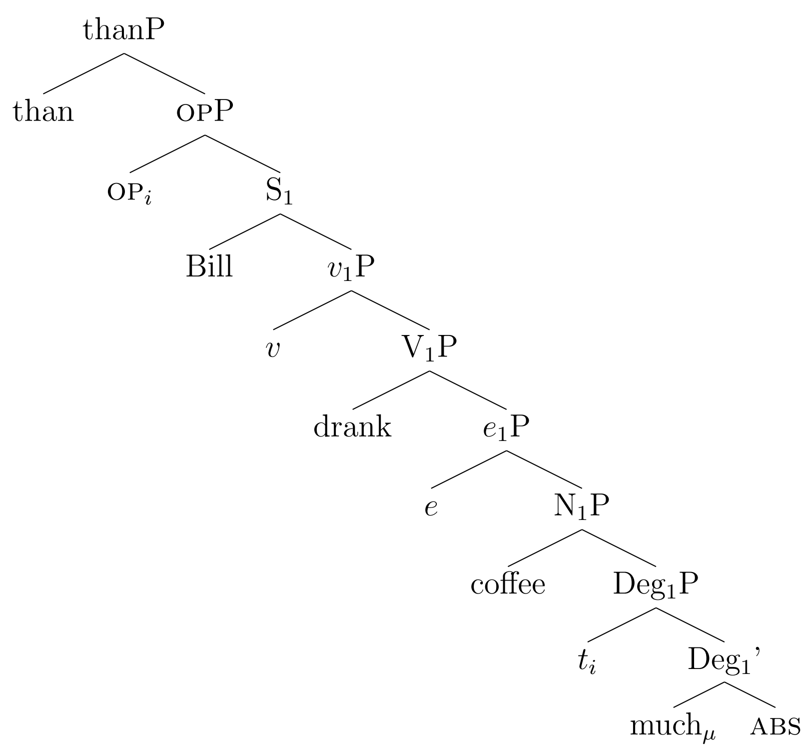
$\lambda e'.\mathrm{Agent}(e')(\mathrm{Al}) \ \& \ \textsc{drink}(e')(\epsilon y[\textsc{coffee}(y) \ \& \ A(\mu)(y) \succ \delta])$ (vi),FA

viii. $= \top$ iff

$\exists e'[\mathrm{Agent}(e')(\mathrm{Al}) \ \& \ \textsc{drink}(e')(\epsilon y[\textsc{coffee}(y) \ \& \ A(\mu)(y) \succ \delta])]$ (vii),$\exists$

The syntax I posit for the *than*-clause of (160) is as in (163). Note that, here and below, I assign the same index μ to the matrix and *than*-clause occurrences of *much*. The present system doesn't preclude these indices from being different, but I will assume that they are the same by default. The interpretation of (163) is given in (164).

(163)



(164) i. $[\![\mathrm{Deg}_1\text{'}]\!]^A = \lambda d \lambda \alpha.A(\mu)(\alpha) \succcurlyeq d$ IR,FA

ii. $[\![\mathrm{Deg}_1\mathrm{P}]\!]^A = \lambda \alpha.A(\mu)(\alpha) \succcurlyeq A(i)$ (i),IR,FA

iii. $[\![\mathrm{N_1P}]\!]^A = \lambda x.\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq A(i)$ (ii),PM

iv. $[\![e_1\mathrm{P}]\!]^A = \epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq A(i)]$ (iii),FA

v. $[\![\mathrm{V_1P}]\!]^A = \lambda e.\textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq A(i)])$ (iv),PM

vi. $[\![v_1\mathrm{P}]\!]^A =$

$\lambda y\lambda e.\mathrm{Agent}(e)(y)\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq A(i)])$ (v),EI

vii. $[\![\mathrm{S_1}]\!]^A =$

$\lambda e.\mathrm{Agent}(e)(\mathrm{Bill})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq A(i)])$ (vi),FA

viii. $= \top$ iff

$\exists e[\mathrm{Agent}(e)(\mathrm{Bill})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq A(i)])]$ (vii),$\exists$

ix. $[\![\textsc{op}\mathrm{P}]\!]^{A:Ai\to d} =$

$\lambda d.\exists e[\mathrm{Agent}(e)(\mathrm{Bill})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq d])]$ (viii),PA

x. $[\![\mathrm{thanP}]\!]^A =$

$\iota d[\exists e[\mathrm{Agent}(e)(\mathrm{Bill})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq d])]$ (ix),FA

Combining (162) and (164), (160) has the logical form in (165). The resulting interpretation is one that is predicted to be judged true just in case Al was the agent of a drinking event involving a portion of coffee whose assigned measure is greater than the assigned measure of some coffee Bill drank. In the context of *drink*, the relevant measure will likely be understood in terms of volume, though weight is possible; temperature, for the reasons discussed in the preceding section, is ruled out.

(165) $[\![$Al drank **more coffee** than Bill did$]\!]^A = \top$ iff

$$\exists e[\mathrm{Agent}(e)(\mathrm{Al})\ \&\ \textsc{drink}(e)(\epsilon y[\textsc{coffee}(y)\ \&\ A(\mu)(y) \succ \iota d[\exists e[\mathrm{Agent}(e)(\mathrm{Bill})\ \&\ \textsc{drink}(e)(\epsilon x[\textsc{coffee}(x)\ \&\ A(\mu)(x) \succcurlyeq d])]])]$$

This derivation (syntactic and semantic) is parallel to that of the attributive adjectival construction discussed in Chapter 2, whose logical form is reproduced in (166). The only difference between these logical forms is that $A(\mu)$ in (165) is replaced with HOT in (166). These truth conditions invoke a specific measure function, TEMPERATURE, rather than a variable over measures.

(166) $[\![\text{Al drank } \textbf{hotter coffee} \text{ than Bill did}]\!]^A = \top$ iff

$$\exists e'[\text{Agent}(e')(\text{Al}) \ \& \ \text{DRINK}(e')(\epsilon y[\text{COFFEE}(y) \ \& \ \text{HOT}(y) \succ$$
$$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \ \& \ \text{DRINK}(e)(\epsilon x[\text{COFFEE}(x) \ \& \ \text{HOT}(x) \succcurlyeq d])]])]$$

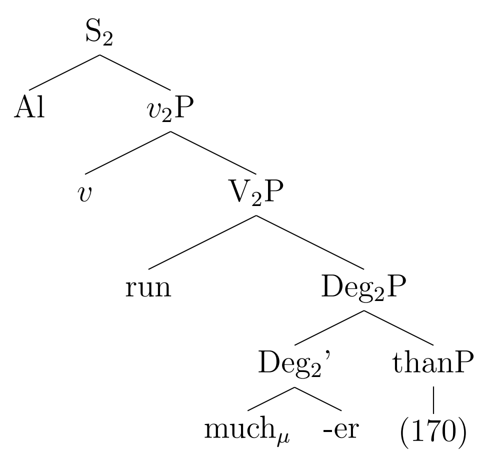
3.3.4. Composition: verb phrases

Comparatives with verb phrases are derived in a parallel fashion to those with adverbs. Consider the verbal comparative in (167).

(167) Al **ran more** than Bill did.

I posit that the matrix clause of (167) has the underlying structure in (168), and its interpretation is derived as in (169), again abbreviating the *than*-clause with δ.

(168)



(169) i. $[\![\text{Deg}_2\text{'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succ d$ IR,FA

ii. $[\![\text{Deg}_2\text{P}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succ \delta$ (i),FA

iii. $[\![\text{V}_2\text{P}]\!]^A = \lambda e' . \text{RUN}(e') \ \& \ A(\mu)(e') \succ \delta$ (ii),PM

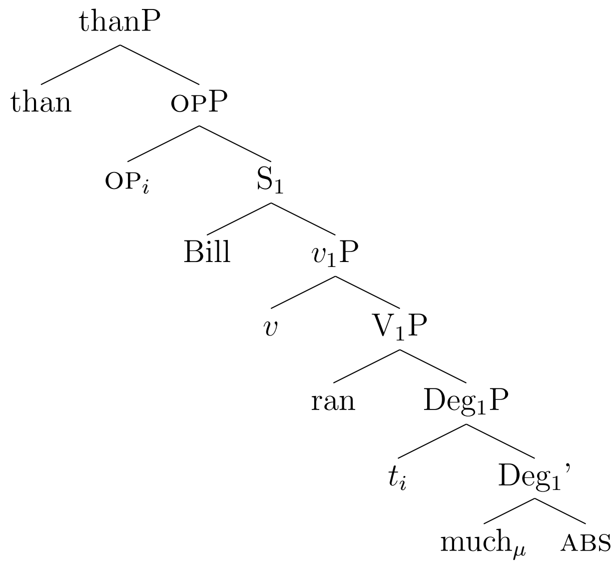
iv. $[\![v_2\text{P}]\!]^A = \lambda x \lambda e' . \text{Agent}(e')(x) \ \& \ \text{RUN}(e') \ \& \ A(\mu)(e') \succ \delta$ (iii),EI

v. $[\![\text{S}_2]\!]^A = \lambda e' . \text{Agent}(e')(\text{Al}) \ \& \ \text{RUN}(e') \ \& \ A(\mu)(e') \succ \delta$ (iv),FA

vi. $= \top$ iff $\exists e'[\text{Agent}(e')(\text{Al})\ \&\ \textsc{run}(e')\ \&\ A(\mu)(e') \succ \delta]$ (v),∃

The *than*-clause of (167) is posited to be like that in (170), and its interpretation is as in (171).

(170)



(171) i. $[\![\text{Deg}_1\text{'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succcurlyeq d$ IR,FA

ii. $[\![\text{Deg}_1\text{P}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succcurlyeq A(i)$ (i),IR,FA

iii. $[\![\text{V}_1\text{P}]\!]^A = \lambda e . \textsc{run}(e)\ \&\ A(\mu)(e) \succcurlyeq A(i)$ (ii),PM

iv. $[\![v_1\text{P}]\!]^A = \lambda x \lambda e . \text{Agent}(e)(x)\ \&\ \textsc{run}(e)\ \&\ A(\mu)(e) \succcurlyeq A(i)$ (iii),EI

v. $[\![\text{S}_1]\!]^A = \lambda e . \text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ A(\mu)(e) \succcurlyeq A(i)$ (iv),FA

vi. $= \top$ iff $\exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ A(\mu)(e) \succcurlyeq A(i)]$ (v),∃

vii. $[\![\textsc{op}\text{P}]\!]^{A:Ai \to d} = \lambda d . \exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ A(\mu)(e) \succcurlyeq d]$ (vi),PA

viii. $[\![\text{thanP}]\!]^A = \iota d[\exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{run}(e)\ \&\ A(\mu)(e) \succcurlyeq d]]$ (vii),FA

The resultant interpretation is given in (172), and is one that is predicted to be judged true just in case Al is the agent of a running event whose assigned measure is greater than the measure assigned to a running event by Bill. The relevant measure here can be one of temporal duration or distance, but not speed.

(172) $[\![$Al **ran more** than Bill did$]\!]^A = \top$ iff

$$\exists e'[\text{Agent}(e')(\text{Al}) \ \& \ \textsc{run}(e') \ \& \ A(\mu)(e') \succ$$
$$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \ \& \ \textsc{run}(e) \ \& \ A(\mu)(e) \succcurlyeq d]]]$$

The interpretation of the comparative with gradable adverbs was derived in Chapter 2; it is reproduced in (173). An utterance of (173) is predicted to be judged true just in case Al is the agent of a running event whose measure by speed exceeds that of a running event by Bill. As with comparatives with GAs like *hot*, here the more specific measure—SPEED—is invoked via the GA *fast*.

(173) $[\![\text{Al ran } \textbf{faster} \text{ than Bill did}]\!]^A = \top$ iff

$$\exists e'[\text{Agent}(e')(\text{Al}) \ \& \ \textsc{run}(e') \ \& \ \textsc{fast}(e') \succ$$
$$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \ \& \ \textsc{run}(e) \ \& \ \textsc{fast}(e) \succcurlyeq d]]]$$

This theory represents a natural extension of the standard so as to account for nominal and verbal comparatives. It is formulated so that the restriction to monotonic dimensions for measurement is a consequence of the meaning of *much*. The definedness conditions on that expression ensure two things: it will be interpretable only with predicates whose domains are ordered; and, the measure functions it can be assigned by A must be homomorphic to such orderings. Which dimensions for measurement are available, then, depends on the sort of thing that $A(\mu)$ applies to. If its α argument is a portion of coffee, TEMPERATURE is not a grammatical dimension for measurement; if it is an event, SPEED is not.

In Schwarzschild (2006), the restriction to monotonic measures is tied to the presence of a silent head that he called Mon°. On that account, *much* denotes a predicate of the degrees Mon° introduces. Similar proposals are compositionally implemented by Rett (2008) and (Solt, 2009, to appear). I next justify my theoretical choices against theirs.

3.4. On much

In this section, I point to other analyses of (the string) *much* found in the literature. Some of them I will not examine in too much detail as the linguistic environments they focus on are too far removed from those that are the focus of this dissertation, and the consequent analyses quite different from that I propose. This is not to indicate that, if a univocal account of *much* is desired, these accounts could not be modified to fit the cases I focus on as well. I sketch these details as necessary.

Kennedy & McNally (2005) focus mainly on degree modifier occurrences of *much*, contrasted with e.g. *very*, (174). Their goal was to determine which properties of deverbal adjectives like *acquainted*, *needed*, and *surprised* could explain why these modifiers seem acceptable with some and not with others. Ultimately, they propose that such modifiers are sensitive to different properties of the adjective's scale structure, which, they suggest, are intimately related to the event structure denoted by their verbal root.

(174) a. The vacation was **much**/?very needed.

b. The congressman was ?much/**very** surprised by the election results.

As for *much*, Kennedy & McNally suggest that this expression only combines with adjectives associated with bottom-closed scales (for details of such scalar properties, I refer the reader to their paper; see also Rotstein & Winter 2004), assigning it the interpretation in (175). This is very much like the interpretation standardly assigned to the POS morpheme, but different in that the standard it invokes is the minimal element of the scale associated with its GA argument, S_g. If a GA fails to have a minimal element, then it will not combine with *much*.[22]

[22] I have modified Kennedy & McNally's denotation in (175) somewhat, which was given in the $\langle d, \langle e,t\rangle\rangle$ type of GAs assumed in their paper. It is reproduced here for completeness: $\lambda g_{\langle d,\langle e,t\rangle\rangle}\lambda x.\exists d[d > !!\text{MIN}(S_G)\ \&\ G(d)(x)]$.

(175) $[\![\text{much}_{KM}]\!] = \lambda g \lambda x.g(x) \succ !!\textsc{min}(S_G)$

I have not built on this interpretation for *much* in the preceding section as, as can readily be seen, it will not compose with the denotations I have assumed for *coffee* or *run*—those expressions denote properties of individuals/events, not measure functions. If (175) was the meaning of *much* needed for nominal and verbal comparatives, there would have to be some other expression that introduces degrees in these constructions.

Moreover, there are empirical issues with Kennedy & McNally's proposal as it stands. By the test of interpretability with *slightly*, *wet* and *closed* are associated with bottom-closed scales (e.g. *slightly wet*, *slightly closed*). If that's so, both should be acceptable with *much*; yet, they are anomalous here, (176).

(176) a. ? The towel is **much wet**.

b. ? The door is **much closed**.

Rett (2008) and Solt (to appear) propose a semantics in which expressions like *much* are not predicates of individuals (or events), but of scalar intervals (i.e., a (convex) set of degrees; this interpretation of *much* is suggested by Schwarzschild 2006). Both accounts share with Kennedy & McNally's that when *much* appears in nominal and verbal comparatives, degrees are introduced by a separate head. I now discuss how and why the present proposal departs from these accounts.[23]

Rett (2008) is primarily motivated to provide a unified account of determiner and comparative-question occurrences of *much*. She suggests that *much*/*many* has a fairly bleached semantics, mapping a scalar interval to a set of degrees, i.e. the singleton set representing the length of the input interval, (177i). A null head, QUANTITY (177ii), maps nominal meanings to the requisite degrees. The μ predicate

[23] I do not discuss yet other alternatives, e.g. those found in Svenonius & Kennedy 2006, or Grano & Kennedy 2012, as their motivating data, and resultant analyses, are yet more distant from the present discussion.

here is assumed to function much like the interpretation of Schwarzschild's Mon°.[24]

(177) i. $[\![\text{much/many}_R]\!] = \lambda D \lambda d'[\textsc{length}(D) = d']$ $\langle\langle d,t\rangle,\langle d,t\rangle\rangle$

ii. $[\![\textsc{Quantity}]\!] = \lambda P \lambda d \lambda Q.\exists x[P(x)\ \&\ Q(x)\ \&\ \mu(x) = d]$

The present chapter has not been concerned with so-called determiner occurrences of *much* (e.g. *much soup spilled*); in this, I would assume a modified version of von Stechow's (1984) account of such occurrences, which features a POS morpheme along with *much*. The combination *much coffee* would denote a predicate of individuals that measure to a significant extent (see Chapter 2), and this in turn would combine with little-*e* before composing with the verb or Voice head. (On von Stechow's account, this POS itself has a determiner sematics; I would not assume this outright, if the same POS is to be used for verbal occurrences of *much*).

For now, note that (177) cannot be used in an account of the data I have discussed in this chapter. To see why, consider that something must introduce a measure function for *-er/as* with nouns in English. We have overt evidence in such contexts that *much/many* is present; however, given Rett's proposal, it can't be that *much/many* performs that function: it does not introduce measures. The type of QUANTITY could be adjusted so that it basically just encodes for μ; then the question is whether both *much/many* and QUANTITY are required; I return to this question below.

Solt (to appear) offers an account very much like mine, but with a crucial difference. Like Rett, she also interprets *much/many* as a map between degrees and intervals. Her account differs in that the null head she posits to introduce degrees with nominals, Meas, has a simpler compositional interpretation than that Rett posits for QUANTITY. In fact, it is practically identical to the interpretation I assign to *much*.[25]

[24] These denotations presuppose the GQ analysis of *-er/as* discussed at the end of Chapter 2. That difference will not affect what I say below.

[25] Again, the order of λs, and the overt λ for the degree argument do not matter for present

(178) a. **Much soup** was spilled.

b. The **many books** fell.

c. John is **generous**, perhaps **too much so**.

d. John read **as many books** as Bill did.

(179) i. $[\![\text{much/many}_S]\!] = \lambda d \lambda I.I(d)$ $\langle d, \langle\langle d,t\rangle, t\rangle\rangle$

ii. $[\![\text{Meas}]\!] = \lambda x \lambda d.\mu(x) \geq d$ $\langle e, \langle d,t\rangle\rangle$

As Solt discusses, an account like the one I advocate is flexible enough to handle the cases hers does; this is due to the fact that the interpretation she assigns to *much/many* has little compositional consequence, and my *much* and her Meas are practically identical. The question, then, is, for Solt and Rett: why not appeal to a single expression, *much*, as opposed to two?

Solt suggests that appeal to a single head cannot explain (180a)-(180b). Without going into detail, I will simply suggest that the asymmetry between (180a) is likely independent of the interpretation of *much*. This pattern could relate more generally to how mass (*vegetation*) versus count terms (*amount*) interact with verbal predicates. Lønning (1987) and Higginbotham (1994) discuss cases like those in (181a)-(181b), exploring the idea that mass terms require homogeneous predicates, which *weighed two grams* is not. In this regard, consider that the same unacceptability persists in (181b) whether *much* is present or not.[26]

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purposes. Our accounts of *much*/Meas otherwise differ in that Solt seems to assume that μ is a metavariable, see the indeterminacy discussion above.

[26] Interestingly, whatever is wrong with (181b) is fixed by prefixing the definite article to *water*, (i), yet this doesn't salvage *much water* (ii). My own judgments are unclear about whether (180b) improves with the definite article, (iii). It is not obvious that either of Solt's or my account can capture these patterns, thus it remains an open question whether data like (180a)-(180b) can be used to argue for her approach.

i. The water weighed two grams.

ii. * The much water weighed two grams.

iii. ? The vegetation that survived the draught wasn't much.

(180) a. * Vegetation that survived the draught wasn't much.

b. The amount of vegetation that survived the draught wasn't much.

(181) a. (Much) water boiled.

b. * (Much) water weighed two grams.

More importantly, a major motivation for a two-head analysis in nominal comparative constructions is the assumption that gradable adjectives denote measure functions, as maintained by the standard theory. Consider an example from Corver (1997) that Solt discusses, (182). Corver, like Bresnan (1973), posits the existence of a head that uniformly appears between *too* and its complement XP, for any lexical category X. Here, the semantics of *so* is said to be identical to *generous*, but its syntax different enough that *much* must be 'inserted' to support that null head.[27]

(182) John is **generous**, perhaps **too much so**.

Indeed, how could *much* appear with an expression with the same semantics as a GA, if both *much* and GAs denote measure functions? A reasonable hypothesis, precisely that of Rett and Solt, is that the semantics of *much* amounts to little more than interpretation as the identity predicate. Correspondingly, preserving the type-theoretic distinction between GAs and nouns requires a distinct null head to introduce degrees in nominal comparatives.

It turns out, then, that if GAs do not denote measure functions (as I will argue in the next chapter), the important difference between the account I offer and those advocated by Rett and Solt effectively disappears: instead of being uniformly (relatively) uninterpreted, *much* can act as a general purpose measure function, regardless of the syntactic category of expression targeted for measurement, no additional null heads required.

[27] I discuss these data in more detail in the next chapter.

3.5. Overgeneration?

Before continuing, one may wonder, if the interpretations of *much*, and expressions like *-er* and *as* are as general as I have suggested they are, why certain intuitively unacceptable comparatives are in fact unacceptable. For example, why not mix and match nominal and verbal loci of comparison, if both can be measured by, e.g., temporal duration, (183)? As given, the theory I have developed might be thought to overgenerate.[28]

(183) Al has **more time** than Bill **ran**.

To see why, consider first the sentences in (184), with a simplified representation of the underlying syntax that I have assumed is elided represented in parentheses. (184a) expresses a comparison by temporal duration, as does (184b); the only difference is that the former is a nominal comparative and the latter is a verbal comparative.

(184) a. Al has **more time** than Bill does (have time).

b. Al **ran more** than Bill did (run).

In (185), the matrix and *than*-clauses of (184) are mixed and matched. The result of such mixing and matching seems, on the face of it, odd. The question is, why? If both ⟦*time*⟧ and ⟦*ran*⟧ can be measured by something like TEMPORAL-DURATION, the results of this mixing and matching should be straightforwardly interpretable, just like the sentences in (184). Nothing I have said so far rules that out.

(185) a. ? Al has **more time** than Bill **ran**.

b. ? Al **ran more** than Bill has **time**.

[28]This potential issue arises for any theory that attempts to account for both nominal and verbal comparatives in terms of a univocal *much* and *-er*.

Conducting an informal survey of judgments on Twitter for the sentence in (185a), responses ranged from "totally out" to "totally fine", with L. Velleman and L. Ackerman suggesting that they improve with contrastive focus on the verbs. L. Velleman, in particular, provided the contextual support in (186), offering the intuition that sentences like (185) in such contexts are in fact straightforwardly interpretable as expressing comparisons by temporal duration.

(186) Context: There's a race where the goal is to get as far as possible in a limited time, and you're required to spend some of that time running and some of that time walking. But the referee screwed up, and gave Al way too much running time, and [the sports announcer—AW] says:
"Al HAD more time than Bill RAN, so he [Al] can still go a little further."

But is this just a matter of "we can make sense of it", meanwhile the sentences are in fact ungrammatical or uninterpretable? Regardless, there is definitely some oddity surrounding (185).[29] The issue would be with the very general meaning I have assigned to the comparative morpheme, repeated in (187i), wherein α is neutral with respect to entities in D_e and events in D_v. Since the *than*-clause delivers only a degree, denoting the function in (187ii), the type of entities compared in the two clauses should be allowed to freely vary so long as the degrees are ordered with respect to one another.

(187) i. $[\![\text{-er}]\!] = \lambda g \lambda d \lambda \alpha . g(\alpha) \succ d$

ii. $[\![\text{than}]\!] = \lambda D . \iota d[D(d)]$

There are three options that could explain the oddity: (i) something having to do with syntax and the interactions between ellipsis and comparative clauses; (ii) a kind of metaphysical issue with comparing measures of *time* with measure of

[29] The fact that prosodic prominence improves such examples could be suggestive; I discuss related phenomena in Chapter 6.

events; or (iii) we haven't yet got the types right for expressions like *-er*. I will briefly explore each of these possibilities in turn.

With respect to (i), it may be that, for reasons that are not well understood, locality restrictions on ellipsis lead to ill-formed *than*-clauses in the examples in (185). Such restrictions have been discussed extensively for comparatives Lechner 2001), gapping (Ross 1970; see Kennedy 2001a), sluicing (Fox & Lasnik 2003) and e.g. *either/or* constructions (Schwarz 1999). If the syntax of comparatives conspires to ensure that the *than*-clause of a sentence like (185a) is like that in (188),[30] such a *than*-clause would be, I presume, ill-formed for independent reasons.[31]

(188) Al has more time than Bill ran (time)

With respect to (ii), perhaps the examples in (185) are odd for the same reason that comparisons like *Al is taller than Bill is happy* are: the outputs of the measure functions in each of the clauses are not degrees that are ordered on the same scale (see Chapter 4 for extensive discussion of this phenomenon). That is, as A. Williams (p.c.) puts it, "time doesn't take time": while it is indeed possible to measure running events in the *than*-clause by temporal duration, is it actually possible to measure times by temporal duration? If it's not, this would explain the oddity of (185): it is an an issue with incommensurable scales.[32]

With respect to (iii), perhaps I have not yet assigned the right interpretation to the comparative morphemes. Kennedy (1998) suggests an analysis (citing antecedents in Klein's 1980 GPSG and Larson's 1988b GB implementations) which assumes a higher type for comparative morphemes and the internals of the *than*-clause which has the effect of ensuring that the same measure function from the

[30]Perhaps having to do with a phenomenon that has been called 'scopal parallelism' (e.g. Fox 2000, Fox & Lasnik 2003; thanks to M. Yoshida for discussion of this point.)

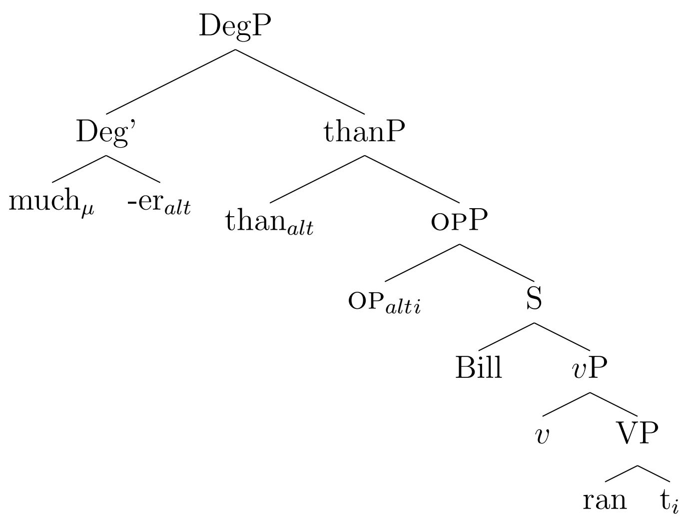
[31]However, see Kennedy 1998 for arguments that 'comparative deletion' constructions do not in fact reflect deletion.

[32]R. Schwarzschild (p.c.) gives an example like *Al gave more attention to Susie than Bill ran* that avoids this potential confound.

matrix clause is reproduced in the *than*-clause. Kennedy's motivations are different from the present ones, so I will provide an account in the same spirit but that differs in the details.

On such an account, the degree phrase in (183) would have the (simplified) syntax in (189), and the alternative interpretations for *more* and *than* would be as given in (190i) and (190ii). Here, OP is an operator that raises and leaves a trace of type $\langle \eta, t\rangle$. This trace will be abstracted over at OPP to deliver a predicate of type $\langle\langle \eta, t\rangle, t\rangle$, which acts as the input to $[\![\textit{than}]\!]$. Combined with that argument, it returns a function of type $\langle\langle \eta, d\rangle, d\rangle$—a function from measure function types to degrees. $[\![\textit{-er}]\!]$ takes such a type as its second argument, and feeds the interpretation of *much* to it. Noteworthy on this account is that ABS is dispensed with.

(189)



Considering the denotations in (190), I assume that these functions are such that: if the type of an input argument is v, then the type of the output must be interpreted relative to v. Only by typing *-er* so that it makes reference both to the type measured in the matrix and the *than*-clause will a type-theoretic solution to the matter work out. Note that C in (190ii) is the denotation of OPP in (189).

(190) i. $[\![\text{more}_{alt}]\!]^A = \lambda g : g \in D_{\langle \eta,d\rangle}.\lambda \mathcal{G} : \mathcal{G} \in D_{\langle\langle \eta,d\rangle,d\rangle}.\lambda x : x \in D_\eta.\ g(\alpha) \succ \mathcal{G}(g)$

ii. $[\![\text{than}_{alt}]\!]^A = \lambda C : C \in D_{\langle\langle \eta,t\rangle,t\rangle}.\lambda g : g \in D_{\langle \eta,d\rangle}.\iota d[C(\lambda\alpha.g(\alpha) \succcurlyeq d)]$

The interpretation of the thanP is derived as in (191). I have indicated FA in (191i) because t_i will be interpreted as a function of type $\langle \eta, t\rangle$; that is, $A(i)$ in this context is only interpretable if it is of predicate type. I have also broken down the steps of λ-conversion at thanP so that it is more easily seen how that interpretation is derived. The result for thanP is a property of measure functions that map Bill's running events to degrees, (191ix).

(191)
i. $[\![\text{VP}]\!]^A = \lambda e.\textsc{run}(e)\ \&\ A(i)(e)$ FA

ii. $[\![v\text{P}]\!]^A = \lambda x \lambda e.\text{Agent}(e)(x)\ \&\ \textsc{run}(e)\ \&\ A(i)(e)$ (i),EI

iii. $[\![\text{S}]\!]^A = \lambda e.\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ A(i)(e)$ (ii),FA

iv. $= \top \text{ iff } \exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ A(i)(e)]$ (iii),$\exists$

v. $[\![\textsc{op}\text{P}]\!]^{A:Ai \to P} = \lambda P.\exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ P(e)]$ (iv),PA

vi. $[\![\text{thanP}]\!]^{A:Ai \to P} =$

$[\lambda C \lambda g.\iota d[C(\lambda\alpha.g(\alpha) = d)]]\ (\lambda P.\exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ P(e)])$ (v),FA

vii. $= \lambda g.\iota d[[\lambda P.\exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ P(e)]](\lambda\alpha.g(\alpha) \succcurlyeq d)]$

(vi),λc

viii. $= \lambda g.\iota d[\exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ [\lambda\alpha.g(\alpha) \succcurlyeq d](e)]]$ (vii),λc

ix. $= \lambda g.\iota d[\exists e[\text{Agent}(e)(\text{Al})\ \&\ \textsc{run}(e)\ \&\ g(e) \succcurlyeq d]]$ (viii),λc

The remainder of the derivation of the DegP would be as in (192). At Deg', the phrase is still neutral with respect to entities and events. However, let us assume that, when a polymorphic function like -*er* combines with something of a type like v, it resolves to 'eventive' *more*, and all of its αs now must come from the same domain of basic entities. By assumption, then, when it combines with the *than*-phrase, its remaining αs must be of type v. The result, then, is a property of events whose measure exceeds the measure of Bill's running event. Assuming that *time* expresses a property of times, it will not now be possible to combine this DegP with it: even **if** $[\![\textit{time}]\!]$ and $[\![\textit{run}]\!]$ are in the domain of a measure function for temporal duration, since the two are not predicates of the same (primitive) type, the result will not be interpretable.

(192) i. $[\![\text{Deg'}]\!]^A = \lambda\mathcal{G}\lambda\alpha.A(\mu)(\alpha) \succ \mathcal{G}(A(\mu))$

ii. $[\![\text{DegP}]\!]^A =$

$[\lambda\mathcal{G}\lambda\alpha.A(\mu)(\alpha) \succ \mathcal{G}(A(\mu))](\lambda g.\iota d[\exists e[\text{Agent}(e)(\text{Al}) \ \&\ \textsc{run}(e) \ \&\ g(e) \not\succcurlyeq d]])$

(i),FA

iii. $=$

$\lambda e'.A(\mu)(e') \succ [\lambda g.\iota d[\exists e[\text{Agent}(e)(\text{Al}) \ \&\ \textsc{run}(e) \ \&\ g(e) \not\succcurlyeq d]]](A(\mu))$

(ii),λ-calc

iv. $=$

$\lambda e'.A(\mu)(e') \succ \iota d[\exists e[\text{Agent}(e)(\text{Al}) \ \&\ \textsc{run}(e) \ \&\ A(\mu)(e) \not\succcurlyeq d]]$ (iii),λc

Should this last option be the most adequate way of capturing the oddity of sentences like (183), the higher-typed versions of the interpretation of *-er* and *than* could be substituted as desired for the lower-typed versions I will continue to use.[33] As these types and calculations are quite involved, as well as not very familiar to the literature, the simplified presentation will be more appropriate in what follows.

3.6. Conclusion

The theory developed in this chapter extended the standard degree-theoretic semantics of comparative constructions to the nominal and verbal domain. For all the similarity between the compositional interpretation I assigned to *much*, and that which the standard theory assigns to GAs, there are a number of important differences.

First, $much_\mu$ does not express a particular measure function, but is assigned

[33] In fact, only for comparatives with a single adjective type. For 'subcomparatives' like those discussed in the next chapter, one would have to retain a deletion-style analysis to get the interpretations right.

one from among a class that are monotonic with respect to the ordering relations on its input argument. Second, it imposes a condition of 'measurability' on that input. Neither of these conditions, monotonicity or measurability, are observed on the standard account of gradable adjectives.

To see the lack of a monotonicity restriction with GA comparatives, consider again *Al drank hotter coffee than Bill did* and *Al ran faster than Bill did* with the relevant portions of logical form in (193a)-(193b), abbreviating the interpretation of the *than*-clause with δ. What COFFEE is true of is also the input to the measure function HOT. The temperature dimension that HOT involves is, as we've seen, non-monotonic on the domain of entities that COFFEE applies to: it represents non-monotonic measurement on such a domain. The same holds, mutatis mutandis, for FAST with respect to running events.

(193) a. $\ldots\textsc{hot}(x) \succ \delta \ \&\ \textsc{coffee}(x)\ldots$

b. $\ldots\textsc{fast}(e) \succ \delta \ \&\ \textsc{run}(e)\ldots$

To see the lack of a measurability distinction, consider that comparatives with GAs like *hot* combine perfectly well with singular count nouns, (194a), as do those with *fast* with singularly-interpreted telic verb phrases, (194b). GA measure functions are apparently insensitive to whether the domain they measure is ordered or not.

(194) a. Al ate **a hotter sandwich** than Bill did.

b. Al **ran to the store faster** than Bill did.

In contrast, anomalous comparative constructions with GAs are usually thought to be the result of the lexical semantics of the relevant adjective or adverb. As we saw in Chapter 2, non-gradable adjectives and adverbs represent a kind of category mistake in comparative constructions because, so the standard theory holds, they fail to denote measure functions, (195).

(195) a. ? Al has a **more wooden piece of wood** than Bill does.

b. ? Al **worked more hourly** than Bill did.

Combining the standard theory of GAs with that just offered for nouns and verbs entails that non-gradable adjectives, which are not interpretable in the comparative, and mass nouns, which do, are assigned the same logical type—that of properties, whether of type $\langle e, t\rangle$ or $\langle v, t\rangle$. That is, on the face of it, we might have expected that ruling out *more wooden* on the basis of semantic type would lead to ruling out *more water* as well. Thus, while the theory provides a certain degree of uniformity (i.e., the interpretation of degree words like *-er* and *as* remain constant), it may not yet provide explanatory uniformity.

I argue in the next chapter that GAs are not really so different from nouns and verbs as the standard theory suggests. I consider distributional, morphosyntactic, compositional, and semantic evidence to the effect that GAs do not in fact denote measure functions. Following Landman (2000) and Fults (2006), I determine that GAs instead denote neodavidsonian predicates of states. Further, if GAs do so denote, it will be possible for *much* to measure their domains of application.

The theory that I propose next is one in which there is only one way of introducing degrees into the compositional semantics of sentences containing degree words: via *much*. This idea, we will see, is supported by morphosyntactic evidence discussed by Bresnan (1973) (cf. Corver 1990). Once we have seen how adjectival domains might be structured, we have all the tools we need to advance this alternative conception.

Chapter 4: Revisiting the standard theory

Nominal and verbal comparatives can be given a uniform compositional semantics that leaves the basic architecture of the standard theory intact: nouns and verbs denote properties of individuals and events, respectively, while *much* and GAs denote measure functions. More specifically, the interpretation of *much* is selected from among a class of measure functions depending in part on what it takes as an argument, while GAs lexically encode specific measure functions.

I now argue for a revision of that basic starting point of the standard theory, the idea that GAs denote measure functions. I suggest instead that the semantics of degree is, across syntactic categories, introduced by *much*. I consider four sets of basic data across the GA, nominal, and verbal domains in constructing this argument: the first pertains to the types of dimensions comparatives give rise to, the second to the distribution of 'incommensurable' comparisons, and the third to the wider distribution of GAs.

By imposing a monotonicity requirement on the meaning of *much* in Chapter 3, I in effect restricted measurement in comparative constructions with nouns and verbs to "extensive" (or, "quantity") dimensions. Rett's (2008) label QUANTITY for her nominal measuring predicate is suggestive in this connection (see also Bochnak 2010). If it is the same stuff measured in (196a) and (196b), namely, $[\![$*coffee*$]\!]$, then the monotonicity requirement hard-wires the fact that the former cannot express a comparison by temperature (an intensive dimension) but the latter can. So GAs, on this view, can give rise to intensive dimensions, whereas *much* cannot.

(196) a. Al has **more coffee** than Bill does.

b. Al has **hotter coffee** than Bill does.

However, in this chapter I show that this distributional difference does not hold up in the general case. Just as *-er/more* with GAs can give rise to what appear to be intensive and extensive measures, so can *more* with nouns and verbs. Building on insights in Champollion (2010), I ultimately suggest that measurement is in fact always extensive, just we're measuring different things in sentences like (196b) than we thought.

The second set of data suggests what those "different things" might be. Presenting and building on discussion in Landman (2000) and Fults (2006), I show that GAs satisfy the various criteria that are often taken to implicate neodavidsonian denotations. Interpreting GAs as predicates of states, it becomes no longer necessary to interpret them also as predicates of degrees. This is of course plausible only if something *else* introduces degrees in adjectival and adverbial comparative constructions.

In this respect, 'incommensurability' phenomena are informative. On Kennedy's (1999) account, sentences like (197) are odd because the two adjectives map entities to degrees on incomparable scales. This is one motivation for treating GAs as degree predicates as opposed to merely vague predicates. Yet, the same phenomena can be found for nominal (198a) and verbal comparatives (198b), where it arises due to *much*. Then, if we have evidence that *much* occurs even in GA comparatives, a uniform explanation for (197)-(198) is possible.

(197) ? The ladder is **wider** than the carpet is **green**.

(198) a. ? More **blood** spilled to the ground than **sound** poured from the speakers.

b. ? Last night Al **sped up** more than Bill **slept**.

Indeed, it appears that there is such evidence. The fourth set of data I consider is (an updated version of) Bresnan's (1973) and Corver's (1997) morphosyntax for comparatives, which (despite their differences) agree that there is a syntactic head that is sometimes pronounced *much* present even in GA comparatives. Combining this with the idea that GAs like *hot* and *quick* denote one-place predicates of states, as in (199), I suggest that here *much* measures states.

(199) a. $[\![\text{hot}]\!] = \lambda s.\textsc{hot}(s)$ $\langle v, t\rangle$

b. $[\![\text{quick}]\!] = \lambda s.\textsc{quick}(s)$ $\langle v, t\rangle$

The theory developed in the rest of the chapter has a number of interesting features. Primary among these is that the monotonicity requirement discussed in Chapter 3 is a general property of comparative constructions (rather than a proper subset thereof), and "measurement" is understood uniformly in terms of extensive mappings to degrees. Furthermore, the distinction between gradable/non-gradable adjectives/adverbs is formally parallel to that between mass/count and telicity.

Along the way, I show how the theory improves on those that I see as its closest antecedents, namely Reichenbach (1947), Cresswell (1976), and Bale (2006, 2008). The chapter concludes with a discussion of some consequences for the distribution and interpretation of *very*, measure phrases (*2 feet tall*), and bare adjectival occurrences (e.g. *Al is tall*, *Al is a tall woman*).

4.1. Data and arguments

4.1.1. 'Intensive'/'extensive'

So far, the nominal and verbal comparatives we have seen were restricted to "extensive" dimensions for measurement, that is, dimensions that respect the mereological structure of the measured domain. If it turns out that GA comparative constructions alone can give rise to "intensive" dimensions, this could suggest that

GAs are of a fundamentally different nature from nouns and verbs.

That is, to preserve the theoretical intuition that *soup* does not denote a predicate of degrees, I said that *much* provides a mapping to degrees with that predicate in comparative constructions. Moreover, since *much* gives rise to variable but constrained measures, its interpretation had to be restricted in a particular way so as to account for why *more soup* can't mean what *hotter soup* means. The restriction I adopted, following primarily Schwarzschild (2006), holds that *much* only invokes monotonic measure functions. On this view, we should expect that all nominal comparatives give rise to extensive dimensions for measurement. Yet, on the face of it, this does not seem to be the case.

Before proceeding, a cautionary note. Often, the terms "intensive" and "extensive" are used in the degree semantics literature to indicate the kind of dimension a measure function invokes. For instance, 'volume' is an extensive dimension, and 'heat' is an intensive dimension. I will proceed using the language this way, but below turn to talking about the dimension *relative* to the measure domain.

Consider that adjectival comparatives can give rise to intensive dimensions like temperature and hardness (200), whereas nominal comparatives with e.g. *coffee* and *plastic* forbid them (201). On the theory in which *much* measures in nominal comparatives, the sentences in (200) and (201) express measurements of the satisfiers of $[\![$*coffee*$]\!]$ or $[\![$*plastic*$]\!]$, which are ordered by the part-of relation; the absence of the temperature and hardness dimensions is expected, as they do not track such relations. These measures are intensive (/non-monotonic) on such domains—smaller portions of the stuff do not necessarily correspond to smaller measures.

(200) a. This coffee is **hotter** than that coffee is. temp, *volume

b. This plastic is **harder** than that plastic is. hardness, *weight

(201) a. Al has **more coffee** than Bill does. *temp, volume

b. Al has **more plastic** than Bill does. *hardness, weight

However, the reverse also obtains: some GAs give rise to extensive dimensions (202), and some nouns to intensive (203). To be clear, exactly the dimensions that were ruled out in (201) are possible in (203), simply by changing the noun that appears following *more*, (202).

(202) a. This glass is **fuller** than that glass is. *temp, volume

b. This plastic is **heavier** than that plastic is. *hardness, weight

(203) a. This rock has **more heat** than that one does. temp, *volume

b. This mattress has **more firmness** than that one does. hardness, *weight

A similar pattern obtains with verbal comparatives. Gradable adverbs give rise to the intensive dimensions speed and loudness (204), whereas the atelic verbs *drive* and *sing* forbid them (205). That is, the sentences in (204) express comparisons of measures of ⟦*drive*⟧ or ⟦*sing*⟧, which, I have said, denote predicates of events that are ordered by the part-of relation. On such domains, speed and loudness are intensive—smaller parts of the relevant events do not necessarily give rise to smaller measures along these dimensions.

(204) a. Al drove **faster** than Peter did. speed, *distance

b. Al sang **louder** than Peter did. loudness, *duration

(205) a. Al **drove more** than Peter did. *speed, distance

b. Al **sang more** than Peter did. *loudness, duration

Yet, again, this pattern reverses: comparatives with adverbs can invoke extensive dimensions for measurement (206), and *more* with verbs can give rise to intensive (207). As above, all we have to do is change the verb, and the dimensions for measurement are correspondingly different.

(206) a. Al drove **farther** than Peter did. *speed, distance

b. Al's singing thundered **longer** than Peter's did. *loudness, duration

(207) a. Al **sped up more** than Peter did. speed, *distance

b. Al's singing **thundered more** than Peter's did. loudness, *duration

Such data are puzzling. In order to explain the restrictions for dimensions on *as much coffee* and *run as much*, I said that *much* must measure extensively (/monotonically). Yet, *much* appears with *heat* and *speed up* as well (*as much heat*, *speed up as much*), where here it appears to be measuring intensively. A natural recourse would be to say that the predicates that give rise to intensive measures themselves denote specific measure functions.[1]

If so, then we have a few options, none of which are, in my view, appealing. One option would be to say that (i) in some cases *much* goes uninterpreted, another is to say that, contra Chapter 3, (ii) it is uniformly interpreted essentially as the identity predicate. If (i), we are tasked with saying precisely when *much* will be interpreted, and when not. (ii) is essentially the proposal of Cresswell (1976), which I discuss later in this chapter.

Here is why (i) is unappealing. The distinction between intensive/extensive measures is not, as we've seen, predictable by syntactic category. It's not clear what else it would be predictable from. For instance, it should be that the differences in meaning between *rock/gold* and *walk/run* would be of just the sort that would give rise to the second of each pair permitting a different dimension for comparison than the first. After all, what differentiates some rock from some gold but a measure of purity (208), and what differentiates a walking from a running but the agent's speed (209)? Yet, such predications resist the conceptually plausible intensive dimensions.[2]

[1]Indeed, when the literature detects "intensive" (or, "quality") dimensions in the nominal and verbal domains, the question of whether to extend the measure function analysis to the relevant predicates is immediately raised. Morzycki (2005) (following discussion in Bolinger 1972) suggests that intensive nouns like *fool* do not denote measure functions, whereas Villalta (2008) and Lassiter (2011a) suggest that verbs like *want* do. I discuss such cases and others directly in Chapter 7.

[2]It turns out that there is something of a debate surrounding (208). Schwarzschild 2006 agrees

(208) a. Al has **more rock** than Bill does. *purity, weight

b. Al has **more gold** than Bill does. *purity, weight

(209) a. Al **walked more** than Bill did. *speed, distance

b. Al **ran more** than Bill did. *speed, distance

We do not yet know when we'll observe intensive versus extensive measures, yet it seems importantly tied to the meaning of the predicate, whatever its syntactic category. Tying observation of intensive dimensions to a lexical item's semantic type seems arbitrary, as it doesn't track independent facts about the language, in particular the distribution of *much*. Since it does not seem that GAs are "freer" than nouns and verbs in this respect, this cannot be used as an argument that GAs should be assigned a different type.

These considerations raise a number of questions. If GAs are not assigned a different type, i.e. if they are not interpreted as denoting functions from individuals and degrees, how are they interpreted? And what would introduce measures in comparatives?

4.1.2. Adjectival phrases

A wealth of data suggests that GAs should have a davidsonian argument, in this case most naturally thought of as a variable over states. They appear with various modifiers, thematic and non-thematic, many of which appear to have the spatio-temporal profile that is normally taken to indicate (potentially complex) properties of eventualities. Moreover, these modifiers can appear within the scope of the comparative, suggesting they contribute to *what is measured* in a way that cannot be captured if they lack such an argument.

with the judgment reported, whereas Bale & Barner 2009 disagree. The relevant point could be made by contrasting e.g. *more coffee* versus *more [hot coffee]*; modifying the noun by *hot* doesn't suddenly allow for a comparison by temperature.

Note that this discussion should be read as suggesting that GAs have a state variable, but not yet as furthermore suggesting that GAs *lack* an individual or a degree argument. Those steps will be taken in the next two sections.

Fults (2006) observes that a battery of modifiers can appear with GAs in comparatives, and, crucially, that they must be interpreted within the scope of the comparative morpheme: (210) cannot be understood as comparing Al's degree of patience directed at Mary, spatially located in a certain way, with Bill's degree of patience simpliciter. This minimally suggests that the modifiers combine with the GA before it combines with the comparative morpheme.

(210) Al is **more patient with Mary on the playground** than Bill is.

This point is made more striking when the modifiers appear following the *than*-clause (211): to the extent that (211) is interpretable, the modifiers are contained within the scope of the *than*-clause alone.[3] The contrast between (210) and (211) further suggests that the modifiers in (210) compose with the GA prior to its combining with *-er*.

(211) Al is **more patient** than Bill is **with Mary on the playground**.

A matrix constituent like *patient with Mary on the playground* must be available for ellipsis resolution separately from the subject *Al*; but, what are these modifiers modifying? They do not appear to be modifying predicates of individuals; at least, not if such modification is conjunctive. None of the examples in (212) seem to be interpreted in such a way as paraphrases like *Al is happier than the standard for happiness & Al is when Carl does well* suggest, which is what we would expect if GAs and modifiers denote predicates of individuals.

(212) a. Al is happy **in the morning.**

[3] I ignore the irrelevant interpretation of (211) that obtains with a large prosodic break after *than Bill is*.

b. Al is happy **with Carl.**

c. Al is happy **because Carl won the lottery.**

d. Al is happy **when Carl does well.**

e. Al is happy **in the country but not the city.**

Moreover, the same types of modifiers regularly show up with verbal predicates like the "fake" stative *sit* (213) and eventive *run*. The simplest hypothesis is that such phrases are uniformly interpreted as predicates of eventualities.

(213) Al sat/ran **with Mary on the playground.**

I would add the observation that, if *more* is post-posed with respect to the GA and its satellites, the comparison can only be in terms of how often a certain sort of state-of-affairs obtains, (214), just like what we have been calling a verbal comparative. This indicates that there may be more structure to the adjectival phrase than is normally posited; I return to data like (214) in Chapter 5.

(214) Al is **patient with Mary on the playground more** than Bill is.

The first set of Fults' examples suggest that GAs have something like a state argument. The second set support an argument against analyzing them as mere properties of individuals.

As Landman (2000) stresses, GA nominalizations appear to involve explicit reference to states, which is distinct from referring to, for example, *the fact that* a particular property is instantiated. For example, *it* in the last clause of (215) can't refer to *the fact that* Oedipus was in love with Jocasta, since in that case the dialogue should sound contradictory, contrary to fact. Rather, Landman writes, the pronoun here must refer to "*the state of* Oedipus being in love with Jocasta". This argument can be reproduced with a GA as in (216).

(215) Oedipus was in love with Jocasta. Though **the fact that he was in love with her** was a burden on his conscience, he had to admit that **it** felt good.

(216) Mary was very happy when John failed his defense. Though **the fact that she was happy** was a burden on her conscience, still she had to admit that **it** felt good.

Landman (2000) further provides the type of arguments that originally motivated Davidson (1967) himself, applied to GAs. Davidson argued, based on data like that in (217), that eventive verbs like *stab* have an additional argument slot that can be used as a pivot for adverbial modification. The alternative, expanding the valence of an expression to treat each of a set of modifiers in sentences like (217a) as optional arguments, is to be dispreferred on the grounds that it fails to capture logical relationships between sentences. Positing arbitrarily many rules to guarantee entailment relationships between such hypothetical predicates would fail to capture the productive generality of the fact that (217a) and (a permutation of (217a)) (217b) are truth-conditionally equivalent, both entail (217c) and (217d), and all, in turn, entail (217e), but not the other way around.

(217) a. Brutus stabbed Caesar **in the back with a knife**.

b. Brutus stabbed Caesar **with a knife in the back**.

c. Brutus stabbed Caesar **in the back**.

d. Brutus stabbed Caesar **with a knife**.

e. Brutus stabbed Caesar.

Such inference patterns are neatly captured by supposing that they reflect a rule of conjunction reduction; as Davidson suggested, this can be accomplished by treating verbs like *stab* as predicates of events, and its modifiers as conjunct predicates of the same variable.

Landman reproduces this pattern with the GA *small*. Since the interpretation of GAs depends on a comparison class in the positive form, this has to be controlled for before we can see the diamond-shaped pattern of entailments. In (218), an explicit standard-degree descriptor *for a pink elephant* is provided, and, according to Landman, (218a) and a permutation of it, (218b), are equivalent. Moreover, both (218a) and (218b) entail (218c), and all, in turn, entail (218d), but not the other way around.

(218) a. Jumbo is a **small (for a pink elephant)** pink elephant.

b. Jumbo is a pink **small (for a pink elephant)** elephant.

c. Jumbo is a **small (for a pink elephant)** elephant.

d. Jumbo is a pink elephant.

e. Jumbo is an elephant.

These considerations suggest that GA interpretations have a Davidsonian argument,[4] but do not speak to the question of how they compose in comparative constructions. Landman (2000) was not concerned with the use of predicates like *small* in comparative contexts, and so did not offer an opinion on this. Fults did of course consider the context of comparative constructions, positing that degrees are introduced in adjectival comparatives by a covert relational predicate DEG, but did not specify where this predicate came from.

In the next section, I consider whether an argument that has been made for the analysis of GAs as measure functions can in fact be used against that analysis. Following this, I present Bresnan's (1973) hypothesis that *much* in fact appears underlyingly in GA comparative constructions.

[4]Parsons 1990 proposed a neodavidsonian analysis for so-called "fake stative" predicates like *sit*, and *lie down*; see also Kratzer 1989 for relevant discussion. Moltmann 2009 analyzes adjectives as state predicates so as to eliminate degrees, which is not the course pursued here, for the reasons discussed in Chapter 2.

4.1.3. Incommensurability

I noted in the introduction to this dissertation that Kennedy (1999) used 'incommensurability' phenomena to argue against vagueness-based approaches to the semantics of gradable adjectives (although see Doetjes 2009 and Van Rooij 2011). This reasoning there was that, without appeal to the notion of 'degree' and 'ordering' (or, 'scale'), such phenomena were unexpected. This argument ultimately served to interpret gradable adjectives as measure functions. However, if the same phenomena are found with nominal and verbal comparatives as well, this suggests that the argument is not about GAs, as opposed to about comparative constructions more generally.

Licit cases of so-called "subcomparatives", as in (219a), feature adjectives like *wide* and *tall*, and pose no difficulty to the understanding: (219a) expresses a comparison of the width of a ladder and the height of a doorway, in which the measure of the former is greater than that of the latter. Similarly, (219b) expresses a comparison of something like the relative saturation of the redness of some curtains and the greenness of a carpet.[5]

(219) a. This ladder is **wider** than the doorway is **tall**.

b. The curtains are **redder** than the carpet is **green**.

In contrast, pairing adjectives that do not traffic in the same dimensions for measurement are odd. It is not clear what (220a) should mean, i.e., it is not obvious how we should understand a comparison of measures of width and greenness, and similarly for measures of redness and height, (220b).[6]

[5] One alternative reading concerns the relative extents of their red- or green-cover; see Kennedy & McNally 2010 for discussion of the potential ambiguity of color terms. It is also not totally clear to me that *redder than* invokes 'saturation' as opposed to something more properly multi-dimensional.

[6] There are plausible alternative interpretations in the vicinity, namely "comparisons of deviation" (Kennedy 1999) or perhaps even "indirect comparisons" (Bale 2008; see also Van Rooij 2011). I discuss these apparent subvarieties of comparatives in Chapter 6.

(220) a. ? This ladder is **wider** than the carpet is **green**.

b. ? The curtains are **redder** than that doorway is **tall**.

Consider the analogous cases in the nominal domain. It is reasonable to compare booze and chocolate in terms of the volume of each that went into a cake, (221a). But now imagine that what Al in fact did was dot the cake with chocolate hearts. (222a) isn't a good way of talking about a comparison of measures by volume of booze and chocolate. Why should it matter if we talk about the stuff, *chocolate*, versus the objects, *chocolate hearts*? Put another way, if *booze* and *chocolate* are fine to compare, so should *booze* and *chocolate hearts* be.

(221) a. Al put **more booze** in the cake than she did **chocolate**. vol

b. Al bought **more greeting cards** than Bill did **crystals**. num

(222) a. ? Al put **more booze** in the cake than she did **chocolate hearts**.

b. ? Al bought **more greeting cards** than Bill bought **crystal**.

Perhaps (222a) and (227b) are odd because there is something like a category mismatch between the expressions to be compared, in which we attempt to compare a mass expression with a plural one.[7] However, it is clear that such an explanation will not work in the general case. Imagine we are describing the aftermath of a particularly raucous heavy metal concert. First, *blood* and *sound* are both mass nouns by the test of compatibility with *much* (223), as are *carpeting* and *light*, by the test of requiring singular agreement on the verb (224).

(223) a. **Much blood** remained on the ground a week later.

b. **Much sound** poured from the speakers.

(224) a. **The carpeting is/*are** red.

b. **The light** in this room **is/*are** bright.

[7]This is actually expected on the theory of plural comparisons that I develop in Chapter 5.

Yet, blood/sound and carpeting/light are not comparable one to the other in terms of e.g. volume (225a) or area/brightness (225b).

(225) a. ? **More blood** spilled to the ground than **sound** poured from the speakers.

b. ? Al asked for a room that has **more carpeting** than it has **light**.

Similar patterns obtain in the verbal domain. While it is natural to compare how much one individual hates or loves another in terms of the extent of the emotional intensity involved (226a), or to compare numbers of events of acting on those devotions (226b), we can't mix and match: we don't know how to compare how much one individual hates another with how much an individual acts on their devotions, (227).

(226) a. Susie **hated her mother more** than Bill **loved his**. intens

b. Susie **visited her mother more** than Bill **called his father**. num

(227) a. ? Susie **hated her mother more** than Bill **called his father**.

b. ? Susie **hated her mother more** than Bill **visited his**.

In a similar vein, *drive*, *speed up*, and *sleep* are all verbs that combine with *so much*, yet the *drive*/*sleep* pair is comparable (229a), while the *speed up*/*sleep* pair is not (229b)—at least on the hypothetical interpretation expressing a comparison by speed.

(228) a. Al **drove so much** yesterday that her back became sore.

b. Al **sped up so much** that she overtook the first four competitors.

c. Al **slept so much** that for once she doesn't need a nap today.

(229) a. Last night Bill **drove more** than Al **slept**. dur

b. ? Last night Bill **sped up more** than Al **slept**.

These data show that, whatever the syntactic category of expression targeted by a comparative construction, intuitions of incommensurability can be evinced. Incommensurability does not distinguish GAs from nouns and verbs. This pattern makes sense if $[\![$-*er*$]\!]$ expresses a greater-than relation between degrees, if and only if the degrees to be compared are on the same scale, as argued by Kennedy (1999) in the context of the standard theory.

On that theory, the explanation for adjectival, on the one hand, and nominal and verbal patterns, on the other, would differ depending on the syntactic category. Adjectives denote specific measure functions, and so it has to be that the measure functions the compared adjectives denote have the same range. With nominal and verbal comparatives, it has to be that the ranges of the two measure functions that value μ in each clause are the same. If, in contrast, GAs denote predicates of measurables (i.e., states) as opposed to measurers, the explanation could, in principle, be the same across syntactic categories: it arises due to an interaction between the semantic properties of *much* and *-er/as*.

For such a theory to work out, it would have to be that (something like) *much* appears in the syntax of GA comparatives. I turn directly to the evidence that this is in fact the case.

4.1.4. Morphosyntax

We have seen that invoking intensive versus extensive measures and incommensurability do not distinguish GAs from nominal and verbal predicates, and we have seen evidence suggesting that GAs, like verb phrases, are predicates of eventualities. If that is so, then it is possible that they are not *also* predicates of degrees. It would have to be that something else introduces degrees for quantification by comparative morphemes. In this section, I present morphosyntactic data suggesting that *much* is there, and so can perform that function.

Bresnan (1973) argues that the underlying syntax of degree phrases is more uniform across syntactic categories than is generally thought in contemporary degree-theoretic analyses. I present a sketch of her analysis, and suggest that, from an LF perspective, it is indistinguishable from that of its apparent rival, Corver (1997; cf. Neeleman et al. 2004). The net result is that something like *much* is present even in GA comparative constructions, regardless of the particular implementation (Bresnan or Corver) one adopts.

First, Bresnan considers the class of comparative morphemes in the nominal domain, observing that all but one of them occurs with *much*, (230). She suggests that this paradigm is explicable if the form *more* decomposes into two morphemes, *much* and *-er*: whenever portions of a nominal's extension are compared, *much* is required.[8]

(230) a. as much soup

b. too much soup

c. so much soup

d. that much soup

e. * more much soup

Next, she notes that **if** *more* decomposes into *much* and *-er*, **and** given that forms like (231a) are grammatical, the prediction should be that all of (231b)-(231e) are possible, contrary to fact. Instead, the grammatical forms for combining comparative morphemes with adjectives like *delicious* are as in (232).

(231) a. more delicious

b. * as much delicious

c. * too much delicious

d. * that much delicious

[8] Thanks to J. Lidz, p.c., for helping me present Bresnan's arguments in a more readable form.

e. * so much delicious

(232) a. as delicious

b. too delicious

c. that delicious

d. so delicious

To maintain the analysis of *more* as a composite of *much* plus *-er*, Bresnan posits the deletion rule in (233). Specifically, this rule deletes *much* before adjectives (and adverbs), and applies **after** the rule that produces *more*. (If it applied in the opposite order, it would bleed that rule.) As a result, what is underlyingly *as much intelligent* surfaces as *as intelligent*.

(233) **much Deletion**:

much $\rightarrow \emptyset$ / __ A

Providing supporting evidence for the hypothesis that there is such a rule of *much*-deletion before adjectives, Bresnan considers the properties of *than*-clauses. She first notes the independent generalization that it is not possible to contract the copular form *is* to *'s* before a deleted constituent; consider the contrast between (234a) and (234b).

(234) a. Al is happy, and Bill is Δ, too. where $[\![\Delta]\!]$ = HAPPY

b. * Al's happy, and Bill's Δ, too. where $[\![\Delta]\!]$ = HAPPY

Finally, she notes that it is not possible to contract *is* to *'s* in the *than*-clause of a GA comparative; contrast (235a) and (235b). On the hypothesis that there is a rule of *much*-deletion as in (233), the ungrammaticality of (235b) can be explained as an instance of whatever is responsible for (234b). If there were no such rule, (235b) would need an independent explanation.

(235) a. The cat is prettier than the dog is ugly.

b. * The cat is prettier than the dog's ugly.

Bresnan's analysis is situated within a model of grammar that posits the levels of Deep Structure and Surface Structure, but can be recast in terms familiar from contemporary Distributed Morphology; see Dunbar & Wellwood (in prep). Updating her account, the posited rule in (233) can be seen as morphophonological (or PF) in nature, and consequently not affecting LF interpretation.

Consequently, Bresnan's account can be seen to predict that there could be cases where a sentence containing an overt *much* alternates with a sentence wherein it is covert, without a change in meaning.

Data noted by Bresnan confirm such a prediction:[9] clauses headed by *than*/*as* can act as interveners for the rule in (233), as shown in (236a) and (237a). Here, the *as*/*than* clauses remain in situ. If they extrapose to the right, as in (236b) and (237b), the conditions for the application of (233) obtain. Importantly, these pairs are not obviously semantically distinct: (236a,b) express a possibility with respect to the plants' height, and (237a,b) express that John's height is at least 6 feet.

(236) a. These plants may grow **as much** as 6 feet **high**.

b. These plants may grow **as high** as 6 feet.

(237) a. John is **more** than 6 feet **tall**.

b. John is **taller** than 6 feet.

On Bresnan's proposal, the underlying structures of the strings in (236) can be given schematically as in (238), and those of (237) as in (239).

[9] Related are cases like those with the GAs *different* and *alike*, *much*-deletion is apparently optional (Bresnan 1973, p278, fn.4). Its presence/absence again fails to affect LF interpretation. This pattern could be due in some way to the apparent morphological complexity of these GAs, although investigating this pattern further is beyond the scope of the present work.

i. A tangerine isn't **as (much) different** from an orange as I'd thought.

ii. You and I are **as (much) alike** as a horse and a cow.

(238) a. These plants may grow [as much <u>as 6 feet</u> **high**]

b. These plants may grow [as ~~MUCH~~ t_i **high** <u>as 6 feet</u>$_i$]

(239) a. John is [-ER MUCH <u>than 6 feet</u> **tall**]

b. John is [-ER ~~MUCH~~ t_i **tall** <u>than 6 feet</u>$_i$]

Corver (1997), agreeing with Bresnan that there is always some head that merges with comparative morphemes before the latter merge with adjectives, reanalyzes Bresnan's data in terms of what have been called, by him and others since, *much*-support. Analogizing to *do*-support, Corver suggests that this "Q head" is phonologically null, but must be phonologically supported in certain environments. Such cases include when it appears next to the pro-form *so* in (240).

(240) John is **generous**, in fact he is **too much** so.

Despite the differences in implementation, both Bresnan and Corver posit the presence of a head that is sometimes pronounced *much* that merges first with comparative morphemes, regardless of the lexical category of expression that these morphemes combine with. Now, either this head has a non-trivial semantics, or it doesn't. I have argued that it is interpreted as a monotonic mapping to degrees, and in what follows, I continue to refer to it as *much*. The rest of this chapter is devoted to explicating a theory on which GAs denote entities of the sort that can be measured.

4.2. On 'measurement'

In my analysis of nominal and verbal comparatives, I appealed to a general predicate *much* that introduced a context-sensitive variable over measures. Permissible values of μ were restricted to those that are homomorphic on the measured domain. This understanding of "measure" is familiar from measurement theory, where measurement is defined as a structure-preserving map from an empirical relational structure (essentially, a set of objects and an observable ordering relation between them) and a numerical structure (essentially, a set of numerical objects and an ordering relation between them—here, I understand these as degree orderings).[10]

On the account I offered, *much* "measures" ordered bits of matter (as with ⟦*coffee*⟧) or process (as with ⟦*run*⟧). If *much* is to measure in adjectival comparatives as well, the question is: what is it measuring?

The answer to this question relates to a question from measurement theory: when you measure an individual for their height, what is the measurement *of*? The object itself, or the object's height? The distinction may seem subtle, but it is important, and can be answered in at least two ways. The **practical** answer is that the object itself is measured; the **conceptual** answer is that the height is measured, *with the help of* or *by means of* the object.

It seems, on the face of it, that when I ask of some coffee *How hot is it?* and engage in some measuring behavior, that what I am measuring is the coffee. And indeed, the standard analysis of GAs as predicates of individuals presupposes such a view. But, as Berka (1983) understands it, the coffee is merely the *measured object* (practical understanding of measurement[11]). The *object of measurement* in this context is properly understood as the heat itself (conceptual understanding of measurement[12]), here *of the* coffee as opposed to of something else. The operative

[10]For practical discussion, references, and introductory material, see Krantz et al. 1971 and Roberts 1985; see Berka 1983 for philosophical discussion. I discuss Berka's ideas in more detail below. See also early discussion in Sapir 1944, and the linking of several ideas from measurement theory to linguistic theory in Sassoon 2007.

[11]"Every measurement is always performed on objectively existing things and phenomena.... there exist no properties or relations as such, but always only spatiotemporally determined things and phenomena having certain properties – things and phenomena which occur in definite relations independently of our conceptual selection of the properties and relations between them." (Berka 1983:28)

[12]"Often, there exist very complex connections between the measured objects, *on* which or *with the help of* which we measure something... and the features which we measure or *with the help of which* we measure these objects.... that *which* we measure, and that *on what* or *by means of* which we measure, are not to be identified...." (Berka 1983:29)

notion is that, whatever phenomena display the properties that are preserved in the mapping to degrees, to use our terms, are *what is measured*.

On the latter view, the concept of measurement is understood as a structure-preserving (or homomorphic) map from an empirical relational structure into a numerical one. The interpretation of $[\![much]\!]$ offered in this thesis is measurement-theoretic in the same sense: it invokes mappings from ordered domains to the domain of degrees.

Objects (and other things) have varying quantities of heat, and these quantities bear certain relations to one another. If measurement is defined as a structure-preserving map from an empirical relational structure (like the relational structure corresponding to, say, observation of all possible heats) to a numerical structure, it couldn't (conceptually) be that we are measuring the coffee, unless the coffee indeed shows the relational properties that are preserved in the measurements. The structure preserved when we assign degrees based on the heat of the coffee is not the structure of, e.g., the coffee, as we saw above, but the structure of a property that the coffee instantiates "in degrees". It is only in virtue of this that it makes sense to assign one degree as opposed to another, and to say that a given degree represents the heat of the coffee.

More concretely, on the standard theory in semantics, the input to the "measure function" incorporated as part of the meaning of *hot* is some stuff x, e.g., that satisfies $[\![coffee]\!]$. If that stuff happens to have some interesting structure, this plays no role in how the output of the HOT function is determined. The output is determined based on an ordering imposed *on* things like coffee, where this ordering is *by* heat. Different properties may (of course) order objects differently depending on the degree to which they possess/instantiate the property. The standard theory thus can be understood as encoding the "practical" understanding of measurement: the measure function takes entities to their measures along some dimension.

(241) $\lambda x.\textsc{hot}(x)$ $\langle e, d\rangle$

However, we may opt instead to say that such a measure function as is expressed by *hot*, if it exists, is complex, and that it involves more kinds of entities than we thought. Considering the "conceptual" understanding of measurement, we could reify "heats" as eventualities that correspond to the heat-states of objects, i.e. *hot* is a predicate of states. In the neodavidsonian context, instead of analyzing e.g. $[\![sleep]\!]$ as a property of individuals ($\textsc{sleep}(x)$), it is a property of a first-class entity in its own right, an event of sleeping ($\textsc{sleep}(e)$), which is related to its participants via explicit thematic relations like Agent, etc. A parallel conception for gradable adjectives is possible: instead of analyzing $[\![hot]\!]$ as a property of individuals or as a relation between individuals and degrees, it is a property of *states* that such entities can instantiate.

(242) $\lambda s.\textsc{hot}(s)$ $\langle v, t\rangle$

While we normally think of HOT as applying to objects directly, on this view it relates indirectly, via a thematic relation or function. On this understanding, when we say something like *This rock is hotter than that rock*, only practically speaking are we measuring the rock; conceptually (and linguistically) we are measuring the states of heat that they have, bear, or instantiate.

So far, there is not yet the question of intensive versus extensive dimensions for measurement, because we are not yet measuring anything like $[\![coffee]\!]$. We are measuring some state that the coffee is in. The question of intensive/extensive arises when we go back to *coffee*, i.e. (243). Combining an expression denoting a predicate like this with *much*, we consider directly the structure of the domain of application of COFFEE, which, we have hypothesized, is an ordering of portions of coffee by the part-of relation. That is because the definedness conditions on *much* require that all permissible values of μ are homomorphic on the measured domains. Domains like this will thus give rise to extensive dimensions only.

(243) $\lambda x.\text{COFFEE}(x)$ $\langle e,t\rangle$

Indeed, if one were to measure such a domain by temperature, the mapping would be intensive. This is precisely what is ruled out by definition with *much*. However, the values of μ in the context of $[\![hot]\!]$ could be different, since it is not coffee, but amounts of heat that are measured. In the next section, I formalize this idea by analyzing adjectival comparative constructions as involving comparisons of measures of states.

4.3. Measuring states

I propose that *much* plays the same semantic role everywhere it appears, and that it appears everywhere there is a comparative morpheme, e.g. with *-er*, *as*, *too*, etc. This section shows how this analysis, based on Bresnan's (1973) morphosyntax, implements *much* mapping states to degrees in GA comparative constructions. All that is required is, for completeness, that we can see even GA comparatives as involving monotonic mappings to degrees.

I adopt from the neodavidsonian theory the requirement that thematic relations are exhaustive and unique. This entails, among other things, that an individual x can be said to be in a *tall* state s only if x bears the right thematic relationship to s, and moreover, if x is in s, it is impossible for some other y to also be in s.[13] I assume that the thematic relations individuals bear to states could profitably be labeled *Holder-of*, *Bearer-of*, or *Instantiates*, but I do not resolve this question

[13]Note that, if thematic uniqueness is assumed, it would sometimes be impossible to order e.g. Al's tall-state s and Bill's tall-state s' with respect to one another without something like *much* further mapping those heights to degrees. That is, it cannot be the case that $s = s'$. The problem would be exacerbated on interval-based theories, in which we would talk of Al's tall-state**s** S and Bill's tall-state**s** S', and the ordering would be understood in terms of inclusion. The two convex sets S and S' would never stand in such a relation, though the degree-intervals that represent their measures could.

here.[14]

4.3.1. The proposal

The interpretable use of *much*, as we have seen, depends on at least two things: first, that whatever it predicates of be in the domain of a (non-trivial) ordering, and second, that the value of μ be chosen from among those that are homomorphic to the relevant ordering. In the cases we've looked at in detail (mass nouns and atelic verbs) the relevant ordering was a part-whole relation. Among other things, if the state satisfiers of $[\![hot]\!]$ don't have mereological parts, combining any *much* that appeals to such a condition with *hot* should result in nonsense.

In discussing any restriction to intensive or extensive measures, it is important to consider a distinction brought to the fore in Champollion (2010): that such measures are only so classified relative to a system. For instance, while above I talked as though the temperature dimension is "intensive" simpliciter, it is only intensive relative to what is being measured. On the standard account, *hotter coffee* expresses, in part, a measurement of portions of coffee. In such cases, TEMPERATURE is an intensive dimension.

However, on the present account, *hotter coffee* represents measures of the state satisfiers of HOT, which are different sorts of entities from portions of coffee with, I presume, their own ordering relations. The question is, then, is TEMPERATURE extensive or intensive with respect to $[\![hot]\!]$?

The interpretation of pseudopartitives is instructive in this respect. Schwarzschild (2006) argues that examples like (244) are ungrammatical because the pseudopartitive construction requires monotonic (/extensive) dimensions for measurement.

(244) * Al drank **30 degrees Celsius of water**.

[14] See Dowty 1989 for relevant discussion towards interpreting the content of thematic predicates.

Yet, as Champollion (2010) points out, there are cases where the pseudopartitive, interpreted with respect to the temperature dimension, are perfectly grammatical; he gives the naturally occurring examples in ((245a,b); ibid., p153) as examples. Here, what is measured is $[\![\textit{fever}]\!]$ and $[\![\textit{global warming}]\!]$; if we are to maintain Schwarzschild's explanation for data like that in (244), then it would have to be that, contrary to intuition, the temperature dimension is monotonic on the domains of such predicates.

(245) a. Emilia was lying on her bed, **with 41 degrees Celsius of fever**.

b. The scientists from Princeton and Harvard universities say just **two degrees Celsius of global warming**, which is widely expected to occur in the coming decades, could be enough to inundate the planet.

As Champollion (p.c.) also points out, we may observe that a smaller amount of heat will have a smaller temperature measure than a larger amount. To think of the temperature dimension as extensive with respect to heat requires the further step of thinking about that smaller amount of heat as a mereological part of the larger amount of heat. Herein lie metaphysical or psychological questions that are beyond the scope of this work; however, the benefits of adopting such a perspective are, as Champollion notes, that it allows us to maintain Schwarzschild's explanation for data like (244), and to see (245) as consistent with it.

It would be worth exploring whether weakening the conditions proposed for the interpretation of *much* in §3.3.2 (i.e., that all that is required is an ordering, not necessarily by part-of), but for the present I will adopt the stronger position: the interpretation of *much* doesn't change. Following Champollion's suggestion, I hypothesize that GAs predicate of states appearing in the domain D of an ordering by $\preccurlyeq^{Part}$.

Although this is likely counter-intuitive, my interest is in the idea that the distinction between gradable and non-gradable adjectives is **of the same basic**

sort as the distinction between mass/count and atelic/telic—all are distinctions in the domains of application for predicates. At present, the best way I know how to maintain that these distinctions are on a par is to assimilate the one to the other.

I thus maintain the interpretation and definedness conditions on *much* posited in Chapter 3: (i) the measured domain must be measurable (i.e., structured); (ii) the mapping must be homomorphic; and, (iii) the mapping must be extensive. In what follows, I try to make more explicit the relationship between the orderings on states that I posit, and the degree orderings that associate with GAs on the standard theory.

On the standard theory, GAs associate with sets of ordered degrees. Cresswell (1976) conceives of degrees as names for equivalence classes of objects based on antecedent, extralinguistic ordering relations, such that the relation relevant to the adjective *hot* might be represented (equivalently) as $\{\langle x, x' \rangle \mid x \text{ is as hot as } x'\}$ or $\{\langle x, x' \rangle \mid x \text{ has as much heat as } x'\}$ (cf. Engel 1989). The collapsing of these relations into equivalence orders is, on Cresswell's account, extralinguistic.[15]

The present account adopts this basic idea, but differs in two ways. First, the binary relation associated with *hot* is an ordering on states, rather than on the individuals that instantiate them—the ordering on individuals can be recovered via the thematic relations that link states with their bearers. Second, degrees are introduced compositionally: states are mapped to degrees when they compose with *much*, whereas on Cresswell's view such mappings are part of the lexical semantics of GAs.[16]

On this theory, the mapping to degrees is uniformly introduced by a single expression across comparative constructions. That expression delimits a class of measure functions depending on the nature of its α argument, one of which will be

[15] I discuss Bale's 2008 lucid and accessible introduction to one way of modeling the construction of scale structure at the end of this chapter.

[16] We will shortly be reminded that, on Cresswell's view, such mappings were also part of the lexical semantics of e.g. mass nouns.

Table 4.1: The (simplified) structures underlying *more coffee* and *hotter coffee*, and the relevant pieces of logical form. 'δ' abbreviates the contribution of the *than*-clause.

more coffee	**hotter coffee**
[[much -er] coffee]	[[[much -er] hot] coffee]
...$\mu(x) \succ \delta$ & $\textsc{coffee}(x)$...	...$\mu(s) \succ \delta$ & $\textsc{hot}(s)$ & $\Theta(s, x)$ & $\textsc{coffee}(x)$...

contextually provided so long as it meets the stated conditions. On this account, *more coffee* cannot express a comparison by temperature because any x that satisfies COFFEE denotes in an ordering of amounts of matter, which are not (by hypothesis) in the domain of the measure function TEMPERATURE. In contrast, *hotter coffee* cannot indicate a comparison by volume because heat-states are not in the domain of VOLUME. The general idea can be seen by inspection of Table 4.1, where Θ abbreviates whatever thematic relation would have to obtain between portions of coffee and states of heat when *hot* occurs prenominally.

Here, the gradable/non-gradable distinction is characterized as formally on a par with the mass/count and atelic/telic distinctions. The hypothesis advanced is that GAs, like mass nouns and atelic verb phrases, denote in structured domains: the extension of a GA like *hot* is a join semi-lattice whose elements are states of heat. Non-GAs like *wooden*, in contrast, are understood as predicates of atomic states, so that, if one is in a state satisfying $[\![$*wooden*$]\!]$, one is in a singular state; with $[\![$*hot*$]\!]$, one is in many more. $[\![$*hot*$]\!]$, then, will meet the definedness conditions for *much*, while $[\![$*wooden*$]\!]$, e.g. (246), will fail to.

(246) ? This piece of wood is **as wooden** as that piece is.

4.3.2. Composition: adjectives II

I have argued that comparative constructions like (247) have an underlying syntax that renders them more like nominal (and verbal) comparative constructions than is usually thought: contra to what was assumed in Chapter 2, GAs do not combine directly with *-er*; *-er* first necessarily combines with *much*. In this section, I provide a compositional semantics for GA comparatives that renders their similarity to nominal and verbal comparative constructions explicit.

(247) Al's coffee is **hotter** than Bill's is.

Just as with verbal comparatives, the external argument of the adjective is introduced by a separate thematic head, here labeled v_S. The semantic function of this head is to introduce the Holder of the state(s) that the adjective is true of ((248); Parsons 1990, Kratzer 1996, Husband 2012).[17]

(248) $[\![v_S]\!] = \lambda x \lambda s.\text{Holder}(s)(x)$

Since GAs have the same logical type as mass nouns and atelic verbs (that is, they are all one-place predicates), composing them with *much* is straightforward: its semantics are reproduced in (249). A GA like *hot* is interpreted as in (250); it combines with *much* just as individual and event predicates do, conjunctively.

(249) $[\![\text{much}_\mu]\!]^A = \lambda\alpha.A(\mu)(\alpha)$ (with conditions)

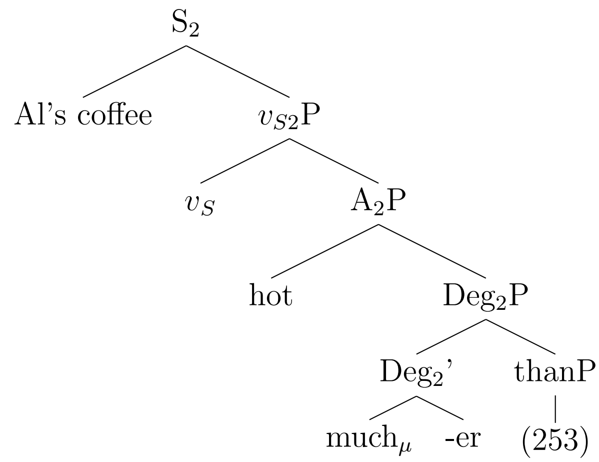
(250) $[\![\text{hot}]\!]^A = \lambda s.\textsc{hot}(s)$

Thus, the (simplified) structure that I posit underlies the matrix clause of (247) is as in (251), ignoring the copular verb. Its interpretation is derived as in (252), abbreviating the *than*-clause as δ. The result is an existential statement

[17] As Kratzer notes, nothing hinges on the choice of label 'Holder'. The specific content of thematic relations with states, as with eventualities of other sorts, remains a yet unresolved issue.

about states of heat that Al's coffee is in, whose assigned measure is greater than the maximal degree measured by δ.

(251)



(252)

i. $[\![\text{Deg}_2\text{'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succ d$ IR,FA

ii. $[\![\text{Deg}_2\text{P}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succ \delta$ (i),FA

iii. $[\![\text{A}_2\text{P}]\!]^A = \lambda s' . \textsc{hot}(s') \ \& \ A(\mu)(s') \succ \delta$ (ii),PM

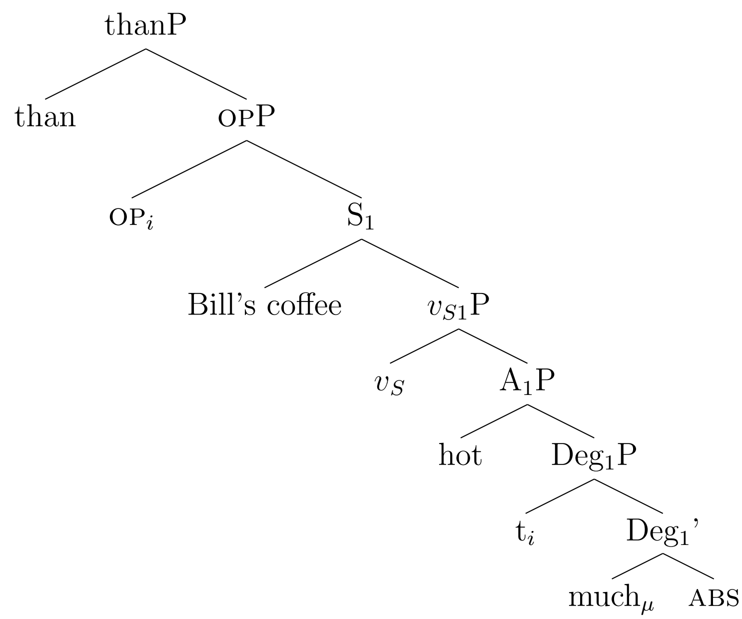
iv. $[\![v_{S2}\text{P}]\!]^A = \lambda x \lambda s' . \text{Holder}(s')(x) \ \& \ \textsc{hot}(s') \ \& \ A(\mu)(s') \succ \delta$ (iii),EI

v. $[\![\text{S}_2]\!]^A = \lambda s' . \text{Holder}(s')(\text{Al's-coffee}) \ \& \ \textsc{hot}(s') \ \& \ A(\mu)(s') \succ \delta$ (iv),FA

vi. $= \top$ iff $\exists s'[\text{Holder}(s')(\text{Al's-coffee}) \ \& \ \textsc{hot}(s') \ \& \ A(\mu)(s') \succ \delta]$ (v),$\exists$

The structure of the *than*-clause of (247) is given in (253), and the derivation of it is interpretation in (254). The result is a definite description over degrees measured by the state of heat that Bill's coffee is in.

(253)



(254) i. $[\![\text{Deg}_1\text{'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succcurlyeq d$ IR,FA

ii. $[\![\text{Deg}_1\text{P}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succcurlyeq A(i)$ (i),IR,FA

iii. $[\![\text{A}_1\text{P}]\!]^A = \lambda s.\textsc{hot}(s)\ \&\ A(\mu)(s) \succcurlyeq A(i)$ (ii),PM

iv. $[\![v_{S1}\text{P}]\!]^A = \lambda x \lambda s.\text{Holder}(s)(x)\ \&\ \textsc{hot}(s)\ \&\ A(\mu)(s) \succcurlyeq A(i)$ (iii),EI

v. $[\![\text{S}_1]\!]^A = \lambda s.\text{Holder}(s)(\text{Bill's-coffee})\ \&\ \textsc{hot}(s)\ \&\ A(\mu)(s) \succcurlyeq A(i)$ (iv),FA

vi. $= \top$ iff $\exists s[\text{Holder}(s)(\text{Bill's-coffee})\ \&\ \textsc{hot}(s)\ \&\ A(\mu)(s) \succcurlyeq A(i)]$ (v),$\exists$

vii. $[\![\textsc{op}\text{P}]\!]^{A:Ai \to d} =$

$\lambda d.\exists s[\text{Holder}(s)(\text{Bill's-coffee})\ \&\ \textsc{hot}(s)\ \&\ A(\mu)(s) \succcurlyeq d]$ (vi),PA

viii. $[\![\text{thanP}]\!]^A =$

$\iota d[\exists s[\text{Holder}(s)(\text{Bill's-coffee})\ \&\ \textsc{hot}(s)\ \&\ A(\mu)(s) \succcurlyeq d]]$ (vii),FA

The result of combining the interpretations of the two clauses is given in (255). (255) encodes the prediction that an utterance of (247) will be judged true just in case there is a state of heat that Al's coffee is in, the measure of which is greater than the measure of that state of Bill's coffee. Since the measured entity is a heat-state, measurement by temperature will be licensed.

(255) $[\![$Al's coffee is **hotter** than Bill's coffee is$]\!]^A = \top$ iff

$\exists s'[\text{Holder}(s')(\text{Al's-coffee})\ \&\ \textsc{hot}(s')\ \&\ A(\mu)(s') \succ$

$$\iota d[\exists s[\text{Holder}(s)(\text{Bill's-coffee}) \ \& \ \textsc{hot}(s) \ \& \ A(\mu)(s) \succcurlyeq d]]]$$

As discussed above, the analysis of GAs as predicates of states is well-suited to the analysis of sentences like that in (210) with multiple modifiers, repeated here as (256). Semantically, (256) expresses a comparison of measures of patience that are directed at Mary and spatially located in a certain way.

(256) Al is **more** patient with Mary on the playground than Bill is.

Again abbreviating the *than*-clause as δ, a simplified derivation of the interpretation of (256) is given in (257). The result is a predicate of patient-states which bear certain relations to other entities such as Mary (M) and the playground (ιp) and whose measure is greater than δ.

(257)

- more patient with Mary on the playground than...
  $\lambda s.A(\mu)(s) \succ \delta \ \& \ \textsc{patient}(s) \ \& \ \textsc{with}(s)(\text{M}) \ \& \ \textsc{on}(s, \iota p)$
  - more than...
    $\lambda \alpha.A(\mu)(\alpha) \succ \delta$
    - more
      $\lambda d \lambda \alpha.A(\mu)(\alpha) \succ d$
    - than...
      δ
  - patient with Mary on the playground
    $\lambda s.\textsc{patient}(s) \ \& \ \textsc{with}(s)(\text{M}) \ \& \ \textsc{on}(s, \iota p)$
    - patient with Mary
      $\lambda s.\textsc{patient}(s) \ \& \ \textsc{with}(s)(\text{M})$
    - on the playground
      $\lambda s.\textsc{on}(s, \iota p)$

Sentences like *Al is patient with Mary on the playground more than Bill is* with *more* post-posed with respect to the modifiers are discussed in detail in Chapter 5. There, I propose a state-to-event mapping that perhaps will be relevant for the analysis of sentences like (258a) and (258b), as well: *very* modifies the core stative predicate, and *on occasion* quantifies over the derived events.[18]

[18] I do not intend the interpretation derived in (257) to suggest e.g. that the interpretation of (i) would be equivalent to the interpretation of (ii). The non-equivalence could be derived, I suspect, by further elaborating the structural heights at which *with*-phrases can attach, with consequent effects on interpretation. It is possible that the *with*-phrase in (i) relates Mary to the state of patience itself (and interpreted as 'patience *directed at/with respect to* Mary'), and in (ii), relates Mary to the occasion of the state's holding ('on that occasion, being patient and *in spatiotemporal proximity* to Mary').

(258) a. Al was **very patient** last week.

b. Al was **patient on occasion** last week.

This account extends that presented in Chapter 3, as applied to GA comparative constructions. The next section shows how this theory applies to comparatives with distinct adjectives, nouns and verbs across the two comparative clauses.

4.3.3. Composition: subcomparatives

The analysis in terms of *much* can account for incommensurability data straightforwardly. I propose an analysis similar to Kennedy's (1999; and references therein): by imposing the natural condition on comparative morphemes that the degrees they compare come from **the same degree ordering**. This is encoded on the present account in the following way. *much*'s definedness conditions say that, for a given measured entity x, there is an ordering on x and that ordering is in the domain of some measure function. A measure function, as on the standard theory, maps entities to degrees. The greater-than relation contributed by $[\![$-*er*$]\!]$ is identical to that of the scale from which the compared degrees are drawn. If there is no scale that orders the two degrees, the result is anomalous.

This requirement on the interpretation of e.g. -*er* (its interpretation is repeated in (259)) may be encoded as a definedness condition, as in (260). (260) effectively restricts the permissible measures in the comparanda of a comparative construction to just those whose ranges are in the same degree ordering.[19]

(259) $[\![\text{-er}]\!] = \lambda g \lambda d \lambda \alpha . g(\alpha) \succ d$

---

i. Al is patient with Mary.

ii. Al is patient and Al is with Mary.

[19]The same requirement also falls out if we adopt the higher-type interpretation for comparative morphemes discussed at the end of Chapter 3.

(260) **Definedness conditions on <u>-er</u>**

For all d, d', $d \succ d'$ just in case there is an ordering $\langle D_{\succcurlyeq^{Deg}}, \succcurlyeq^{Deg} \rangle$, such that

i. $d, d' \in D_{\succcurlyeq^{Deg}}$; and

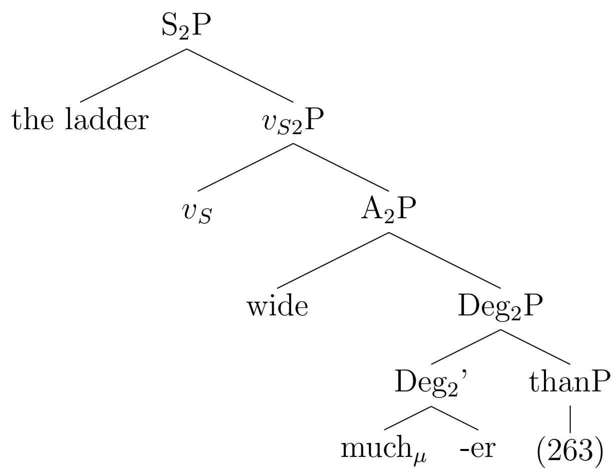
ii. $d \succ^{Deg} d'$.

Consider the commensurable example (219a), repeated in (261). (261) is perfectly interpretable, expressing that a ladder has a width that exceeds the height of a doorway. An utterance of such a sentence would be judged true, for example, if the width-measure of the ladder is 6 feet, and the height-measure of the doorway is 5 feet. While *wide* and *tall* are different in that they express predicates of different sorts of states, they are comparable because there is class of measure functions that map both sorts of states to the same degree ordering—an ordering on degrees representing length.

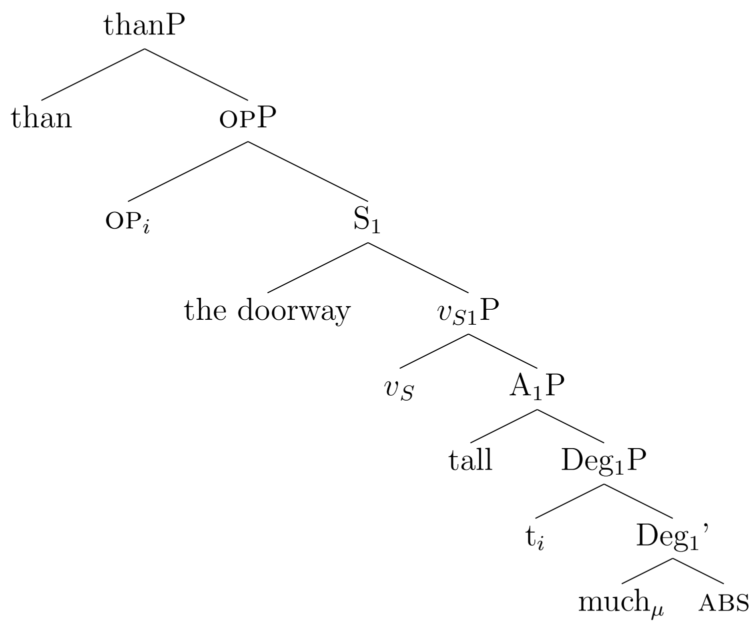
(261) This ladder is **wider** than the doorway is **tall**.

Following the discussion in the preceding section, I posit that the underlying (simplified) structure of the matrix and *than*-clauses of (261) are exactly as those we saw in the preceding section (262), with the only differences that the *than*-clause as in (263) contains a token of a distinct adjective from that of the matrix clause, (262). Ultimately, these structures are pronounced differently as well: the distinct adjective *tall* in the *than*-clause will be spelled out overtly.

(262)



(263)



The calculation of the interpretation of these structures is the same as in the case where a token of the same type of adjective appears in the matrix and *than*-clauses, except for the difference in adjectives, (264). In (264), ιL abbreviates the interpretation of *the ladder*, and ιD the interpretation of *the doorway*. The result is that an utterance of (261) is predicted to be judged true just in case the assigned measure of the ladder's wideness exceeds the measure of the doorway's tallness; since both *wide* and *tall* denote in the domain of the measure function LENGTH, the comparison succeeds so long as such a measure function is assigned by A.

(264) $[\![$The ladder is **wider** than the doorway is **tall**$]\!]^A = \top$ iff

$$\exists s'[\text{Holder}(s')(\iota L) \ \&\ \textsc{wide}(s') \ \&\ A(\mu)(s') \succ$$
$$\iota d[\exists s[\text{Holder}(s)(\iota D) \ \&\ \textsc{tall}(s) \ \&\ A(\mu)(s) \succcurlyeq d]]]$$

Inspecting the interpretation in (264), we can see where the interpretive restrictions on $[\![$-*er*$]\!]$ are enforced. As soon as $[\![$-*er*$]\!]$ composes with $[\![$thanP$]\!]$, the range of permissible interpretations of '$\succ$' is fixed: it must be an ordering on degrees that represent measures of tallness-states. This serves to restrict the range of permissible measures invoked by the interpretation of *much* in the matrix clause.

Next, consider a case with incommensurable adjectives, as in (220a), repeated here as (265). Again, *wide* and *green* express predicates of different sorts of states, but they are incomparable because there is no class of measure functions that map both of these sorts of states to the same degree ordering. If the states predicated of by $[\![$*wide*$]\!]$ are not in the domain of any measure function in the class that maps to degrees representing saturation, for example, or the states predicated of by $[\![$*green*$]\!]$ are not in the domain of any measure function in the class that maps to degrees of length, then the requirements of -*er* are not satisfied.

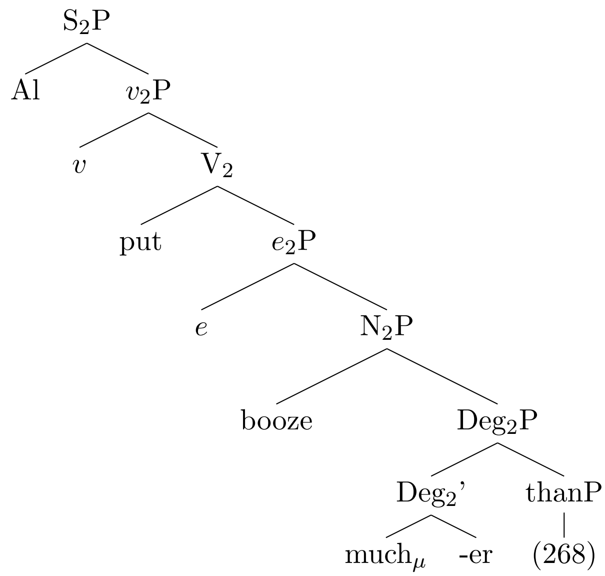
(265) ? This ladder is **wider** than the carpet is **green**.

Next, we can consider (in)commensurabilities in the nominal domain, the explanation of which is exactly parallel. Consider (221a), repeated here as (266). While *booze* and *chocolate* are different in that they predicate of different sorts of entities, they are comparable because they denote in the domain of a class of measure functions that map to degrees of volume.

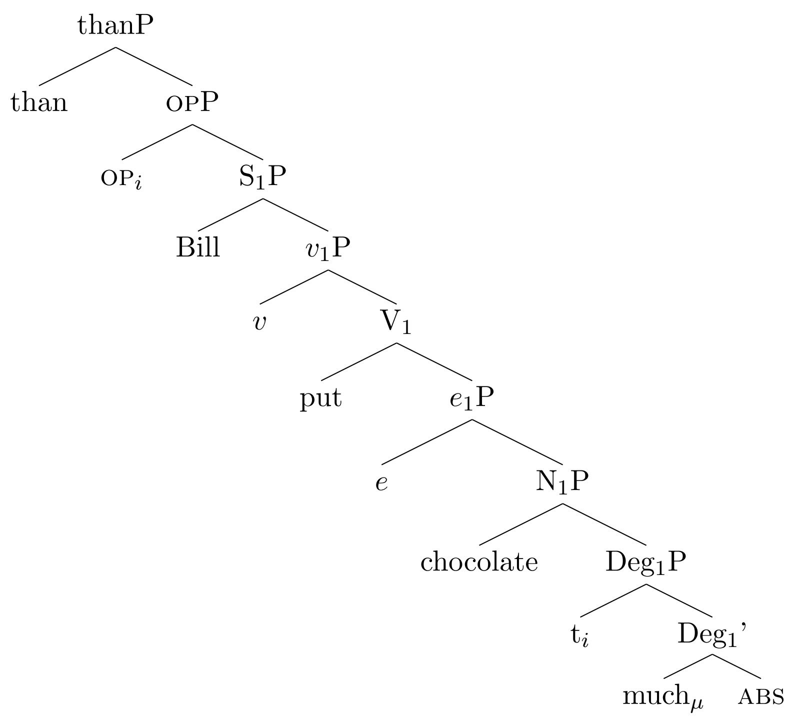
(266) Al put **more booze** in the cake than she did **chocolate**. vol

The sentence in (266) has, I assume, the structure in (267)/(268), ignoring the modifier *in the cake*.

(267)



(268)



Calculating the interpretation of these structures delivers the representation in (269): this says that an utterance of (266) is predicted to be judged true just in case there is an event of Al putting booze in the cake that measures a greater quantity than that measured by the chocolate she put in. The *than*-clause denotes a definite description over degrees that represent monotonic measures on the satisfiers of CHOCOLATE; namely, degrees representing the volume or weight of the chocolate.

Correspondingly, measurement in the matrix clause will be restricted to degree orderings along one or the other of these dimensions. Combining with the matrix nominal *booze* will work out, then, because the satisfiers of BOOZE denote in the domain of the same range of measure functions.

(269) $[\![$Al put **more booze** in the cake than she did **chocolate**$]\!]^A = \top$ iff

$$\exists e[\text{Agent}(e')(\text{Al}) \ \& \ \textsc{put}(e')(\epsilon x'[\textsc{booze}(x') \ \& \ A(\mu)(x') \succ$$
$$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \ \& \ \textsc{put}(e)(\epsilon x[\textsc{chocolate}(x) \ \& \ A(\mu)(x) \succcurlyeq d]]]]])$$

Similarly for examples like (270). *blood* and *sound* indeed predicate of different sorts of entities, but they are incomparable because *booze* denotes in the domain of a measure function in the class that maps to degrees of volume, whereas *sound* does not: it denotes in the domain of the class that maps to degrees of loudness. Such measure functions map into different degree orderings, and thus *-er* cannot order their respective degrees.

(270) ? Al saw **more blood** than he heard **sound**.

The explanation works the same way for commensurabilities in the verbal domain like (271), though there is a slight twist here. Events satisfying DRIVE are in the domain of measure functions that map to degrees representing temporal duration, as are events satisfying SLEEP. Restricting *-er* to comparing such degrees at the point where the *than*-clause merges with the complex *much-er* restricts the range of permissible measures to just those whose range contains degrees representing temporal duration. Hence, (271) is predicted to be evaluable.

(271) Last night Al **drove** more than Bill **slept**. dur

The situation with incommensurabilities in the verbal domain is somewhat more subtle. Consider (272). On one way of approaching this sentence, it is incommensurable: *sped up* in the *than*-clause is most naturally read as being measured by speed. But, it may also be read more eventively, as expressing a measure by temporal duration. If it is possible to fix on such an interpretation, (272) might be acceptable.

(272) ? Last night Al **slept** more than Bill **sped up**.

On the theory just developed, the insights of the standard theory with respect to incommensurability can be maintained, however, they are unified with parallel effects in the nominal and verbal domain. Incommensurability needn't, then, be seen as an argument for scales lexically associated with adjectives; it can be seen as an effect of the interaction between the measure functions contributed by *much* and the semantic requirements of comparative morphemes like *-er*. Capturing these data in a unified way relies on the idea that GAs are predicates of (measurable) states, for which there is independent evidence; moreover, this move allowed me to account for their modification behavior in comparative constructions.

It might be argued that the data discussed in this chapter so far could have led one to exactly the opposite conclusion: why not hypothesize, instead, that all 'gradable' adjectives, nouns, or verbs (i.e., the ones that are evaluable in comparative constructions) in fact denote measure functions? Then, all of their 'non-gradable' counterparts can denote simple properties. This option, in fact, corresponds to Cresswell's (1976) theory; I turn to comparisons with his and other closely related accounts directly.

4.4. Monotonicity everywhere

On the theory I have proposed, GAs do not denote measure functions, but properties of states. I suggested that we can understand the difference between 'gradable' and 'non-gradable' adjectives not in terms of their type ($\langle e, d\rangle$ versus $\langle e, t\rangle$), but in terms of whether their domains are ordered; GAs denote in structured domains, whereas non-gradable adjectives do not.

I now compare this theory with three closely related alternatives, and suggest how the present account might improve on them. My theory shares with Cresswell (1976) a unified account of adjectival with nominal comparatives, and an acknowledgement of the uniform presence of *much* in these constructions (whether overt or covert). However, it differs in that he encodes the mapping to degrees directly in the lexical entries of adjectives and nouns, rendering *much* semantically vacuous. My theory shares with Bale (2006, 2008) the idea that there are more 'primary' or 'primitive' orderings associated with adjectives, but differs in that it does not posit a 'universal' scale that these orderings are mapped to. Finally, the theory shares with Reichenbach (1947) appeal to something like 'specific properties' (here, *states*), but Reichenbach states comparisons directly over those entities rather than over degrees.

In what follows, I show how consideration of each of these differences weigh in favor of the present approach.

4.4.1. Comparison with Cresswell

On the account I've proposed, there is nothing irreducibly linguistically different about the gradability of adjectives and adverbs, on the one hand, and nouns and verbs on the other. All denote entities/events/states that can be measured by $[\![$*much*$]\!]$, and the result of measurement compared by $[\![$-*er*$]\!]$ or $[\![$*as*$]\!]$, etc. This proposal was supported by (i) the observation that there is no in principle difference in the kinds of dimensions for measurement the various constructions can give rise to (intensive/extensive), (ii) that, regardless of syntactic category, incommensurability phenomena are observed, and (iii) the morphosyntactic evidence that *much* is uniformly present.

A uniform treatment seems to be what Cresswell (1976) (also von Stechow

1984) endorsed. On Cresswell's theory, every lexical item interpretable in comparative constructions is treated of a formal piece, regardless of any conceptual differences between them. Crucially, however, Cresswell posits that *all* of the relevant lexical items involve lexically specified measure functions. He follows Bresnan (1973) as I do in assuming that *much* is always present in comparatives, but, importantly, Cresswell holds that the semantic function of that expression is merely to mark the presence of a degree argument.

As Cresswell himself notes, his analysis predicts that pairs like (273a)-(273b) should be synonymous, contrary to fact. The difference in meaning here must be due to (at least) the presence of *much*, but this would be impossible if it were effectively meaningless (Cresswell 1976:290-1). Indeed, if ⟦*much*⟧'s only job is to signal the presence of a degree, and if ⟦*water*⟧ involves those, then (273a) should not even be generable.

(273) a. Drink **this water**.

b. Drink **this much water**.

On the account I advocate, *much* introduces degrees. Such degrees can be demonstrated, (273b). There is no degree to demonstrate in (273a).

There is a yet more tangible difference between the accounts. As we've seen, assigning *much* an interpretation allowed us to maintain the idea that nouns and verbs denote properties (whether gradable or non-gradable), while capitalizing on independently motivated ideas concerning the structure of their domains of application. If the mapping to degrees that *much* performs has to be monotonic, then we understand why only certain dimensions for comparison are available with e.g. *coffee* and *run*. On Cresswell's theory, the tight connection between mereological structure and dimensionality in comparatives is effectively accidental.

4.4.2. Comparison with Bale

The account I have offered hypothesizes that the orderings of individuals, events, and states that the grammar of measurement and comparison requires can accessed and talked about only via the semantics of *much*. This type of account presupposes, of course, that there are many degree scales that can be recruited for such talk. However, there is an alternative style of approach in which degree scales are **constructed** on the basis of antecedent orderings. This is the account offered most prominently by Bale (2006; 2008) for adjectival comparatives. I briefly discuss his proposal and some of the pieces of it that should be incorporated into the present account, as well as the shortcomings that prevent me from adopting it.

Bale's theory has two major ingredients, supplemented as discussed below. The first is that gradable adjectives denote what he calls 'primary scales', i.e. binary relations between individuals. Comparative constructions are particular in that they involve expressions that map relative positionings of individuals on primary scales to what he calls the Universal Scale, notated Ω. Ω is a degree structure isomorphic to the rational numbers between 0 and 1, inclusive, and the greater-than ordering on those numbers.

On Bale's account, gradable adjectives denote binary relations between individuals that corresponds to the relation expressed in English by the equative, e.g. *as beautiful as*. Each of these relations, being described essentially in terms of $\succcurlyeq$, is transitive, reflexive, and connected. Notice they are **not antisymmetric**. For suppose that a and b are equally beautiful (i.e. $\langle a, b\rangle, \langle b, a\rangle \in$ BEAUTIFUL), it is nevertheless false that $a = b$. These primary orders are very similar to the orderings I posit for GAs, except Bale's order individuals rather than states.

(274) **Primary scales (Bale)**

i. BEAUTIFUL $=_{df}$ $\langle D_\beta, \{\langle x, y\rangle \mid x \text{ has as much beauty as } y\}\rangle$

ii. $\text{INTELLIGENT} =_{df} \langle D)_\iota, \{\langle x, y\rangle \mid x \text{ has as much intelligence as } y\}\rangle$

iii. $\text{TALL} =_{df} \langle D_\tau, \{\langle x, y\rangle \mid x \text{ has as much height as } y\}\rangle$

iv. $\text{WIDE} =_{df} \langle D_\upsilon, \{\langle x, y\rangle \mid x \text{ has as much width as } y\}\rangle$

Comparatives demand linear orders, which adds that every individual is comparable to every other individual in the relation; this requires an antisymmetric relation. By collapsing the entities in these relations into equivalence classes under $\succcurlyeq_{\text{ADJ}}$, Bale maps them to linear orders. The set of all equivalence classes relative to a given primary scale is defined as in (275). The linear order on the set of all equivalence classes can be defined a couple of ways, (276).

(275) **Defining the set of all equivalence classes (Bale)**

For all binary relations $\zeta = \langle D_\zeta, \succcurlyeq_\zeta\rangle$,

i. $a \sim_\zeta b$ iff $\forall x(\zeta(a, x) \Leftrightarrow \zeta(b, x)\ \&\ \zeta(x, a) \Leftrightarrow \zeta(x, b))$ — equivalence

ii. $\forall x \in D_\zeta$, $\bar{x}^\zeta =_{df} \{y \mid y \in D_\zeta\ \&\ x \sim_\zeta y\}$ — equiv. class

iii. $E_\zeta =_{df} \{X \subseteq D_\zeta \mid \exists x \in D_\zeta\ (X = \bar{x}^\zeta)\}$ — all equiv. classes

(276) **Defining an ordering on equivalence classes (Bale)**

i. $\forall X, Y \in E_\zeta$, — option 1

$(X \succcurlyeq_{E_\zeta} Y)$ iff $\exists x, y[(x \in X)\ \&\ (y \in Y)\ \&\ \zeta(x, y)]$

ii. $\forall x, y \in D_\zeta$, — option 2

$(\bar{x}^\zeta \succcurlyeq_{E_\zeta} \bar{y}^\zeta)$ iff $\zeta(x, y)$

These pieces in place, Bale defines the universal scale Ω as in (277).

(277) **The universal scale Ω (Bale)**

Let $\Omega = \langle D_\omega, \succcurlyeq_\omega\rangle$, such that

i. D_ω is a set of degrees in one-to-one correspondence with the set of rational numbers between 0 and 1 inclusive. Elements are labeled d_x, where x is a rational number.

ii. For all $d_x, d_y \in D_\omega$, $d_x \succcurlyeq_\omega d_y$ iff $x \geq y$.

Primary scales are mapped to the universal scale by the universal homomorphism, $\mathfrak{H}$, defined in (278). The domain of $\mathfrak{H}$ is the set of all primary scales, and its range is a set of functions from elements of those primary scales to elements of Ω that preserves the ordering relation between them. This homomorphism can be seen as roughly equivalent to the understanding I have accorded to *much* above.

(278) **The universal homomorphism (Bale)**

Let $\mathfrak{H}$ be a function from Σ to $\mathcal{H}$ such that

i. Σ is the set of all possible (primary) scales with a finite domain.

ii. $\mathcal{H} = \{h \mid \exists \langle E_\zeta, \succcurlyeq_{E_\zeta} \rangle \text{ s.t. } \forall x, y \in E_\zeta,\ x \succcurlyeq_{E_\zeta} y \Leftrightarrow h(x) \succcurlyeq_\omega h(y)\}$.

On Bale's theory, GAs denote functions from comparison classes (type $\langle e, t\rangle$) to measure functions ($\langle e, d\rangle$), except the mapping to degrees proceeds by reference to $\mathfrak{H}$ in the lexical entry of the adjective *adj*, (279).

(279) $[\![\text{adj}]\!] = \lambda C \lambda x. \mathfrak{H}_{(\text{ADJ}\restriction C)/\sim}(\bar{x}^{\text{ADJ}\restriction C})$ type $\langle\langle e, t\rangle, \langle e, d\rangle\rangle$

C in (279) is a context variable whose value is either given by the context, or can be explicitly set via a *for*-phrase, for example as in (280). *for*-phrases are interpreted as a **restriction** on the set of individuals in the binary relation associated with a given adjective, (281). Intuitively, $R{\restriction}A$, for some primary scale, is just like R, except it only orders the entities that are in the set A (i.e., it only contains pairs of entities drawn from A).

(280) Al is **taller for a woman** than Bill is **tall for a man**.

(281) **Restriction (Bale)**

For all binary relations R and sets A,

$R \restriction A =_{df} \langle (D_R \cap A), (\succcurlyeq_R \cap (A \times A))\rangle$.

for-phrases, on this account, don't contribute to the at-issue content of sentences containing them: their NP arguments are interpreted as a set A, and a presupposition is triggered that $A = C$, as in (282).

(282) **Presuppositions of <u>for</u>-phrases (Bale)**

For all predicates P, comparison classes C, and sets A,

$[\![\text{for}_{cc}(D)(A)]\!](P) = P$, defined iff $(C = A)$.

Finally, (non-decomposed) *more* combines with a gradable adjective *adj* after *adj* combines with C, then takes the degree d denoted by the *than*-clause to return a property of individuals.

(283) $[\![\text{more}_{Bale}]\!] = \lambda g \lambda d \lambda x. g(x) \succ d$ type $\langle\langle e, d\rangle, \langle d, \langle e, t\rangle\rangle\rangle$

Now we can see how Bale accounts for simple adjectival comparatives (like those we have focused on in this chapter) and what he calls 'indirect' comparisons like that in (284). Bale notes that it can't be that entities ordered on the scales associated with *beautiful* and *tall* are directly commensurable (i.e., degrees-of-beauty and degrees-of-smartness are not orderable with respect to one another), and so something else must explain the fact that (284) is perfectly interpretable.

(284) Esme is **more beautiful** than Seymour is **intelligent**.

On Bale's account, (284) is fine because we're not comparing along the primary scales associated with *beautiful* and *smart* directly, but rather along the universal scale. To see how this works, consider the truth conditions he assigns to (284), in (285), assuming a uniform comparison class variable for the matrix and *than*-clauses. Here, 'e' represents Esme, and 's' represents Seymour. (285) says that an utterance of (284) is predicted to be judged true just in case Esme is more highly ranked on the primary scale associated with *beautiful* than how highly Seymour is ranked on the primary scale associated with *intelligent*.

(285) $[\![(284)]\!] = \top$ iff $\mathfrak{H}_{(\beta\restriction C)_{/\sim}}(\bar{e}^{(\beta\restriction C)}) \succ \mathfrak{H}_{(\iota\restriction C)_{/\sim}}(\bar{s}^{(\iota\restriction C)})$

Such represents the basic case for Bale's analysis of comparatives. In contrast, what he calls 'direct' comparisons like that in (286) are more complex. In (286), the heights and widths of other people do not (or cannot) matter, so it can't be that it compares Seymour's ranking on the primary scale associated with *tall* to his ranking on the primary scale associated with *wide*. In that case, (286) would be predicted to be judged true even if Seymour's width is in fact greater than his height (it just so happens that he's taller and skinnier than most people). Yet, the basic apparatus that Bale has constructed relies on finding an individual's relative position on two primary scales, mapping those positions to positions on the universal scale, and comparing universal degrees.

(286) Seymour is **taller** than he is **wide**.

To address what appears to be a direct comparison of measures in such cases, Bale posits that elements of **conventional measurement schemes** participate as individuals in the binary orders associated with adjectives. What this means is that things like $6'11''$ are included in the domain of the primary scale, for example, as elements of the set in (288).[20]

(288) $\{\mathrm{Al}, \mathrm{Bill}, \mathrm{Seymour}, 2'11, 5'2'', 5'', ...\}$

For comparisons like (286) to be defined, Bale is explicit in requiring that the utterance context provide three things, namely that (i) the measurements that participate are a finite set, (ii) they have a definite granularity (i.e., the set cannot

[20]This is not altogether untoward, because it is true (as Bale points out) that a phrase like *6 feet* can appear in subject position, and be predicated of *tall*; however, this could be an artifact of the predicate *be tall*, perhaps allowing for ellipsis of material indicating a measurement:

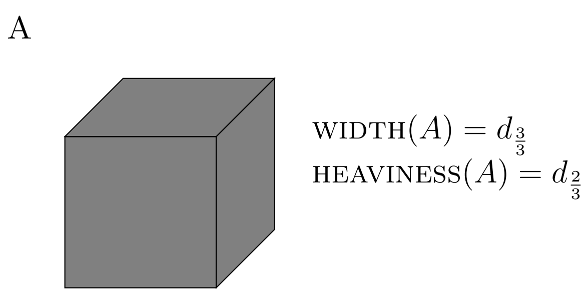
(287) a. 6 feet is tall.
b. ? 6 feet is unexpected.
c. ? 6 feet is a tall measure.

be *dense*[21]), and (iii) there are the same number of levels of measurements for the two conventional schemes so associated. So long as these requirements are fixed in a context, and so long as the adjectives in each clause have such an associated "measuring stick", the result is predicted to be judged not only interpretable, but true. This is so because the fact that we're talking *about* height or width effectively drops out of the picture in the mapping to universal degrees. Does this account make the right predictions?

Consider (289) against Fig. 4.1. By stipulation, there is only a single box in the universe. Now assume: the scale for width gives units in inches, and spans from 1 to 3 units, which gives universal degrees $\{d_{\frac{3}{3}}, d_{\frac{2}{3}}, d_{\frac{1}{3}}\}$. The scale for weight gives units in pounds, and spans from 1 to 3 units, which gives universal degrees $\{d_{\frac{3}{3}}, d_{\frac{2}{3}}, d_{\frac{1}{3}}\}$. The stipulated set of measures is finite, the granularity is limited, and both measurement schemes have the same number of levels, i.e. 3. Here, (289) should not only be judged perfectly interpretable, but determinately true. This fails to accord with intuition.

(289) ? Box A is **wider** than it is **heavy**.

Figure 4.1: (In)commensurability on Box A



To take a more esoteric example, suppose that we fix some conventions for measuring pinkness and due-westness; with those conventions fixed, (290) also should

[21]See Solt & Gotzner 2012 for arguments based on experimental evidence that this assumption may not accord with speaker judgments.

be perfectly acceptable and determinately judged true or false.[22]

(290) ? That house is pinker than it is due west.

Such examples are potentially problematic for Bale's theory of 'direct' comparisons.[23] A. Djajali (p.c.) points to a class of examples that are problematic for Bale's account of 'indirect' comparisons. Say a given woman, Al, is the superlative exemplar of two categories, neither of which associates with a conventional measurement scheme, e.g. beauty and cleverness, and Al is such that (291) is judged true in a context. In this case, whatever fractional degree is assigned to Al with respect to the two categories, for any numbers of levels of degrees n, they will both equal $d_{\frac{n}{n}}$ and so such sentences should be judged either incoherent or false, contrary to intuition.

(291) Al is **more beautiful** than she is **clever**.

Since Bale's account may not correctly predict that 'direct' comparisons depend on sharing a dimension for measurement, and fails to predict the interpretability of 'indirect' comparisons in superlative contexts, the account does not appear adequate to capture the interpretation of comparatives more generally.

However, so far Bale's account correctly predicts that sentences like (292) only have an 'indirect' comparison reading, which others cannot (see Bale 2011). That is to say, (292) is not read as a comparison of Seymour's width to his height directly (so he doesn't have to be wider than he is tall): indeed, if the primary scale associated with *tall* is restricted to the set of men, then measurement values can't get in!

(292) Seymour is **wider for a man** than he is **tall for a man**.

Nonetheless, the account of examples like (292) in terms of restriction by comparison classes account faces its own challenges. Schwarz (2010) notes that not

[22]Thanks go to M. Morreau (p.c.) for this example.

[23]A. Bale (p.c.) does not agree that these are problematic, since given the right context (290) should be fine and interpretable as a direct comparison. Further investigation is needed here.

all *for*-phrases are interpreted as restrictions on the binary relation underlying the gradable adjective. While (293a) will be correctly derived on Bale's account (e.g., as expressing that Mia's height is significant for a three year-old's height), (293b) will not be. On the other hand, Schwarz's own analysis, by his admission, can't account for examples like (292).[24]

(293) a. Mia is tall **for a 3-year old**.

b. Mia has an expensive hat **for a 3-year old**.

There are aspects of Bale's account which are shared with my own: GAs denote in ordered domains, and comparatives involve homomorphic mappings from these domains to degrees. However, by not constructing scales in the manner he does my account is able to avoid the potential issues we've seen with his. For completeness, however, I must extend the theory I've developed here into one that can accommodate the contributions of *for*-phrases.[25]

Lastly, it seems to me that what Bale calls an 'indirect' comparison like (284) isn't indirect at all, just the nature of the degrees has been misdiagnosed. One could imagine that the (ordered) states predicated of by $[\![$*beautiful*$]\!]$ and $[\![$*intelligent*$]\!]$ are just the sort to be measured along a (shared) dimension like SUBJECTIVE VALUE. I discuss Bale's 'indirect' comparisons in some more detail in Chapter 6.

4.4.3. On 'specific properties'

The logical form I propose for GAs is most similar to that proposed by Reichenbach (1947). After introducing his account, I discuss Bartsch & Venneman's (1972) major criticism of it, and then detail how the present proposal avoids that

[24] See Schwarzschild 2013 for a recent attempt to acount for both Bale's and Schwarz's data.

[25] A sketch of an idea is: analyze the head, *for*, as denoting a thematic relation between its NP complement and the states predicated of by the adjective. Such an account likely would rely on a notion of equivalence classes of states. Consideration of this possibility would take me too far afield here, however.

criticism.

Reichenbach doesn't appeal to particulars like events or states in his analysis of verb phrases, but rather to 'specific properties'. Specific properties are properties that are unique to the individuals that bear them, and that themselves can have various (higher-order) properties. On his account, verbs like *move* denote one-place properties of specific properties, rather than relations (as on the traditional view, or on accounts with partial thematic separation as that assumed here), as do adverbs.

(295) gives the logical form that Reichenbach's account assigns to a sentence like that in (294). (295) says that there is a specific property f of Al which itself has the MOVE property.

(294) Al moves slowly.

(295) $\exists f[f(\text{Al}) \;\&\; \textsc{move}(f) \;\&\; \textsc{slow}(f)]$

There is a specific property f that Al has, f is in the class of movement properties, and f is in the class of slow properties.

We can note that this analysis bears more than a family resemblance to the neodavidsonian analysis following Parsons (1990) for similar sentences, (296). The major difference is that, following Davidson (1967), the kind of 'specific property' Reichenbach has in mind is here reified as a first-order entity in its own right.[26]

(296) $\exists e[\text{Agent}(e, \text{Al}) \;\&\; \textsc{move}(e) \;\&\; \textsc{slow}(e)]$

There is an event e of which Al is agent, e is a moving and e is slow.

To see the problems that arise for Reichenbach's account, consider how he analyzes the comparative in (297a) and the measure phrase construction in (297b), in (298a) and (298b), respectively.

[26]Indeed, if one could understand the 'Agent' relation as a kind of 'expressive' as opposed to 'denotational' instance of functional application, formally the two accounts may be indistinguishable. In terms of natural language ontology, they differ considerably.

(297) a. Al is taller than Bill is.

b. Al moves at 50mph.

(298) a. $\exists f \exists g[f(\text{Al}) \;\&\; g(\text{Bill}) \;\&\; \textsc{tall}(f) \;\&\; \textsc{tall}(g) \;\&\; f > g]$

There is a specific property f and a specific property g, Al has f and Bill has g, f and g are in the class of tallness properties, and f is greater than g.

b. $\exists f[f(\text{Al}) \;\&\; \textsc{move}(f) \;\&\; f = 50]$

There is a specific property f that Al has, f in the class of motion properties, and f is equal to 50.

Bartsch & Venneman (1972) criticize the forms in (298a) and (298b) on two points. First, what is the ordering relation '>' between specific properties that (298a) appeals to? This can be corrected by positing orderings such as those we've discussed in this chapter. More importantly, how can a **specific** property equal the number 50?

To see the problem in perhaps starker light, consider how Reichenbach's analysis would extend to the equative sentence in (299), given in (300). The issue is in the stated identity between f and g. A major motivation of Reichenbach's account is that (like Agent or Holder relations), specific properties are unique to their bearers. How can f and g be unique to Al and Bill, respectively, and yet nevertheless be identical?

(299) Al is as tall as Bill is.

(300) $\exists f \exists g[f(\text{Al}) \;\&\; g(\text{Bill}) \;\&\; \textsc{tall}(f) \;\&\; \textsc{tall}(g) \;\&\; f = g]$

There is a specific property f and a specific property g, Al has f and Bill has g, f and g are in the class of tallness properties, and f is equal to g.

Interestingly, precisely the problems that face Reichenbach's account dissolve on the account that I propose. (Note that, in (301), I am retaining Reichenbach's style for ease of comparison.) On this account, the states s and s' are uniquely related to their bearers, and the relevant identity is stated over the **measures** of those states, rather than over the states themselves.

(301) $\exists s \exists s'[\text{Bearer}(s, \text{Al})\ \&\ \text{Bearer}(s', \text{Bill})\ \&\ \textsc{tall}(s)\ \&\ \textsc{tall}(s')\ \&\ \mu(s) = \mu(s')]$
There is a state s and a state s', Al is the bearer of s and Bill is the bearer of s', s and s' have the tall property, and the measure of s is equal to the measure of s'.

I have showed that Cresswell's, Bale's, and Reichenbach's theories have potentially problematic aspects that are avoided on the theory I propose. With respect to Cresswell, by positing the separation of the measure function from the adjective, I am in a better position to account for the distribution and semantic contribution of *much*. With respect to Bale, by presupposing (rather than constructing) degree orderings I am able to account for perceived incommensurabilities. Finally, with respect to Reichenbach, by stating comparisons between degrees rather than between 'specific properties', I am able to avoid stating implausible identities.

Before concluding this chapter, I consider two sets of questions that arise for my account specifically: the question of the fine-grainedness of states, and of the interpretation of adjectives with *very*, measure phrases, and when they occur bare (in a copular or attributive construction).

4.5. Fine-grainedness

One question that arises for neodavidsonian analyses generally, and equally well here, is the question of how a conjunct like '$\mu(s) \succ \delta$' can be true or false, independent of the information that s is a state of tallness. That is, I have not relativized the interpretation of *much* to a predicate directly, which might be thought necessary to provide the description under which the measured entity is being viewed. The interpretation of '&' as Boolean conjunction depends on it.

The same question arises with respect to the interpretation of thematic relations themselves. To see the issue, consider the sentences in (302a)-(302b). Suppose that there is, intuitively, exactly one event in the world that suffices to make both (302a) and (302b) true.

(302) a. Al **sold Bill a car**.

b. Bill **bought a car from Al**.

The problem is, if there is just one event (which happens to be describable in multiple ways), how does the Agent function in (303a) and (303b) know, independently of the information that e is a buying or a selling, who to map e to? The Agent of e could equally well be Al the seller or Bill the buyer, etc.

(303) a. ...Agent(e, Al)...

b. ...Agent(e, Bill)...

There are two major options. One involves hypothesizing that, naïve intuitions aside, there just *are* two events involving Al, Bill, and the car. Thus, Agent is a function in virtue of the fine-grainedness of the entities that value the e variables (see e.g. Parsons 1990, for whom it is unproblematic to assume that the buying and the selling are, in fact, distinct events). The second involves relativizing the Agent function to the verbal description (see e.g. Schein 2002 who introduces relativization via perspectives, or scenes, on events). For discussion of these options and others, I refer the reader to Pietroski (in prep).

The analysis I have offered assumes that the individuals, events, and states that a measure function μ predicates of are fine-grained enough to do the semantic work required of them. As with neodavidsonian analyses generally, the account can be recast within a relativist's aesthetic, as desired.

4.6. *very*, MP, 'positive'

Lastly, I address the so-called 'positive' construction, *very*, and measure phrases with GAs. Until such data have been addressed, it is not clear how to ultimately compare the proposal I offer with the standard theory. Some of the major reasons for thinking that GAs are (type-theoretically) different from nouns and verbs is that they are context-sensitive when they appear bare in the copular construction, they combine directly with *very* (*very tall/fast*, but not **very soup, run*) and with measure phrases (*2 feet tall*). In this section, I offer suggestions for how to account for these patterns on the present theory.

First, the standard analysis of GAs as denoting measure functions allows us to neatly explain why *very* combines with GAs but not with nouns and verbs. What is this test diagnosing, if not the presence of a measure function-denoting expression?

To answer this question, suppose that *very* is a comparative morpheme, on a par with *-er*, *as*, etc.[27] On my account, this means that it must combine with *much* before it combines with an expression of any other category. Indeed, *much* is required with *very* when that expression modifies nouns and verbs, see (304b,c). Why is *much* prohibited in (304a)? It appears to me that *much* cannot surface in (304a) for precisely the same reason that it can't surface with *as*: obligatory *much*-deletion (Bresnan 1973).[28]

(304) a. Al wasn't **very (*much) intelligent**.

b. Al didn't eat **very *(much) soup**.

c. Al didn't **run very *(much)**.

[27] For the semantics of *very*, see discussion and proposals in Wheeler 1972, Lasersohn 1999, Katz 2005, Bale 2006, and references therein.

[28] These examples use a negative environment to illustrate the distribution of *very* and *much*, because (the overt form of) *much* is odd in positive contexts. Instead of *Al ate (very) much soup*, English speakers say *Al ate a lot of soup*. I have no explanation for this pattern; see Bolinger 1972 for discussion of the (diachronic and synchronic) fluidity of form of degree words, also Doetjes 1997; Solt 2009 discusses the NPI-like behavior of *much*.

Second, how is (305) interpreted, if *tall* does not denote a measure function? The standard theory can successfully capture such data by positing that *6 feet* denotes a degree, which saturates the degree argument of $[\![tall]\!]$ (on the individual-degree relation analysis of GAs) or that of ABS (on the measure function analysis). Without a degree variable to saturate, such sentences should be predicted to be judged anomalous.

(305) Al is **6 feet tall**.

On this point, I appeal to the fact that very few gradable adjectives actually appear in the measure phrase (MP) construction, as Schwarzschild (2005), Bale (2006), and Beck (2011) point out. The standard theory, on which all GAs are degree predicates, predicts that measure phrases should always be able to show up with GAs in such constructions; however, witness the failure in English of examples like (306).

(306) a. * Al is **160 pounds heavy**.

b. * That book is **a thousand dollars expensive**.

c. * The temperature is **99 degrees Fahrenheit hot**.

Such negative data can be multiplied, and some positive data added: all of the GAs that are anomalous or ungrammatical in the MP construction are fine with MPs in the comparative (*This dress is two pounds too heavy/a thousand dollars more expensive than that one*). This suggests that the analysis of MP constructions needn't, and probably shouldn't, be taken as central to the semantics of GAs. Regardless, the present account could be augmented with a lexically-specified type-shifting rule to capture the good cases (see Schwarzschild 2005 for an analysis like this; though Schwarzschild's particular solution would have to be modified considerably). My theoretical intuition about this, however, would be to pin the matter on expressions like *6 feet*, rather than *tall*: for instance, MPs could be lifted to the type of states in limited cases.

In this vein, a similar sort of objection can be leveled at the standard theory of GAs. Nearly any GA can be modified by an XP that picks out an entity or state of affairs that typifies some standard for the GA, for example (307). The present account could be expanded to handle such facts by appealing to equivalence classes of states (this relates to an analysis for MP constructions briefly entertained by Bale 2006). That is, the interpretation of a sentence like (307a) could be paraphrased as *Al is in a state of heaviness that it is in an equivalence class with a state of heaviness that Andre-the-Giant is/was in.* In any case, the type of construction in (307) is productive in English, yet there is no obvious sense in which expressions like *Andre the Giant* or *dinner at the Ritz* are degree-denoting.

(307) a. Al is **Andre-the-Giant heavy**.

b. Our meal was **dinner-at-the-Ritz expensive**.

c. The temperature is **Florida hot**.

Third, what about the occurrences of bare GAs in the copular construction or in attributive position? Interpreting GAs as predicates of states (simpliciter) might, on the face of it, incorrectly predict that they have a weaker meaning when they occur here: the examples in (308) should just express that there is a state of height that Al is in (cf. $\exists s[\textsc{tall}(s)\ \&\ \mathrm{Holder}(s, \mathrm{Al})]$), which would be predicted to be trivially true whenever the referent of *Al* physically exists.

(308) a. Al is **tall**.

b. Al is a **tall** woman.

There are at least four ways of approaching this question, some of which may be more theoretically appealing than others.[29]

[29] The following discussion focuses on the copular construction, but should extend to the attributive construction.

The first would be to accept that, indeed, such sentences would have a trivial interpretation, and so receive strengthened interpretations in context. This route is pursued by Panzeri & Foppolo (2012) and Panzeri et al. (2013) to explain otherwise puzzling developmental data. They found that 3 year-old children treated novel objects of any size as positive instances of adjectives like *tall* or *short*, and that adults could be made to act the same way when it was made clear that informativity was not at stake.[30] Their explanation of this pattern was that children start out with a literal (i.e., weak) meaning for GAs, and as pragmatic competence develops, they strengthen this meaning, as adults generally do.

The second option would be to posit that there is a covert *much* in the positive construction, which is deleted by the same rule that applies in adjectival comparative constructions with, e.g., *as*, *too*, and *how*. One could then adopt von Stechow's (1984) analysis of e.g. *Much gold fell off the counter*, in which a morpheme like POS applies to *much*. However, positing two covert morphemes whenever there is a bare occurrence of a GA makes such an account less than desirable.

The third option would be to blame the construction itself.[31] Consider that (309a) expresses that the relevant argument meets some minimal standard of validity, while (309b) means that the relevant argument exceeds some significant standard. Assuming a theory in which a GA's measure function is somehow retained in its nominalization (see Chapter 7 for discussion of such accounts in the adjectival-verbal direction), it is not obvious why (309a) fails to require the exceeding of a **significant** standard. Perhaps certain constructions, like (309b), require a notion of 'exemplification' that other, minimally contrasting constructions don't. More pairs are given in (310).

[30] Here's how they did this. They presented adults with an alien puppet who, they said, is just learning the language, and tasked them to say of his statements whether they were correct or not. However, they should not say he is incorrect when what he says is just "not optimal" yet strictly speaking "true", i.e., in cases where a scalar implicature is violated.

[31] To extend this explanation to attributive occurrences of GAs, they would have to be analyzed as involving something like a small clause, with a covert copula or equivalent morpheme.

(309) a. This argument **has validity**.

b. This argument **is valid**.

(310) a. Al has **beauty** / is **beautiful**.

b. Al has **intelligence** / is **intelligent**.

c. Al has **tallness (height)** / is **tall**.

d. Al has **width** / is **wide**.

Finally, the fourth way of approaching the issue would be to blame the concepts associated with the GAs themselves. What would it mean to be TALL, simpliciter? We know that, minimally, it would be to HAVE HEIGHT. But, very many things have height, and not all of them can be tall, lest the concept lose all significance. Yet, we know exactly what it would mean for one individual to be taller than another, namely, it is to have more height, and the question of whether one *is* tall doesn't arise. However, here's one way you might figure out whether something falls under the concept TALL: see if it is at least *as tall* as the tallest individual in the context. Schmidt et al. (2009) provide evidence suggesting that copular adjectival predications require 'indifference' or 'equivalence' with respect to the superlative exemplar of the category in an evaluation context.

Regardless, some general observations suffice to show that copular adjectival constructions should not be analyzed as a comparative construction in the first place, casting doubt on the explanatory value of degree-theoretic, POS-based accounts of their semantics. First, no overt exponent of POS has been found in any language in which it has been sought. Mandarin's *hen* at one time seemed to counter this trend, but Grano (2012) argues convincingly that it is not. Moreover, appeal to the presence of a degree-theoretic POS suggests a precision and crispness that the positive construction simply lacks (see Fults 2006 and Kennedy 2007 for data, discussion, and arguments).

For another, data from Navajo suggest that the copular predication is very different from other comparative constructions, which is not predicted on any account that appeals to a degree-theoretic POS. Navajo GAs are marked by either 'comparative' or 'absolute' aspect. When they appear bare in the copular construction, a GA like *tall* can only take absolute aspect, yet other Navajo comparative constructions (like the comparative, equative, etc.) require comparative aspect (this pattern is observed and discussed by Bogal-Allbritten 2013a).

Lastly, it may not be that GAs are particularly special when it comes to context-sensitivity. Indeed, we don't know whether *tall* or *expensive* applies to an individual until we know what comparison class we're talking about, (311). Al may be tall for a jockey, but not tall for a basketball player, etc. Such facts might lead one to the conclusion that, since GAs require appeal to a standard for their interpretation, they should have a different compositional semantics. I will now suggest that appeal to context-sensitivity and standard-dependence is neither necessary nor sufficient to delimit GAs from expressions of other categories.

(311) a. Al is **tall (for a jockey)**.

b. This bracelet is **expensive (for plastic jewelry)**.

With respect to **necessary**. As Rotstein & Winter (2004) and Kennedy & McNally (2005) discuss, there are many GAs whose standards are *not* context-dependent in the same way, and which consequently do not make a lot of sense with *for*-phrases. *dirty* counts as a GA, as evidenced by the fact that it combines with the usual host of comparative morphemes, (312).

(312) a. This cloth is **dirtier** than that one is.

b. This cloth is **as dirty** as that one is. *etc.*

However, *dirty* does not comfortably combine with a *for*-phrase specifying a comparison class in the positive construction (313). The explanation for this is that any amount of an object's being dirty is enough to classify it as *dirty*, and as such it is lexically specified for a "minimum standard". This results in an interpretive clash when we attempt to provide it a relative standard-degree descriptor. (An alternative would be to say that it is unclear what the standard of dirtiness 'for a terry cloth' should be.)

(313) This cloth is **dirty** (?for a terry cloth, ?for a bar towel).

In this connection, it is interesting to question why mass nouns and atelic verbs might not combine with standard phrases, see (314). This could be for the simple reason that they are much like minimum standard GAs (Morzycki 2012): (315a) is intuitively true if some non-zero amount of wine actually passed through John's gullet, and (315b) is true if John did at least the minimum required for what he was doing to count as running.[32]

(314) a. Al drank **wine** (?for a lightweight, ?for a box of wine).

b. Al **ran** (?for a running, ?for a marathon).

(315) a. Al drank wine.

b. Al ran.

With respect to **sufficient**. Despite not combining comfortably with *for*-phrases, mass nouns and atelic verbs do display some degree of context-sensitivity in "how much" of what they predicate of needs to be present for an example to be felicitous. (This example based on one given by Schwarzschild & Wilkinson 2002,

[32]Interestingly, V. Hacquard (p.c.) observes that examples like (314) seem possible with *much*:

i. Al didn't drink **much wine for an alcoholic**.

ii. Al didn't run **much for a world champion marathon runner**.

A plausible avenue for analysis, then, is that **even in the adjectival case**, with *for*-phrases a silent MUCH is present. I leave investigation of this intriguing possibility for future research. Regardless, the similarity drawn in the text, then, might seem a disanalogy, if minimum standard adjectives indeed cannot appear with *for*-phrases.

p12.) The quantity of wood expected for (316a) to be judged true is normally quite different from that expected for (316b) to be judged true. The barest fragment of a wood shard is enough to make (316a) true, but it is harder to say that the same quantity would make (316b) true.[33]

(316) a. There's **wood in my eye**.

b. There's **wood in my truck**.

The same can be shown for atelic verbs like *run*. The amount required of running in (317a) is presumably exponentially smaller than the amount of running required for (317b), again considering normal circumstances.

(317) a. The rat **ran a maze**.

b. Al **ran a marathon**.

Continuing on this thread, it is likely that intensive nouns like *idiot* and verbs like *love* are probably better analyzed parallel to relative standard GAs: a minimal degree of idiot-like behavior is probably not enough to earn one the label of *being an idiot* (318a), and some small amount of loving affection is probably not enough to warrant the declaration in (318b).

(318) a. John is **an idiot**.

b. John **loves Mary**.

The proper analysis of bare adjectival predications with GAs (and the relation to adjectival comparative constructions) remains, to my mind, an open question; these thoughts are suggestive, but I do not yet deem any of them conclusive. Further research is required to see whether and how which of these possibilities could be fruitful. Nonetheless, I henceforth assume that bare adjectival copular constructions do not involve a (degree-theoretic) POS morpheme as part of their interpretation.

[33] Of course, this discussion may just be about felicity, and not truth. In the context of a murder investigation, and a crucial bit of evidence is whether there is wood in the back of a given pickup truck, any detectable amount of wood would suffice for truth.

4.7. Conclusion

This chapter argued for a revision of one of the basic tenets of the degree analysis in natural language semantics: that gradable adjectives (and adverbs) denote neodavidsonian *properties*, rather than measure functions (or, by extension, individual-degree relations). The semantic data that have been argued in the literature to set GAs apart from nouns and verbs (namely giving rise to intensive dimensions for measurement, and incommensurability phenomena) do not really seem to. Moreover, data from iterated modification, and a closer look at the morphosyntax of comparative constructions, support such a conclusion.

The theory I developed crucially appeals to a different notion of 'measurement' in semantics than is standardly employed. Following discussion by Berka (1983), I suggested that, instead of thinking of measure functions as acting *on* objects and measuring them *for* specific dimensions, we measure properties directly. These 'specific properties' can be thought of as states that a given object is in. Once this distinction is made, measurement can be uniformly understood as a monotonic mapping from ordered domains to degrees.

Following previous literature, I showed how the restrictions on the interpretation of *-er* (namely, that it orders only degrees on the same scale) can be used within the context of the new theory to explain cases of commensurable and incommensurable 'subcomparatives' across syntactic categories. While the explanation for (in)commensurability indeed ultimately rested on the interpretation of the comparative morpheme, I showed how it can be understood in the context of a theory in which *much* alone introduces measure functions.

Finally, I compared the resultant theory with some of the less-standard theories in the literature, those of Cresswell (1976), Bale (2006, 2008), and Reichenbach (1947). Each of these theories was shown to founder on some or other aspect of the distribution and interpretation of comparatives in English, while the present theory does not.

In the next chapter, I turn to another class of phenomena that similarly cross-cuts syntactic category divides: classes of sentences that uniformly give rise to comparisons by number.

Chapter 5: Grammar in measurement

One of the major results of the theory developed in Chapters 3 and 4 was that the notion of measurable and non-measurable predicates is uniform across syntactic categories: measurable predicates are those that meet the definedness conditions on *much*, i.e., requiring that the measured domain is ordered, and that licit mappings from those domains to a degree structure be homomorphic.

There, this distinction played a role in distinguishing expressions at what I will call an 'internal' level. The relevant data are summarized in (319): mass nouns like *coffee* are distinguished from (singularly-interpreted) count nouns like *idea* (319a); atelic verb phrases like *run* are distinguished from singular telic verb phrases like *kill Peter* (319b), gradable adjectives like *patient* are distinguished from non-gradable adjectives like *pregnant* (319c), and finally, gradable adverbs like *quickly* are distinguished from non-gradable adverbs like *hourly* (319d).

(319) a. Al had **more coffee/?idea** than Bill did. nominal

b. Al **ran in the park/?killed Peter** more than Bill did. verbal

c. Al is **more patient/?pregnant** than Susie is. adjectival

d. Al worked **more quickly/?hourly** than Bill did. adverbial

In this chapter, I show that what are usually non-measurable predicates can become measurable, in a certain sense. That is, I am now concerned with more 'external' levels, and its consequences for measurability.

In the nominal domain, count nouns are interpretable in the comparative by the addition of the plural morpheme -*s*, (320a). In the verbal domain, comparisons with telic verb phrases are licit if they can be construed as repeatable (i.e., interpreted habitually), (320b). In the adjectival domain, comparisons with non-gradable adjectives are interpretable with post-adjectival *more*, if they can be construed as Stage-level (320c). Finally, in the adverbial domain, comparisons with non-gradable adverbs are interpretable with post-adverbial *more*, seemingly as regular verbal comparisons (320d).

(320) a. Al had **more coffees/ideas** than Bill did. — nominal

b. Al **ran to the park/hit Peter** more than Bill did. — verbal

c. Al is **patient/pregnant more** than Susie is. — adjectival

d. Al worked **quickly/hourly more** than Bill did. — adverbial

All of (320a)-(320d) can (and in some cases, must) be read as comparisons of numbers of entities (i.e., their cardinality, or their numerosity[1]): (320a) expresses a comparison of numbers of coffees/ideas, (320b) of numbers of running-to-the-park/hitting-Peter events, (320c) of numbers of occasions on which a certain sort of state obtains, and (320d) of numbers of events of a certain sort. The theory I develop in this chapter holds that such readings uniformly arise when comparisons are made between predicates that are, overtly or covertly, plural-marked.

Measuring with *much*, **which measures are possible** depends importantly on the nature of **what is talked about**. Adding structure can have the effect of changing what is talked about—e.g., masses in (319a) versus pluralities in (320a). This point is crucial because, across the various cases, it is not obvious that the explanation could be pinned on any particular lexically-specified measure function. While the facts I discuss in this chapter would not be impossible to capture on the

[1]For the purposes of this chapter, I set aside proportional readings as discussed by e.g. Tanaka 2006 for Japanese comparatives, and, similarly, such readings of expressions like *many*; see Barwise & Cooper 1981, Partee 1989, among others.

standard theory as presented in Chapter 2, they are expected on the account I have advanced and I extend in this chapter.

I first discuss the distribution and interpretation of forms like those in (320a)-(320b), paying particular attention to the role of aspect in verbal comparatives. I then present the formal framework for plural representations that I will assume, and my analysis of how *much* interacts with such representations to guarantee comparisons by number in the cases where it is observed. Next, I focus on cases like (320c), paying particular attention to the role of Stage versus Individual level interpretations of adjectives. Lastly, I discuss possibilities for the relating this analysis to the observation that verbs like *want* have both stative and eventive readings in comparatives.

5.1. Plurality and aspect

This section examines structural consequences for measurement in comparisons across the nominal and verbal domains. In each domain, two things are illustrated: (i) that adding to or changing the functional structure of a sentence renders formerly non-measurable predicates measurable, and (ii) that such additions or changes to a predicate that was already measurable have the effect of excluding dimensions for comparison that were formerly possible.

There are three salient features of nominal and verbal comparative constructions that any adequate proposal for their semantics should address. In Chapter 3, I captured two of them, given certain assumptions about the lexical properties of nouns and verbs: first, that predicates understood as relevantly 'singular' are anomalous here, due to the semantic properties of *much*; and second, that measures must be monotonic with respect to a given ordering, again due *much*. The third feature is that certain structural environments lead only to comparisons by number.

Table 5.1: 'Internal' and 'external' factors affecting dimensions for measurement in the **nominal** domain.

	mass		**count**	
	expression	measure(s)	expression	measure(s)
−plural	*rock*	volume, weight	*idea*	*
+plural	*rocks*	number	*ideas*	number

Table 5.2: 'Internal' and 'external' factors affecting dimensions for measurement in the **verbal** domain.

	atelic		**telic**	
	expression	measure(s)	expression	measure(s)
perfective	*run*-PFV *in the park*	dur, dist	*reach*-PFV *the top*	*
imperfective	*run*-IMPF *in the park*	dur, dist, num	*reach*-IMPF *the top*	number

The data that I discuss in this section is summarized in Tables 5.1 and 5.2.

Unlike the mass-count flexible *rock*, abstract count nouns like *idea* are anomalous in the comparative: (321a) cannot express a comparison by e.g. the profundity of the idea, or by the number of ideas satisfying the predicate. However, by adding the plural morpheme, a count noun is perfectly interpretable and is interpreted only as a comparison of numbers of entities (321b).

(321) a. * Susie has **more idea** than Al does. *profundity, *num

b. Susie has **more ideas** than Al does. *profundity, num

With the bare mass noun in (322a), certain varied dimensions for measurement are possible, but many are not. In addition to prohibiting comparison by TEMPERATURE, COLOR, etc., we may observe that (322a) does not express a comparison by number. However, adding the plural morpheme as in (322b) leads to **only** comparisons by NUMBER (322a). This was discussed by Bale & Barner (2009) and demonstrated experimentally by Barner & Snedeker (2005).[2]

[2] Giving children a choice between e.g. area and number to answer a *more* question, formulating the question with the bare mass term children chose area, but they chose number when it was formulated with the plural noun.

(322) a. Al found **more rock** than Bill did. weight, vol, *num

b. Al found **more rocks** than Bill did. *weight, *vol, num

Similar patterns can be observed in the verbal domain: certain non-measurable predicates become measurable by the addition of functional structure, and certain dimensions for measurable predicates are ruled out by those same additions.

As mentioned in Chapter 3, plurality in the verbal domain can be detected using aspectual morphology in languages that mark the relevant distinctions, and is here often referred to as 'pluractionality'.[3] We saw there that telic VPs with perfective aspect are ungrammatical in the comparative, see (323)-(325). The perfective involves non-plural verb phrases (Ferreira 2005); with telic predicates, they are relevantly like singular count nouns with respect to the comparative.

(323) **Perfective telic (Bulgarian)**

*Minalata sedmica Ivan **izkaĉi** **vrâh Musala poveče** ot Maria.
last week Ivan climb-PFV.PAST top Musala more from Maria

'Last week, Ivan climbed Musala more than Maria.'

(324) **Perfective telic (Spanish)**

*La semana pasada Juan **subío** **al Mt.Tom más** que María.
the week past Juan climbed-PFV the Mt.Tom more than María

'Last week, Juan climbed Mt.Tom more than María.'

(325) **Perfective telic (Hindi)**

*John **uupar-tak** Mary-se **zyaadaa pahunc-aa**.
John top-till Mary-than more reach-PFV

'John reached the top more than Mary.'

In contrast, the result of combining telic predicates with imperfective morphology (Bulgarian, Spanish) or habitual morphology (Hindi) is perfectly grammatical

[3] See Cusic 1981 for extensive discussion of pluractionality across languages, also Cabredo Hofherr & Laca 2012. Bach 1986, Ferreira 2005, van Geenhoven 2004, 2005, Nakanishi 2007, Henderson 2012, a.o. give formal implementations of plurality in the verbal domain. Wellwood et al. 2012 discuss interactions between aspect and *more*.

(326)-(328), and the only interpretation expressed is as a comparison of numbers of events. Imperfective morphology can express habitual aspect, which, it has been said, indicates that the verb phrase is plural (Ferreira 2005[4]).

(326) **Imperfective telic (Bulgarian)**

V	onezi	dni	Ivan	**izkaĉvasê**	**vrâh**	**Musala**	**poveče**	ot	Maria.
in	those	days	Ivan	climb-IMPF.PAST	top	Musala	more	from	Maria

'In those days, Ivan climbed Musala more than Maria.'

(327) **Imperfective telic (Spanish)**

En	esos	días	Juan	**subía**	**al**	**Mt.Tom**	**más**	que	María.
in	those	days	Juan	climbed-IMPF	the	Mt.Tom	more	than	María

'In those days, Juan climbed Mt. Tom more than María.'

(328) **Habitual telic (Hindi)**

Ram	**yeh**	**film**	Sita-se	**zyaadaa**	**dekh-taa**	hai.
Ram	this	film.F	Sita-than	more	see-HAB	be.PRS

'Ram watches this film more than Sita.'

Bulgarian, Spanish, and Hindi show us that singularly-interpreted (i.e., perfective) telic verb phrases are incompatible with the comparative, and plurally-interpreted (i.e., imperfective) telic verb phrases are necessarily interpreted as comparisons by number. This pattern can be replicated in English, aspectually deficient as it is, in how the comparative interacts with 'repeatable' versus 'non-repeatable' telic predicates (Nakanishi 2007).

A repeatable verb phrase is one whose action can be performed by a single agent multiple times (i.e., that can be performed habitually). The predicate *climb the mountain* is like this; observe that with *for an hour* it cannot be interpreted as describing the temporal duration of a single event, while with *in an hour* it does, (329a). In the comparative, only a comparison by numbers of events is possible with such a predicate (329b).

[4] Imperfective is also used to express progressive aspect, which, on Ferreira's view, occurs when the imperfective contains a singular verb phrase.

(329) a. Al used to climb the mountain **?for an hour / in an hour**.

b. Al **used to climb the mountain more** than Bill did.

In contrast, a non-repeatable verb phrase is one whose action cannot be performed by a single agent multiple times. The verb phrase *make his chair* patterns as a telic predicate (330a), where the iterative reading with *for an hour* is odd, as it implies the chair was made multiple times. Predicates like this resist relevantly plural interpretations. As may perhaps by now be expected, such predicates in the comparative, too, are odd.

(330) a. Al made his chair **?for an hour / in an hour**.

b. ? Yesterday, Al **made his chair more** than Bill did.

In English, we can also use other temporal modifiers to indicate whether a singular or plural interpretation is intended. In some cases, collective telic predicates like *form a triangle* are anomalous in the comparative: with a punctual adverbial (331a), *more* cannot be used to express something about the relative sizes of the relevant triangles, or the number of triangles formed. Changing to a durative adverbial like *that afternoon* leads to a comparison by number (331b), wherein the time frame is wide enough to admit of a plurality of events.

(331) a. * **Then** the boys **formed a triangle more** than the girls did. *size, *num

b. **That day** the boys **formed a triangle more** than the girls did. *size, num

In Chapter 3, we saw that the telicity profile of a verbal predicate has a similar effect in verbal comparatives to that observed with mass nouns. However, this distinction only plays a role when there is no plural or pluractional interpretation: when there is, the 'internal' properties of expressions cease to affect the available dimensions for comparison, and even render those dimensions inaccessible. We saw this for plurality in the nominal domain, and by the pluractionality inferrable from verbal aspect in the verbal domain.

Before introducing what I will consider to be parallel data in the adjectival domain, I first turn to the question of how plural and pluractional reference may be modeled.

5.2. Plur(action)als

This section considers two major issues in the semantics of plurals: whether plural reference includes singular entities, §5.2.1, and the question of whether plurals are represented as individual sums, plural variables, or sets, §5.2.2. The discussion will be brief, as the resolution of these issues (in particular the second) is not within the scope of this dissertation. Nonetheless, I ultimately suggest that adopting a sets-based approach to plurality makes it easier to see why plural representations interact how they do with comparative morphemes. I hope to show, despite this choice, that nothing crucial hinges on it.

After presenting the formalism for nominal plurality that I will adopt, I show how parallel representations can be generated in the verbal domain. With these pieces in place, the next major section offers a treatment of the S-/I-level distinction that I again render formally parallel: with post-verbal *more*, S-level predicates are represented as pluralities of events during which a certain sort of state holds.

5.2.1. In/exclusivity

This section considers whether plural denotations are *inclusive* or *exclusive* with respect to atomic entities ('inclusive', 'exclusive' terminology is due to Farkas & de Swart 2010). The **exclusive theory** posits that the plural form of a noun *N* essentially means *two or more N* (Link 1983, Chierchia 1998b). The **inclusive**

theory posits that the plural form essentially means *one or more N* (Krifka 1989, Sauerland 2003, Sauerland et al. 2005, Chierchia 2010). The exclusive theory expects plural nominals to behave as though they do not apply to singular entities, and the inclusive theory expects them to behave as though they do.[5]

'Dependent plurals' (de Mey 1981) pose a problem for both theories (see Schwarzschild 1996 for discussion). Consider first the problem they pose for the inclusive theory. Construed inclusively, (332) should be paraphrasable as *Five boys flew one or more kites*, and so is predicted to be judged true in a situation wherein five boys flew only one kite in total. This fails to accord with intuition, however; utterances of sentences like (332) are intuitively judged true just in case the boys flew more than one kite. Yet, if *kites* **can apply** to singular entities, this is unexpected.

(332) Five boys flew kites.

Consider next the problem dependent plurals pose for the exclusive theory. The exclusive theory suggests that sentences like (333) should be paraphrasable as *No boys flew two or more kites*, and so utterances of such sentences should be judged true in a situation in which any number of boys flew no more than one kite each. This fails to accord with the intuition that such utterances would be judged true only if *no* boy flew *any* kites. This is unexpected, if plurals **cannot apply** to singular entities.

(333) No boys flew kites.

Zweig (2008; 2009) offers a pragmatic solution to the challenges posed by dependent plurals.[6] On Zweig's account, plurals are uniformly, basically interpreted inclusively, with exclusivity inferred just in case it strengthens the interpretation of the sentence in context. 'Strength' can be defined as in (334).

[5]This discussion owes a great debt to Champollion 2010.

[6]This analysis is also suggested in Gillon 1992:620, fn.23.

(334) Sentence S_1 is **stronger** than sentence S_2 iff:

$[\![S_1]\!]$ will be judged true in less contexts than $[\![S_2]\!]$.

To see how this helps with (332), consider that *Five boys flew one or more kites* will be judged true in any situation in which *Five boys flew two or more kites*, but not vice versa. Therefore, an utterance of (332) will trigger the exclusivity inference, as expected on Zweig's account.

The situation is reversed with (333) and in downward-entailing contexts generally: *No boys flew two or more kites* will be judged true in any situation in which *No boys flew one or more kites* will, and not vice versa. Hence, the exclusivity inference would not strengthen the interpretation of the utterance, and thus will not be triggered, again as expected.

I henceforward assume that Zweig's suggestion is basically correct: plural expressions refer not only to pluralities proper, but also to the singular entities that comprise them. I turn next to the question of how pluralities themselves are represented.

5.2.2. Plur(action)al reference

It is often assumed, as we've seen, that a count noun like *cup* denotes a set of (singular) objects, with no ordering relation between them. However, theories differ on what is the appropriate representation of a plural noun like *cups*.

(335) $[\![\text{cup}]\!] = \{a, b, c\}$

First, note that plural noun phrases have the cumulativity property, unlike singular count nouns, (336). Following discussion in Chapter 3, this suggests that they denote something with the structure of a join semi-lattice. In this context, adopting the inclusive theory for plurals boils down to whether the minimal elements in those lattices are singular entities ($|x| = 1$) or plural entities ($|x| > 1$).

(336) **Nominal plural cumulativity**

a. $\top$ If these are *cups* and those are *cups*, their sum is *cups*.

b. $\bot$ If this is *a cup* and that is *a cup*, their sum is *a cup*. cf. *cups*

There are four major approaches to the question of what plural reference involves.[7] The **individual sums theory** (beginning with Link 1983), the **plural variable theory** (beginning with Boolos 1984; see also Schein 1993, et seq, Pietroski (2005), et seq; see Nicolas 2008 for an extension to mass nouns), the **sets theory** (Winter 2001 cites Scha 1981, van der Does 1992, and van der Does 1993 for early works; also Schwarzschild 1996, Winter 2001), and the **aggregates** theory (Gillon 1992; see also Bale & Barner 2009).[8] Assuming the "background set" in (335), the satisfiers of $[\![cups]\!]$ would be represented by each of the theories as in (337).[9]

(337) **Different theories of the satisfiers of plural expressions**

i. Individual sums $a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c$

ii. Plural variables $(a), (b), (c), \begin{pmatrix} a \\ b \end{pmatrix}, \begin{pmatrix} a \\ c \end{pmatrix}, \begin{pmatrix} b \\ c \end{pmatrix}, \begin{pmatrix} a \\ b \\ c \end{pmatrix}$

iii. Sets $\{a\}, \{b\}, \{c\}, \{a, b\}, \{a, c\}, \{b, c\}, \{a, b, c\}$

iv. Aggregates $\{a, b, c\}, \{ab, c\}, \{ac, b\}, \{bc, a\}, \{ac, ab\}, \{ab, bc\}, \{ac, bc\}, \{abc\}$

Here, in brief, is the main way in which these representations differ. The individual sums theory treats entities and sums of entities as equivalent sorts of objects in the domain. So D_e contains, in addition to the individual cups a and b, their sum, $a \oplus b$. The plural variable theory admits only of the cups a and b in D_e, and allows variables to be satisfied by multiple entities simultaneously. So,

[7]See also the extended discussion in Lasersohn 2011.

[8]Bunt 1985 offers a theory in terms of 'ensembles', which are relevantly like aggregates for present purposes.

[9]Note that Link 1983 did not include singular entities in his plural denotations. The individual-sums theory given in (337) is updated based on the sorts of considerations discussed in the previous section.

the braces in (337ii) enclose the value(s) of a plural variable on a given assignment. The sets theory treats pluralities as sets of entities. Depending on one's theory, in addition to admitting the cups a, b in D_e, there may also be sets of such entities in D_e. The aggregates theory can be seen as a hybrid of the individual sums theory and the sets theory: *aggregates* themselves are roughly equivalent to individual sums, and are elements of the domain of entities, but the satisfiers of plural expressions are *sets* of such entities, which (depending on one's theory) may or may not be in D_e.[10] This discussion is summarized in (338).

(338) **Ontological commitments of the four theories**

i. Individual sums — D_e includes entities like a, b, c and like $a \oplus b$

ii. Plural variables — D_e includes entities like a, b, c

iii. Sets — D_e includes entities like a, b, c and (perhaps) like $\{a, b\}$

iv. Aggregates — D_e includes entities like a, b, c, like ab, and (perhaps) like $\{a, bc\}$

The theories thus differ in how ontologically committed they are. However, what is relevant for present concerns is what all of the theories share. Regardless of the particular representation chosen amongst (337), and the ontological commitments thereby inherited, there is a natural ordering between the satisfiers of plural expressions that we may neutrally refer to as 'plural part-of', a relation that defines a join semi-lattice. On the individual sums theory, x is a plural part of y just in case every atom in x is an atom in y. On the plural variables theory, x is a plural part of y just in case every entity among the xs is an entity among the ys. On the

[10] An *aggregation* is "a set of aggregates with the requirement that their join yields the greatest aggregate... and [which] is minimal," i.e., "no aggregate in the set is a proper sub-aggregate of any other aggregate in the set" (Gillon 1992:619). This is the aggregates-based version of the notion of a "cover" on sets: "A cover is just like a partition except it is not restricted to disjoint sets", i.e. "X covers Y iff $X \subseteq P(Y) \wedge \emptyset \notin X \wedge UX = Y$" (Gillon 1992:617, fn. 15), where P indicates powerset and U generalized union.

sets theory, x is a plural part of y just in case x is a subset of y. On the aggregates theory, x is a plural part of y just in case every aggregate in x is an aggregate in y.

Because of the relative equivalence between the theories at this level of abstraction, I can essentially remain neutral with respect to the proper representation of plurals in what follows. What is most relevant is just that representations like those in (337) are appropriate for plural-marked nominals.[11] All involve atomic entities and pluralities formed from them.

Nonetheless, I will opt to represent plurals using the sets theory. This representation needn't inherit any particular ontological baggage, since it needn't posit that sets are in D_e. The plural arguments of the relevant functions can be defined as ranging over subsets of the powerset of the background set, i.e. the extension of the bare nominal. This constructive approach builds sets out of basic entities, rather than positing that they are themselves basic.

Turning to the verbal domain, recall that I am assuming that the telicity distinction is formally parallel the mass/count distinction. Atelic verb phrases like *run in the park* have mass-like referential properties, while telic verb phrases like *eat two apples* have count-like referential properties. I am now concerned with the greater functional structure that such phrases may be embedded within. We saw that it was possible to detect the verbal equivalent of plurality by looking at languages that have imperfective morphology: with telic verb phrases, this is interpreted as habitual aspect. Ferreira (2005) suggests that this pattern indicates that a verb phrase is (covertly) plural-marked, while, on the other hand, perfective and progressive involve non-plural verb phrases.

Importantly, plural verb phrases are cumulative, whereas singular verb phrases are not. To see this in English, we can make use of the contrast between habitual

[11] This is not to say that representations like these are not appropriate for some nouns without plural marking, e.g. *furniture*. See, among others, Gillon 1992, Bale & Barner 2009 for relevant discussion.

eat apples and perfective *eat two apples.* Indeed, *Al eats apples* gives rise to the cumulativity inference, but *Al ate two apples* does not.

(339) **Verbal pluractional cumulativity**

a. $\top$ If this is *eat apples* and that is *eat apples*,
their sum is *eat apples.*

b. $\perp$ If this is *eat two apples* and that is *eat two apples*,
their sum is *eat two apples.*

Consequently I suggest that it is appropriate to talk about pluractional reference using the same vocabulary as for plural reference, except with respect to D_v. (340) displays the kinds of entities proposed to satisfy plural expressions on the four theories discussed previously, as applied to the domain of events.

(340) **Different theories of the satisfiers of pluractional expressions**

i. Individual sums $e, e', e'', e \oplus e', e \oplus e'', e' \oplus e'', e \oplus e' \oplus e''$

ii. Plural variables (e), (e'), (e''), $\begin{pmatrix} e \\ e' \end{pmatrix}$, $\begin{pmatrix} e \\ e'' \end{pmatrix}$, $\begin{pmatrix} e' \\ e'' \end{pmatrix}$, $\begin{pmatrix} e \\ e' \\ e'' \end{pmatrix}$

iii. Sets $\{e\}, \{e'\}, \{e''\}, \{e, e'\}, \{e, e''\}, \{e', e''\}, \{e, e', e''\}$

iv. Aggregates
$\{e, e', e''\}, \{ee', e''\}, \{ee'', e'\}, \{e'e'', e\}, \{ee'', ee'\}, \{ee', e'e''\}, \{ee'', e'e''\}, \{ee'e''\}$

As noted above and discussed in greater detail below, I will use the language of the sets theory to talk about verbal pluractionality as well as nominal plurality.

5.3. Measuring pluralities

In Chapters 3 and 4, I offered a theory of comparative constructions in which *much* introduces degrees, regardless of the syntactic category of expression that forms the basis for the comparison. In this section, I show how this account naturally extends to contexts in which only comparisons by number are expressed.

I begin by presenting an analysis in which the presence of the nominal plural morpheme necessarily leads to comparisons by number with *much*. I contrast this theory with the widely held view that comparisons by number in the nominal domain in English are due to the semantics of a different expression, *many*. I show that, for crosslinguistic morphological reasons as well as for semantic reasons, such an account is both unnecessary and unwarranted.

5.3.1. Constructing measurables

On the analysis in which *much* monotonically maps entities/events/states to degrees, pervasive grammatical effects on the available dimensions for comparison should be expected: (almost) all we need to know is how the composition of plural and/or aspectual structure affects the measured domain, and dimensionality can be made to follow.

When $[\![much]\!]$ measures, the nature of **what is measured** determines the possibilities for **how it's measured**. Given the disassociation between 'internal' and 'external' measurability, I propose that plural morphemes introduce a new kind of (measurable) entity, which, by its nature, restricts the interpretation of *much* to measurement by number. The definedness conditions on *much* are, as discussed in Chapters 3 and 4, that (i) the domain for measurement must be structured; (ii) the mapping to degrees must be homomorphic; and (iii) the mapping must be extensive.

On this view, if measuring a plurality is a different thing than measuring entities directly, the pattern in (341a)-(341b) is expected.

(341) a. * Susie has **more idea** than Al does. *num

b. Susie has **more ideas** than Al does. num

What has to be explained, though, is why with plural-marked nouns like *rocks*, the only possible dimension for comparison is number, despite the conceptual availability of other dimensions, and their availability in the absence of plural marking. An analysis in terms of *much* faces two challenges. The first can be seen by observing that (342a) cannot express a comparison of measures by weight, which would seem to be monotonic on a domain of objects. However, given the intuitions surrounding (342a), there is the serious question of why this dimension is ruled out. The second is the question of why the form *many* surfaces in examples like (342b). I address each of these challenges below.

(342) a. Al has **more rocks** than Bill does. num, *weight

b. Al has **as many rocks** as Bill does. num, *weight

With respect to the first challenge, it is true that, on the face of it, a measurement by weight would meet the monotonicity condition on *much*'s interpretation. My solution crucially relies on the idea that pluralities are **different kinds of things** than singular entities.

On the sets theory, while count nouns have a denotation like that in (343i), plural count nouns have a denotation like that in (343ii). Were we to attempt to apply $[\![much]\!]$ to the entities satisfying *cup*, it would fail since there is no ordering on that set. However, the sets in (343ii) are ordered by the plural part-of relation, and so measurement can proceed. Moreover, since the measured objects are sets (i.e., pluralities), measurement by number can be invoked. As Schwarzschild (2006) points out, number is monotonic with respect to plural part-of structures; meanwhile, sets don't have weights.

(343) i. $[\![\text{cup}]\!] = \{a, b\}$

ii. $[\![\text{cups}]\!] = \{\{a\}, \{b\}, \{a, b\}\}$

I believe that a similar account can be adapted to the other representations of plurality, but it is not as obvious to me how to say it. I submit that however we ultimately understand plural representations, it should have as a consequence that only cardinal measures are defined for it. What is important for this dissertation is the proposal that this correspondence is necessary: if a measured domain is plural, then it is necessarily interpreted as a comparison by number.

Next, there is the question of how essentially (or 'lexically', 'internally') mass expressions interact with plurality. We have seen, on the one hand, that flexible terms like *rock* may be pluralized, and consequently the comparative in which they're embedded interpreted as a comparison by number, (344).

(344) Al drank **more coffees** than Bill did. num, *vol

Here is what I propose to account for these data. Following the discussion in Chapter 3, I hold that the base or 'internal' nominal and verbal expressions denote anti-atomic join semi-lattices. However, in order to be pluralized, they must first be mapped to a set of atoms. For this function, I propose a covert 'singulative' morpheme in the nominal and verbal domains, which I motivate presently.

Following that discussion, I address the challenge posed by *many*.

5.3.1.1. The singulative

Following discussion and argumentation in Mathieu (2012), I propose that *more coffees* contains a covert 'singulative' morpheme—i.e., an expression that maps mass domains into the count domain. Only once they have been 'singulativized' can mass expressions be pluralized. The inclusion of this morpheme is not necessary for what I will ultimately argue (one could posit a type-shift from mass domains to atomic domains in English, or even lexical ambiguity), but setting up the kind of mass-to-atomic domains will allow for a clear statement of the parallels between the nominal and adjectival domains to come.

Table 5.3: Different modes of singulative formation across languages. Sources and citations are from Mathieu (2012).

non-singular ref.	singular ref.	language	source
lyod 'ice' MASC	*l'dina* 'block of ice' FEM	Russian	Greenberg 1972
geot 'grass'	*geot-enn* FEM 'blade of grass'	Breton	Trépos 1980
gwer 'glass'	*gwer-enn* FEM 'a glass'	Breton	Ternes 1992
teen 'mud'	*teenah* SG 'a chunk of mud'	Class. Arabic	Mathieu (AlQahtani p.c.)
xamer 'wine'	*xamrah* 'an amount of wine' SG	Class. Arabic	*ibid.*
*owiiyaas***i** 'meat' IN	*owiiyaas***a** 'a piece/cut of meat' AN	Fox	Goddard 2002

The notion of the **singulative** (in the languages that show it overtly) as having the semantic role of 'atomizer' goes back to Greenberg (1972) (these and the rest of the references in this paragraph are from from Mathieu 2012). Remnants of the singulative can be detected in Russian (Greenberg 1972), Hebrew (Doron & Müller 2010), Breton (Stump 2005, Trépos 1980), Classical Arabic (Greenberg 1972), Syrian Arabic (Cowell 2005), German and Dutch (Wiltschko 2006, De Belder 2008, 2011, Ott 2011), Ojibwe (Rhodes 1990, Piggott 2007), and Fox (Goddard 2002). Table 5.3 shows some of the varieties of ways that languages mark this: in Russian and Breton, it is via a gender shift; in Classical Arabic via a singulative suffix; and in Fox via an animacy shift.

Of interest here is that, in many cases, the result of singulativizing a mass (or collective) noun can be pluralized, as the examples in Table 5.4 show.[12]

Mathieu (2012) offers an account of the singulative building on the typology of heads that encode semantic 'division' in Borer's (2005) theory. Abstracting away from the derivational details of Mathieu's account, for my purposes his proposal can be distilled as in (345), which represents the Ojibwe *mkwamiins-ag* ('pieces of ice, icicles'). In (345), the singulative is represented using SG (realized morphophonologically in Ojibwe as diminutive morphology in this example), and the plural using PL. The function of SG, on my interpretation, is to map the mass domain denoted

[12]Intriguingly, É. Mathieu (p.c.) confirms that, in singulative-marking languages, nouns marked with the singulative are ungrammatical in comparative constructions.

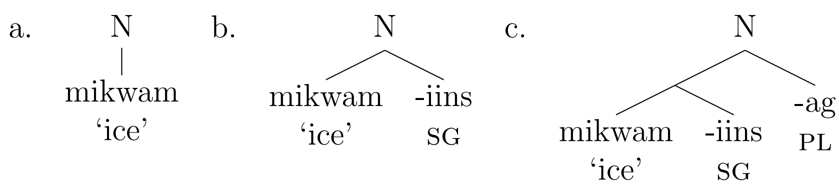
Table 5.4: Plural-marked singulatives across languages.

base	**singular reference**	**language**
se'ar 'hair' MASC	*sa'ar-a* 'hair (sg)' FEM	Hebrew
buzhug 'worms (coll)'	*buzhug-enn* 'worm (sg)' FEM	Breton
*zhooniyaah***i** 'silver, money' IN	*zhooniyaah***a** 'coin, bill' AN	Fox
mikwam 'ice'	*mkwamiins* 'ice piece, icicle' DIM	Ojibwe

plural reference	**source**
sa'ar-ot 'hairs' FEM-PL	Doron & Müller 2011
buzhug-enn-oú 'worms (pl)' FEM-PL	Stump 2005
zhooniyaaha-ki 'coins, bills' AN-PL	Goddard 2002
mkwamiins-ag 'ice pieces, icicles' DIM-PL	Rhodes 1990

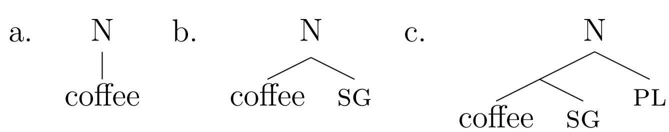
by 'ice' to a set of atoms, which PL can then map to a set of sets whose members are atomic entities constituted by ice.

(345) **(Simplified) structure for pluralized singulatives (Ojibwe)**



I propose that English *coffees* hides similar structure, as in (346).

(346) **(Simplified) structure for pluralized masses (English)**



Before continuing, a note on how this analysis is similar yet different from that offered by Kratzer 2005 (building primarily on Krifka 1992, Landman 1996, and Chierchia 1998b). Kratzer hypothesizes that all nouns (count or mass) are lexically plural: they denote sets of atoms and (in the Link 1983-style approach) the sums of those atoms. Count nouns seem singular (i.e., like sets of atoms) because they have incorporated a classifier that takes a plural predicate to the set of its atoms.[13] Moreover, both count and mass nouns must combine with a classifier like this before they can combine with the plural morpheme. Thus, on Kratzer's view (which she extends to verb phrases), there is no such thing as a singular morpheme per se.

In this dissertation so far, I have been assuming that count nouns are lexically singular, that is, that they denote sets of atoms when they come out of the lexicon.[14] This aspect of the account can be recast in Kratzer's terms, namely that they have lexically incorporated a classifier. However, I do not assume (with Chierchia 1998) that mass noun denotations are essentially the same as count noun denotations; instead, they are underspecified with respect to atomicity (Chapter 3; Gillon 1992, Bale & Barner 2009, among others). Thus, the classifier that mass nouns would need to combine with before they can be pluralized is essentially what I will propose for the singulative.

The semantics I propose for this morpheme is not one that selects atoms from the mass denotation, but rather one that introduces atoms **constituted** of the stuff denoted by the mass noun. The constitution relation idea comes from Link (1983), who uses it to account for the fact that examples like (347) are not judged contradictory. If the ring were nothing but the sum of the gold that constitutes it, that stuff, call it g, would be such that it is both NOT OLD and OLD. Link solves this problem by positing that the ring denotes an object, call it r, which stands in the '(materially) constituted-of' relation to the gold, i.e. $r \rhd g$.

(347) The ring is new but the gold is old.

The analysis I propose ties comparisons by number to the presence of an overt or covert plural morpheme. In the nominal domain in English, this is the overt

[13] I abstract away from her discussion of the ambiguity of this classifier; namely that it can map to individual *or* kind atoms.

[14] See pertinent discussion of nouns that appear to behave as plurals yet are morphologically unmarked, i.e. Turkish and Western Armenian; Bale et al. 2010. Wellwood et al. 2012 discuss two different strategies within a single language for marking plurality, e.g. in Bulgarian and Finnish.

plural morpheme *-s*. I will assume, following Ferreira (2005), that this corresponds to a covert plural morpheme in the verbal domain.

In the next section, I explain the relationship that I posit to hold between *much* and *many*, and then give the compositional details.

5.3.1.2. many as much-PL

The preceding section addressed in greater detail what I called the first challenge to the analysis of plural comparisons in terms of *much*: why it is that only comparisons by number are permitted here, rather than other (conceptually plausible, and monotonic) dimensions like weight. There was another challenge, however: namely, why it is that the form *many* surfaces in e.g. equative constructions like that in (348a), and, it has been inferred, also underlies *more* in (348b).

(348) a. Al has **as many rocks** as Bill does.

b. Al has **more rocks** than Bill does.

Often, the posited *many* in (348b) is assumed to hard-code a mapping from pluralities to their cardinalities (e.g., a function like NUMBER: $D_e \mapsto D_{\mathbb{N}}$). Such a proposal can be found in Heim (1985, 2000), Bhatt & Pancheva (2004), Hackl (2001, 2009) (cf. Higginbotham 1994, Doetjes 1997, and Chierchia 1998a; Schwarzschild 2006, Rett 2008, Solt 2009, to appear, take a different perspective in which *much* and *many* both denote predicates of scalar intervals containing an underspecified μ term). On the other hand, if *many* is not a primitive denoting something like the cardinality function, we need to explain why plural denotations must be measured by number in the comparative.

Bale & Barner (2009) give a non-decompositional (i.e, they give an analysis of *more*, not *much-er*) in which the nature of a plural denotation leads to a restriction to cardinal measures. This is achieved by stipulating an ordered list of measure functions $\mu_1, \mu_2, \mu_3, ...$, the first of which is the cardinality function. If a denotation is in the domain of that function, it must be chosen. Although Bale & Barner do not address monotonicity with nominal and verbal predicates, generalizing the ordered list approach would require one to stipulate, for each lexical item, which position(s) in the list one 'stops at' to select a measure function in a given context. Moreover, it would have to explain the apparent optionality of measurement with expressions like *more coffee*.

I argue, instead, that *many* is just the suppletive form of *much* plus the nominal plural morpheme, the result of a rule like that in (349), where small caps indicate lexical primitives. The reasoning will be based on the fact that a *much/many*-type opposition is not typically found across languages, but rather appears to be a quirk of English The semanticists' task, then, is to specify what it is about plural denotations that leads only to number-based interpretations in comparatives.

(349) **many formation** *(morphophonological rule)*

MUCH → *many* / __ PL

A summary of a survey of a typologically-diverse set of languages is given in Table 5.5, with the English pattern at the top and the indicated dimensions for comparison, volume or number, listed across the top. In each of the languages reported, the same interpretations are possible for nominals expressing similar concepts. In French, there is no morphological distinction between the form of *beaucoup* used with a bare or a plural marked noun. In Spanish and Italian, the same base form *mucha* or *molt-* is used, surfacing either bare or with plural agreement. In Mandarin, which lacks plural marking, the classifier *kuai* indicates that number is at issue with *henduo*. In Bangla, the classifier affix *-gulo* on *onek* indicates the same.

Moreover, this pattern does not merely reflect the fact that some nouns are (at least notionally) mass or count. The same pattern obtains for mass-count flexible nouns like *rock* or *beer*.

Table 5.5: 'much' and 'many' across languages.

volume	number	mode	language
much soup	many cookies	suppletion	**English**
beaucoup de soupe	beaucoup de biscuits	-	**French**
mucha sopa	muchas galletas	agreement	**Spanish**
molta minestra	molti biscotti	agreement	**Italian**
mnogu supa	mnogu kolaci	noun affix	**Macedonian**
henduo tang	henduo kuai quqi	classifier	**Mandarin**
onek sup	onek-gulo biskuT	classifier	**Bangla**

Spanish *más* ('more') is invariant in form, but the dimension for measurement that it compares along correlates with the presence/absence of plural agreement. (350a), for example, is interpreted as expressing that the volume of beer Silvia drank was significant, while (350b) says the same about the number of units of beer drunk.

(350) a. Silvia tomó **mucha** cerveza durante la cena
Silvia took **much** beer during the dinner
'Silvia drank a lot of beer during dinner'

b. Silvia tomó **muchas** cervezas durante la cena
Silvia took **much.pl** beer.pl during the dinner
'Silvia drank many (bottles/cups of) beer during dinner'

French is similar in that e.g. *trop* ('too') is invariant in form. Meanwhile, often the contrast between plural and non-plural is not audible (though the orthography distinguishes it, e.g. *bière*, *bières*), however, it be detected through verbal agreement, as in (351a)-(351b). In (351a) with singular agreement, the comparison expressed is in terms of the volume of the beer that was drunk, while with (351b) with plural agreement (*ont été*), the comparison expressed is in terms of the number of beers that were drunk. (These examples from M. Gagnon, p.c.)

(351) a. Beaucoup de bière **a** été bue hier soir.
much DE beer **have**.SG been drunk last night
'Much beer was drunk last night.'

b. Beaucoup de bières **ont** été bues hier soir.
much DE beers **have**.PL been drunk last night
'Many beers were drunk last night.'

The same or very similar patterns can be shown in Bulgarian (R. Pancheva, p.c.), Mandarin (A. He, p.c.), Macedonian (I. Stojanovska, p.c.), and Bangla (Biswas 2012); see also Doetjes (1997) for discussion of categorial underspecification of comparative morphemes across languages.

So we see that, in general, some morphosyntactic indication of plurality leads to interpretations by number, both with lexically count and mass nouns. Such data suggest that comparisons by number are not, in general, due to the meaning of a distinct lexical primitive. Rather, they are due to something like *much* in combination with a plural, however a language marks this. Thus, I posit that, across languages, a rule like that in (352) applies. How MUCH and PL are realized on the surface varies.

(352) **many formation** *(morphophonological rule)*

MUCH → *many* / __ PL

In the next section, I give the compositional details for this analysis of cross-categorial plural comparisons. Following that, I address potential counter-examples to this claim for English, namely cases involving expressions like *much mashed potatoes.*

5.3.2. Composition: plurals

The plural morpheme, I suggest, requires that the predicate it combines with be true of atomic entities. With some nouns, this 'singularness' is inherent (at least in the way we've been talking; e.g. *idea*). However, some mass nouns (like *rock*) can be pluralized, though, as I assumed, are most naturally interpreted as substance-denoting. To account for the fact that these can combine with the plural morpheme as well, I posited the existence of a covert singulative morpheme in English that maps anti-atomic domains into atomic domains.

I begin by discussing the derivation of sentences like that in (353), wherein the count noun *toy* is pluralized.

(353) Al broke **more toys** than Bill did.

Recall that, in Chapter 3, we hypothesized that the denotations of such nouns are quantized, and encoded this by positing that the satisfiers of functions like that in (354) contain only atoms.

(354) $[\![\text{toy}]\!] = \lambda x.\textsc{toy}(x)$

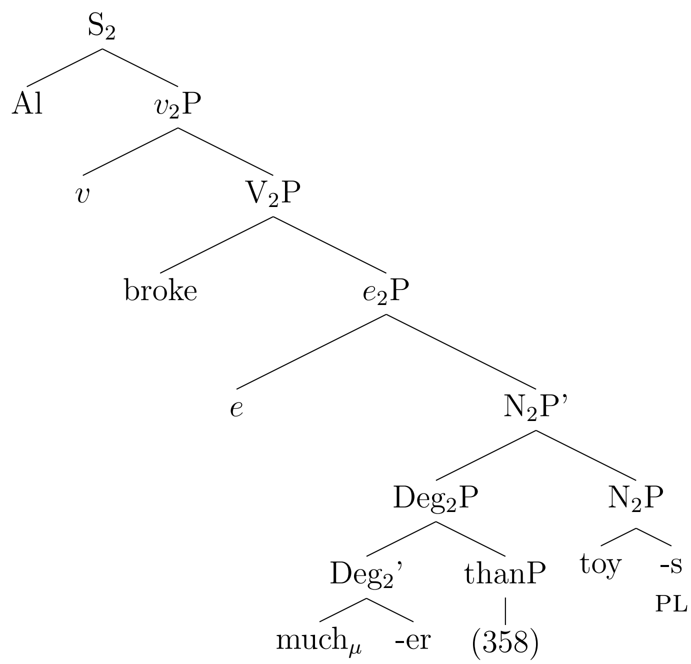
The denotation of the plural morpheme that I propose is as in (355). This morpheme requires that the predicate it pluralizes be atomic (capturing the fact that pluralities are always comprised of atomic entities), and, given such a predicate returns one that is true of **sets** of such entities (see Link 1983, Landman 1989, Chierchia 1998a, among many others, for analyses in which the plural morpheme contributes algebraic closure of an atomic set; however, on these approaches, the 'minimal parts' of the lattice are individuals, not singleton sets). As in previous chapters, I use the variable names α, β to indicate **neutrality** with respect to the types of entities e or events v. I encode the X argument as ranging over elements of the powerset, $\mathcal{P}$, of the relevant domain of entities.[15]

(355) $[\![\textsc{pl}]\!] = \lambda P_{\langle \eta,t \rangle} : \text{Quantized}(P).\lambda X : X \in \mathcal{P}(D_\eta).\forall \beta \in X[P(\beta)]$

Nouns that lexically denote sets of atoms combine with the plural morpheme without further ado. Given these assumptions, (353) has the posited (simplified) matrix-clause structure in (356). Here and below, I assume for simplicity that PL merges within the extended projection of the lexical category, in this case N.

[15] This means that, on this theory, sets are not elements of the domain of entities; this avoids some of the ontological worries discussed above.

(356)



The interpretation of (353) is derived as in (357); as usual, the *than*-clause is abbreviated δ. I have also omitted the steps above e_2P for simplicity; nothing at these levels changes from previous derivations. The result is an existential claim about breaking events involving a plurality of (atomic) toys whose measure is greater than δ.

(357)
i. $[\![\text{Deg}_2\text{P}]\!]^A = \lambda\alpha.A(\mu)(\alpha) \succ \delta$ — IR,FA x 2

ii. $[\![\text{N}_2\text{P}]\!]^A = \lambda X' : X' \in \mathcal{P}(D_e).\forall x' \in X'[\textsc{toy}(x')]$ — FA

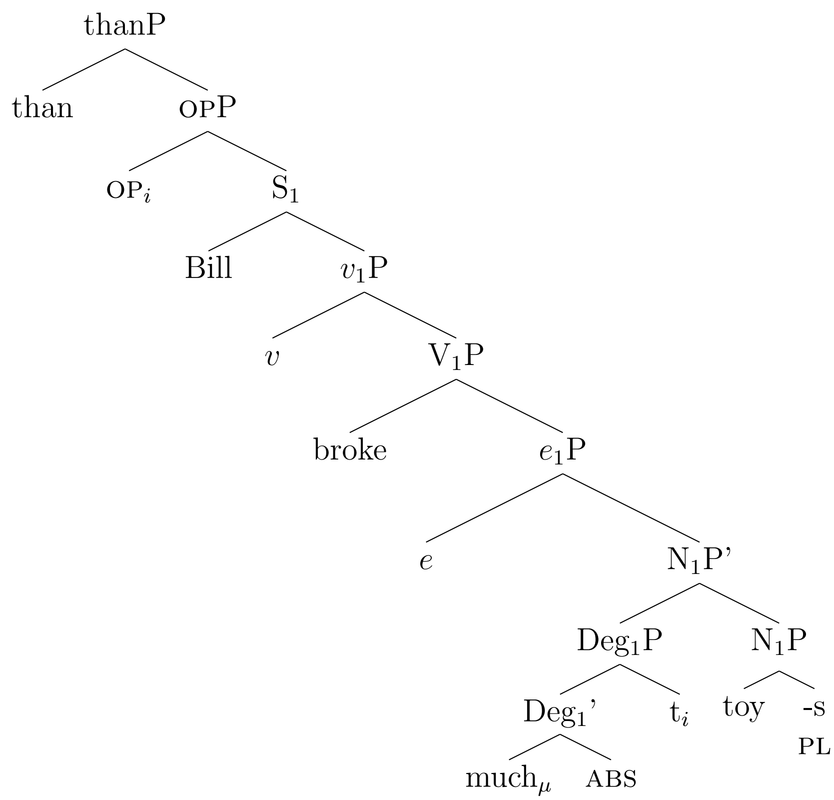
iii. $[\![\text{N}_2\text{P'}]\!]^A = \lambda X' : X' \in \mathcal{P}(D_e).\forall x' \in X'[\textsc{toy}(x')]\ \&\ A(\mu)(X') \succ \delta$ — (i),(ii),PM

iv. $[\![e_2\text{P}]\!]^A = \epsilon X'[\forall x' \in X'[\textsc{toy}(x')]\ \&\ A(\mu)(X') \succ \delta]$ — (iv),FA

v. $[\![\text{S}_2\text{P}]\!]^A = \top$ iff
$\exists e'[\text{Agent}(e')(\text{Al})\ \&\ \textsc{break}(e')(\epsilon X'[\forall x' \in X'[\textsc{toy}(x')]\ \&\ A(\mu)(X') \succ \delta])]]$

The *than*-clause of (353) has the structure in (358), and its interpretation given in (359). It is a definite description of degrees that represent the measure of the plurality of toys that Bill broke.

(358)



(359) $[\![\text{thanP}]\!]^A =$

$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \;\&\; \textsc{break}(e)(\epsilon X[\forall x \in X[\textsc{toy}(x)] \;\&\; A(\mu)(X) \succcurlyeq d]]]$

Combining the two, the result is as in (360). This interpretation encodes the prediction that (353) will be judged true in a context where Al was the agent of a breaking event involving a plurality of toys whose measure is greater than that of the toys that Bill broke. Since here a plurality is measured, it will be understood as a comparison by number.

(360) $[\![\text{Al broke } \textbf{more toys} \text{ than Bill did.}]\!]^A = \top$ iff

$\exists e'[\text{Agent}(e')(\text{Al}) \;\&\; \textsc{break}(e')(\epsilon X'[\forall x' \in X'[\textsc{toy}(x')] \;\&\; A(\mu)(X') \succ$

$\iota d[\exists e[\text{Agent}(e)(\text{Bill}) \;\&\; \textsc{break}(e)(\epsilon X[\forall x \in X[\textsc{toy}(x)] \;\&\; A(\mu)(X) \succcurlyeq d]]]])]]$

For the case of a mass noun appearing in the plural, I posit a somewhat richer structure. The plural morpheme was defined so as to require that the predicates it combine with be atomic. Consequently, if a noun like *coffee* denotes an anti-atomic join semi lattice (as we supposed in Chapter 3), it will not meet that condition.

The interpretation of the singulative morpheme that I propose is as in (361). It takes a property of individuals or events P that are anti-atomic[16] to a property of atomic entities β. It maps those entities to truth values just in case there is some α satisfying the mass predicate P, and α stands in the constitution relation with the atom β. '$\rhd$' is read as 'β is constituted of α' (e.g. Link 1983).

(361) $[\![\text{SG}]\!] = \lambda P_{\langle\alpha,t\rangle} : \text{Anti-Atomic}(P).\lambda\beta : \text{Atom}(\beta).\exists\alpha[P(\alpha) \ \& \ \beta \rhd \alpha]$

The interpretation of a mass noun like *coffee* is repeated in (362). Since such a predicate is cumulative, we understand that the xs satisfying COFFEE are ordered by the part-of relation. Moreover, since such a predicate does not suggest reference to minimal parts, the lattice denoted by this predicate is anti-atomic; thus, it will meet the definedness conditions of SG.

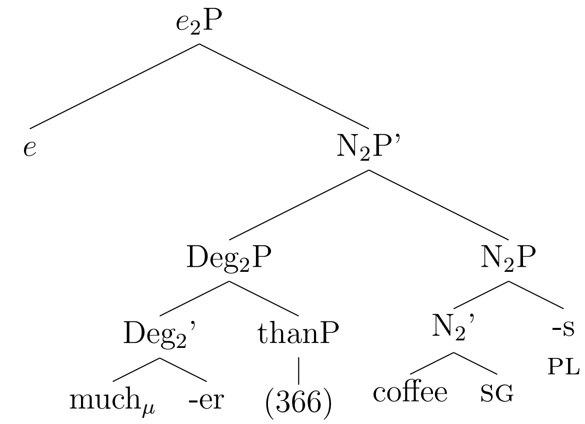
(362) $[\![\text{coffee}]\!] = \lambda x.\text{COFFEE}(x)$

Now we can see how a sentence like that in (363) is derived, focusing on the noun phrases. The structure that I posit for the relevant parts of the matrix clause are as in (364). Of note in this structure is the inclusion of the morpheme 'SG' in between *coffee* and *-s*. The derivation of e_2P is given in (365), with δ abbreviating the *than*-clause.

(363) Al drank **more coffees** than Bill did.

[16] If $[\![$*furniture*$]\!]$ is an atomic join semi-lattice, and if (distributional) mass nouns need to be singularized before they are pluralized as I have said, then combined with the interpretation in (361), **furnitures* is correctly predicted to be ungrammatical.

(364)



(365) i. $[\![N_2\text{'}]\!]^A = \lambda y' : \text{Atom}(y').\exists x'[\textsc{coffee}(x') \;\&\; y' \rhd x']$ FA

ii. $[\![N_2P]\!]^A = \lambda X' : X' \in \mathcal{P}(D_e).\forall y' \in X'[\exists x'[\textsc{coffee}(x') \;\&\; y' \rhd x']]$ (i),FA

iii. $[\![Deg_2\text{'}]\!]^A = \lambda d \lambda \alpha. A(\mu)(\alpha) \succ d$ IR,FA

iv. $[\![Deg_2P]\!]^A = \lambda \alpha. A(\mu)(\alpha) \succ \delta$ (iii),FA

v. $[\![N_2P\text{'}]\!]^A =$

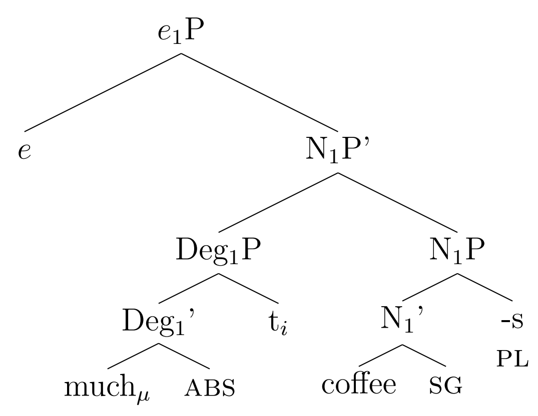
$\lambda X' : X' \in \mathcal{P}(D_e).\forall y' \in X'[\exists x'[\textsc{coffee}(x') \;\&\; y' \rhd x']] \;\&\; A(\mu)(X') \succ \delta$

(ii),(iv),PM

vi. $[\![e_2P]\!]^A = \epsilon X'[\forall y' \in X'[\exists x'[\textsc{coffee}(x') \;\&\; y' \rhd x']] \;\&\; A(\mu)(X') \succ \delta]$ (v),FA

The composition of the same phrase in the *than*-clause in (366) is exactly as above. Its interpretation is as in (367).

(366)



(367) $[\![e_1P]\!]^A = \epsilon X[\forall y \in X[\exists x[\textsc{coffee}(x) \;\&\; y \rhd x]] \;\&\; A(\mu)(X) \not\succ A(i)]$

Combining the two clauses, the interpretation of (363) is as in (368). (368) says that there is a drinking event involving Al and a plurality of coffees, the measure of which is greater than the measure of the coffees Bill drank.

(368) $[\![$Al drank **more coffees** than Bill did.$]\!]^A = \top$ iff

$\exists e'[\text{Agent}(e')(\text{Al})\ \&\ \textsc{drink}(e')(\epsilon X'[\forall y' \in X'[\exists x'[\textsc{coffee}(x')\ \&\ y' \rhd x']]\ \&\ A(\mu)(X') \succ$

$\iota d[\exists e[\text{Agent}(e)(\text{Bill})\ \&\ \textsc{drink}(e)(\epsilon X[\forall y \in X[\exists x[\textsc{coffee}(x)\ \&\ y \rhd x]]\ \&\ A(\mu)(X) \succcurlyeq d]]]])]$

In this section, I suggested how the plural morpheme might compose with atomic predicates to deliver pluralities (i.e., elements of the powerset of the atomic set). I suggested that such entities are measurable only in terms of number, because they are a **different sort of thing** than either singular entities (which, as we've seen, are not measurable) and masses. I then suggested how this account extends to plural contexts with lexically mass predicates.

In the next section, I consider a set of potential counter-examples to the claim that the form *many* arises whenever there is a plural *much*. Following that, I turn to my proposal for the interpretation of plural verbal comparatives.

5.3.3. On 'mass plurals'

There is a set of potential counter-examples to the claim that the form *many* arises whenever there is a plural *much*, and similarly to the claim that such configurations necessarily lead to comparisons by number. Expressions in this class have been called 'mass plurals' (Schwarzschild 2012; he cites McCawley 1975 and Ojeda 2005; see also Lasersohn 2011, who also cites Jespersen 1913 for discussion). Schwarzschild gives those in (369) as examples of members of this class.

(369) belongings, fumes, preparations, directions, brains, dregs, suds, droppings, guts, valuables, outskirts

As can be seen in the naturally occurring examples in (370), many of these are natural with *much*.

(370) a. **How much belongings** can I bring?[17]

b. If one purposely sniffs gasoline or glue, or accidentally gets **too much fumes** while painting inside a closet, he can get damage to the lungs, brain, etc.[18]

c. **Too much suds** push the door outward.[19]

d. On average five hens produce **as much droppings** as one medium sized dog and unlike dogs, chicken and rabbit droppings can be easily composted.[20]

Schwarzschild (2012) points out that, like 'regular' plurals, mass plurals trigger plural agreement on the verb (371a), and combine with plural demonstratives (371b). However, unlike regular plurals, they seem odd with numerals and other count modifiers, (372).

(371) a. The suds **were/*was** spilling out of the machine.

b. I can't take **these/*this** fumes.

(372) a. ? a sud, *several fumes, *many dregs

b. ? How **many preparations** did you make for the party?

c. ? He gave me **too many directions** to your house.

Moreover, as Solt (2008) notes, for expressions like *mashed potatoes* that combine equally well with both *much* and *many*, there is a distinctly different flavor to the interpretation in the two cases. (373a) seems to suggest a call for a measure phrase-based response like *2 scoops* whereas (373b) calls for a numeral-based response like *2*.

[17] https://answers.yahoo.com/question/index?qid=20130310170420AAnE04Q

[18] https://www.healthtap.com/topics/can-breathing-in-gasoline-fumes-get-you-sick

[19] http://skp.samsungcsportal.com/integrated/popup/FaqDetailPopup3.jsp?cdsite=in&seq=211364

[20] http://www.wetaskiwintimes.com/2013/06/27/backyard-ag-an-actual-boost-to-city-says-reader

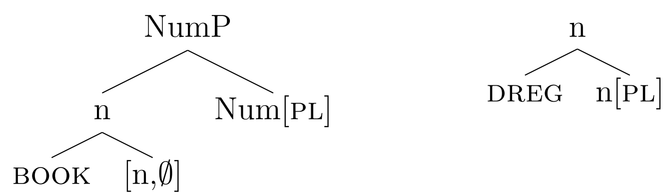
(373) a. How **much mashed potatoes** do you want?

b. How **many mashed potatoes** do you want?

Schwarzschild (2012; he (p.c.) cites Acquaviva 2008) suggests an analysis of mass plurals (for our purposes: those that appear to be plural-marked yet nonetheless combine with *much*) in terms he dubs the 'internal' plural, posited to have an underlying structure like that in (374a), versus the 'external' (or, 'regular') plural, which has a structure like that in (374b). In (374a), PL is a feature on the head of a projection labeled Num, whereas in (374b) it is a feature on the categorizing head, little-*n*.

a. **outer plural**: *books* b. **inner plural**: *dregs*

(374)



While both plurals are available for certain agreement processes (cf. (371)), they are differentially available for (i) semantic processes and (ii) (I will argue) certain other agreement processes.

With respect to (i), consider a modified version of Schwarzschild's examples in (375) (his (28)-(29)). Suppose there are two people, Al and Chris, that together are the plural referent of *they* in (375a). Then, (375a) is paraphrasable as *there are two directions such that Al and Chris went in those directions.* In contrast, (375b) is not interpreted in this way: the only interpretation of (375b) is that *there are some directions that Chris gave me which are different from those someone else gave me.* Schwarzschild likens the difference in interpretation between such examples to the presence of the two different plurals, as indicated on the right hand side of (375).

(375) a. They went off in **different** directions. DIRECTION + PL_{outer}

b. Chris gave me **different** directions. DIRECTION + PL_{inner}

He makes a similar point with the interpretation of reciprocals (citing an example from Gillon 1992; Schwarzschild's (38)-(39)). With two sets of directions explicitly mentioned by way of coordination, the reciprocal *each other* is licensed, (376a). However, without coordination and just *the directions you gave me*, the reciprocal is not licensed, (376b).

(376) a. The directions you gave me and the directions she gave me contradicted **each other**.

b. * The directions you gave me contradicted **each other**.

With respect to (ii), I suggest that mass plurals require a more specific interpretation of the morphophonological rule I gave in the preceding section, repeated here in (377). Using Schwarzschild's terminology, I posit that the structural conditions for this rule are met just in case MUCH combines with (something like) NumP, rather than the bare nominal. Suppose that in these cases the plural 'feature' on NumP projects. Then we can understand (377) as being a local, automatic consequence of *much* merging with NumP. On this account, the agreement facts in (371) arise because of an agreement relation triggered by the verb and targeted at the subject noun phrase. In the case of the inner plural, I assume that the structural conditions for the rule in (377) are **not** met: the plural feature on little-n does **not** project.

(377) **many formation** *(morphophonological rule)*

MUCH $\rightarrow$ *many* / __ PL

The more important question for our purposes, then, is: what about the semantic contribution of PL when it merges lower in the structure (e.g., with SUD)? First, observe that the sentence in (378) seems perfectly interpretable as a comparison in terms of volume, and not at all (truth-conditionally) interpretable in terms of number.

(378) There are **more suds** in the sink than in the dishwasher.

There are at least two options that immediately present themselves. The first is to posit that the inner plural is not semantically interpreted at all (in this light, the facts in (375) and (376) may be expected), and so *suds* denotes the same kind of anti-atomic join semi-lattice as *coffee*, modulo the nature of the stuff. The second option is that Schwarzschild's (2012) analysis of nouns is correct, and that all are actually predicates of states, not predicates of individuals. On that account, the external plural on the noun expresses that a **plurality of states** is at issue, whereas the internal plural expresses that a (single) **multiparticipant state** is at issue.

If Schwarzschild's analysis is correct, then the mereologies of mass expressions will have to be (potentially radically) reunderstood. This may be a welcome consequence; for one thing, it would highlight the similarities that we have seen in this and the preceding chapter between nouns, verbs, and adjectives (i.e., all are, at root, predicates of eventualities). However, advancing this project is beyond the scope of this dissertation. Thus, I will rest the 'mashed potatoes' matter on the morphosyntactic explanation given above, and assume henceforth that the internal plural is semantically uninterpreted.

5.3.4. Composition: pluractionals

Parallel to the nominal domain, I posit that there is a verbal plural morpheme that requires of the verb phrases it combine with that they denote atomic predicates. Atomic predicates are incompatible with *much*, unless they are pluralized. This section presents the compositional details.

I build on proposals in Sternefeld (1998), Sauerland (1998) Beck (2000), Beck & Sauerland (2000) and Ferreira (2005) (cf. Kratzer 2005) in positing a silent verbal plural morpheme, which serves to introduce pluralities of events just as the nominal plural introduces pluralities of individuals. In the comparative in Bulgarian, the combination of a telic predicate with imperfective morphology is interpreted with habitual aspect, signaling that the verb phrase is plural (cf. Ferreira 2005, Wellwood et al. 2012). When this is the case, the comparative is necessarily read as a comparison by number, (379).

(379) **Imperfective telic (Bulgarian)**

V	onezi	dni	Ivan	**izkaĉvasê**	**vrâh**	**Musala**	**poveče**	ot Maria.
in	those	days	Ivan	climb-IMPF.PAST	top	Musala	more	from Maria

'In those days, Ivan climbed Musala more than Maria.'

Similarly, in English, where the simple past form can have both a perfective and an imperfective/habitual interpretation, telic predicates like that in (380) must be interpreted habitually (i.e., by my assumptions, as involving a plurality of events). If the predicate were read perfectively, the comparison would be uninterpretable. In such cases the denoted events are atomic, by assumption, and consequently non-measurable.

(380) Al **reached the top of Everest** more than Bill did.

For simplicity, I will present the compositional details using the verb *jump*. It is assigned the interpretation in (381). Again by assumption, *jump* is a predicate that is true of atomic jumping events, and as such will meet the definedness conditions of the plural morpheme in sentences like (382). The denotation I assigned to the plural morpheme is repeated in (383).

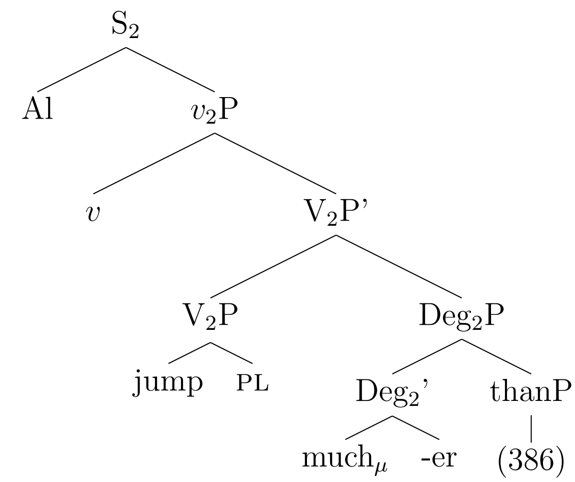
(381) $[\![\text{jump}]\!] = \lambda e.\textsc{jump}(e)$

(382) Al **jumped more** than Bill did.

(383) $[\![\textsc{pl}]\!] = \lambda P_{\langle \eta,t\rangle} : \text{Atomic}(P).\lambda X : X \in \mathcal{P}(D_\eta).\forall\beta \in X[P(\beta)]$

The structure that I posit underlies the matrix clause of (382) is as in (384). The interpretation of this clause is as in (385), using 'δ' to abbreviate the *than*-clause.

(384)



(385) i. $[\![\text{Deg}_2\text{'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succ d$ IR,FA

ii. $[\![\text{Deg}_2\text{P}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succ \delta$ (i),FA

iii. $[\![\text{V}_2\text{P}]\!]^A = \lambda E' : E' \in \mathcal{P}(D_v).\forall e' \in E'[\textsc{jump}(e')]$ FA

iv. $[\![\text{V}_2\text{P'}]\!]^A =$

$\lambda E' : E' \in \mathcal{P}(D_v).\forall e' \in E'[\textsc{jump}(e')]\ \&\ A(\mu)(E') \succ \delta$

(ii),(iii),PM

v. $[\![v_2\text{P}]\!]^A =$

$\lambda x \lambda E' : E' \in \mathcal{P}(D_v).\text{Agent}(E')(x)\ \&\ \forall e' \in E'[\textsc{jump}(e')]\ \&\ A(\mu)(E') \succ \delta$

(iv),EI

vi. $[\![\text{S}_2]\!]^A =$

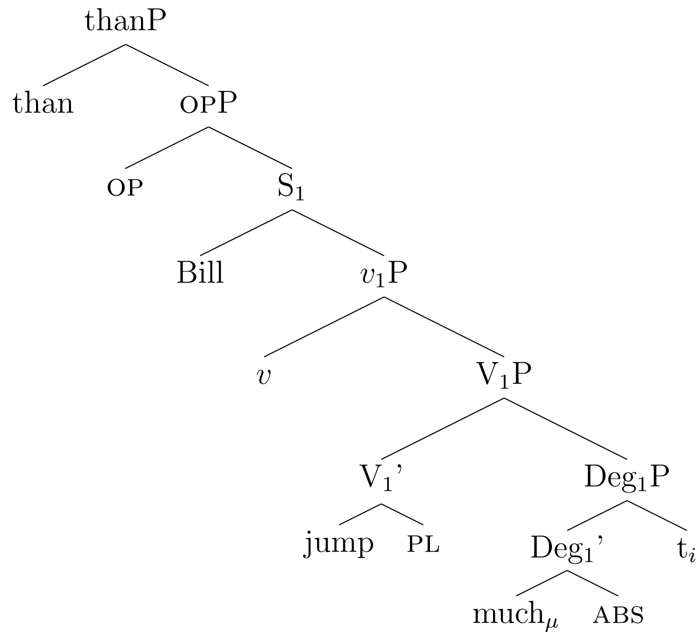
$\lambda E' : E' \in \mathcal{P}(D_v).\text{Agent}(E')(\text{Al})\ \&\ \forall e' \in E'[\textsc{jump}(e')]\ \&\ A(\mu)(E) \succ \delta$

(v),FA

vii. $= \top$ iff $\exists E'[\text{Agent}(E')(\text{Al})\ \&\ \forall e' \in E'[\textsc{jump}(e')]\ \&\ A(\mu)(E') \succ \delta]$ (vi),$\exists$

The structure underlying the *than*-clause is as in (386). The derivation proceeds in exactly the same way, modulo the familiar contributions of OPP, etc.; the interpretation of the *than*-clause in (386) is as in (387). It is interpreted as a definite description of the degree measured by the plurality of Bill's jumping events.

(386)



(387) $[\![\text{thanP}]\!]^A = \iota d[\exists E[\text{Agent}(E)(\text{Bill})\ \&\ \forall e \in E[\textsc{jump}(e)]\ \&\ A(\mu)(E) \succcurlyeq d]]$

Combining the two, the result is as in (388). (388) says that an utterance of (382) is predicted to be judged true just in case Al was the agent of a plurality of jumping events measuring greater than the measure of Bill's plurality of jumping events. Since pluralities are measured, μ resolves to a measure by number.

(388) $[\![$Al **jumped more** than Bill did.$]\!]^A = \top$ iff

$$\exists E'[\text{Agent}(E')(\text{Al})\ \&\ \forall e' \in E'[\textsc{jump}(e')]\ \&\ A(\mu)(E') \succ$$
$$\iota d[\exists E[\text{Agent}(E)(\text{Bill})\ \&\ \forall e \in E[\textsc{jump}(e)]\ \&\ A(\mu)(E) \succcurlyeq d]]]$$

Parallel to mass nouns appearing in the plural, we have seen that expressions like *run in the park* permit a comparison by number in the verbal comparative, (389). However, they do not do so obligatorily. I first sketch the analysis, and then offer a tentative explanation for this phenomenon.

(389) Al **ran in the park more** than Bill did. num, time

By assumption, *run* will not, on its own, meet the condition for pluralization.

Its interpretation is repeated in (390). Since this predicate is cumulative, we understand that the es satisfying RUN are ordered by the part-of relation, and so we say that the domain of this predicate has the structure of a join semi-lattice. Since we do not detect minimal parts in this domain, this semi-lattice is anti-atomic.

(390) $[\![\text{run}]\!] = \lambda e.\textsc{run}(e)$

To combine *run* with the verbal plural, I posit that there is a verbal singulative (cf. Ferreira's 2005 verbal singular morpheme) that *run* first combines with. On this account, the fact that (389) allows for measures by temporal duration **or** number is possible because the singulative and the verbal plural are both covert: speakers can infer their mutual presence or absence. The interpretation of the singulative morpheme is repeated in (391). Since $[\![run]\!]$ is anti-atomic, it will be defined for the singulative.

(391) $[\![\textsc{sg}]\!] = \lambda P_{\langle \eta,t\rangle} : \text{Anti-atomic}(P).\lambda\beta : \text{Atom}(\beta).\exists\alpha[P(\alpha)\ \&\ \beta \rhd \alpha]$

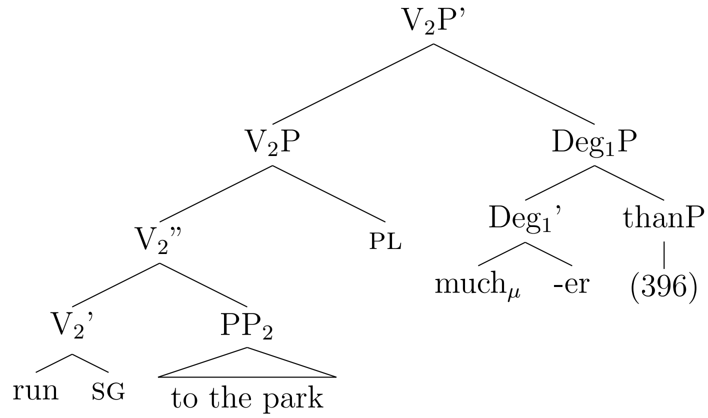
In contrast, if *run* appears with a modifier like *to the store*, the only possible interpretation in the comparative is a comparison by number. I assume, then, that modifiers like *to the park* require atomic events (e.g., they express that those events are contained within a given space); in such cases, *run* must be singularized before the two can combine. I do not attempt to account for the semantics of such predicates, but use the simplifying assumption that if *to the park* has the domain condition in (393), anything it combines with will meet the definedness conditions on PL. Without it, the result would be anomalous (e.g. **jump*-SG *more*).

(392) Al **ran to the store more** than Bill did.

(393) $[\![\text{to the park}]\!] = \lambda e : \text{Atom}(e).\textsc{to-the-park}(e)$

Thus, the structure that I posit underlies the relevant portions of the matrix clause of (392) is as in (394), and its interpretation derived as in (395), abbreviating the *than*-clause as δ.

(394)



(395)
i. $[\![\text{Deg}_2\text{'}]\!]^A = \lambda d \lambda \alpha . A(\mu)(\alpha) \succ d$ IR,FA

ii. $[\![\text{Deg}_2\text{P}]\!]^A = \lambda \alpha . A(\mu)(\alpha) \succ \delta$ (i),FA

iii. $[\![\text{V}_2\text{'}]\!]^A = \lambda e''' : \text{Atom}(e''').\exists e''[\textsc{run}(e'') \,\&\, e''' \rhd e'']$ FA

iv. $[\![\text{V}_2\text{"}]\!]^A =$

$\lambda e''' : \text{Atom}(e''').\exists e''[\textsc{run}(e'') \,\&\, e''' \rhd e''] \,\&\, \textsc{to-the-park}(e''')$ (iii),PM

v. $[\![\text{V}_2\text{P}]\!]^A =$

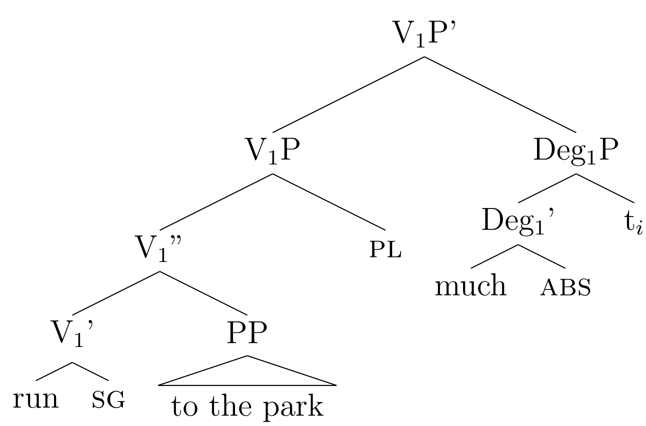
$\lambda E' : E' \in \mathcal{P}(D_v).\forall e''' \in E'[\exists e''[\textsc{run}(e'') \,\&\, e''' \rhd e''] \,\&\, \textsc{to-the-park}(e''')]$ (iv),FA

vi. $[\![\text{V}_2\text{P'}]\!]^A =$

$\lambda E' : E' \in \mathcal{P}(D_v).\forall e''' \in E'''[\exists e''[\textsc{run}(e'') \,\&\, e''' \rhd e''] \,\&\, \textsc{to-the-park}(e''')] \,\&\, A(\mu)(E') \succ \delta$ (ii),(v),PM

The relevant portion of the *than*-clause of (396) is as in (396), and its interpretation given in (395).

(396)



(397) $[\![\text{thanP}]\!]^A =$

$\iota d[\exists E[\text{Agent}(E)(\text{Bill}) \,\&\, \forall e' \in E[\exists e[\textsc{run}(e) \,\&\, e' \rhd e] \,\&\, \textsc{to-the-park}(e')]$

$$\& \ A(\mu)(E) \succcurlyeq d]]$$

Combining the two, the result is as in (398). (398) says that an utterance of (392) is predicted to be judged true just in case Al was the agent of a plurality of atomic running events whose measure is greater than the measure of Bill's plurality. Since pluralities are measured, $A(\mu)$ must be a measure by number.

(398) $[\![$Al **ran to the store more** than Bill did.$]\!]^A = \top$ iff

$$\exists E'[\text{Agent}(E')(\text{Al}) \ \& \ \forall e''' \in E'[\exists e''[\textsc{run}(e'') \ \& \ e''' \rhd e''] \ \& \ \textsc{to-the-park}(e''')] \ \& \ A(\mu)(E') \succ$$
$$\iota d[\exists E[\text{Agent}(E)(\text{Bill}) \ \& \ \forall e' \in E[\exists e[\textsc{run}(e) \ \& \ e' \rhd e] \ \& \ \textsc{to-the-park}(e')]$$
$$\& \ A(\mu)(E) \succcurlyeq d]]]$$

I have presented data from comparative constructions across the nominal and verbal domains which is suggestive of the ways that grammar conspires to express comparisons by number. I then argued for a particular analysis of how those readings come about: namely, they are the result of the interpretation of a plural morpheme interacting with the semantics of *much*. In English and languages like Bulgarian, such a morpheme is covert. However, in languages like Bulgarian its presence can be detected via how it interacts with aspectual morphology. In these languages, mass or atelic expressions must first be singularized (mapped to a set of atomic entities) before they can be pluralized (mapped to a predicate of pluralities).

Next, I turn to data in the adjectival domain that I suggest can be analyzed as instances of the same singular versus plural distinction in the domain of events.

5.4. Measuring derived events

We have seen that a distinction relevant to comparison at one level (what I called 'internal') becomes irrelevant at another level: non-measurable expressions like singular count nouns and telic verb phrases became measurable with the addition of plural morphology (overt or covert), and, I argued, by the same addition,

Table 5.6: Factors affecting dimensions for measurement in the **adjectival** domain.

measures: pre-adjectival / post-adjectival *more*

	gradable		**non-gradable**	
	expression	measure(s)	expression	measure(s)
I-level	*tall*	height / *	*wooden*	* / *
S-level	*drunk*	drunkenness / number	*pregnant*	* / number

dimensions for measurement that were available with mass nouns and atelic verb phrases became unavailable.

I now show what I will argue is parallel phenomena in the adjectival domain, wherein certain structural configurations lead only to comparisons by number. The distinctions to be discussed are summarized in Table 5.6.

5.4.1. Stages and individuals

Chapters 2 and 4 discussed gradability with adjectives: adjectives that are perfectly interpretable in comparative constructions are called 'gradable', and ones that are not are called 'non-gradable'. This notion flags the difference between, for example, sentences like (399a) and (399b).

(399) a. Al is **taller** than Sue is.

b. ? This piece of wood is **more wooden** than that piece of wood is.

Another distinction relevant to the interpretation of adjectives is that between Stage- and Individual-level predicates (henceforth abbreviated S-/I-level; these terms are Carlson's 1977).

The intuitive distinction is between those that denote states that (normally) hold temporarily, and those that (normally) hold for a lifetime. Such states are tested for by combining different phrases with expressions that imply an individual goes in and out of the state.[21] Consider the predicates *be my favorite number* (S-level) and *be prime* (I-level). Suppose that the truths of mathematics always hold, but my preferences change from time to time. Use of such predicates with a modifier like *last year* suggests that whatever held then does not hold now. In such contexts, (400b) is odd, since it implies that the number '2' is no longer prime.

(400) a. The number '2' was **my favorite number last year**.

b. ? The number '2' was **prime last year**.

The complement of perception verbs (Carlson 1977) imply that the state an individual is perceived to be in is one that they're not normally in. If a predicate is preferentially understood as denoting a property that always holds of the individual (I-level), then that predicate is correspondingly odd here.

(401) a. Al saw **Bill drunk/healthy**.

b. Al saw **the firemen happy**.

c. ? Al saw **Bill tall/male**.

d. ? Al saw **the firemen altruistic**.

S-level predicates are those that are natural in there-existentials, unlike I-level predicates (Milsark 1974). (402c) and (402d) seem to imply that the relevant people and doors are no longer tall or wooden, respectively.

(402) a. There were **people drunk**.

b. There were **doors open**.

c. ? There were **people tall**.

d. ? There were **doors wooden**.

[21] This discussion draws on Husband 2012. I discuss the S-/I-level distinction as though it is lexical in nature, parallel to how the mass/count distinction was treated. Husband 2012 argues that it is better understood as phrasal/syntactic, and the account I offer below is likely complementary to his position.

S-level predicates can induce an existential interpretation[22] of their bare plural subjects in the present tense, (403a), whereas I-level predicates only allow for generic interpretations of their subjects (at least in the present tense; Carlson 1977), (403b).

(403) a. Firemen are **available**. $\exists$, GEN

b. Firemen are **altruistic**. $^*\exists$, GEN

We can see the distinction clearly in a language like Spanish, which distinguishes between the two types of predicates with the use of different copulas, i.e. *ser* ('essential being') and *estar* ('temporary being'; cf. Camacho 2012). The adjective *embarazada* ('pregnant') is odd with *ser* (404a) because it expresses the odd thought that María is in a persistent state of being pregnant. With *estar* (404b), the more typical thought is expressed that an individual is in a transient state is expressed.[23]

(404) a. ? María **es embarazada**.

b. María **está embarazada**.

With this much in place, consider the contrast in comparatives with *more* preversus post-posed with respect to the adjective. While (405a) with *more pregnant* is odd, since *pregnant* is generally thought non-gradable, while (405b), in contrast, straightforwardly expresses a comparison of numbers of occasions during which a certain state obtains. While lexical gradability is relevant for preadjectival *more*, the I-/S- level distinction is relevant for postadjectival *more*: *pregnant* is a non-gradable, but S-level predicate.

(405) a. ? Al is **more pregnant** than Sue is.

b. Al is **pregnant more** than Sue is.

[22]This is the term Husband 2012 and references therein employ; one could equally well say that the predication is 'episodic'.

[23]The Spanish data and judgments were discussed with S. Lago, p.c.

In Spanish, even in the context of combining *embarazada* with *estar* there is an interpretive contrast between the pre-posed (406a) and post-posed (406b) *más* ('more'). With *más* pre-posed, the sentence is odd in the same way as the English *more pregnant*, (406a), and with *más* post-posed, it expresses a comparison of numbers of occasions during which a state of being pregnant obtains, just like English *pregnant more*, (406b).

(406) a. ? María está **más embarazada** que Susana.

b. María está **embarazada más** que Susana.

In contrast, consider the case of gradable *tall.* (407a) with *more* pre-posed is perfectly fine, expressing a comparison of the heights of two individuals. (407b), in contrast, is odd; it implies that Al regularly goes in and out of a state of being tall. The oddity arises if we usually understand that, if you're tall on Tuesday, you're tall on Wednesday, etc.; *tall* is a gradable, but, on this understanding, I-level predicate.

(407) a. Al is taller than Bill.

b. ? Al is tall more than Bill is.

We can now see that the S-/I-level distinction is independent of the gradable/non-gradable distinction, and that each plays a role depending on the syntax of the comparative. With *more* pre-posed, non-gradable adjectives are odd (408c)-(408d). Moreover, the range of dimensions for comparison expressed varies with the adjective (408a)-(408b).

(408) a. This giant is **taller** than that giant. gradable

b. This alcoholic is **drunker** than that alcoholic. gradable

c. ? This wooden slab is **more wooden** than that wooden slab. non-gradable

d. ? This lady is **more pregnant** than that lady. non-gradable

The S-/I-level distinction becomes relevant when *more* is post-posed. I-level adjectives are odd here, (409a) and (409c), and moreover the dimensions for comparisons with S-level adjectives are uniform: (409a) and (409d) only express comparisons by the numbers of occasions during which a certain sort of state obtains.[24]

(409) a. ? This giant is **tall more** than that giant. I-level

b. This alcoholic is **drunk more** than that alcoholic. S-level

c. ? This wooden slab is **wooden more** than that wooden slab. I-level

d. This lady is **pregnant more** than that lady. S-level

A similar pattern obtains with non-gradable adverbs. With *quickly*, the interpretation of pre-posed as opposed to post-posed *more* differs sharply. (410a) expresses a comparison of the speed of two running events, and cannot express a comparison by numbers of events. In contrast, (410b) cannot express a comparison in terms of speed, but can express a comparison in terms of numbers of occasions of running quickly.

(410) a. Al **ran more quickly** than Bill did. speed, *num

b. Al **ran quickly more** than Bill did. *speed, num

Finally, as we've seen, *hourly* with *more* is awkward (411a). However, with *more* post-posed in (411b) the sentence expresses a comparison between Al's having performed a certain kind of activity on a greater number of occasions than Bill did.

(411) a. ? Al **worked more hourly** than Bill did. *hourly, *num

b. Al **worked hourly more** than Susie did. *hourly, num

[24] I have heard speculation from some native speakers that post-adjectival *more* comparisons may not **necessarily** be carried out in terms of number. This judgment is not stable, either within speakers or across them. R. Schwarzschild (p.c.) points out that there is potentially a different kind of postadjectival interpretation, easily detected with phonologically 'heavy' phrases, e.g. *He's (very) interested in Renaissance art, more than most first-graders are.*

In this section, we have seen another case of syntactic context affecting whether a predicate is measurable, and which dimensions for measurement are possible. As with the nominal and verbal domains, some contexts are interestingly restricted to comparisons by number. I next propose that, here, such comparisons arise because a plurality is measured.

5.4.2. From states to events

In Chapter 4 I analyzed non-gradable adjectives as denoting (the characteristic functions of) sets of atomic states, and gradable adjectives as denoting anti-atomic join semi-lattices. This distinction is relevant for pre-posed *more* comparatives, which involve measuring the states predicated of by an adjective directly, (412). With an intuitively non-gradable adjective like *pregnant*, (412b), the comparison goes through only if it can be coerced into having a gradable reading.

(412) a. Al is **more intelligent** than Sue is.

b. ? Al is **more pregnant** than Sue is.

The relevant distinction for post-adjectival *more* is the S-/I-level distinction, and that this distinction is independent of gradability, contrast (412a)-(413a) and (412b)-(413b). Moreover, the kinds of interpretations that are possible for (412) are not possible for (413). Rather, (413b) expresses a comparison of the number of occasions on which a certain state holds: it implies that the number of occasions of Al being pregnant exceeds the number of occasions of Sue being pregnant. (413a) goes through only if we can coerce *tall* into having an S-level meaning, and then it is interpreted the same way (mutatis mutandis) as (413b).

(413) a. ? Al is **tall more** than Sue is.

b. Al is **pregnant more** than Sue is.

To account for the fact that post-adjectival *more* is sensitive to the S-/I-level distinction, I propose that post-adjectival *more* indicates event comparison. To accomplish this, I suggest that the states denoted by the adjective are first converted into a predicate of events by a covert 'eventizer' that I will call EV. The output of this function is a predicate of atomic events, themselves defined relative to the adjectival state's holding. To be compatible with the semantic requirements of the comparative construction, this (now eventive) predicate must be pluralized.

The existence of a covert expression that maps states to events is not new to semantic theory; something like it has been proposed both by Kratzer (2000; see also von Stechow 2002). One of Kratzer's goals was to classify verbs according to their (in)ability to provide a 'target state' (Parsons 1990) as the input to further operations (cf. von Stechow 2002, and Piñón 1999 [cited by Kratzer 2000]). If a de-adjectival verb can appear in a target state passive modified by *immer noch* ('still'; (414), **and** if it allows a certain implication when modified by *für*-phrases (415), then such verbs are argued to have both event and state arguments.

(414) Die Reifen sind immer noch aufgepumpt.
the tires are still pumped.up
'The tires are still pumped up.'

(415) Wir werden das Boot für ein paar Stunden aufpumpen.
we will the boat for a few hours pump.up
'We will pump up the boat for a few hours.'

BUT IMPLIES: the boat will remain inflated for a few hours

In my proposal, events are introduced separately from the stative predicate, while on Kratzer's they are both part of the expression's lexical denotation. Hence, she assigns a type $\langle v, \langle v, t\rangle\rangle$ to the verb after it has applied to its internal argument. One or the other of its type v arguments (the event or the state one) will be exposed, depending on whether the verb combines with an 'eventizer' or a 'stativizer'. The eventizer has the interpretation in (416i), and the stativizer that in (416ii). Here,

R ranges over event-state relations, and applied to such an argument the function returns either a predicate of states or a predicate of events. An example of one such value for R is as in (417).

(416) **Kratzer's eventizer and stativizer**

i. $[\![\text{EVENT}]\!] = \lambda R : R \in D_{\langle v,\langle v,t\rangle\rangle}\lambda s.\exists e[R(s)(e)]$

ii. $[\![\text{STATE}]\!] = \lambda R : R \in D_{\langle v,\langle v,t\rangle\rangle}\lambda e.\exists s[R(s)(e)]$

(417) $[\![\text{das Boot aufpumpen}]\!] =$

$\lambda s\lambda e.[\text{PUMP}(e) \text{ \& Event}(e) \text{ \& INFLATED(the boat}, s) \text{ \& Cause}(s,e)]$

I propose to encode the basic idea of a mapping from states to events here, but couched within the neodavidsonian framework that I assume. That is, instead of the stative predicate carrying along its own event argument, the covert expression EV introduces it. Here is how I use this to explain the relevance of the S-/I-level distinction in post-adjectival comparatives. If a state description can only be understood to hold once and for always of an individual, then it will fail to meet the conditions for generating a plurality of events that are defined in terms of a kind of state coming in and out of existence. I-level predicates can be mapped to events, but only to singular events: ones that an individual participates in just once, and whose temporal duration is that individual's lifetime.

In contrast, if a state description can be understood to hold on-again, off-again for a given individual, pluralization will succeed, and comparisons between pluralized predicates will be understood in terms of numbers of events.

5.4.3. Composition: adjectives III

To account for comparatives with post-adjectival *more*, I propose the existence of the morpheme EV that maps stative predicates to (sets of) atomic events. Post-adjectival *more* is, on this view, just verbal *more*. Pluralizing that set using the same morpheme as I did for the nominal and verbal domains leads to S-level interpretations of the adjectival predication. Thus, if any adjective's denotation is conceived of as rigidly I-level, it will be anomalous in this construction.

The denotation of EV that I propose is as in (418). It takes a predicate of states and returns a function from the atomic subset of D_v to truth values, just in case a 'constitution' relation holds between the event and the state.

(418) $[\![\textsc{ev}]\!] = \lambda P : \text{Stative}(P).\lambda e : \text{Atom}(e).\exists s[P(s) \ \& \ e \rhd s]$

Here is how I propose we understand '$\rhd$' in this context, proceeding by analogy. Consider the example of the ring and the gold. In Link's ontology, the two are distinct, but they are intimately related: the ring wouldn't exist without the gold, for example. In order to capture the notion of an atomic event that intimately depends on a certain state's holding, we need a relation like this. es constituted by ss, then, can be understood as representations of, for a stative predicate P, events defined by an individual's being P.[25]

To see how this works, consider the sentences in (419a) and (419b). (419a) has the posited logical form in (420), in light of the theory developed in Chapter 4. Here, $[\![much_\mu]\!]$ applies to those states that are predicated of by DRUNK, which restricts the available range of measure functions to just those with such states in its domain.

(419) a. Al is **more drunk** than Bill is.

b. Al is **drunk more** than Bill is.

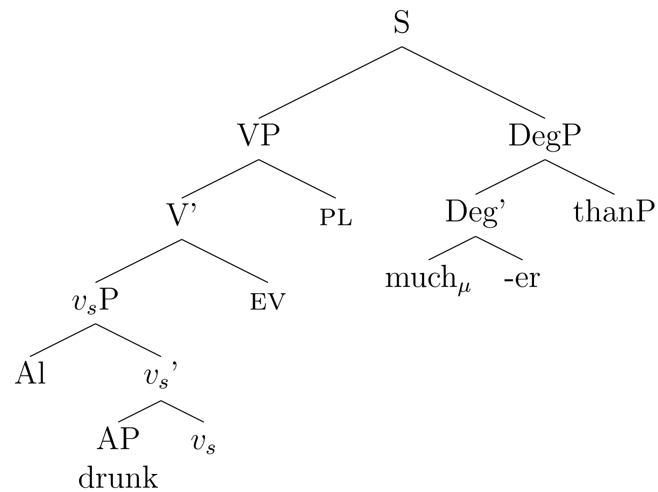
(420) $[\![\text{Al is } \textbf{more drunk} \text{ than Bill is}]\!]^A = \top$ iff

$$\exists s[\text{Holder}(s)(\text{Al}) \ \& \ \textsc{drunk}(s) \ \& \ A(\mu)(s) \succ \iota d[\exists s'[\text{Holder}(s')(\text{Bill}) \ \& \ \textsc{drunk}(s') \ \& \ A(\mu)(s') \succcurlyeq d]]]$$

[25]See Mourelatos (1978) for discussion of the distinction between the occasion of a situation, and the situation itself, e.g. *Tom loved Mary* (state) *when he was a teenager* (occasion).

In contrast, consider the proposed underlying structure for (419b) in (421), ignoring the internal complexity of the *than*-clause. Here, the adjective phrase and the head that introduces its thematic subject, a predicate of states, merge with EV which, I posit, heads a verbal projection. V' is interpreted as a predicate of (atomic) events, which is then pluralized. This entire complex will be interpreted as the measurand for $much_\mu$.

(421)



The relevant portions of the derivation of this structure are given in (422), abbreviating the *than*-phrase with δ. Since *Al drunk* denotes a stative predicate, it meets the conditions for the application of EV; after EV has applied, the resultant complex meets the conditions for the applications of PL. The result is a property of pluralities of atomic events that are temporally constituted by some state of drunkenness of which Al is the Holder.

(422)
i. $[\![v_S\text{'}]\!]^A = \lambda x \lambda s.\text{Holder}(s)(x)\ \&\ \textsc{drunk}(s)$ FA,EI

ii. $[\![v_S\text{P}]\!]^A = \lambda s.\text{Holder}(s)(\text{Al})\ \&\ \textsc{drunk}(s)$ (i),FA

iii. $[\![\text{V'}]\!]^A = \lambda e : \text{Atom}(e).\exists s[\text{Holder}(s)(\text{Al})\ \&\ \textsc{drunk}(s)\ \&\ e \rhd s]$ (ii),FA

iv. $[\![\text{VP}]\!]^A =$

$\lambda E : E \in \mathcal{P}(D_v).\forall e \in E[\exists s[\text{Holder}(s)(\text{Al})\ \&\ \textsc{drunk}(s)\ \&\ e \rhd s]]$

(iii),FA

v. $[\![\text{Deg'}]\!]^A = \lambda d\lambda\alpha.A(\mu)(\alpha) \succ d$ IR,FA

vi. $[\![\text{DegP}]\!]^A = \lambda\alpha.A(\mu)(\alpha) \succ \delta$ (v),FA

vii. $[\![\text{S}]\!]^A = \lambda E : E \in \mathcal{P}(D_v).$

$$\forall e \in E[\exists s[\text{Holder}(s)(\text{Al}) \ \& \ \textsc{drunk}(s) \ \& \ e \rhd s]] \ \& \ A(\mu)(E) \succ \delta$$

(iv),(vi),PM

viii. $=$

$$\exists E[\forall e \in E[\exists s[\text{Holder}(s)(\text{Al}) \ \& \ \textsc{drunk}(s) \ \& \ e \rhd s]] \ \& \ A(\mu)(E) \succ \delta]$$

(vii),$\exists$

Completing the derivation of the interpretation delivers (423); it is predicted to be judged true if there is a plurality of events, each constituted by a state of drunkenness instantiated by Al, and that plurality measures greater than the measure of Bill's corresponding plurality. As again we are measuring pluralities, the understood measure will be in terms of number.

(423) $[\![\text{Al is } \textbf{drunk more} \text{ than Bill is}]\!]^A = \top$ iff

$$\exists E[\forall e \in E[\exists s[\text{Holder}(s)(\text{Al}) \ \& \ \textsc{drunk}(s) \ \& \ e \rhd s]] \ \& \ A(\mu)(E) \succ$$
$$\iota d[\exists E'[\forall e' \in E'[\exists s'[\text{Holder}(s')(\text{Bill}) \ \& \ \textsc{drunk}(s') \ \& \ e' \rhd s']] \ \& \ A(\mu)(E') \succcurlyeq d]$$

The derivation of the other examples is similar. The result of pluralizing the derived states will be evaluable just in case the underlying stative predicate is one that can be 'on and off again'—one that denotes states that can underlie pluralities of atomic events.

5.5. 'Gradable' verbs

Before concluding the chapter, I would like to offer some mainly speculative remarks about the interpretation of verbs that appear to be 'gradable' (i.e., interpreted non-eventively) in the context of comparatives, and to highlight their similarities to adjectives. I first present two accounts for gradability with attitude verbs like *want*, that of Villalta (2008), cast in the more traditional possible worlds framework (building on Heim 1992, Stalnaker 1968; see also Katz et al. 2012), and the alternative, probabilistic approach of Lassiter (2011a,b). After that, I present some data that suggests how these proposals might be incorporated into the theory of comparatives that I've been developing.

The crucial parts of the interpretation of *want* that Villalta (2008) and Lassiter (2011b) propose may be summarized as in (424) and (425). Both, as on traditional analyses of attitude verbs, posit that *want* denotes a relation between individuals x and propositions p, but have the added property that these are also related to degrees. The two accounts differ mainly in what they take the mapping to degrees to consist in; the relevant hypotheses are noted on the right hand side.[26]

(424) $[\![\text{want}_{Villalta}]\!](d)(p)(x) = \text{WANT}_x(d)(p)$ $\qquad$ WANT_x invokes $>_{\text{DES}_{x,w}}$

(425) $[\![\text{want}_{Lassiter}]\!](d)(p)(x) = \mathbb{E}_x(d)(p)$ $\qquad$ $\mathbb{E} \approx$ expected utility

The degree analysis is warranted in this case, according to Lassiter, because *want* has a similar distribution and interpretation to gradable adjectives; see the naturally-occurring examples he gives in (426).[27]

(426) a. [M]any library officials **want more to intimidate than** to really change an institutional culture that has squelched feedback.

b. I am an American and I **want very much** to travel to Cuba.

I begin by reviewing Villalta's (2008) account. She constructs degrees as equivalence classes of propositions, i.e. sets of worlds, via the steps in (427i)-(427v). She starts with a primitive ordering on worlds in (427i), in which a world w' is considered

[26]They also differ factually in that Villalta offers a degree relation analysis (a la von Stechow 1984, Heim 1985) whereas Lassiter offers a measure function analysis (a la Bartsch & Venneman 1992, Kennedy 1999). I have reduced this difference for ease of comparability.

[27]I note, in passing, that this distribution isn't quite the same as that of GAs; e.g. (426b) shows that *very* combines with *much* as opposed to *want* directly (cp. *very tall*).

better according to an individual x at world w just in case w' is more desirable than w'' to x. An ordering on propositions (sets of worlds) is defined in terms of this relation, (427ii): a proposition p bears the $>_{\text{DES}_{x,w}}$ relation to proposition q just in case: according to x in w, every world in q is better than some world in p, and some world in p is better than every world in q. An equivalence order on propositions is defined in terms of $>_{\text{DES}_{x,w}}$ as in (427iii), where W is the set of all possible worlds. Finally, she defines an ordering on these equivalence classes as in (427v), where $[p]$ names the equivalence class containing p. These equivalence classes are degrees of desire.

(427) **More desirable (Villalta)**

i. $w' >_{x,w} w''$ ("better") iff w' is more desirable to x than w''

ii. $p >_{\text{DES}_{x,w}} q$ iff

  i. $\forall w' \in q\ \exists w'' \in p$ s.t.: $w'' >_{x,w} w'$, and

  ii. $\neg(\forall w' \in p\ \exists w'' \in q$ s.t. $w'' >_{x,w} w')$.

iii. $p \approx_{\text{DES}_{x,w}} q$ iff $\forall p', q' \subseteq W$

  i. $p >_{\text{DES}_{x,w}} p' \Leftrightarrow q >_{\text{DES}_{x,w}} p'$; and

  ii. $q' >_{\text{DES}_{x,w}} p \Leftrightarrow q' >_{\text{DES}_{x,w}} q$.

iv. $\forall p \in D_{>\text{DES}_{x,w}}$, $[p] = \{p' \mid p \approx_{\text{DES}_{x,w}} p'\}$

v. $[p] \succ_{>\text{DES}_{x,w}} [q] \Leftrightarrow p >_{\text{DES}_{x,w}} q$

Lassiter (2011a) raises several challenges for Villalta's account, though I will mention only one here. This takes issue with the fact that a proposition p will be judged more desirable than a proposition q whenever there is a single p world that is better than all q worlds. The consequent degree ordering doesn't care at all whether the very **worst** worlds also happen to be in p, so long as just one of them is better than all of the worlds in q. At the heart of Lassiter's concern is that the degree-ordering is ultimately based on a pairwise comparison between worlds.

Lassiter's own account builds on that of Levinson (2003), in which the semantics of *want* place conditions on the **probability-weighted average preference** (i.e., the expected utility, $\mathbb{E}(\cdot)$) of the worlds in the proposition-denoting argument taken by *want*. The idea is that a proposition p is better than a proposition q just in case the expected utility of p is higher than the expected utility of q, as in (428). Degrees of desire are, on this account, representations of the expected utility of a proposition relative to an attitude holder.

(428) **Expected utility (Lassiter)**

$$\mathbb{E}(p) = \sum_{w \in p} \mathbb{U}(w) \times prob(\{w\}|p)$$

i.e., the expected utility of p is the weighted average of the desirabilities ($\mathbb{U}$) of the worlds $w \in p$, where the weight is given by the conditional probability that w will be actual if p obtains.

There are two data points that should be considered in light of these proposals, that, once incorporated, might suggest an analysis of gradable verbs couched more in the terms worked out in this dissertation. The first is the fact that *want* appears with *much* in examples like (426b), as noted above. If the theory presented in this dissertation is correct, this raises the question of how both *want* and *much* can introduce degrees for comparison by expressions like *-er* (cf. the discussion of Bresnan and Corver in Chapter 4). The second is that *want* can be used to explicitly refer to a state of desire, (429).

(429) The opioid antagonists seem to work in part by affecting the liking of food, as opposed to **the wanting of food**.[28]

Further, *want* supports not just gradable but eventive readings in comparatives. Consider (430a) and (430b). In the context of a single lunchtime event, (430a) does indeed seem to involve comparing degrees of desire. However, in the context

[28]Based on an example from *The Gravity of Weight*, books.google.com

of several lunchtime events in (430b) it seems that the comparison can be about numbers of occasions of desiring. A contrast like that between (430a) and (430b) is reminiscent of the 'gradable'/'S-level' interpretations of GAs, which suggests they could have a similar analysis in terms of EV.

(430) a. Each day, students choose between cupcakes and strawberries.
Friday at lunchtime, Al **wanted a cupcake more** than Bill did.

b. Al chose cupcakes three times, Bill only once.
Last week, Al **wanted cupcakes more** than Bill did.

A proposal that may be worth exploring is to reify desires as states, and to build comparisons (using *much*) off of an ordering that represents their magnitudes, as in (431). Such a proposal would remain neutral as to how such things are measured, which could perhaps sometimes be something like Villalta's $\geq_{\mathrm{DES}_{x,w}}$, Lassiter's $\mathbb{E}$, or perhaps other things.

(431) $\succcurlyeq_{want} = \{ \langle s, s' \rangle \mid s \text{ is as much desire as } s' \}$

On such an account, an attitude verb like *want* would be 'born' into the syntax as a stative predicate, which *much* can access, and which leads to a degrees-of-desire reading. Applying an 'eventizer' like that proposed in this chapter could relate those states to events; and once pluralized, measuring the events would lead to a comparison by number. Such an account would effectively explain (431) in terms of structural ambiguity.

5.6. Conclusion

In this chapter, I examined data from the nominal, verbal, and adjectival comparatives that express comparisons by number. Across domains, we saw that what was in bare form non-measurable, could be made measurable by the addition of functional structure with its concomitant semantic commitments. We also saw that the dimensions for comparison that were possible with bare forms became inaccessible in the new syntactic contexts.

I proposed that these data could be accounted for within the same theory as I developed in Chapters 3 and 4. The only expression that introduces measure functions into the interpretation of comparative sentences, regardless of syntactic category, is *much*.

Extending this theory faced two major challenges. The first was why certain prima facie monotonic dimensions for measurement were not possible with plurals like *rocks*, and the second why the form *many* surfaces in nominal equatives. I suggested, in response to the first challenge, that a different sort of thing is measured in bare versus plural contexts—pluralities, which I modeled as sets—and that pluralities can only be measured by number. In response to the second challenge, I provided a number of pieces of cross-linguistic evidence to suggest that *many* is not, in fact, a lexical primitive, and thus comparisons by number must be in the purview of an analysis that appeals only to an expression like *much*.

Finally, I provided some speculative remarks about whether and how the theory could apply in contexts with gradable attitude verbs like *want*, which show properties of both stative and eventive comparisons. In Chapter 7, I discuss what may represent a similar sort of case, namely so-called 'degree achievements' like *The soup cooled*. Such sentences can be used to convey 'degrees-of-coolness'-type comparisons, as well as 'time-spent-cooling' comparisons.

In the next chapter, however, I turn to a somewhat broader question. The literature has proposed that there exist many more varieties of constructions with *-er* than I have so far admitted. The goal of the next chapter, then, is to show that, if anything, there are two such varieties. I further argue that the theory of comparatives developed thus far is flexible enough to handle these varieties.

Chapter 6: The comparative in English

This curious world which we inhabit is more wonderful than it is convenient, more beautiful than it is useful; it is more to be admired and enjoyed than used...
— Henry David Thoreau

In this dissertation so far, I have examined what, for convenience, might be called 'commensurating' (or, 'regular', 'direct') comparatives, canonically illustrated by sentences like those in (432). As on the standard theory, I have said that such sentences express (strict) greater-than relations between various sorts of degrees, themselves understood as measures along various dimensions: (432a) expresses that the measure of Al's height strictly exceeds that of Bill, (432b) expresses that the measure of Al's height strictly exceeds that of Bill's width. It is possible to compare heights and widths because their measures are comparable in terms of length.

(432) a. Al is **taller** than Bill is.

b. Al is **taller** than Bill is **wide**.

Comparatives like the naturally-occurring examples in (433) seem different, in that they don't seem to invoke measures, at least not obviously in the same way. (433a) is most naturally read as qualifying the ease of acquiring *this badge* in terms of time, rather than in terms of its difficulty; (433b) suggests *the problem* is better thought of in terms of the "psychological" as opposed to the "real", and so on. Given the discussion in Chapters 2 and 4, such sentences should perhaps seem more odd than they do, if any of the dimensions along which e.g. addictiveness and funness are measured are incommensurable. This second variety we may refer to, again for convenience, 'categorizing', as they intuitively suggest that what is at issue is the aptness of a particular predication holding of an object, rather than the ordering of measurements directly. The quote at the beginning of the chapter perfectly illustrates this variety; it manages to not only be coherent, but evocative.

(433) a. This badge is more **time-consuming** than it is **difficult**.[1]

b. The problem is more **psychological** than it is **real**.[2]

c. Frankly, I think Farmville is more **addictive** than it is **fun**.[3]

d. Her outfit is more **interesting** than she is **talented**.[4]

The literature on comparative constructions recognizes several varieties, all of which have repeatedly been suggested to be irreducible one to another. The regular (or 'commensurating') comparative in (434a) has been distinguished from 'metalinguistic' comparatives like (434b) (Bartsch & Venneman 1972, McCawley 1988, Kennedy 1999, Bale 2006, 2008, Morzycki 2011), 'comparisons of deviation' (434c) (esp. Bartsch & Venneman 1972, Kennedy 1999) and 'indirect comparisons' (434d) (esp. Bale 2006, 2008). How many different varieties are there, in fact? And, how does the theory developed in this disseration fit in?[5]

(434) a. Al is **taller** than Bill is (**wide**). regular/commensurating

b. Your problems are more **financial** than **legal**. 'metalinguistic'

c. The Red Sox are more **legitimate** than the Orioles are **fraudulent**. 'comparison of deviation'

[1]www.kongregate.com/games/Vitaly/feudalism

[2]www.vinayahs.com

[3]www.gamasutra.com/.../Farmville_Social_Gaming_and_Addiction.php

[4]www.huffingtonpost.com/2011/02/13/grammys-2011-nicki-minaj-_n_822654.html

[5]This chapter is mainly concerned with *-er/more* comparatives, as has the literature been. I overheard this equative sentence in March, 2014, which seems a plausible candidate for the categorizing variety: *Your plan is as foolhardy as it is desperate.*

d. Esme is more **intelligent** than Einstein is **clever**. 'indirect comparison'

In this chapter, I first discuss the intuitive distinction between commensurating and categorizing comparatives, and use this as a basis for showing that (most) of the sentences of the type in (434) are best thought of as categorizing. As we saw in the discussion of Bale's theory in Chapter 4, many of what he calls 'indirect' comparisons are likely commensurating, they perhaps only seem different in that the measure functions that are applicable for comparisons of beauty and intelligence are more exotic than those we use for heights and widths. I suggest that the remainder are indistinguishable from what I call the 'categorizing' variety.

The main goal of this chapter is to argue that the apparent variety reduces to a single type, that there is in fact *the* comparative construction in English, and not several, contra e.g. Kennedy (1999), Morzycki (2011) and Giannakidou & Yoon (2007). I develop an account of the categorizing comparative that builds on the morphological analysis of 'metalinguistic' comparatives proposed by Embick (2007), and relates to a notion of measuring credence proposed by Davis et al. (2008). The idea to be developed is that categorizing comparatives express a greater degree of credence on the part of the speaker towards one proposition (that denoted by the matrix clause) over another (that denoted by the *than*-clause). On this account, comparative morphemes and *much* remain univocal, unlike on previous accounts.

6.1. Basic data

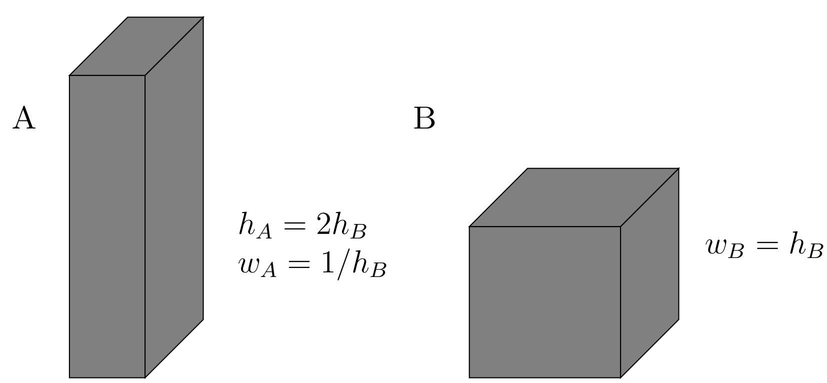
In this section, I introduce the intuitive distinction between commensurating and categorizing comparatives, and then discuss their similarities and differences in some detail. I focus on these two (apparent) types in order to fix intuitions about their properties as cleanly as possible, before turning to a comparison of their properties with the other types of comparatives that have been claimed to be distinct.

6.1.1. Commensuration or categorization

Consider (435), a familiar enough example of a comparative construction with a single adjective type figuring in the comparison. It expresses that Box A's height-measure is strictly greater than Box B's height-measure. Such a sentence is intuitively judged true in a situation like that depicted in Fig. 6.1. In this figure, Box A is in fact twice as tall as Box B.

(435) Box A is **taller** than Box B is.

Figure 6.1: Boxes A and B



Consider now the case with two adjectives that are commensurable via a scale representing lengths. (436a) is naturally read as describing Box A's height as strictly greater than its width. Both (436a) and (436b) are intuitively judged true when evaluated against the situation depicted in Fig. 6.1. In that figure, Box A's height-measure is twice its width-measure, which is twice Box B's width-measure.

(436) a. Box A is **taller** than it is **wide**.

b. Box A is **taller** than Box B is **wide**.

In the same scenario, (437), talking only of Box B, is intuitively judged false.

(437) Box B is **taller** than it is **wide**.

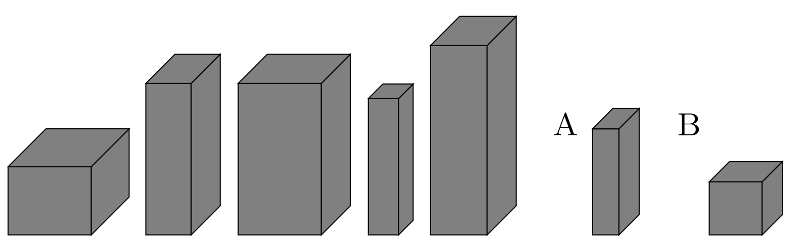
Commensurating comparatives do not entail attribution of the positive form of the adjective to the subject in either of its two clauses. We can see this by looking at Fig. 6.2, which is just like Fig. 6.1 except additional boxes have been added to the context. This additional context is necessary for the interpretation of the positive form of adjectives, as in the sentences in (438); we don't know what it is to count as *tall* or *wide* in the absence of further information (see the discussion at the end of Chapter 4). Against Fig. 6.2, the sentences in (436a)-(436b) are intuitively judged true, however, their combined truth is not enough to ensure the truth of any of (438); in fact, all of (438) are intuitively false in this context.

(438) a. Box A is **tall**.

b. Box A is **wide**.

c. Box B is **wide**.

Figure 6.2: Boxes



Such are the basic properties of commensurating comparatives.

Turning to **categorizing comparatives**, consider Fig. 6.3.[6] (439) features the analytic form *more tall* as opposed to the synthetic form *taller*, with focal stress

[6]Note that I will refer to this class with a different label than any that has been used for the various varieties of comparatives in the literature because, as I show shortly, they do not have any of the properties which, as a class, have been taken as characteristic of any of those classes.

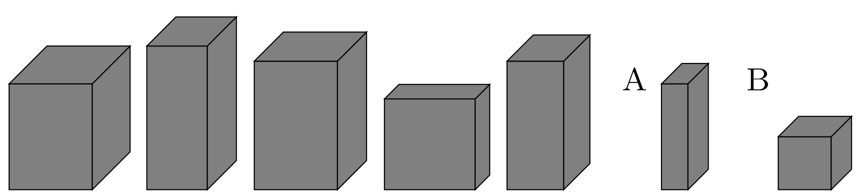
on *tall* as indicated by small caps.[7] Intuitively, interpreting (439) requires accessing different information than does (435): it suggests a comparison between Box A's and Box B's height-measures with respect to the heights of the other boxes in the context. That is, it suggests that Box A is a better exemplar of the category TALL in this context than Box B is.

(439) Box A is more **tall** than Box B is.

In this context, it is unlikely that Box A will be taken as *tall* (probably it will not be taken as *short* either); however, Box A is taller than at least two other boxes (Box B, and the middle box), whereas Box B is wider only than one other box (Box A). This situation seems to verify (440), now with two (commensurable) adjectives. While there is still some uncertainty whether Box A (or Box B, for that matter) count as positive instances of the category TALL (or WIDE) in this context, (440) indicates a greater degree of certainty in that categorization of Box A than the respective categorization of Box B.

(440) BOX A is more TALL than BOX B is WIDE.

Figure 6.3: Boxes



We saw that commensurating comparatives fail to entail the positive attribution of the matrix adjective to its subject, and there is some question about whether the categorizing variety has such an implication. In the next section I will suggest that it has no such implication.

[7] Bringing out the categorizing is aided by stressing the comparanda; I offer some speculation about this below when I turn to the morphological discussion, though I will offer nothing like a complete account.

6.1.2. Explorations of difference

There is a wealth of evidence to suggest that commensurating and categorizing comparatives are distinct varieties of construction, with the attendant differences in their interpretations. We will consider seven pieces of evidence for a difference: (i) dependence on a (wider) context, (ii) morphosyntax, (iii) a requirement for commensurable adjectives, (iv) polarity sensitivity, (v) distribution of measure phrases, (vi) lexical flexibility, and (vii) presuppositions.

First, with respect to context dependence. Commensurating comparatives are not context-sensitive, whereas categorizing comparatives are. Consider a situation with just one box, as in Fig. 6.4. If we suppose that to count as *wide*, a box must be $3'$, and to count as tall it must be $4'$. Box C in Fig. 6.4 falls 1 inch short of *wide*, but 1 foot short of *tall*. In this context, (441a) is intuitively false; the difference in the width-measure and height-measure of Box C with respect to contextually-specified standards is irrelevant. In contrast, (441b) has at least a passing shot at being intuitively judged true: Box C measures **closer** to the contextual standard for width than it does to the standard for height.[8]

(441) a. Box C is **wider** than it is **tall**.

b. BOX C is more WIDE than it is TALL.

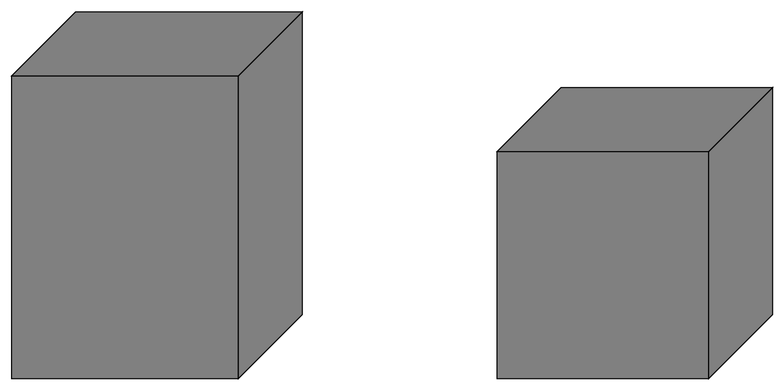
Second, commensurating comparatives may not appear with a bare adjective in the *than*-clause (442a), but categorizing comparatives may, (442).[9] Moreover, constructing the parallel examples with the equative, as in (443), a bare adjective in the comparative clause is fine so long as *much* appears in the matrix clause. I will

[8]It may be that judgments for the categorizing reading are more difficult in the case where the commensurating reading is false. If so, I do not have an explanation of this at present. The example in Fig. 6.4 may just not be ideal; Box C just clearly doesn't count as *wide* nor *tall* in the context given, so an utterance of (441b) might just be taken to be pointless in such a context.

[9]This was observed by di Sciullo & Williams (1987), and discussed by Embick 2007 in the context of discussing "metalinguistic comparatives"; see also Morzycki 2011. They give it a '*', my intuitions are not so sharp. I return to this point below.

Figure 6.4: The "standard box", and Box C

STD(WIDTH) $= 3'$ WIDTH(Box C) $= 2'8''$
STD(HEIGHT) $= 4'$ HEIGHT(Box C) $= 3'$



argue below, following Embick (2007), that these unusual morphological patterns are the result of a subtle structural difference between 'regular' and categorizing comparatives.

(442) a. ? Box A is **taller** than **wide**.

b. Box A is more TALL than WIDE.

(443) a. ? Box A is as **tall** as **wide**.

b. Box A is as much TALL as WIDE.

Third, categorizing readings of comparatives with adjectives expressing incommensurable dimensions for measurement are perfectly interpretable, while the commensurating reading seems unavailable. (444a) is difficult to interpret as a commensurating comparative, because there is no obvious dimension along which height and intelligence are comparable. In contrast (444b) has the by-now familiar interpretation in which Susie is more apt to be categorized as TALL than Al is to be categorized as SMART. What is compared is the aptness of the categorization, the difference in dimensions is irrelevant.[10]

(444) a. ? Susie is **taller** than Al is **smart**.

b. Susie is more TALL than Al is SMART.

Fourth, commensurating comparatives are sensitive to the polarity of the compared adjectives, unlike categorizing comparatives. (445a) cannot, for example, compare the heights of Susie and Al directly, whereas (445b) compares, again, the aptness of the respective categorizations. They are impervious to the fact that the two adjectives point to opposite ends of the same scale.[11]

(445) a. ? Susie is **taller** than Al is **short**.

b. Susie is more TALL than Al is SHORT.

Fifth, commensurating comparatives allow for a bare measure phrase in their *than*-clause (446a), whereas categorizing comparatives do not (446b).[12] (446a) expresses that John's height exceeds 6 feet, whereas (446b) is odd; it perhaps improves if the *than*-clause is clausal, e.g. *than 6* FEET *is tall*.

(446) a. John is taller than 6 feet.

b. ? John is more TALL than 6 FEET.

Sixth, categorizing comparatives are flexible with respect to the syntactic category of expression they combine with, both lexical (447) and functional (448):[13] I have provided context sentences to ease interpretation in some case, in parentheses before the target sentence.

[10]It is likely, though, that in many cases very different dimensions will be pragmatically infelicitous.

[11](445a) represents what Kennedy 1997 calls Cross-polar anomaly (see also Büring 2007, Heim 2006, 2008). I do not discuss antonyms in detail in this dissertation, though see Chapter 7.

[12]This was observed by Giannakidou & Yoon 2008, in their discussion of "metalinguistic" comparatives.

[13]Sentences labeled with a superscript m are from Morzycki 2011, small caps mine. Sentences labeled superscript e are from Embick 2007. The sentence with superscript l is from Lin 2009.

(447) **Lexical categories**

a. (Al is successful.) She's more ENTHUSIASTIC than she is TALENTED. AP

b. (Will Al commit to Bill?) Al more LIKES Bill than LOVES him. VP

c. That man is more BENEATH CONTEMPT than BEYOND HELP.[m] PP

d. Al swam more EXCITEDLY than SKILFULLY. AdvP

e. Al is more LAS VEGAS than MONTE CARLO.[e] PrN

(448) **Functional categories**

a. The world is more to be admired and enjoyed than used. TP

b. (Claim that Al finished reading the book.) What? Al might have LOOKED at the book more than READ it. AspP

c. (Do what Bill says.) Bill is more A boss than THE boss. DP

d. (That cloud looks like a duck.) Its more a ROOSTER than a DUCK. DP

e. Al believes more that Bill LIKES her than that she LOVES him. CP

f. Her mother cried more because Julie LIED than because she STOLE.[l] CP

g. George is more INCREDIBLY DUMB than REALLY CRAZY.[m] DegP

h. Al is more SEVEN feet tall than SIX AND A HALF feet tall. MP

The range of categories that can be compared in categorizing comparatives is thus great.[14] It is not clear that comparable examples of the commensurating

[14]And not likely as restricted as the examples in the main text suggest. In (447)-(448), the compared expressions are phrasal constituents. However, it appears that non-phrasal constituents can be compared as well, (449). In (449a), the phrase *to the store* may be so dislocated, and in (449b), *Dick*.

(449) a. (A claim that he rushed.) John more STROLLED than RAN to the store. V

b. George more FEARS than LOVES Dick. V

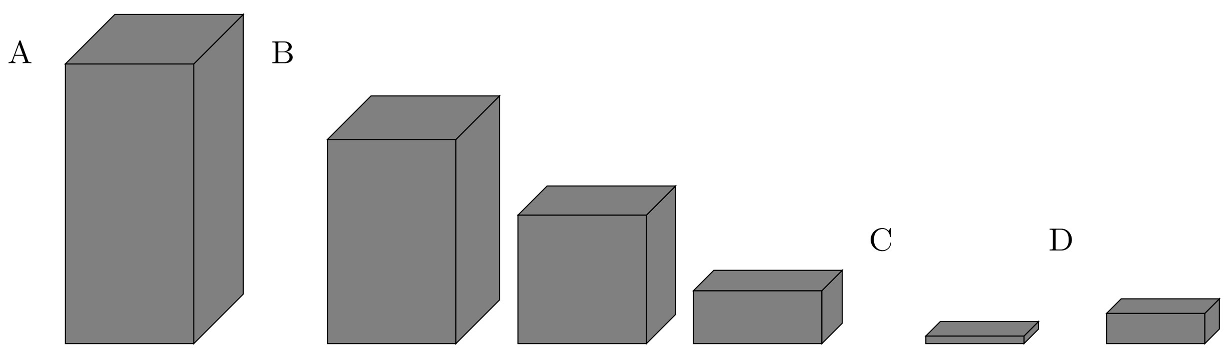
These may plausibly be analyzed as right node raising (RNR) constructions, the result of a syntactic process that Across-the-Board moves arguments of the verb to a higher functional projection. Morzycki judges such examples as particularly degraded, while McCawley 1988 finds them acceptable, as do I and the speakers I have consulted. Although the RNR approach occurred to me independently, Morzycki credits a reviewer for pointing it out to him. Morzycki analyzes these in terms of ambiguity: one lexical entry for *fear* requires a syntactic object, the other does not.

In (447)-(448), the compared expressions are drawn from the same lexical or functional category. Morzycki (2011) offers (450) to show that the categories need not match.

variety can be constructed.

Lastly, the two varieties may differ with respect to their conditions of felicitous use. To see this, consider the context depicted in Fig. 6.5. Here, both of the sentences in (451) are intuitively judged true. The height of Box A exceeds that of every other box (it is the tallest box), and the height of every box exceeds that of Box C (it is the shortest box). In this context, it would be odd to utter the pairs of sentences in (452), whereas the sentences in (453) seem blandly true. If it is already established in the discourse that a given box exceeds a certain contextual standard along a given dimension, it seems unnecessary to say that it is *more* in that category than another.

Figure 6.5: More boxes



(451) a. Box A is **tall**.

b. Box C is **short**.

(452) a. Box A is tall. Indeed, it's more tall than Box B is.

b. Box C is short. Indeed, it's more short than Box D is.

(453) a. Box A is **tall**. Indeed, it's **taller** than Box B is.

(450) a. Susanna was more afraid of Dick than in love with him. AP/PP

b. The official is more a war criminal than criminally insane. DP/AP

b. Box C is **short**. Indeed, it's **shorter** than Box D is.

Such data suggest that the categorizing comparative presupposes either that there is some uncertainty about whether the positive form of the adjective holds of the subject of its clause, or that the positive form does *not* hold. The commensurating comparative is neutral with respect to this pragmatic condition.

6.2. Metalinguistic, indirect, deviation

In this section, I evaluate whether 'metalinguistic comparatives' (MCs), 'indirect comparisons' (ICs), and 'comparisons of deviation' (CODs) represent distinct classes of comparatives from those I have been calling 'categorizing'. These various types are supposed to differ from each other in their implicational profiles. I argue that these implicational profiles do not in fact differ, which suggests indeed that we are dealing with a uniform class.

As we saw at the beginning of this chapter, these four types are proposed for examples like those in (454). I will suggest that most of the non-regular examples that have been cited as instances of these types in fact fall in the categorizing class. However, it seems likely that some of the cases Bale refers to as ICs can be understood as regular comparisons.

(454) a. Al is **taller** than Bill is (**wide**). regular

b. Your problems are more **financial** than **legal**. MC

c. The Red Sox are more **legitimate** than the Orioles are **fraudulent**. COD

d. Esme is more **intelligent** than Einstein is **clever**. IC

Following this discussion, I argue for a reduction of categorizing and commensurating comparatives. That is, in all of the relevant semantic respects, they are indistinguishable. The differences between them derive from the fact that while commensurating comparatives involve measurement of adjectival denotations (and those of expressions of other syntactic categories) directly, categorizing comparatives represent measurement of something else.

6.2.1. Whither presuppositions

Bartsch & Venneman (1972), McCawley (1988), Kennedy (1999), Bale (2006,2008), and Morzycki (2011) discuss, in greater or lesser detail, what have usually been called "metalinguistic" comparatives (MCs). Bartsch & Venneman and Kennedy describe them as comparatives with incommensurable adjectives that presuppose that the positive form of the matrix adjective holds of the subject. One of McCawley's examples of a MC is (455).

(455) Your problems are more **financial** than **legal**.

Bale (2006) rejects this conclusion for the class of comparatives that he calls "indirect", and in Bale (2008) he distinguishes this class from MCs and CODs. Consider the examples in (456). He admits that these seem to imply that the view is beautiful in (456a), and that Heather is intelligent in (456b).

(456) a. The view is more **beautiful** than the phone call is **urgent**.

b. Heather is more **intelligent** than Paul is **devious**.

However, he suggests that the implications of (456a,b) are not presuppositions, since they fail to project under negation (457a), in questions (457b), or the antecedent of a conditional (457c).

(457) a. The view **isn't** more beautiful than the phone call is urgent.

b. **Is** the view more beautiful than the phone call is urgent?

c. **If** the view is more beautiful than the phone call is urgent, **then** I won't answer the phone.

Moreover, the implication is cancelable. Imagine a context in which we assume that the phone is ringing because a telemarketer is calling back to again try and sell us car insurance (which we already have). To describe the view from the hotel room (which looks out onto a brick wall), I could utter (458). The very low degree of urgency is used to imply a very low degree of beauty.[15]

(458) Unfortunately, the view is **as beautiful as** the phone call is **urgent**.

Even canonical MCs fail to show the implication under these circumstances. Using McCawley's original MC sentence, the implication that your problems are financial does not arise, as in (459a-c).

(459) a. Your problems **aren't** more financial than legal.

b. **Are** your problems more financial than legal?

c. **If** your problems are more financial than legal, **then** you should speak to an accountant as opposed to an attorney.

Morzycki (2011) writes that, indeed, MCs implicate, but do not in fact entail the positive attribution of a property to an individual. His evidence for this is that the inference to *Clarence is tall* from the MC in (460a) is cancelable, (460b).[16]

(460) a. Clarence is more TALL than UGLY.

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

We have seen that categorizing comparatives neither entail nor presuppose that the positive form of the matrix adjective holds of it subject. Thus, by this

[15] Sentences like (458) also sound like they'd only be used sarcastically; it's not clear what that means for the present, however.

[16] Note that it is difficult to construct a similar example using the original McCawley sentence. For example, *Your problems are more financial than legal, but they're not really financial.* This might be because *financial* is likely non-gradable: consider that *This is a very financial matter* sounds anomalous.

diagnostic, we have not yet seen a difference from the class we have been calling 'categorizing'.

6.2.2. Whither entailments

Another class of comparatives that have been discussed are called 'comparisons of deviation' (CODs). An example of a COD is (461). Kennedy (2001b) holds that examples like that in (461) entail, in both the matrix and the *than*-clauses, the attribution of the positive form to the subject. That is, (461) is said to entail (at least) that the Red Sox exceed the contextual standard for legitimacy.

(461) The Red Sox are more **legitimate** than the Orioles are **fraudulent**.

Kennedy's judgment of this entailment is the basis for Bale's differentiation of CODs from what Bale calls 'indirect' comparisons like that in (462), and Morzycki's differentiation of Kennedy's CODs from McCawley's MCs. If CODs entail the positive attribution of the matrix adjective to the subject, while MCs and ICs only (we've now seen) *implicate* such an attribution, then ICs and MCs are distinct from CODs.

(462) Esme is more **beautiful** than Einstein is **clever**.

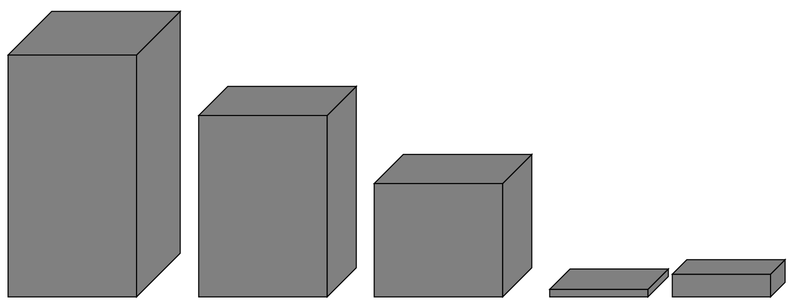
I do not share this intuition (and neither does Embick 2007). For example, consider (463). This sentence doesn't seem contradictory, yet the literal meaning of the continuation should contradict the proposed entailment that the Red Sox meet the contextual standard for legitimacy. This suggests that CODs do not properly entail the positive attribution of the matrix adjective to its subject.

(463) The Red Sox are more **legitimate** than the Orioles are **fraudulent**, and this is kind of hilarious because **the Red Sox aren't even remotely legitimate**.

Is the difference between CODs, on the one hand, and MCs/ICs on the other, just supposed to be that the two adjectives compared are antonymous? To check this, consider (464) in the context of Fig. 6.6. Observe that, in this figure, the third box from the left and the fourth box from the left neither count as *tall* nor *short* respectively. Suppose that is true. Now consider (464). By assumption the positive attribution is false, yet nonetheless (464) is neither false nor incoherent, in fact it is intuitively judged true.

(464) The second box is more tall than the third box is short.

Figure 6.6: Boxes again



Finally, we can consider Bale's ICs. He claims that these are different from both MCs and CODs because they do not entail the positive attribution of the matrix adjective to that clause's subject. Instead, ICs like that in (465) license the (weaker) conditional inference that *if* the positive attribution of the adjective in the *than*-clause holds of that clause's subject, then the positive attribution of the adjective in the matrix clause also holds of its subject.

(465) Mary is more **beautiful** than Susie is **intelligent**.

$\Rightarrow$ **If** Susie is very intelligent, **then** Mary is (at least) very beautiful.

However, licensing this sort of conditional inference does not differentiate ICs from CODs (466) and MCs (467).

(466) The Orioles are more **fraudulent** than the Red Sox are **legitimate**.

$\Rightarrow$ **If** the Red Sox are very legitimate, **then** the Orioles are (at least) very fraudulent.

(467) Her outfit is more INTERESTING than she is TALENTED.

$\Rightarrow$ **If** she is very talented, **then** her outfit is (at least) very interesting.

However, the inference does fail if the same individual is denoted by the subject of each clause, and the clauses contain antonymous adjectives, (468), and it fails if the two categories compared are mutually exclusive more generally (e.g., some claimed MC patterns), (468).

(468) Mary is more **beautiful** than she is **ugly**.

$\not\Rightarrow$ **If** Mary is very ugly, **then** she is (at least) very beautiful.

(469) Your problems are more **financial** than **legal**.

$\not\Rightarrow$ **If** your problems are very legal, **then** they are (at least) very financial.

Recall that I said in Chapter 4 that it seems some of Bale's ICs might better be analyzed as 'regular' comparatives. The fact that vanilla examples like (470) fail to license the conditional inference may be taken as evidence against such speculation. Standards just do not seem to matter here, and the conditional inference is constructed on top of bare adjectives whose use comes with its own particular commitments. It may be that Bale's ICs can be read either as 'commensurating' or 'categorizing', and on the 'categorizing' reading they license the inference. It is difficult to know, because all of his examples involve a 'subjective' dimension for comparison that isn't easy to pin down.

(470) Al is wider than he is tall.

$\not\Rightarrow$ If Al is very wide, then he is at least very tall.

Thus, it does not appear that there are stable presuppositions or entailments of MCs, CODs, or ICs that differentiate them one from the other. In the next section, I suggest that, if anything, we are left with the distinction we started this chapter with: that between commensurating and categorizing comparatives.

6.3. A clarification

In this section, I consider how commensurating and categorizing comparatives might differ with respect to their implicational profiles more directly, using some of the diagnostics described in the preceding two sections. While the literature has proposed more distinctions in the types of comparatives that are, if anything, distinctions within these classes, it has not yet been rigorously examined what specifically to pin the distinctions on.

I will examine combinations of the following properties: same or distinct subjects of the two clauses, commensurable versus incommensurable adjectives, and of the same or opposite polarity. What we will see is that commensurating comparatives care about all of these properties except the first, while categorizing comparatives care about none of them. However, commensurating and categorizing comparatives do differ in their implicational profiles: categorizing comparatives tend to license Bale's conditional inference, but commensurating comparatives do not seem to.

The commensurating comparatives that can be constructed with each of these parameters in mind are as in (471). I have used a question mark to indicate those examples that cannot receive a commensurating reading. As this collection shows, it is possible to get a commensurating reading whether there is the same or distinct subjects of the two clauses, so long as the adjectives across the two clauses are commensurable. The good examples are interpreted as a comparison of the width-measure of the alley with its length-measure or that of the street.

(471) **Commensurating**

a. The alley is wider than it is long.

b. ? The alley is wider than it is clean.

c. ? The alley is wider than it is short.

d. ? The alley is wider than it is dirty.

e. The alley is wider than the street is long.

f. ? The alley is wider than the street is clean.

g. ? The alley is wider than the street is short.

h. ? The alley is wider than the street is dirty.

The same type of examples but with the synthetic form *more* and prosodic emphasis on the compared adjectives are given in (472). To my ear, none of these are awkward or difficult to interpret, and all express that the alley is a better exemplar of the category WIDE in the context than it/the street is an exemplar of the category LONG, DIRTY, etc. Categorizing comparatives are insensitive to all of the properties that commensurating comparatives are sensitive to.

(472) **Categorizing**

a. The alley is more WIDE than it is LONG.

b. The alley is more WIDE than it is CLEAN.

c. The alley is more WIDE than it is SHORT.

d. The alley is more WIDE than it is DIRTY.

e. The aley is more WIDE than the street is LONG.

f. The alley is more WIDE than the street is CLEAN.

g. The alley is more WIDE than the street is SHORT.

h. The alley is more WIDE than the street is DIRTY.

Moreover, neither commensurating readings (the interpretable examples in (471) nor categorizing readings entail the positive attribution of the adjective to the subject in either of the clauses. As indicated in (473), the relevant sentences can be followed up with expressions negating that inference without contradiction.

(473) a. (472a)/(471a) ...but of course it's not actually wide or long.

b. (472b) ...but of course it's not actually wide or clean.

c. (472c) ...but of course it's not actually wide or short.

d. (472d) ...but of course it's not actually wide or dirty.

e. (472e)/(471e) ...but of course the alley isn't actually wide nor the street long.

f. (472f) ...but of course the alley isn't actually wide nor the street clean.

g. (472g) ...but of course the alley isn't actually wide nor the street short.

h. (472h) ...but of course the alley isn't actually wide nor the street dirty.

Moreover, all of the categorizing comparatives in (472) license the (respective) conditional inferences in (474), while none of the commensurating comparatives do. That is, the alley can be longer than it is wide, for example, while being neither a positive exemplar of the categories LONG and WIDE, as should be obvious. This follows from the fact that commensurating comparatives, unlike categorizing comparatives, are insensitive to context.

(474) a. If the alley is very long, then it is (at least) very wide.

b. If the alley is very clean, then it is (at least) very wide.

c. If the alley is very short, then it is (at least) very wide.

d. If the alley is very dirty, then it is (at least) very wide.

e. If the street is very long, then the alley is (at least) very wide.

f. If the street is very clean, then the alley is (at least) very wide.

g. If the street is very short, then the alley is (at least) very wide.

h. If the street is very dirty, then the alley is (at least) very wide.

In summary, there are detectable meaning differences between the categorizing and commensurating comparative. What is the nature of that difference? In the next section, I briefly review two previous proposals for the interpretation of 'metalinguistic' comparatives, which I will understand as analyses for comparatives on the categorizing reading, and present a sketch of an alternative account following that.

6.4. Previous proposals

This section considers two previous analyses of what have been called 'metalinguistic' comparatives. Both are 'meta' in the sense that they require something more like pragmatic calculations to formulate the truth conditions of such sentences, and both posit that the difference between categorizing and commensurating comparatives turns on distinct lexical entries for *more*. Following this discussion, I present a speculative alternative analysis that does not posit such an ambiguity, rather appealing to differences in what is measured on the two readings.

6.4.1. Morzycki

Morzycki (2011) in that it maintains a fairly standard analysis of regular comparatives, which express comparisons along lexical scales provided by GAs. For categorizing comparatives, he posits that the comparison is made along a scale of 'precision', building on ideas found in Lasersohn (1999).

The first ingredient of Morzycki's analysis is the rule of Hamblin Functional Application, by which expressions (now denoting sets of functions rather than single functions; Morzycki follows the formulations in Kratzer & Shimoyama 2002 and

Shimoyama 2006, which themselves build on Rooth 1985). I omit the C parameter from the interpretation function for readability, as it does not play a role in Morzycki's analysis. The d parameter on the interpretation function indicates the degree of precision at which the input is to be interpreted. (Note: I am representing these rules in the manner familar from Chapter 2 of this dissertation, rather than how Morzycki represents them.)

(475) *Hamblin Functional Application (HFA)*

If σ is a branching node, $\{\beta, \gamma\}$ the set of σ's daughters, and $[\![\beta]\!]^d$ is a function whose domain contains $[\![\gamma]\!]^d$, then $[\![\sigma]\!]^d = \{b(c) : b \in [\![\beta]\!]^d \wedge c \in [\![\gamma]\!]^d\}$.

Here, the denotation of a typical S node will be a set of propositional alternatives, rather than a single proposition. Thus, Morzycki posits a default rule of existential closure that applies to such sets (what I will represent as type $\langle \omega, t \rangle$) to return a set of worlds, i.e. a single proposition.[17] Given these rules, we can see first how Morzycki derives the interpretation of (what he calls) regular comparatives. Consider the sentence in (476).

(476) George is **dumber** than Dick.

I will not go through the steps of the derivation.[18] The result is that the interpretation of *dumber than Dick* in (476) is as in (477). Here's what this means. If the degree of precision parameter is set to absolute precision (i.e. $d = 1$), then the comparison expressed would be that *George is dumb to a degree to which Dick isn't dumb*. Interpreted at lower degrees of precision, predicates like *foolish* which merely resemble *dumb* play a role.[19] The result is then existentially closed.

[17]Morzycki notes that his version of this rule, called Hamblin-Intensional Existential Closure, differs in important ways from Kratzer's and Shimoyama's.

[18]Note that the basic shape of the meanings of comparative morphemes that Morzycki assumes is the A-not-A analysis; see Chapter 2.

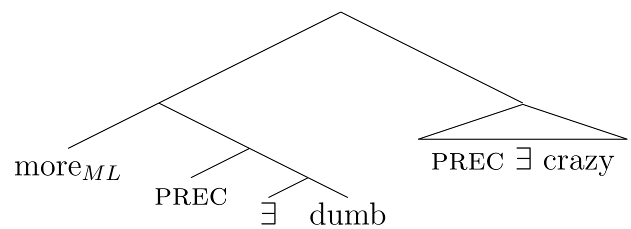
[19]A word on how Morzycki rules out incommensurabilities, while allowing that distinct adjectives can be compared by regular *more*. Some of the alternatives in the set in (477) would lead to comparisons of degrees of dumbness and degrees of foolishness, which are incommensurable. Since

(477) $[\![$George is dumber than Dick$]\!]^d$

$$= \left\{ \begin{array}{l} \lambda w.\exists d'[\textsc{dumb}(d')(\mathrm{G})(w) \wedge \neg\textsc{dumb}(d')(\mathrm{D})(w)], \\ \lambda w.\exists d'[\textsc{dumb}(d')(\mathrm{G})(w) \wedge \neg\textsc{foolish}(d')(\mathrm{D})(w)], \\ \lambda w.\exists d'[\textsc{foolish}(d')(\mathrm{G})(w) \wedge \neg\textsc{dumb}(d')(\mathrm{D})(w)], \\ \lambda w.\exists d'[\textsc{foolish}(d')(\mathrm{G})(w) \wedge \neg\textsc{foolish}(d')(\mathrm{D})(w)], \\ \ldots \end{array} \right\}$$

Now we can see how a categorizing comparative is derived on this account. They have a structure like that in (478). Noteworthy is that there is a distinct lexical item, *more*$_{ML}$, and the POS morpheme; Morzycki indicates that he is thinking about PREC and existential closure $\exists$ as nodes in structure, but that they could be thought of as type-shifters or composition rules as desired.

(478)



On this account, the interpretation of the comparative phrase in (479) is as in (480). This set of worlds corresponds to the proposition: there is a degree of precision at which some alternative to *dumb* holds of George, but at which no alternative to *crazy* holds of George.

(479) George is more DUMB than CRAZY.

(480)

$$[\![(479)]\!] = \left\{ \lambda w.\exists d' \left[\begin{array}{l} \exists f[f \in [\![\text{dumb}]\!]^{d'} \wedge f(\text{George})(w)] \wedge \\ \neg\exists g[g \in [\![\text{crazy}]\!]^{d'} \wedge g(\text{George})(w)] \end{array} \right] \right\}$$

In sum, Morzycki analyzes categorizing comparatives as expressing comparisons of degrees of precision, cast in a technical framework that appeals to rich additions to our stock of interpretive rules, which, however, may be independently

both predicates would have to apply to the same degree d, these alternatives are ruled out. If two adjectives are "so similar" that they compare along the same scale, then these would "survive".

necessary. More saliently, the account has as a consequence that any comparative morpheme evoking a categorizing interpretation is ambiguous, not just within a single language, but across languages. This may be undesirable, given that, in general, a univocal form (like *more*) surfaces.

I turn now to Giannakidou & Yoon's analysis, which shares this property of Morzycki's account, but which differs considerably in the details.

6.4.2. Giannakidou & Yoon

Giannakidou & Yoon (2011) (updating Giannakidou & Stavrou 2009; henceforth GY) offer an alternative approach to categorizing comparatives, [20] which differs from Morzycki's (2011; they cite a previous version of that paper from 2009) account primarily in the following ways. First, they question whether categorizing comparatives are always about (im)precision, citing data that they take to indicate that speakers are rather expressing **preferences** for one utterance over another. More generally, they indicate that there appears to be more variability in the pragmatic force of utterances of categorizing comparatives than is captured on Morzycki's account.

Their main issue, then, i sthat Morzycki's account doesn't allow $more_{ML}$ to operate at a propositional level, but rather over properties. For one, they claim that this cannot capture the fact that expressions like **hotter than humid* fail to have categorizing interpretations, and are in fact ungrammatical.

On GY's account, $more_{ML}$ is a sentential modifier. However, they understand speakers to use such constructions to express an attitude of desirability, appropriateness, or preference, as the case may be, which they suggest falls under the umbrella notion of "desirability". The expression of this attitude is contained in the meaning

[20]In fact, they also discuss comparatives with expressions like *rather* and, also Korean "negative preferential comparatives". I leave investigation of these constructions for a later date.

of $more_{ML}$. In (481), u, u' are understood to range over **quotations** of sentences in the sense of Potts (2007), and α is the "individual anchor" in the sense of Farkas 1992 and Giannakidou (1998, 1999)); I have omitted reference to the context variable c.

(481) **"Accuracy assessment MC" (Giannakidou & Yoon)**

$[\![\text{more}_{ML2}]\!] = \lambda u \lambda u'.u \succ_{\text{DES}(\alpha)} u'$.

Further elaborating on the intended interpretation of (481), GY indicate that the comparison is ultimately conducted in terms of degrees; I infer that the quoted utterances are then mapped to degrees, and the comparison is takes place between those.

Like Morzycki, GY posit an ambiguity of *more*. They cite as evidence for this data from Greek, which has a distinct standard-marker *para* that appears with *perissotero* (*more*) that unambiguously signals an MC interpretation, (482). Their paraphrase of the interpretation of (482) is, "the degree d to which the speaker desires the sentence 'Paul is a philologist' is greater than the degree d' to which he desires the sentence 'Paul is a linguist"' (*ibid.*, p639). They do not give a paraphrase of the same sentence with *apoti*, but indicate that such sentences indicate "regular comparative assessment".

(482)

o	Pavlos	ine	**perissotero**	filologhos	**para/apoti**	glossologhos.
the	Paul	is-3SG	more	philologist	than	linguist

'Paul is more a philologist than a linguist.'

An investigation of why there is this distinction in Greek is beyond the scope of the present work. However, it is potentially interesting that GY do not give an example of a *para* comparative with a plainly clausal complement. It may be that the distribution of *para* versus *apoti* is the result of more boring syntactic reasons than they suppose: *para* is phrasal *than* and *apoti* is clausal or reduced clausal *than* (cf. Pancheva 2009, Merchant 2009).

Interestingly, for my purposes, the major difference between Morzycki's and GY's account is that each try to capture categorizing comparatives more or less in terms of an attitude expressed by the speaker: whether that is a judgment of (im)precision, or of preference. In Morzycki's case, 'measures' of imprecision are invoked, but GY's account does not appeal to measures, just an ordering on preferences.

In the next section, I offer an analysis of the categorizing comparative construction in which I suggest that, indeed, it is a distinct construction in a particular sense: it has a particular form and meaning that distinguishes it from commensurating comparatives. However, the interpretations of the relevant functional expressions are nonetheless no different from those assigned throughout this dissertation. The difference, I suggest, is that categorizing comparatives represent measures of speakers' belief states.

6.5. Measuring beliefs

We saw that contrasting adjectives such as *tall* and *wide* are amenable to an interpretation by *commensuration*: these adjectives associate with a scale of length which provides common degrees for comparison. As we've seen, commensurating readings are (as their name suggests) impossible if one cannot construe a common scale for measurement across the two clauses. This is expected given the analysis discussed for comparatives in this dissertation: permissible '$\succ$'s are defined only for sets of degrees of the same ilk.

I now argue that categorizing comparatives are instances of the same general comparative form and meaning, but they represent measurement and comparison of different things than does the class we've been calling 'commensurating'.

6.5.1. The idea

On the theory proposed in this dissertation, consonant with the tradition going back to Cresswell (1976), the semantics of comparatives requires a common scale for measurement across the two clauses of the comparative. This type of theory accounts for commensurating comparatives like (483a): Al's height-measure and his width-measure are comparable, as they are both measured by degrees on a scale of LENGTH. It also correctly predicts the anomaly of (483b): whatever 'prettiness-measures' are, they are not degrees on the same scale as degrees of length.

(483) a. Al is **taller** than she is **wide**.

b. ? Al is **taller** than she is **pretty**.

But what to say about the examples in (484)? Here the dimensionality of the adjectives is irrelevant; in fact, it seems that the precise extent to which Al instantiates any of the relevant properties is unimportant, but rather, what is at issue is the extent to which the categories TALL and WIDE apply to her at all. If this *more* is the same in (483) and (484), and if that expression has the semantics I have assigned it, then what is being measured and compared in such examples?

(484) a. Al is more TALL than she is WIDE.

b. Al is more TALL than she is PRETTY.

Discussion in the previous literature suggests that categorizing comparatives do involve degree comparison, whether between degrees of appropriateness (Embick 2007), precision (Morzycki 2011), or preference (Giannakidou & Yoon 2011). This variability in the scales for comparison that are available is familiar from our discussion of expressions like *more coffee* and *run more*, which could suggest that a common analysis is available. In what follows, I will present a plausible morphosyntax for categorizing comparatives that can facilitate measurement and comparison, and then speculate on how the semantics might look.

I build primarily on the morphological analysis of Embick (2007), embedding it within a syntax more favorable to Giannakidou & Yoon's compositional interpretation. That is to say, I will appeal to a silent morpheme κ, and sentential-level modification for the interpretation of categorizing comparatives. On this account, the ambient morphology and syntax will differ between sentences like (484) and (483), but the morphemes *much* and *-er* appearing in both have a uniform semantics.

In brief, Embick (2007) was interested to capture the distribution of the synthetic comparative form *-er* from the analytic form *more*. He is primarily concerned with basic comparative sentences like those in (485a,b), as well as the fact that (485b) can alternate with the analytic form in the correlated 'metalinguistic' comparative (485c). He argues that (485a,b) is explained by his theory of 'blocking' in the application of morphological rules on a Distributed Morphology-style approach, and that (485b,c) show that the linear adjacency requirement on such rules is, while necessary, not sufficient.

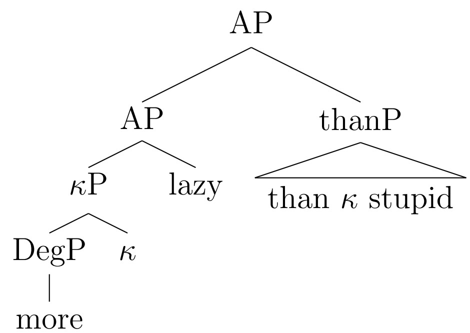
(485) a. Al is **more intelligent** than Bill is.

b. Al is **smarter** than Bill is.

c. Al is **more smart** than Bill is.

I will not go into the finer details of Embick's morphosyntactic derivation of forms like *smarter*, and the blocking effects that he posits may be overcome as in (485c). That would require refinement to (re-)accommodate the Bresnan (1973) idea that even forms such as (485b) contain a covert *much* (though see Dunbar & Wellwood, in prep). Instead, I will simply adopt his idea that "the syntax of such 'metalinguistic' ['categorizing'—AW] comparatives differs from that found with normal comparatives. The absence of synthetic comparatives follows from this structural difference in such a way that... the metalinguistic comparative Deg and a potential host are never adjacent in the relevant sense" (Embick 2007:12).[21] Building on Bresnan's (1973) account of MCs, *more than stupid* as a unit combines with *lazy*. However, Embick posits that there is an additional element which has the effect of destroying any linear adjacency between the comparative head and the adjective, namely κ. The (simplified) structure he proposes is as in (486).

(486)



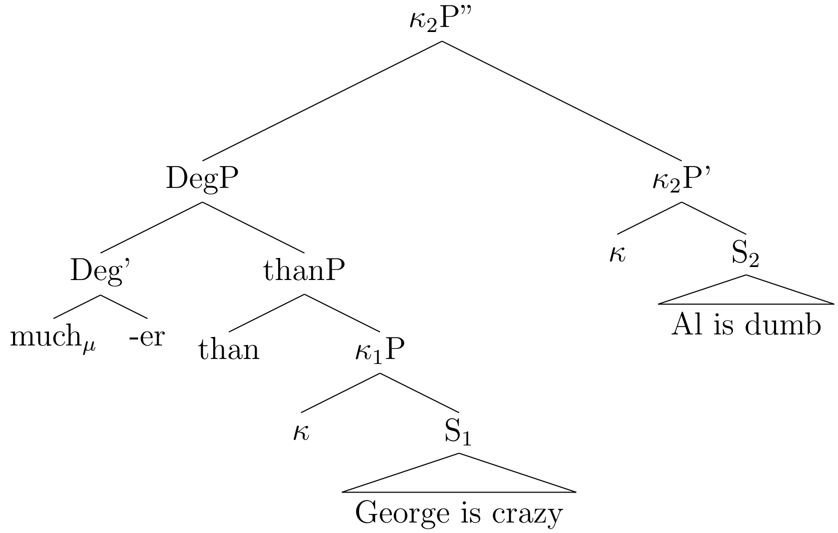
On this account, one might pin the fact that prosodic prominence on the adjective/noun/verb/&c indicates (i) the optional realization of κ as a kind of stress, or (ii) some interaction with a focus licensing element, such that focusing the element would force one to interpret it along with a κ or equivalent element (thanks to E. Dunbar for clarifying these possibilities to me). It is unclear at present which of these options would be more explanatory.

I adopt the basic structure of this account, but with a few semantically-motivated modifications, since whatever the structure of κ-marked comparatives, they have to be interpretable. It seems that sentences like *Al is more* DUMB *than George is* CRAZY express an attitude on the part of the speaker. Attitudes are generally understood as relations between attitude-holders, and propositions. However, with the scope of comparison in (486), the κ-comparative has no access to the rele-

[21] It is worth noting that it is not ultimately clear whether the analytic and synthetic forms (where it is possible for these to alternate) absolutely distinguish a commensurating from categorizing comparatives. Bartsch & Venneman 1972, Kennedy 1999, are tentative in this conclusion; as Bale 2006 puts it: "in certain constructions *-er* **tends to** only allow direct comparisons whereas more **tends to** allow only [non-direct] comparisons" Embick's morphosyntactic account, or my semantic proposal, may need refinement in the details if both types of interpretation are possible with the synthetic comparative. It may just be easier to get the categorizing reading using the synthetic form with prosodic cues, but it is not clear that even the examples in (471) can't be made interpretable by reanalysis as categorizing comparatives.

vant proposition-denoting nodes.[22] The (simplified; see below) structure I propose instead is as in (487).

(487)



Syntactically, this analysis renders categorizing comparatives structurally similar to sentences like that in (488), or to Japanese examples discussed by Sawada (2007), cited by Morzycki (2011). In that language, categorizing comparatives are expressed with a morpheme *iu* (homophonous with the verb 'to say') affixed to the *than*-clause head *yori*, (489). The interpretation of such sentences seem adequately captured by paraphrases like *I'd be more likely to say that* p *than to say that* q. The question is, what does it mean to be more likely to say that p than to say that q?

(488) It's **more that** Al is lazy **than that** George is dumb.

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

I propose that categorizing comparatives express comparison of **degrees of credence**: i.e., that the speaker's confidence in the truth of one proposition is

[22]It will be worthwhile in future work to explore accounts that invoke 'local' interpretations of what are normally thought of as sentence-level adverbials; for example Schein to-appear, Nouwen 2011, or Bogal-Allbritten 2013b, 2014. My preliminary attempts at extending these accounts to the present case were not successful.

greater than their confidence in the truth of another proposition.[23] A speakers' confidence can presumably have many sources, whether it is based on evidence or self-deception (I have in mind here that the "desirability" of a proposition's being true could influence one's confidence in how likely it is to be true). It could be that such a notion is more bleached than the alternatives that have been proposed, and consequently could give rise to the variety of intuitions about what sorts of degrees are compared in these constructions.

I propose that categorizing comparatives like that in (490a) have an interpretation similar to that of the sentence in (490b). κ, then, on this account, has an interpretation similar to that of the expression *confidence*. Extending the theory developed in Chapter 4, this will be a predicate of states. I propose that we understand these as mental states of speakers, states with intentional content (building on ideas in Hacquard 2006 and Kratzer 2006).

(490) a. Al is more LAZY than George is DUMB.

b. I **have more confidence that** Al is lazy **than that** George is dumb.

Such an analysis can capture the fact that categorizing comparatives are more permissive in the types of lexical categories they can combine with: allowing for comparisons over incommensurable GAs, and a freedom of expressions of different syntactic categories in the comparanda. That is, neither *much* nor *-er* impose any restrictions on the internals of the two sentences that ultimately act as input to κ—they measure the mental states introduced by that morpheme, not any part of the content associated with those states.

[23] Importantly, while talk of 'credence' is related to 'belief', I am not sure that it is reducible to it; the idea that belief simpliciter is gradable is controversial (cf. Villalta 2008, Anand & Hacquard 2013), while the idea that speakers assign different likelihoods to propositions being true has been gaining foothold (e.g. Davis et al. 2008, Swanson 2011).

6.5.2. Composition

In this brief section, I only spell out what I propose for the logical form of categorizing comparatives, and provide suggestions as to the truth-conditional contribution of the various pieces. My goal in what follows is merely to sketch the possibility of an account on which *much* and *-er* retain a uniform semantics with that otherwise provided in this dissertation; the finer points of the semantics will need to be spelled out in much more detail in future work, as noted below.

The interpretation I propose for κ is as in (491). This morpheme is intensional, first combining with a propositional argument (via Intensional Functional Application; Fintel & Heim 2002). So combined, it returns a function from credence states of the speaker $A(s)$ to truth values. Here I understand credence states to be sets of beliefs that have propositions (type $\langle \omega, t\rangle$, with ω the type of worlds[24]) as their contents, along with an ordering relation over those contents analogous to $\{\langle p, p'\rangle : A(s)$ has as much credence with respect to p as with respect to $p'\}$.[25] The relation R between such states and a proposition (the denotation of the internal argument of κ) may be understood as the relevant 'with respect to'; the precise nature of this relation awaits future work.

(491) $[\![\kappa]\!]^{A,w} = \lambda p \lambda s'.\textsc{credence}_{A(s),w}(s')\ \&\ R(s')(\lambda w.p(w))$
type $\langle\langle \omega, t\rangle, \langle s, t\rangle\rangle$

After combining with its propositional argument, κ is a predicate of credence states, analogous to TALL and HAPPY being predicates of states of tallness or happiness. Such entities are what *much* requires, and since they are different sorts of entities, they may be measured in different ways. In previous chapters, I posited

[24]It is more standard to use type s for worlds, but the suite of variable names with s in this dissertation is quite busy already.

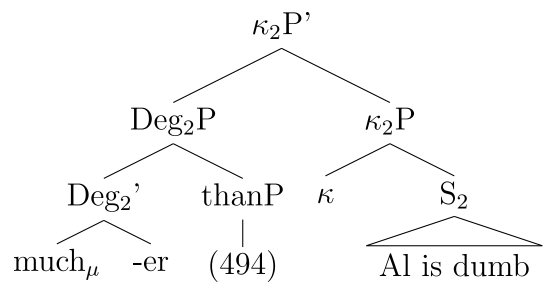
[25]Hacquard 2006 (also Kratzer 2006), combining the traditions of Hintikka 1962, Lewis 1983, and Stalnaker 1984, with that stemming from Davidson 1967, proposes that attitudes are (Davidsonian) states borne by individuals. They are different than e.g. *sitting on the wall* states in that they have associated intentional content.

that measuring the states predicated of by *hot* led to different measures than did measuring the portions of matter predicated of by COFFEE, and so I posit that measuring the states predicated of by CREDENCE licenses yet other sorts of measures. One intriguing possibility is to link credence states plus $much_\mu$ to the 'credence measures' defined in Davis et al. (2008) (also cf. Swanson 2011), with credence states approximating subjective probability spaces.[26]

Turning to the compositional details, I posit that the surface constituency of a sentence like that in (492) is considerably different from that of its LF counterpart, whose matrix clause is given in (493). As I have posited for nominal, verbal, and adjectival comparatives, the complex of *more than...* is a phrasal adjunct, in this case adjoining to κP.

(492) Al is more DUMB than Bill is CRAZY.

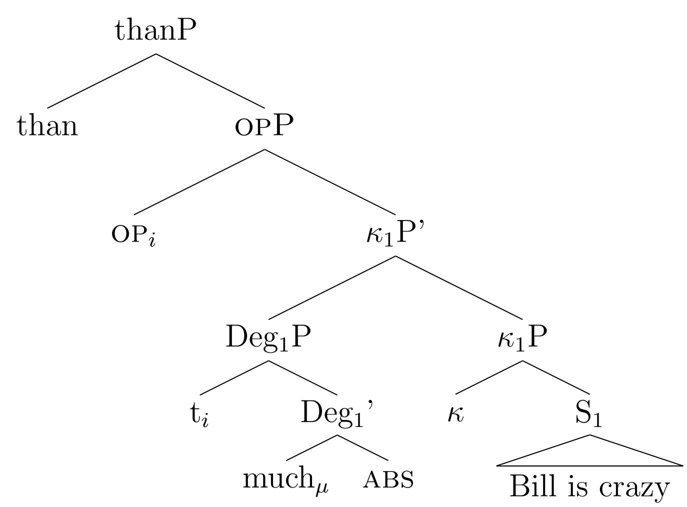
(493)



The internal structure of the *than*-clause I posit is as in (494), expanded from the sketch provided in the preceding section to show the relative positionings of OP and ABS that I assume.

[26] The question of monotonic measurement appears to be addressable straightforwardly on such an interpretation; that is, probability spaces are algebraic structures which admit of lattice-theoretic description. So long as the structure of the probability space is preserved in the mapping to degrees, measurement by *much* will be monotonic. The question of mereological structure is raised again, perhaps with the same suspicion as it was in Chapter 4; I leave these important questions for the future. Thanks to A. White and Z. Stone (p.c.) for preliminary discussion here.

(494)



For simplicity, I will not go through the composition of the S_1 and S_2 nodes; they are represented as in (495a) and (495b), respectively. In what follows, I will abbreviate these propositions as AL-IS-DUMB and BILL-IS-CRAZY.

(495) a. $[\![\text{Al is dumb}]\!]^{A,w} = \top$ iff $\exists s'[\text{Holder}_w(s')(\text{Al})\ \&\ \textsc{dumb}_w(s')]$

b. $[\![\text{Bill is crazy}]\!]^{A,w} = \top$ iff $\exists s[\text{Holder}_w(s)(\text{Bill})\ \&\ \textsc{crazy}_w(s)]$

The derivation of the matrix clause is given in (496), with the *than*-clause abbreviated as δ. The result is a predicate of credence-states of the speaker $A(s)$ at world w, the content of which is the proposition $[\![$*George is crazy*$]\!]$, and which measures greater than δ.

(496) i. $[\![\kappa_2\text{P}]\!]^{A,w} =$

$\lambda s''.\textsc{credence}_{A(s),w}(s'')\ \&\ R(s'')(\lambda w'.\textsc{Al-is-dumb}(w'))$ (495i),FA

ii. $[\![\text{Deg}_2\text{'}]\!]^{A,w} = \lambda d\lambda\alpha.A(\mu)(\alpha) \succ d$ FA

iii. $[\![\text{Deg}_2\text{P}]\!]^{A,w} = \lambda s''.A(\mu)(s'') \succ \delta$ (ii),FA

iv. $[\![\kappa_2\text{P'}]\!]^{A,w} =$

$\lambda s''.A(\mu)(s'') \succ \delta\ \&\ \textsc{credence}_{A(s),w}(s'')\ \&\ R(s'')(\lambda w'.\textsc{Al-is-dumb}(w'))$

(i),(iii),PM

The derivation of the *than*-clause is given in (497).

(497) i. $[\![\kappa_1\text{P}]\!]^{A,w} = \lambda s'.\textsc{credence}_{A(s),w}(s')\ \&\ R(s')(\lambda w'.\textsc{Bill-is-crazy}(w'))$ (495ii),FA

ii. $[\![\text{Deg}_1\text{'}]\!]^{A,w} = \lambda d\lambda\alpha.A(\mu)(\alpha) \succcurlyeq d$ FA

iii. $[\![\text{Deg}_1\text{P}]\!]^{A,w} = \lambda\alpha.A(\mu)(\alpha) \succcurlyeq A(i)$ (ii),FA

iv. $[\![\kappa_1\text{P'}]\!]^{A,w} =$

$\lambda s'.A(\mu)(s') \succcurlyeq A(i)$ & $\textsc{credence}_{A(s),w}(s')$ & $R(s')(\lambda w'.\textsc{Bill-is-crazy}(w'))$

(i),(iii),PM

v. $=$

$\exists s'[A(\mu)(s') \succcurlyeq A(i)$ & $\textsc{credence}_{A(s),w}(s')$ & $R(s')(\lambda w'.\textsc{Bill-is-crazy}(w'))]$

(iv),$\exists$

vi. $[\![\textsc{op}\text{P}]\!]^{A:i\to d,w} =$

$\lambda d.\exists s'[A(\mu)(s') \succcurlyeq d$ & $\textsc{credence}_{A(s),w}(s')$ & $R(s')(\lambda w'.\textsc{Bill-is-crazy}(w'))]$

(v),PA

vii. $[\![\text{thanP}]\!]^{A,w} =$

$\iota d[\exists s'[A(\mu)(s') \succcurlyeq d$ & $\textsc{credence}_{A(s),w}(s')$ & $R(s)(\lambda w'.\textsc{Bill-is-crazy}(w'))]]$

(vi),FA

Putting (496) and (497) together, the interpretation is as in (498). The result is that an utterance of (492) is predicted to be judged true just in case the speaker is in a state of credence with respect to the proposition denoted by *Al is crazy*, which is measured greater than the measure of their state of credence with respect to the proposition denoted by *George is crazy*. In other words, that the speaker has more confidence in the truth of the first proposition over the second.

(498) $[\![\text{Al is more } \textsc{dumb} \text{ than Bill is } \textsc{crazy}]\!]^{A,w} = \top$ iff

$\exists s''[\textsc{credence}_{A(s)}(s'')$ & $R(s'')(\lambda w'.\text{A-}\textsc{is-dumb}(w'))$ & $A(\mu)(s'') \succ$

$\iota d[\exists s'[\textsc{credence}_{A(s)}(s')$ & $R(s')(\lambda w'.\text{B-}\textsc{is-crazy}(w'))$ & $A(\mu)(s') \succcurlyeq d]]]]$

In sum, it is possible to maintain a uniform analysis of expressions like -*er*, *much*, and *than* (in fact, the basic architecture of comparison constructions in English) even in the face of what appears to be a radically different class of comparisons. Building on an independently motivated morphosyntactic analysis

(Embick 2007), and with a nod to independently motivated semantico-pragmatic analysis (e.g. Davis et al. 2008), one has only to posit a bit more structure than at first appears. There is not necessarily the need to posit that degree words are ambiguous.

6.6. Conclusion

In this chapter, I first elaborated on what appears to be a robust distinction between two kinds of comparatives: those I labeled 'commensurating', and those I labeled 'categorizing'. The two appear to differ with respect to the flexibility of the lexical and syntactic categories they combine with, and with respect to the licensing of a kind of conditional inference discussed by Bale (2006).

I then compared the distribution and interpretation of these to other types of comparatives that have been proposed in the literature: metalinguistic comparisons, comparisons of deviation, and indirect comparisons. I argued that the implicational profiles of these varieties do not distinguish them from regular commensurating comparatives ((in)direct comparisons) or categorizing comparatives (comparisons of deviation, and metalinguistic comparisons).

Next, I discussed two previous proposals for the semantics of metalinguistic comparatives, evaluated as proposals about the categorizing class. Both accounts appealed to a distinct morpheme $more_{ML}$, which is somewhat less than consonant with the fact that, in English and other languages, the same string 'more' is used in sentences with these readings.

Offering my own account of categorizing comparatives that did not appeal to ambiguity, I assimilated them to regular commensurating comparisons that operate over credence states rather than the states denoted by the gradable adjectives appearing in the matrix or *than*-clauses. A complete comparison of this proposal with that of Morzycki (2011) and Giannakidou & Yoon (2011), and a precisification of its details, awaits future research.

This chapter accomplished two things, then. It reduced the number of possible comparative types from four (or so) to one. I claimed that, at root, there is only one kind of comparative in English, constructed out of two pieces that are univocal across their various occurrences: *much* and *-er*. Secondly, this chapter showed how the very different-seeming interpretation of the categorizing variety might be constructed out of those pieces. As in previous chapters, the differences in dimensionality (now expanded to include more pragmatic dimensions for comparison) arise due to the properties of what *much* measures.

The next chapter concludes the dissertation with some speculative discussion about how the present theory might be applied in closely related empirical areas, and the bigger-picture consequences the account suggests.

Chapter 7: Prospects

In this dissertation, I have argued that the only avenue for introducing the notion of 'measurement' into comparative constructions in English is via the morpheme *much*. This argument was based primarily on the interpretation of that expression when it appears overtly in comparative constructions with nouns and verbs, but was applied to comparatives with adjectives and adverbs on the basis of three major sources of evidence: semantic, compositional, and morphosyntactic.

I argued that the same analysis could be maintained in two further empirical domains, even in the face of suggestions that a fundamentally different semantics was there involved: comparatives restricted to expressing comparisons by number, and comparatives that give rise to a flavor of metalinguistic comparison. In each of these areas, I suggested ways in which the analysis by *much* could be maintained, while capturing the clear interpretive differences that nevertheless obtain, in terms of differences in what *much* measures.

This concluding chapter has one major goal, which is to show how the work developed in this dissertation provides clear avenues for future investigation. I discuss three such avenues, roughly corresponding to the empirical, the theoretical, and the experimental/typological.

On the empirical front, there are at least two closely-related empirical domains that I have not yet said anything about, wherein an appeal is made to composition with lexically-specified measure functions. One is so-called 'verbs of scalar change', which include 'degree achievement' verbs like *cool* and 'path of motion' verbs like *ascend*. Another is apparently 'gradable' nouns like *fool* (see esp. Bolinger 1972). I discuss here how my hypothesis about pre- and post-adjectival comparatives, as well as my speculations about layered stative and eventive nodes with gradable attitude verbs, might find parallels here.

Theoretically, this study raises questions regarding how natural languages package meaning into compositional units. The question, as I posed it at the outset, is why the meaning of *much* isn't simply incorporated into the meaning of *-er*, *as*, etc., but rather composes independently. Considering some of the traditional and non-traditional thought on the nature of primitives in syntax and their relation to meaning, I suggest that language might fail to do this because it **can't** do it.

This theoretical discussion leads to interesting questions regarding language acquisition, psycholinguistics, and the expectation of cross-linguistic variation in the domain of comparative constructions. I address each of these briefly. In broad strokes, I speculate that: (i) the restriction on "how much" meaning can be packed into a single compositional primitive would be a boon for the language learner; (ii) that decompositional analyses can be tested using 'psychosemantic' approaches to language comprehension and production; and (iii) that the heavy reliance on a single expression like *much* could lead to large gaps in the lexical and syntactic inventories of languages.

I keep discussion of each of these points brief, but, I hope, suggestive.

7.1. Related domains

7.1.1. 'Scalar change' verbs

Several authors have profitably appealed to 'degree scales' to spell out the truth-conditional contribution of certain verbs. If such verbs did have a degree-semantics, the question from the perspective of this dissertation would be whether an expression like *much* somehow figures into their compositional semantics. However, I think it more plausible that the mappings between degrees and events that such theories posit in fact reflect mappings between states and events, or even times. If such an approach could be made to work, it dispenses with the idea that these verbs associate with degrees at all.

Rappaport Hovav (2008) suggests that (at least) two kinds of verbs relate to degree scales: those involving 'property scales' (e.g., *lengthen, shorten, dim*; see Dowty 1979 for discussion in terms of 'degree achievements'; also Hay et al. 1999, Kennedy & Levin 2008) and those involving 'path scales' (e.g., *ascend, descend, enter*).[1] Part of the motivation for this classification is that use of such verbs implies that an entity is in a state at time t' that is 'degrees different' from a qualitatively similar antecedent state at t.

(499) a. The tailor **lengthened** the dress.

b. The balloon **ascended**.

First, observe that such verb phrases do not combine directly with comparative morphemes; like other verbs, they require *much*, (500). As Rett (2013) also notes, if these verbs associate with degree scales, it is in a much different fashion than GAs (on the standard theory) do (see discussion in Chapter 4).

(500) a. The pants were **lengthened as *(much)** as the dress was.

b. The balloon **ascended as *(much)** as the kite did.

Degree-theoretic accounts of such verbs first assume an analysis of GAs in terms of measure functions, look towards verbal predications to see if they have GA-like properties, and, detecting such properties, analyze the relevant verbs as denoting (at least in part) measure functions. As should be clear, the same reasoning

[1] There are also those involving 'extent scales'. See discussion in Hay et al. 1999, Caudal & Nicolas 2005, Piñón 2008, Bochnak 2010, and Henderson 2013.

can be applied with a different starting assumption about GAs, namely, that they predicates of states; then, we can ask what it is about the states in the extension of e.g. *lengthen* that makes them measurable.

Moreover, the examples in (500) have (in addition to their 'degree' readings) the kinds of readings we have come to expect from eventive comparatives. That is, consider the sentences in (501), with *for*-adverbials included to ensure an atelic interpretation of the verb phrase. Taking these sentences to be true, and knowing nothing else about to what extent the pants or the skirt became longer, I believe that there is a reading of (502) that is intuitively judged true in such a situation.

(501) a. The pants were lengthened **for an hour**.

b. The skirt was lengthened **for 45 minutes**.

(502) The pants **were lengthened more** than the skirt was.

One might hypothesize, then, that the verbal-form masks a stative and eventive component, each of which (provided the relevant states and events meet the definedness conditions of $[\![much]\!]$) may be targeted by μ. For example, measuring the stative component in (500a) results in a comparison by degrees-of-length, and measuring the eventive component in (502) results in a comparison by temporal duration.

7.1.2. 'Gradable' nouns

So far in this dissertation, I have mainly considered comparisons involving nouns like *coffee* and *rock*. Both of these types of nouns give rise to the (by now) expected dimensions for measurement with mass nouns, e.g. volume and weight. Yet, there is a class of nominals that, much like verbs of scalar change, seem to have a more plainly 'gradable' component to their meaning.

Consider first that, using combination with *more* as a diagnostic, both *fool* and *person* pattern like count nouns. That this, they do not retain their 'usual' meaning here, but must be coerced into a mass-type interpretation.

(503) a. ? Bill is **more fool** than Al is.

b. ? Bill is **more person** than Al is.

With the indefinite article and/or partitive *of*, (504a) expresses something apparently equivalent to *more foolish*, while (504b) is interpretable, so long as we agree that there are degrees of personhood. If Bill and Al were robots, but Bill was more lifelike than Al, perhaps (504b) could be truly uttered.

(504) a. Bill is **more (of) a fool** than Al is.

b. Bill is **more (of) a person** than Al is.

Bolinger (1972) observed that, with an expression like *such*, a clear interpretive difference emerges. In (505a), what is expressed is that someone who is foolish *to that great an extent* will likely be unsuccessful. In contrast, the most natural reading of (505b) is as expressing that a person *of that type/category* will likely be unsuccessful.

(505) a. **Such a fool** as that will never get ahead in life!

b. **Such a person** as that will never get ahead in life!

Morzycki (2005) analyzes sentences like the closely related (506), wherein adjectives like *big* appear ambiguous with nouns like *fool* (having both a 'size' and a 'degree' reading).[2]

(506) a. Al is a **big idiot**.

b. Al is a **big person**.

[2]Such cases are related to Kennedy's 1999 discussion of *a large city*.

To analyze these, he posits that expressions like *idiot* contain a mapping to degrees as part of their denotation, which is lexically related to a standard degree, (507a); s_{+dim} here indicates the 'standard for *dim*' in the context. As this degree is not freely available in the syntax, yet seemingly modifiable as in (506a), Morzycki posits a null operator that can 'reveal' that variable for modification by expressions like *big*, (507b). *big* itself remains univocal; what derives the ambiguity of (506a) is whether or not the expression DEG-SIZE in (507c) offers up the lexical degree variable of *idiot*.

(507) i. $[\![\text{idiot}_{d,s+idiocy}]\!] = \lambda x.\text{dim}_{+idiocy}(x) = d \;\&\; d > s_{+idiocy}$

ii. $[\![\text{big}_{s+size}]\!] = \lambda x.\text{dim}_{+size}(x) \succ s_{+size}$

iii. $[\![\text{DEG-SIZE}]\!] = \lambda N_{\langle d,\langle,et\rangle\rangle}\ \lambda A_{\langle e,t\rangle}\ \lambda x.A(\iota d[N(d)(x)])$

I will not go through the details of Morzycki's account here. For my purposes, it suffices to point out the similarities in form of this kind of analysis, and that offered for e.g. gradable verbs or degree achievements. The observation is that some expressions seem to give rise to degrees along a property dimension *in addition to* their more 'regular' nominal or verbal dimensions. In the case of verbs, I have speculated that structural ambiguity may be involved. Such an explanation is potentially more far-fetched in the case of nouns. However, given that the ingredients of Morzycki's semantic analysis are analogous to those often offered for nominal gradability, it seems to me that the present account could be tailored to accommodate them, modulo the complications attending any account of variable dimensionality: i.e., what *idiot* is true of denotes in more than one ordering.

7.2. Theoretical issues

Sentences have parts, and the meaning of a sentence depends on the meanings of its parts. While compositionality is a generally accepted principle of semantic interpretation, there is not yet consensus on what counts as the *primitive* or smallest units that feed compositional interpretation. In traditional generative grammar, the primitives are 'words', including both the semantically simple *do* and the semantically complex *redo* (i.e., *do+again*; e.g. Chomsky 1965, di Sciullo & Williams (1987)). An alternative view holds that the smallest formal units and the smallest units of linguistic meaning are in fact inseparable, so that forms like *redo* are syntactically, as opposed to merely morphologically, complex (e.g. Halle & Marantz 1993, Embick & Noyer 2007, a.o.; see Borer 2005a,b,c for a view in which most distinctions often thought lexical are in fact syntactic).

On the standard theory in degree semantics, gradable adjectives are not amenable to further morphological analysis (i.e., they are morphemes), yet they are assigned a complex semantics that distinguishes them from morphemes of other syntactic categories such as nouns and verbs.[3] That is, *tall* contains both the information that the height property is under discussion, *and* the information that a measure of that property is under discussion.

In this dissertation, I separated out the property information from the measure function information, assigning the latter task to *much* in comparative contexts. This appears compatible with the DM-type view that there is only "so much" meaning the primitives of syntax can bear, though precisely what this hypothesis is supposed to amount to has not, to the best of my knowledge, been worked out from a semantic perspective. The question we might ask, then, is: once the interpretative contribution of *much* is 'severed' from the adjective, why is it not just included as part of the meaning of comparative morphemes themselves? Why the separate morpheme?

Two considerations suggest the answer to this question is: language packages

[3]This statement applies only to the 'simple' nouns and verbs that we've seen, which uncontroversially have a property-type semantics. I continue to restrict my attention to distinctions related to degree semantics only.

meanings into morphemes in this way because it **can't** do things otherwise. Making this argument would take another dissertation, perhaps, but there is some suggestive evidence that such a conjecture is true. The first concerns recent semantic analyses of negation in comparatives, which are currently thought to form a syntactically-separable part of negative adjectives like *short* and the negative comparative *less*; the second concerns recent morphological analyses of superlatives, which suggests that (universally) superlative meanings are constructed out of comparative meanings.

To help answer this question, we might consider the role of negation in comparative contexts. Recent proposals in semantics suggest that the negative comparative *less* and negative antonyms like *short* in English are syntactically, as opposed to merely morphologically complex. For instance, suppose that the negative comparative *less* in English decomposes as it does in German (*wenig-er*, LITTLE-ER), and *short* into LITTLE TALL (Rullmann 1995, Heim 2006, Büring 2007). Positing a silent LITTLE as part of the English expressions correctly predicts that *more*/*less* and *tall*/*short* are semantic duals, just as they are in German. One consequence of this view is that the sentences in (508) are equivalent as a matter of logical syntax.

(508) a. The building is **taller** than the ladder is.

b. The ladder is **shorter** than the building is.

c. The ladder is **less tall** than the building is.

Decompositional approaches are well-suited to explain patterns of cross-polar anomalies, as well. Kennedy (2001) explains the oddity of (509a) as due to *tall* and *short* taking (incommensurable) perspectives on those degrees-of-height, "positive" and "negative" (**Kennedy's constraint**). As Büring (2007) points out, however, such an account incorrectly predicts that (509b) should be odd as well, since *short* is negative and *wide* positive. On Büring's decompositional approach, the antonyms *short* and *tall* share a common lexical core, whereas the non-antonymous *short* and *wide* do not. Moreover, the pronunciation of the form *shorter* is ambiguous: one parse of is [LITTLE-ER] TALL (on this, (509b) expresses a licit less-than comparison between positive degrees), and another parse is -ER [LITTLE TALL] (a greater-than comparison of positive and negative degrees, barred by Kennedy's constraint).

(509) a. ?? The ladder is **shorter** than the building is **tall.** ??height

b. The ladder is **shorter** than the building is **wide.** length

Here, on either parse, (509a) is problematic: analyzing *short* as -ER [LITTLE TALL] results in a greater-than relation between TALL and LITTLE TALL (barred by Kennedy's constraint), and [LITTLE-ER] TALL results in a less-than relation between two instances of TALL (barred for (509a) by obligatory Comparative Deletion, Bresnan 1973).

Büring's account naturally extends to account for ambiguities evidenced equally by forms like *less high* and *lower* (cf. Seuren 1973, Rullmann 1995), by positing (with Heim 2006) that the silent LITTLE can QR from its base position. However, Heim (2008) points out that there are contexts where *slower* does not show the same scope possibilities as e.g. *less fast*. Wanting to maintain Büring's other results, however, Heim ultimately ends up positing two distinct LITTLEs, one for the decomposition of *less* (scopally-mobile LITTLE), and another for *short* (scopally-immobile LITTLE).

Future work in this vein should examine cross-linguistic data and see what light it may shed on this issue. For example, in Hixkaryana the antonym of an adjective like *long* is formed by two pieces (*kawo-hra* LONG-NOT; Bobaljik 2012). Considering facts like these, *short* may not spell out LITTLE LONG (i.e., [NOT MUCH] LONG) but NOT LONG. This analysis is made possible by the fact that the theory proposed in this dissertation (unlike other approaches) provides a non-trivial meaning for *much*.

If syntactic operations target parts of lexical items, then those lexical items cannot be syntactic primitives. As typological and semantic work in various areas deepens, the idea that word meanings are decomposable in ways that are not necessarily transparent becomes more plausible. Moreover, it suggests a very strong constraint on a language learner's hypothesis space, and stringent constraints on what we should expect to find when we look to new languages.

7.3. Languages and learning

It would be quite interesting if the standard picture, on which gradable adjectives are unique in lexicalizing measure functions, were correct. It would suggest a strong syntax-semantics mapping that children could use in acquiring the meanings of novel words. That is, if a child were able to categorize an expression as a gradable adjective, she would immediately know that it can be used in the array of comparative constructions.[4] In this dissertation, I have argued that gradable adjectives are not linguistically so very different from mass nouns and atelic verbs.

There is suggestive crosslinguistic evidence that the category of 'gradable adjective' is not very robust. Some languages appear to fail to instantiate the syntactic category 'Adjective' at all.[5] If only a subset of adjectives denote measure functions, then it is unclear to me what should be predicted for such languages. Will they lack words that express concepts like those underlying (English) *tall* or *intelligent*? Or will they have words with similar meanings that just have a different logical type? And what would the consequences of such variation be?

On the theory I offer, the gradability of adjectives and adverbs is not fundamentally different from that of nouns and verbs. Rather, that intuition tracks a felt difference between the "sorts of things" that *much* measures, which are, to be sure, quite different. From a formal perspective, however, *hot*/*fast* express things that come in various levels/extents *along the relevant dimensions*, as do *coffee*/*run*

[4] This is already a difficult problem, as opposed to merely determining that the expression is of the category Adjective. See Waxman & Lidz 2006 and Syrett 2007 for discussion of the acquisition of expressions of this category.

[5] A summary discussion of such languages appeared on the Linguist List, 4.442, Wed 09 June 2013, "Sum: Languages without adjectives".

express things that come in various levels/extents *along the relevant dimensions*. What "sorts of things" they are doesn't play a crucial role in the logical form.

Because the functional vocabulary (*much*, *-er*, etc) place restrictions on what the expressions they combine with can apply to (namely, those things must be **ordered** or **orderable**), the theory could be used to test syntactic bootstrapping theories in language acquisition (Gleitman 1990; see a.o. Borer 2004 for pertinent discussion). Once a child has acquired the meanings of comparative morphemes, this knowledge can guide their hypotheses about the meaning of novel adjectives, nouns, etc., that occur in this environment. For instance, if a child can isolate the relevant property as one they represent as gradable when presented with *This is a dax-y one*, they should immediately understand what is meant when presented with *This one is as dax-y as that one*.

These thoughts suggest a bold conjecture about what we should expect to see in the crosslinguistic picture: no language should lexicalize open-class expressions as measure functions. This runs contrary to the hypothesis of Beck et al. (2010), in which languages can vary parametrically this (they can also vary with respect to whether they allow degree abstraction in *than*-clauses, though see Shimoyama 2012 for criticism). The idea that languages parametrically vary with respect to whether GAs lexicalize measure functions is taken up by Bochnak (2013), specifically to argue that languages like Washo lack lexical measure functions unlike English.

My alternative conjecture would be that if a language lacks a morpheme like *much* in English, the expression that introduces measures, then it would not be possible to express direct measurements using expressions like those that depend on it—*-er*, *as*, etc. Moreover, if those languages lack not only adjectival, but nominal and verbal comparatives as well, this would provide strong support for the idea that it is not adjective meanings, but *much*, that introduces degrees.

Finally, the view on which there is only "so much" meaning a morpheme can bear is an interesting one, and with potentially interesting implications for language acquisition and typological investigation. But how might it ultimately be tested?

Recent work in psycholinguistics has begun to explore the idea that the logical representations we assign as the interpretations of expressions constitute psychological hypotheses about the representational format of linguistic meanings. Results so far have been very interesting, and suggestive that this mode of investigation will be very promising for the future, both with children (Halberda et al. 2008, Odic et al. in-press, Wellwood 2012b) and adults (Pietroski et al. 2009, Hackl 2009 Lidz et al. 2011, Odic et al. in prep, Tomaszewicz 2011, Kotek et al. m.s., 2011).

A strong hypothesis is that, each symbol proposed in the logical representation of the meaning of a sentence corresponds to a hypothesis about the class of cognitive operations that will be invoked during linguistic understanding (and production). I look forward to investigating this hypothesis further, in the context of the present theory.

7.4. Conclusion

This dissertation examined comparative constructions with the comparative morphemes *-er*, *as* and others across their adjectival, adverbial, nominal, and verbal occurrences. I first discussed a way of analyzing the cross-categorial data in which GAs denote measure functions, unlike nouns and verbs. I then proposed an alternative, in which *much* alone introduces measure functions. The resultant theory provides, among other things, an account of why *much* appears everywhere with comparative morphemes in English (even when it doesn't appear so on the surface): it is required to introduce degrees for elaboration by expressions like *-er* and *as*. A consequence of the theory is that the interpretation of gradable adjectives (the original impetus for the degree-theoretic analysis of comparative morphemes) is rendered much like that of nouns and verbs: all denote properties, just of different sorts of entities. The theory was extended to two areas that posed a challenge to the idea that the language of measurement and comparison was univocal: comparatives that only give rise to comparisons by number, and a variety of constructions that have been thought about as somewhat “meta” in their interpretation. It was shown that these constructions, too, fit within the same analytic framework as the others. Finally, a variety of further directions were explored. A strong conjecture about why language should look the way it does in the domain of comparative was offered, and its implications for the theoretical, typological, and experimental landscape were briefly explored. The picture that emerged was that, even within a broader frame of reference, thinking about things the way this dissertation lays out will potentially be quite fruitful for the linguistic enterprise.

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