Comparison and Superlatives: What's the Best?

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Abstract

This paper investigates several phenomena of superlatives, contrasts them with documented observations about the comparative, and proposes a theory for the semantics of the superlative. Superlatives will be explored with respect to such properties as ambiguity, operator scope, polarity environments, negation, interactions with modality, and inferential behavior. A brief survey of degree variable, extent variable, difference variable, and interpretive approaches will explore the possible paradigms for a theory of superlatives. The necessity for a new theory, treating the superlative as an independent phenomenon related in part to the comparative, will be demonstrated.

The resulting proposal is based on a Klein-style model-theoretic extent-based account for comparatives, augmented with a Larson-style lambda calculus approach for operator-based representation of scopal phenomena. Attempts to directly apply comparative theories to the superlative are shown to be inadequate, though initial formulations from the comparative are adopted. These are refined with the addition of two semantic constraints, the exclusion constraint and the membership constraint. The membership constraint imposes a set inclusion constraint on the head of the superative; the exclusion constraint enforces set complementarity upon the second comparand. The final result is a higher-order logic account for the meaning of the superlative which supports several of the superlative-related observations introduced. Its compatibility with several standard assumptions from the comparative theories, including implicitude and uniqueness, are demonstrated. Finally, future directions are indicated along which the foundation laid in this paper could be pursued.

If the realm of language is seen as a cosmos, vast, largely unexplored and sometimes bewildering, then the comparative construction must be a microcosmos, reflecting all the complexity of the whole.

Hoeksema [14]

1. Introduction

In this paper we will introduce a theory for representing the semantics of superlative constructions in English. We will note how related constructions, comparatives, are well documented in the linguistics literature. This will lead us to consider whether accounts of the comparative are adequate for superlatives.

An introductory section proposes the approach we will take and the problems we will attempt to address. Then, in a short section, we review several fundamentals of the superlative construction and its usage.

We then present an overview of four different types of semantic theories for comparatives: degree variable, extent variable, difference variable, and interpretive approaches. At the same time, we will explore several semantic properties that these theories describe. It will be noted that in some important ways superlatives behave differently than comparatives, and thus call into question the (usually) tacit assumption that superlatives can be accounted for by a direct appeal to one or another of the theories of the comparative.

This process of contrasting and comparing the superlatives and comparatives will lead us to formulate a partially independent approach to superlatives. We augment an initial object expression with two constraints: the exclusion constraint, and the membership constraint. The membership constraint imposes a set inclusion constraint on the head of the superative; the exclusion constraint enforces set complementarity upon the second comparand. The result will be applied to several different examples to show how it can account for several semantic phenomena of the superlative in English.

Finally, we will suggest future directions of work which could pursue the questions raised in this discussion.

2. The Problem

The superlative construction is a commonly used, complex phenomenon of natural language. Perhaps surprisingly, it has also been relatively unexplored as an independent phenomenon in some domains of the linguistic literature. This is especially true of the areas of syntactic

and semantic description. For reasons we shall explore, this lack of direct discussion about the superlative has been the main motivation for this investigation.

On the other hand, a considerable literature has developed on the topic of the comparative construction. Several different approaches have been formulated to account for the syntactic behavior of comparatives. In fact, the comparative construction has in many ways served as a touchstone to validate or refute particular analyses designed to address more general phenomena. Significant debate has thus emerged concerning the semantic descriptions required to adequately represent the meaning expressed by the comparative. The different theories do not always seek to integrate in a seamless fashion the syntactic and semantic components, and thus require some degree of interpolation if one wishes to apply them in an overall treatment.

In this paper we shall seek to bootstrap our discussion of the superlative by appealing to the debate on the comparative construction. We will, of course, mention the few cases where proponents of a particular approach have discussed an explicit theory of the superlative. More often, however, we will be left to infer what a particular approach would say about the superlative. Indeed, we will show that it is difficult to reconcile any single approach with the superlative-related observations we will attempt to address.

There are many issues to consider in this rich but relatively underexplored domain. The familiar questions of ambiguity, operator scope, polarity environments, negation, interactions with modality, and inferential behavior will be addressed. In addition, questions more directly related to comparison, such as the definition of degrees, how items are compared, ongoing debate over the prior status of attributive or predicative adjectives, will figure in our discussions.

We will discuss the various hypotheses and class them into four general groups: degree variable approaches, extent variable approaches, difference variable approaches, and interpretive approaches. We will discuss the claims that each type of approach makes about the syntax and semantics of comparatives, the observations that motivated its formulation, and the areas it does not address. More significantly, and in parallel, we will formulate observations about the superlative and then apply them to the various theoretical approaches, evaluating the relevance of each to the superlative. In this manner we will be able to shadow the investigations made into the comparative, evaluating their relevance to the superlative, and adding insights uniquely pertaining to the latter.

The result will be an emerging theory of the superlative as an independent phenomenon in part related to the comparative.

3. Preliminaries

Before starting our investigation, we first pause to review some fundamentals of the superlative. In so doing we will be able to fix the terminology used in this presentation and the scope of the investigation.

3.1. Comparison degrees

Adjectives and adverbs generally admit different levels, or degrees of comparison:

- the positive (or neutral) degree: *John is tall*
- the comparative degree: *John is shorter than Mary, John is as tall as Mary*
- the superlative degree: *John is the tallest scientist.*

The extent to which these degrees are thought to be related to each other is a subject of considerable debate.

3.2. Superlative formation

Superlatives are formed from several constituent parts. We will briefly make mention of each.

First, they all have some kind of comparative operator, always an adjective or adverb. The operator can be either:

- synthetic (or derived), meaning that they are formed with the comparative marker morpheme *-est*
  (e.g. *tallest, happiest,* etc.)
- analytic (or periphrastic), meaning that they appear jointly with the comparative marker word *most*[1]

[1] **Our treatment of the superlative will not address the independent usage of *most* as a partitive head or plural determiner, for example in expressions like:**

(1) most of the interesting books ...
most books...

or *least*
(eg. *the most interesting, the least confusing,* etc.)

In our discussion, we will rarely have reason to note this distinction, and will consider the two types to be semantically equivalent.

Like comparatives, superlatives have a head. Although it may be gapped (by ellipsis, deletion, or another mechanism) it, along with the comparative operator, forms the head of the comparative/superlative construction.

Superlatives are also usually signalled by the presence of a definite article: *This is* the *most interesting song I have ever heard.* As with many other topics in semantic analysis, the presence of a definite article here implies that the superlative degree exhibits interesting properties with respect to uniqueness, existentiality, and generic expressions.

Finally, an optional superlative complement is a part of the construction. We will discuss this in more detail presently.

3.3. Superlative categories

The superlative is a construction that can be formed from several different parts of speech. These include:

- adjectives:
  John was the tallest of the boys.
- adverbs:
  John ran the fastest of all the boys.
- nouns:
  John spent the most money that I could ever hope to earn.
- prepositional phrases:
  John is the most in the know of any journalist.

Superlatives can apply to simple (i.e. lexical) or complex (i.e. phrasal) categories (as in the last example). In our discussion we will deal mainly with superlatives of the adjectival type.

3.4. Superlative complements

As mentioned above, the superlative includes a complement. It specifies some object or class (called by some the *secundum comparationis),* with which the head is to be compared. English permits several different types of complements:

- finite clausal: That is the biggest skunk *(that) I have ever seen.*
- non-finite clausal: His program was the fastest *to crash.*
- phrasal: His is the loudest *of all those children.*

An important point to note for our discussion involves examples like the following:

(2) John is the saddest that nobody came.
He is the least likely to succeed.

Here the complements are not part of the superlative construction, but rather adjectival complements subcategorized by *sad* and *likely* respectively. Compare (2) with:

(3) John is the saddest of all my brothers that nobody came.
He is the least likely of any of her students to succeed.

which have both superlative complements and adjectival complements.

Though we will discuss this point later, we mention at this time that the superlative complement is considered by many to be obligatorily extraposed:

(4) That is the brightest star that anyone has ever seen.
*That is the brightest that anyone has ever seen star.

Note, though, that a phrasal complement may instead be topicalized: *Of all the girls, she plays basketball the best.*

Complements also have complement introducers. Finite clausal complements for the superlative are introduced by the word *that,* which may optionally remain unrealized. Phrasal complements are introduced by such words as *of* which we will consider to be a preposition. We will assume that the different forms do not introduce a great difference in deep semantic meaning.[2]

[2] **This is somewhat disputed by Hoeksema in [13].**

3.5. Superlative types

There are two types of superlatives in English:

- the superlative of superiority:
  That was our happiest day.
- the superlative of inferiority:
  His was the least informative answer.

We will only discuss superlatives of superiority, with the assumption that our principles also apply, with minor adaptation, to those of inferiority.

3.6. Affective pseudosuperlatives

As has been done traditionally for comparatives, a distinction can be drawn between two different kinds of apparent superlatives, "indefinite" superlatives and "definite" superlatives. The former never take complements, never allow synthetic adjectives, and only take the indefinite article. Consider:

(5) Yours was (a / *the) most kind answer.
Yours was (the / *a) most kind answer that I have ever heard.
Your was a (most kind / *kindest) answer.

In our discussion we will only concern ourselves with definite superlatives.

Superlative constructions can sometimes also be used as elatives:

(6) You will use me for your best work of administration.
I will leave them until they meet God with their best works.
May God repay the Yarbū' according to their worst activity.

These constructions are not to be taken literally; instead, here superlatives are only used for their emotive force, hyperbolic value, and quasi-metaphoric connotations. Indeed, the superlative adjective can be replaced by the positive or even deleted entirely without change in meaning; hence superlatives so used are sometimes called *epitheta ornanta*. Such usages are popular, for example, in religious literature (e.g. Quaranic, Talmudic and Biblic), since the elative is very common in Semitic langauges and it is usually rendered

directly as a superlative in English (see, for example, Bravmann [7], which provides the examples above). Perhaps more common are the related pseudosuperlatives (also called epithetical superlatives), exemplified by these sentences from Keenan [18] and Holmback [15] respectively:

(7) There's the biggest dog in the garden!
There is the most beautiful view from my window.

where the adjectives are not entirely devoid of force, yet not true superlatives either. Since superlatives like these are typically used for emotive force and usually not in any literal sense, and their interpretation is a largely a non-literal, discourse-related one, we will not treat the elative use of superlatives in this paper.

Similarly, there are some superlatives which, as Gross [10] has shown for comparatives, have frozen into fixed lexical forms. These idiomatic superlatives, such as *best in the west,* are not discussed explicitly in this paper, although it should be possible to apply the principles to these constructions as well, either compositionally or *in toto.*

We are now ready to discuss the different types of semantic theories proposed to describe the comparative construction, and apply them where possible to the superlative.

4. Semantic Theories of the Comparative

In this section we will sketch various approaches that have been proposed to account for the syntactic and semantic properties of the comparative. Only those aspects deemed directly relevant to our investigation of the superlative are treated.

4.1. Degree variable approaches

The first way to describe to the comparative can be called the degree variable approach. In this section we will discuss degree variable approaches and discuss their relevance to superlative constructions.

4.1.1. Degree variables

As implied by its name, this class of theories seeks to describe the comparative in terms of a variable ranging over degrees of measurement. These so-called degree variables, as

formulated by Bresnan, are underlying expressions of quantity. We begin by summarizing her discussion of degree variables for comparatives and superlatives, and her syntactic treatment of these phenomena. Then we discuss Cresswell's attempt to specify a semantic description of these variables.

The motivation for positing an underlying variable comes from various syntactic observations noted by Bresnan in her dissertation [8]. For example, note these comparative examples of hers (cf. Bresnan 262-275):

(8) He's sadder than anybody is.
*He's sadder than anybody's.

Bresnan proposes a constraint precluding verb contraction before a gapped constituent; although needed independently to account for other types of constructions, it would presumably apply, as here, in comparative constructions as well. We note that the same constraint holds for superlatives with clausal complements:

(9) He's the saddest that any man is _.
*He's the saddest that any man's _.

(10) John wants to be the best manager that anybody is _.
*John wants to be the best manager that anybody's _.

(11) Mary is the most excited about her work, and John is _ about his house.
*Mary is the most excited about her work, and John's _ about his house.

(12) This table is the longest that any door is _ wide.
*This table is the longest that any door's _ wide.

On the basis of these (and other) observations, Bresnan proposes a constituent for the gaps indicated above. This underlying variable, as we shall see shortly, is not realized in English. While not (usually) explicitly expressed in English, there is some evidence of overt degree variables in languages such as Bulgarian (see Rudin [34]) and Quebecois French (see Vercaigne-Ménard [40]).

In particular, a Quantifier Phrase (QP) specifier for Adjective Phrases (AP) is posited with structure as follows:

(QP (DET *-est)* (Q *much))*

The noun phrase "the tallest man" would thus be represented as in Figure 1.

The surface form for the superlative would be obtained transformationally as follows:

(13) much-deletion (optionally) deletes *much* in the Q constituent
the DET *-est* empties and cliticizes onto the head Q
the QP raises to spec AP
the AP shifts to spec NP
than+ is an $\overline{S}$ in QP's DET, extraposes to its final position
a rule of comparison deletion is used to delete any gapped variables

Other derivation sequences leading to the final surface syntactic form have also been proposed.[3]

This seemingly complex sequence of optional and mandatory transformational rules licenses and excludes many different lexical cooccurrences between comparatives and modifiers (such as *so*, *much*, etc.).

We now illustrate how Bresnan's scheme could apply to a superlative sentence:

(14) John is the tallest man that anybody's father is _.
John is the *(-est tall a man)* that anybody's father is *(x-tall a man)*.

As with the comparative, a rule of deletion would operate to delete under identity the predicate noun phrase constituent in the clausal complement, leaving a gap in its place. See Figures 2, which shows a phrase structure diagram for (14).

Though the syntax of such constructions is not the central issue in our discussion, we have sought here to briefly sketch the reasoning and motivations for underlying degree variables. These objects, implicit as they are, nonetheless form an important element in any semantic approach for comparison.

[3]Kuno [21] gives an alternative derivation sequence which could also be applied to the superlative.

Figure 1: The comparand *the tallest man:*

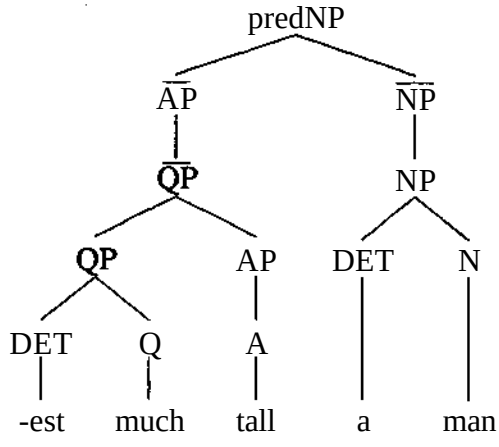
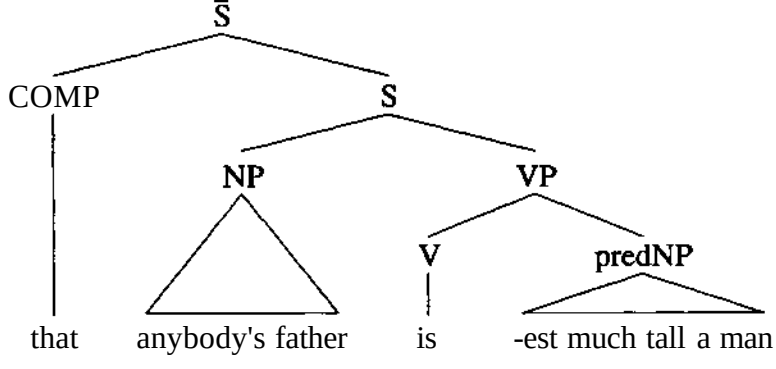


Figure 2: The comparison item *that anybody's father is _:*



4.1.2. Degree variable semantics

We now discuss the semantic treatment of these underlying degrees, which has been proposed within a Montagovian framework. The degree variable approach is typified by Cresswell's theory, one of the earliest and still considered one of the best (see von Stechow [41]) for the comparative.

Cresswell [9] proposes a theory of comparatives (and superlatives) which is based on a contextually supplied scale. A degree is an equivalence class of objects whose measurements coincide in the given scale. A comparison is the relation between the individual and its degree of adj-ness. Thus the comparative form of an adjective is not compositional with respect to the positive, but both are rather derived from a more abstract structure.

To speak of *T*s tallness, for example, is to discuss the unique degree of tallness associated with /. In particular the translation of the positive adjective in the sentence *J is tall:*

(15) pos(tall)(J) <↠ 3d[O(d) & tall(J,d,) where O() means "higher than average"

is a two-place relation associating an individual with degrees. "tall(J,d)" thus represents the fact that d is the degree of *Ts* tallness. Here is an example with the comparative:

(16) A is taller than B
(Vd,)(Vd$_2$)[tall(A,di) & tall(B,d$_2$) -*di> d$_2$]

Cresswell was one of the first to consider that comparative complements behave as NP's, and thus must be raised and have nominal-related scopal properties. Most theories reflect this perspective, as we shall see.

With this background, we now consider Cresswell's formulation of the superlative. One of the few to explicitly treat the superlative (albeit his examples are scanty), Cresswell's approach could be exemplified by the following instantiation:

(17) a. J is the tallest person.
b. the degree *-est* operates on the object-attribute relation <tall,person> in such a manner that there is some degree of tall-ness of J is such that it is greater than any degree of tallness of any other person.
c. (3d$_1$)(Vd$_2$)[tall(J,d$_1$) & (Vx)[tall(x,d$_2$) ->d,> d$_2$]]

We next investigate how Cresswell's representation can be used to show certain semantic

properties of the comparative construction.

Russell's ambiguity (see Russell [35]) is a phenomenon relating to the semantics of the comparative. The sentence:

(18) I thought your yacht was longer than it is.

is ambiguous, with one meaning logical and the other inconsistent. The first, logically consistent (and most easily obtainable), can be illustrated with an instantiation like: / ***thought your yacht was 24' long, but now I see it's only 18' long.*** **The second, logically** inconsistent rendition can be paraphrased as: / *thought that the length of your yacht was greater than the length of your yacht.* Expressed with variables, the ambiguity would be represented by Russell as:

(19) Ax[I thought your yacht is x-long] er-than Ax[it is x-long]
I thought (Ax[your yacht is x-long] er-than Ax[it is x-long])

where "er-than" is simply a two-place relation over properties.

The first, consistent reading is due to wide scope of the variable, whereas the second is due to narrow scope.

Cresswell's theory is able to represent the different readings of this ambiguous sentence, while predicting that the second one is not as readily available because of the logical inconsistency in its comparison of the degrees. Hence we see how the use of scope operators can represent the scopal properties of underlying Bresnan-style degree variables.

The next semantic property we investigate within Cresswell's paradigm is the behaviour of connectives in comparative complements. Coordinate conjunctions have been shown to operate in interesting ways in comparatives (see von Stechow [41]). For example, in:

(20) A is nicer than B or C.

A is nicer than B.
A is nicer than C.
A is nicer than B and A is nicer than C.

the last three sentences follow from the first.[4] In other words, *or* in a comparative comple-

[4]Of course, a disjunctive reading is also possible, as in A *is nicer than B or* C, *but I'm not sure which.*

ment can behave like *and*.[5] CresswelFs formulation supports the equivalence just described.

(21) (Vd_{1f} d_2) [A is di-nice & ((B or C) is d_2-nice) ->di> d_2]

(Vdi, d_2) [A is di-nice & B is d_2-nice -»di> d_2] &
(Vdi, d_2) [A is di-nice & C is d_2-nice —»di> d_2]

Similarly, (21) can be likewise represented via quantifying-in:

(22) (B & C) Ax[(Vdi, d_2) [A is di-nice & x is d_2-nice - • d ^ d_2]]

reflecting the raised status of the complement and the *or/and* equivalency in this environment. Thus Cresswell's semantics licenses these quantifier-connective interactions for comparative clauses. We shall later see how these aspects relate to the superlative construction.

Negative polarity is also a phenomenon which has been central to discussions about the comparative. Briefly, there are classes of lexical items (primarily adverbs) which have negative polarity: such items include, for example, the adverbials *any, ever, much.* On the other hand, positive polarity items are lexical items like: *still, rather, already,* and *just as well.* Negative polarity items (NPFs) may only occur when licensed, in particular within the scope of so-called negative-polarity operators. Conversely, positive-polarity items may not appear within the scope of such operators:

(23) Sue is taller than any boy that I (ever / *still) met.
I cried more than I could help.
My teeth are brighter than they have (ever / *rather) been before.
*Sue is taller than some boy that I ever met. *(some* is a PPI operator)

It has been shown by Hoeksema in [14] that in comparatives, the tensed comparative complement is a negative-polarity environment[6] and that the comparative head is a negative-polarity operator.

As discussed by von Stechow in [41], Cresswell's semantics supports the NPI-related

[5]**One might be tempted to counter that this is simply a manifestation of De Morgan's Law whereby a negated disjunction is equivalent to a conjunction of negated conjuncts, but crucially Cresswell does not posit anywhere here an underlying negation. We shall see that other approaches do in fact follow this proposal.**

[6]**In fact, considerable debate centers around the status of other kinds of complements as negative-polarity environments for the comparative.**

observations for comparatives, given a particular definition of what constitutes a negative-polarity operator. Ladusaw [22] has proposed that any downward-entailing operator can satisfy this definition. Determiners, for example, are downward-entailing for common nouns, so that the optional presence of the NPI *ever* in the relative clause in:

(24) Every boy who has ever met her is delighted.

is licensed by the theory. Similarly, based on the examples given in (20), *nicer* is downward-entailing; since the first sentence entails the second in:

(25) A is nicer than B or C (=A is nicer than B and A is nicer than C.

it is an NPI operator. This fact, taken together with Cresswell's semantic description above, thus supports the theory of negative polarity in comparatives.

Though there are other properties of the comparative semantics that Cresswell's approach supports, we will for the time being be content with describing these ones. Later we will see how these properties relate to the superlative, and also compare Cresswell's theory with that of other approaches on the basis of these properties.

It should be noted that there have been some objections raised to Cresswell's semantics. One criticism is that it can't describe the semantics of measure-phrase (MP) constructions in the comparative. Note the following sentences with MP examples:

(26) John is six feet tall.
John is almost 4 inches taller than Bill.

The latter sentence's specification of the difference in height between John and Bill cannot be accommodated in Cresswell's formulation. This has been the motivation for competing theories, as we shall see.

Another objection that has been raised to this approach is that the definition involves a certain circularity. Note that in (15) the positive *tall* is defined with respect to a degree O which represents "higher than average", which in turn is a comparative relation treated as an unanalyzed primitive.

4.2. Extent variable approaches

Extent variable approaches arose largely as a reaction to the degree variable approach discussed above. In this section we discuss extent variables, their use in an overall theory

of the comparative, and the phenomena they seek to explain. We then apply these claims to superlative constructions, and evaluate the appropriateness of this approach as a solution for the superlative.

Common to the different extent variable approaches is the assumption of an underlying negative component in the meaning of the comparative. In general, when the property of a given individual is compared to that of another individual, one of them is found to lack to some extent the property in question.

Claims have been made to the effect that the existence of a negative component in comparison is observable not only in the semantics, but even in the (surface) syntax or the lexical properties. Seuren, for example, has participated in the debate about possible syntactic and morphological evidence for the integration of a negative morpheme during the diachronic development of comparative complement introducer *than* in English (see also Joly [16]). Similarly, Romance languages and, in fact, many typologically disparate languages (see Stassen [38]) exhibit some form of negation in (at least) the semantics of comparison. Though this is an interesting discussion we will not pursue it here; rather, we will simply entertain *prima facie* the assertion that the underlying semantics of comparison involves some type of negation.

As a point of departure, Seuren's semantic description in [36] is the most perspicuous. He would represent the following comparative sentence and its interpretation as:

(27) Joe is taller than Bill is.
3e ([Joe is tall to e] & -.[Bill is tall to e])

In other words, there is an extent e to which Joe is tall and to which Bill is not.

Note that this formulation can give a direct account for negative-polarity item distribution as described above. In this case, as is argued by Seuren, the negative-polarity operator licensing NPFs in the comparative complement is simply the negative operator itself; Ladusaw's more general definition involving downward-entailment is not necessary here.[7]

Note that a possible-world treatment is possible with extent variables, using standard modal operator assumptions:

(28) Joe can't be taller than Bill is.
-»O3e ([Joe is tall to e] & --[Bill is tall to e])

However, this approach has a serious drawback; it permits the licensing of unwarranted

[7]**This rejection of the more general principle is crucial to Seuren because he objects to it on other grounds.**

inferences where negative quantification is concerned. For example, since no provisions are made for lambda abstraction, von Stechow argues that Seuren allows invalid inferences like the following:

(29) Joe is taller than Bill is. f=Joe is taller than everybody is.
3e([Joe is tall to e] & -^[Bill is tall to e]) |=
3e([Joe is tall to e] & ^[{everybody} is tall to e])

That is, a generalization-based inference is allowed, even though it would result in a semantically anomalous situation. Hence Seuren's extent-based description seems to be too simplistic.

Still, we pause for a moment to suggest how a Seuren-like approach might propose an interpretation for the superlative. It could perhaps be formulated as follows:

(30) J is the tallest boy.
3e[tall(J,e) & Vx[boy(x) ->-tall(x,e)]]

Paraphrased, this formula would read: there is an extent to which John is tall and to which all boys are not tall.

Seuren desires to keep formal semantic machinery to a minimum so that psychological plausibility and computability can be maintained. His description, which is embedded in a wider account of incremental discourse semantics, largely rejects a possible-worlds/Montagovian framework, instead entertaining admittedly "unorthodox notions of natural language logic". We will not have much more to say about Seuren's theory, but we will evaluate and refine related formulations in a later section.

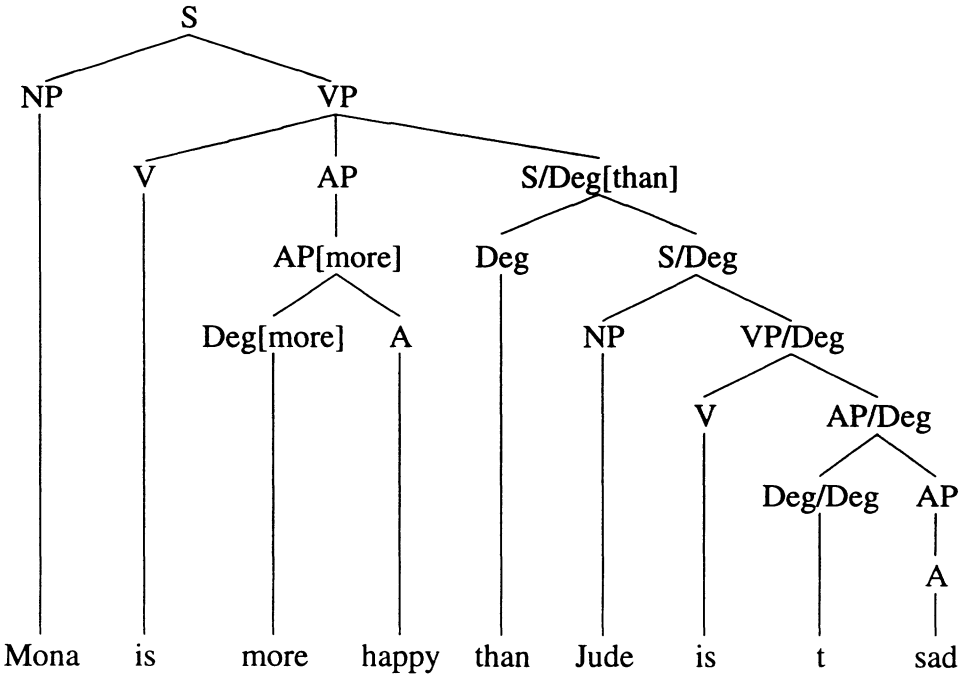
On the other hand, Klein [19] follows more conventional notions of model-theoretic semantics in an extent-based framework. He begins by more completely articulating his notions of the grading relation, and introducing the notion of compositionality into comparison.

The comparative (and, one could venture, by extension the superlative) is said to be built compositionally upon the positive. An adjective in the positive degree is simply a one-place predicate which evaluates over individuals as true, false, or neither. Thus the grading relation used in comparison depends on an interpretation of the positive along with the appropriate context. In particular, comparison involves quantification over comparison classes, between individuals which are compared directly. These comparison classes which involve individuals and which emerge from the context we call extents; extent variables (ri-variables) are used in representing the semantics of comparatives and superlatives. The

use of a degree is thus rejected: rather than comparing two abstract degrees, one instead compares two individuals directly.

Klein casts his analysis of the comparative in a GPSG-style syntax, though he claims that a transformational framework, or for that matter any other syntactic theory, could also be used for embedding his semantics. Bresnan's degree variables are represented by Klein as traces; their related gapping information is propagated by rules for semantic interpretation and syntactic elaboration.

Figure 3: Klein-style Syntactic Representation



Domination of the trace-constituent and the schema-based cooccurrence of items like *more ... than* or *as ... as* are established by GPSG rules; the precise details can be found in his discussion.

Klein represents the semantics of these sentences as follows:

(31) A is taller than B
$\exists\eta[\,\eta\{\text{tall}\}(A) \,\&\, \neg\eta\{\text{tall}\}(B)\,]$

(32) A is less tall than B
3ii[-Ti{tall}(A)&Ti{tall}(B)]

(33) A is as tall as B
VTi[T!{tall}(B)^Ti{tall}(A)]

where extents are applied directly to each other and are derived via the contextually-conditioned application of the one-place partial predicate {tall} over comparands.

As with the Seuren proposal, Klein's theory provides a straightforward description of polarity item distribution: negative-polarity items are only allowed within the scope of the negative operator.

It also supports the alternate representations of Russell's ambiguity:

(34) I thought your yacht was longer than it is.
3r|[I thoughtr|{long}(yacht) & -*T|{long}(yacht)]
I thought 3r|[TI{long}(yacht) & -«r|{long}(yacht)]

The former reading is the consistent one, and the second is the inconsistent one. Of course, for reasons mentioned above, this approach also supports quantifier/connective interactions and modality operators.

In a further refinement of the Klein analysis, Larson [24] substantially extends the notion of scope in comparatives; scopal properties account for distribution of such items as negation, quantifiers, and intensionality operators. His would appear to be the most thorough discussion to date of the interaction of quantified noun phrases and the scope of comparative complements. Larson's theory, which introduces levels of lambda-extraction to account for the scope-related behaviors mentioned, can be summarized by the following lambda-formulae:

(35) *-er* =»AQAQAP3TI[Q(Ax[-ni{Q}(x)]) & P(Ax[ii{Q}(x)])]

less ^AQAQAP3TI[Q(AX[TI{Q}(X)]) & P(Ax[-^{Q}(x)])]

as ^AQAQAPVTI[Q(Ax[r|{Q}(x)]) -> P(AX[TI{Q}(X)])]

Note how closely the meaning of the first form (comparative of superiority) could be correlated with at least a partial description for the meaning of an expression in the

superlative: in superlatives, one referent is described as having some property to an extent at which the others don't. We shall pursue this observation in a later section.

With the system specified above, Larson is able to show the equivalencies of several meanings between different equatives and comparatives; indeed, he shows how quantification and scopal properties captured by his schemata even permit a treatment of intentional contexts. For example, a straightforward derivation can be obtained for the sentence below:

(36) Rob could be less callous than he is.
[3 less callous than he is i [g Rob could be et]]

$$AQA\overline{Q}A\overline{P}3n[\overline{Q}(Ax[Ti\{Q\}(x)])\&\wedge x[\neg\eta\{Q\}(x)])]\,x\,\{callous\}\,x\,(\lambda P_i[P_i(Rob)])\,x\,(\lambda P_i[\Diamond P_i(Rob)])$$

which reduces to:

$$3r|[r|\{callous\}(Rob)\ \&\ O[-r|\{callous\}(Rob)]\ ]$$

The last form could be roughly paraphrased as:

(37) There is an extent to which Rob is callous, and it is possible that he not be callous to that extent.

In a later section we will use the intuitions Larson develops to propose a theory for interpretation of the meaning of superlatives. We will also relate expressions in the superlative to those in the comparative. Larson's theory is apparently the only which will allow such cross-construction equivalencies to be derived.

4.3. Difference variable approach

The third paradigm among theories of the comparative, the difference variable approach, combines insights from both degree variable and extent variable hypotheses. In this section we sketch difference variables, their motivation, and their application. Again, we relate this discussion to superlatives.

The account in Hellan [11] of the comparative construction illustrates canonically the notion of a difference variable. Here the comparative is a relation between an individual and a degree, but where a degree is defined in terms of real numbers. There is also another variable involved in the canonical definition: a difference variable is provided via the

context. Hence proponents of difference variable theories assume that the meaning of a comparative is built around the specification of a variable representing the delta in degrees of adj-ness of the various discourse entities.

For example, Hellan's approach would be expressed as:

(38) P is taller than Q.
//more//(P)(Q)=l <> (3di, d_2, d_3)[P(di) & Q(d_2) & d!=d_2+d_3& d_3>0]

This can be paraphrased as: there is a non-zero number (d_3) such that it represents a difference between the adj-ness (d_2) of P and the adj-ness (di) of Q. The difference variable d_3 is thus derived via context (either explicitly via measure phrases as in (26), or else implicitly).

Hellan uses the subtraction operator for less-than comparatives, and the multiplication operator for the equative *(as... as)* in place of the plus operator in (38).

His syntactic formulation, although influenced by Bresnan's analysis, involves raising/lowering as one constituent the entire combined *-er than+*. The complement is said to be a property of degrees, so that "than(i) she is t(i) smart" is a property which is true for all d's iff she is smart to degree d. The comparative morpheme *-er* is of the same type as DET, and thus combines with the aforementioned property to create a QP, which can then undergo raising and be Chomsky-ajoined in place. Interpretation is supplied through lambda-abstraction.

As we speculate now on possible applications of Hellan's analysis to superlatives, two possible alternative arithmetic comparison operators could be used;

(39) A is the tallest boy.
//most//(P)(Q)=l *> (3 d_{lf} d_2, d_3)[P(di) & Q(d_2) & di=d_2+d_3& d_3>0]
//most//(P)(Q)=l <> (3 d_{lf} d_2, d_3)[P(di) & Q(d_2) & d!=d_2*d_3& d_3>l]
where P = A's tallness and Q = the maximum tallness of all other boys[8]

are both possible formulae for the sentence in question. It's not clear which of these operators would be better to use in the superlative; the question may be moot as they are equivalent over reals anyway.

[8]Actually, one wonders how this comparison would be done: is the value for Q determined pairwise in round-robin fashion? from a MAX-inducing function over the entire set of heights simultaneously, or some other manner?

Hellan's approach has of course shown to be useful for measure phrases. However, some of the phemonena we have already mentioned are not supported by Hellan's approach. Von Stechow [41] has shown that Hellan's approach does not account for the quantifier/conjunction interactions we have mentioned, nor for negative polarity phenomena, nor indeed for possible worlds and other intentionality operators.[9]

Another difference variable approach was proposed by Bierwisch in [3] and [4]. His is one of the analyses which mention superlatives explicitly. He considers the superlative to be related to the comparative in the sense that the two sentences are equivalent:

(40) John is the tallest Q.
John is taller than any/all other Q.

Vy3c [[Q y] & [y^JOHN] -+[[VERT JOHN] = [T]V [[VERT y] = [N+v]] + c]]]

In this formulation N is a measurement or comparison norm which is supplied by context. Some variance, v, from the norm licenses use of the relevant adjective (here *tall* since n>0). Finally, the c is the difference variable we have discussed, similar in intent to Hellan's d3. Thus in Bierwisch's core semantics for the comparative, intervals emerge from the comparison operation, whereas Cresswell says they are primitives defined by equivalence classes. As such it resembles Hellan's approach, except that it subdivides the difference variable *(d$)* into components for the norm (N) and the variance (v). Care should be taken not to confuse the usage of r| here (as an operator to bind the variance variable) with its use as a variable in the extent-based approach. Note, too, that there is no negative in the underlying representation of the complement's content.

Bierwisch's approach was developed to account for phenomena not addressed in the other approaches. For example measure phrases, as those mentioned in (26), can be represented in this manner (see Bierwisch [4] for details). In addition, this allows adjectives which are opposites, like *tall* and *short,* to be unified on a single scale (e.g. VERT), with respective evaluations provided by the norm and variance parameters of the scale. Finally, many norm-related phenomena can be explained using difference variables. As there seems to be little carryover from these subjects to the superlative, we will not study them in detail here. Still, we will see that an intuition sketched by Bierwisch will be useful for our theory of the superlative.

Another recent difference variable account was proposed in von Stechow [41]. In his comprehensive review of different approaches to semantic theories of the comparative, von Stechow formulates a battery of tests based on observations gleaned from the literature. He

[9] **In a rebuttal, Hellan [12] proposes complex mechanisms including double indexing as partial solutions.**

leverages these tests to identify shortcomings with the different theories, and finishes by proposing a new theory. In large measure it represents a merging of the difference variable approach with, to a lesser extent, the degree variable approach. His has been recognized as probably the most thorough examination of the comparative. Unfortunately, he does not apply his observations to the superlative, or even make reference to superlatives anywhere in the paper.

Bierwisch's Norm+variance substructure is used by von Stechow; like Hellan, he also uses +/- for non-equative comparison, and * for equatives. Crucially, though, von Stechow follows Cresswell's proposal in raising the *that+* complement, which he considers to be a constituent. Also following Cresswell, he considers the complements to be similar to nominals, allowing them to raise and Chomsky-adjoin. He is thus able to describe a wide range of phenomena discussed previously under these two different analyses.

Interestingly, in order to assign to comparative complements an appropriate polarity operator, von Stechow introduces a function, MAX, which operates over all the degrees expressed in the complement. He can therefore invoke Ladusaw's notion of downward-entailment to provide appropriate polarity contexts for comparatives.

A wide range of comparative-related phenomena addressed by the difference variable approach have been demonstrated for English (see Bierwisch [3] and [4]), German (see Bierwisch [2]), and even Yoruba (see Sofunke [37]).

4.4. Interpretive approaches

The last general paradigm for comparative theories we shall consider involves interpretive approaches. Allen's proposal [1], a predominantly interpretive theory, develops an admittedly ad-hoc semantics for comparatives whose goal is to satisfy the requirements of an interpretive meta-language mediating between the meaning and the surface phenomena. It was largely developed in reaction to the approaches we have already described. He focuses on notions he calls "committedness" and "pull", which are related to and helped clarify the norm-relatedness phenomena we have already alluded to.

Pinkham, in her dissertation [26], proposes an interpretive approach to comparatives in English and French. Noting that in French proforms are explicit in comparative constructions, she argues that a deletion approach like all those mentioned so far will not work for French.

Comparatives are thus said to be interpreted anaphorically, with the constituent in the main clause an anaphor of the constituent in the comparative clause. Of course, this is be

subject to different constraints which Pinkham develops. The principal constraint is one of parallelism: there must be "identity in kind" between the anaphor and its realization.

After presenting various arguments which can be made against a deletion approach, Pinkham develops a system which still relies heavily on Bresnan-style phrase structure rules, quantifier structure, and extraposition and ellipsis rules. However, in Pinkham's approach the quantifier is a base-generated preform (null for English, explicit for French). In order for one to interpret its meaning it must obey certain conditions and pass certain filters. For example, the already-mentioned semantic restriction enforcing identity in kind between the anaphor and its realization must be obeyed. In addition, a syntactic condition, Q-binding, must be possible between the quantifier and the COMP position of the sentence. Other constraints on what kinds of constituents can be removed under what conditions are also developed; they are too detailed to investigate thoroughly here.

The most detailed level of semantic description Pinkham introduces involves a notation for representing the prepositional content of the clauses participating in the comparative. The interpretive step is described as the copying of predicates in different ways. Though more semantic in nature than Allan's work, it still leaves many semantic details relatively unexplored.

Pinkham does address thoroughly a further step in the construal of comparative meaning: ellipsis. Arguing that other theories' application of comparative ellipsis is too unconstrained, she develops restrictions and defines the domain of application and direction for comparative ellipsis.

Finally, she stipulates the existence of a certain class of comparative constructions which can only be base-generated; their derivation from the principles she develops is not possible. These base-generated phrasals, though a central motivation for Pinkham's approach, don't have any bearing on superlatives.

Rayner and Banks [32] also propose an interpretive approach which eliminates the need for deletion. Instead, through a sequence of interpretive operations, a complex data structure called a quant-tree is elaborated, and relevant slots are filled in. However, the quant-tree formulation seems designed to provide a computational framework which appears somewhat unmotivated in its application to human cognition. They also do not address the superlative construction, though presumably the quant-tree structure could support some level of interpretation for superlatives. We shall not pursue this here, though.

In all of these interpretive theories, a relatively large level of granularity with respect to semantic description is noticeable. However, one useful insight that these approaches develop is an abstraction away from the transformational deletion-based approaches in the syntax underlying the early semantic theories. Instead, other processes like *wh*- item

interpretation, base-generated proforms, and interpretive copying have provided a less arcane system for representation of the underlying variables, whether extents, degrees, or numbers.

5. A Constraint-based Theory

Up to this point we have surveyed several different descriptions of the comparative construction, and have tried to either infer or illustrate their appropriateness for analysis of the superlative. In this section we will illustrate how an approach using different aspects of each can be established which does handle at least most of the semantics of superlatives. In particular we will propose using extent variable primitives for representation of the comparison. In addition, the motivation for two additional constraints, the membership constraint and the exclusion constraint, will be presented. Illustrations will be given to show how the constraint-based approach can be used to account for the various phenomena we have discussed.

5.1. Introduction

As a point of departure, we shall briefly reconsider each of the types of theory we have described.

It would appear that the difference variable formulation is overly complex for the superlative construction; difference variables, and for that matter measure phrases of any kind, are rarely overtly specified in the superlative. Furthermore, (at least in English) they can only be expressed in oblique forms such as prepositional phrases, which have to be independently accounted for in a theory relating syntax and semantics. Even setting aside concerns about the psychological plausibility of such a representation, the difference variable approach would seem to be unnecessarily complex to represent the core meaning of the superlative.

The interpretive approach is also potentially applicable, but it unfortunately does not articulate the semantics or the semantics/syntax interface to any great degree. Furthermore, its main motivation, the distinction between base-generated phrasals and those of the canonical type, does not arise in superlatives anyway.

The degree variable approach holds promise, but we will not pursue it as an alternative here mostly because it commits us to a highly abstract and non-compositional system of meaning primitives. However, we will rely on some of the basic notions that approach

provides us.

Instead, we will note that superlatives can been seen to follow naturally several aspects of the extent variable approach. Hence we will develop our theory of the superlative from the work of Larson. In particular, we will assume Klein-style model-theoretical definitions for the comparison relation, extents, and compositionality.

5.2. Initial formulation

In our initial formulation of a theory for the superlative, we note the close synonymy of the following comparative/superlative sentence pair:

(41) a. J is as tall as he can ever be.
b. J is the tallest that he can ever be.

While the convergence of meaning is clear in this sentence pair, it must be noted that this is of course not generally true of equatives and superlatives. Still, in cases like this pair, we can assume that the semantics of the first sentence is sufficient to represent the meaning of the second, at least as a first approximation. Accordingly, will assume as a baseline the Larson extent variable description for the comparative of equality. Hence the preliminary representations for the equative morpheme:

(42) as ^AQAQAPVTI[$\overline{Q}$(Ax[ti{Q}(x)]) -> $\overline{P}$(AX[TI{Q}(X)])]

and for the adjective phrase *as tall:*

(43) as tall =>A$\overline{Q}$A$\overline{P}$VTI[$\overline{Q}$(Ax[r|{tall}(x)]) -> $\overline{P}$(Ax[r|{tall}(x)])]

Then, in a manner analogous to that used in the derivation of example (36) shown earlier, we will arrive at the formula:

VT![OTi{tall}(J)-.Ti{tall}(J)]

which represents the interpretation of (41) above. Of course, by standard modal logic operations, one could also derive other equivalent forms such as:

-3r|[On{tall}(J) & -r|{tall}(J)]

It is clear that either of these *equative r*-variable equations also represents the meaning of the superlative sentence above by virtue of the synonymy of the sentences we have

discussed. We shall see presently, though, that this is only true because of the special nature of the superlative we have chosen. We note, before continuing, that in this case the superlative head *J* and the head of its complement *he* is identical, referring to the same individual. Naturally, this is not the only formation allowed for superlatives in English. Such superlatives we will call "head-identical" superlatives.

To summarize, so far we have seen that:

(44) Larson's equative expression can represent the interpretation of head-identical superlatives.

To see that our use of Larson's equative schema for the meaning of superlatives is not justifiable in the general case, consider an equative/superlative juxtaposition where the superlative sentence is not head-identical (i.e. where the superlative head and the complement head are not identical):

(45) a. J is as tall as all of the boys,
b. J is the tallest of all the boys.

In this case the synonymy of the sentences is less straightforward. The only way in which the two can be true is if the first sentence were construed in the sense of:

(46) J is (at least) as tall as all of the boys.

because clearly a situation where all (or even n where n>l) boys have the same height as *J* is not tenable given the superlative sentence. More precisely, the superlative sentence requires us to ascribe to / a tallness-extent which all the other boys do not have.[10] Our equative approach to the superlative is not as descriptive as it needs to be to capture the essential meaning of this unique extent:

$$\forall\eta[\ [\forall y[\mathrm{boy}(y) \rightarrow \eta\{\mathrm{tall}\}(y)]] \rightarrow [\eta\{\mathrm{tall}\}(J)]\ ]$$

in that it only addresses extents shared by all the boys including *J*.

On the other hand, note that Larson's *-er* formula for the comparison of superiority gives us the ability to consider some extent of the subject's adj-ness which is not shared by that of the complement subject's. In other words, the *-er* expression of Larson's would seem better suited to represent the interpretation of the sentence (42b.) above.

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[10] **Lagacé [23] discusses this problem in detail for Quebecois French; his remarks largely carry over to English.**

Accordingly, we begin by using for (41b.) above Larson's expression, repeated here for convenience:

(47) $\lambda Q \lambda \bar{Q} \lambda \bar{P} \exists Ti[\bar{P}(\lambda x[Ti\{Q\}(x)]) \& \bar{\bar{Q}}(\lambda x[\neg Ti\{Q\}(x)])]$

and apply it to the adjective *tallest:*

(48) tallest $= \lambda \bar{Q} \lambda \bar{P} \exists r[\bar{P}(\lambda x[Ti\{tall\}(x)]) \& \bar{Q}(\lambda x[\neg Ti\{tall\}(x)])]$

Next, representing in standard form the complement *of all the boys* as the quantifier $\lambda R[\forall y[boy(y) \rightarrow R(y)]]$, we can continue the interpretation for the following superlative open sentence:

(49) tallest of all the boys
$(\lambda \bar{Q} \lambda \bar{P} \exists Ti[\bar{P}(\lambda x[Ti\{tall\}(x)]) \& \bar{\bar{Q}}(\lambda x[\neg Ti\{tall\}(x)])])(\lambda R[\forall y[boy(y) \rightarrow R(y)]])$

If we were then to apply this open sentence to a subject /, we would have the following:

(50) J is the tallest of all the boys
$(\lambda \bar{P} \exists Ti[\bar{P}(\lambda x[Ti\{tall\}(x)]) \& (\forall y[boy(y) \rightarrow \neg \eta\{tall\}(y)])])(\lambda P_i[P_i(J)])$

$\exists r][Ti\{tall\}(J) \& (\forall y[boy(y) \rightarrow \neg \eta\{tall\}(y)])]$

Recall that, so far, this formulation is synonymous with / *is taller than all the boys,* since it is a straightforward application of Larson's schema for the *-er* comparative. While it is better than the equative schema for reasons we have already described, clearly this form is still insuffficient to represent the superlative. In particular, note that the following are not entirely synonymous:

(51) a. J is taller than all the boys,
b. J is the tallest of all the boys.

since, for example, the first could be felicitous if / is a building or a mature giraffe.

Still, we have seen that the strategy of using Larson's comparative formula for *-er* allows us a partial representation for non-head-identical superlatives. In the next section we refine this approach. -

53. The exclusion constraint

We have seen that the previously derived expression in (47) is not completely correct when applied to the superlative. It says that there is some extent to which *J* is tall and to which all of the boys are not. But here *J* must also be a boy:

(52)# J is the tallest of all the boys, but he is not a boy.

We shall call this second type of superlative sentence, one where the superlative head and the head of the complement stand in a head-superset relationship, "head-superset superlatives". If the second conjunct of our expression (47), a universal formula over boys, were to be evaluated for *J,* we would have an infelicitous result because the sentence we have been considering is just such a superlative. Instead, we want the second conjunct to apply to every boy *except J* (i.e. to the set-complement of *J):*

(53) J is the tallest of all the boys. [=A11 the other boys are not as tall as J.
3ri[Ti{tall}(J) & (Vy[boy(y) & $[y \neq J \rightarrow \neg\eta\{tall\}(y)])]]$

This we can accomplish by augmenting our original schema (47) as follows:

(54) *-est*=^
AQA$\overline{Q}$A$\overline{P}$3T|[$\overline{P}$(AX[TI{Q}(X)])& $\overline{Q}$(Ax[$\overline{P}$(Az[x^z]) $\rightarrow \neg\eta\{Q\}(x)])]$

We therefore must introduce a new condition, which we will refer to as the "exclusion constraint", on the original schema. The basic intuition for the exclusion constraint is this: the head of the superlative must be excluded from all the other elements in its comparison class before extents can be compared; in other words, the head of the superlative must be contrasted to its set-complement. In what follows, we will use inequation in the interest of simplicity: a membership check over the head's set-complement is closer to the intuition we have developed here.

With the newly revised schema, we have a description that satisfies the exclusion constraint. Intuitively, it assures the equivalency of:

(55) J is the tallest boy.
J is taller than all the other boys.

We have thus shown that:

(56) Larson's *-er* formula together with the exclusion constraint can account for head-superset superlatives.

5.4. The membership constraint

As has already been mentioned in the preceding sections, the superlative seems to specify a set membership relation for the head, either explicitly or implicitly. For example, all of the following include valid inferences:

(57) J is the tallest boy. |=J is a boy.
J is the tallest of all the boys. f=J is a boy.
J is the tallest that all the (other) boys can ever hope to grow. (=J is a boy.

Note, though, that our formula, even with the exclusion constraint, does not specify this information about J:

(58) J is the tallest of all the boys.
3e[r|{tall}(J) & [Vy[boy(y) -+[y^J ->-ri{tall}(y)]]]]

As we saw in (51), although the comparative does not impose such a restriction on the head, this would seem to be essential to the interpretation of superlatives. The refinement to (46) required for this information would have the form:

3e[[boy(J) ->Ti{tall}(J)] & [Vy[boy(y) $\rightarrow$ [y$\neq$J $\rightarrow$ $\neg\eta${tall}(y)]]]]

The lambda-calculus schema initiating the derivation sequence for this we stipulate to be:

(59) *-est* ^
AQAR$\bar{A}\bar{Q}\bar{A}$P3n[$\bar{P}$[$\bar{R}$(Ax[r|{Q}(x)])] & $\bar{Q}$(Ax[[$\bar{P}$(Az[x^z])] $\rightarrow$ $\neg\eta${Q}(x)])]

In the next section we will explore the motivation for this formula and its application.

We have thus added a second constraint, which we shall call the membership constraint, to specify the set membership of the superlative head. Applied along with the exclusion constraint to Larson's comparative rule, we have a detailed account of the semantics of some kinds of superlatives. Specifically, we have refined (56) to become:

(60) Larson's *-er* formula with the exclusion and membership constraints allow us to account for head-superset superlatives.

5.5. Implicitude and superlatives

In this section we will demonstrate how the formula in (59) can be applied. We begin by noting the synonymy of the following two superlative sentences, at least at the deep semantic level:

(61) a. J is the tallest of all the boys.
b. J is the tallest boy of all the boys.

Considerable debate has arisen in the literature on the prior status and differences in meaning of predicate versus attribute adjectives, which we won't engage here. However, for superlatives, we venture to posit that there is little reason to expect such a dichotomy.

We now rewrite the second sentence using our formula, with the superlative head *boy* represented by the quantifier AR[Ay[boy(y) —>R(y)]]:

(62) tallest =>
$A\bar{R}A\bar{Q}A\bar{P}3Ti[\bar{P}[\bar{R}(Ax[Ti\{tall\}(x)])]\&\ \bar{Q}(Ax[[\bar{P}(Az[x/z])] \rightarrow \neg\eta\{\mathbf{tall}\}(\mathbf{x})])]$

(63) tallest boy
$A\bar{R}A\bar{Q}A\bar{P}3r|[\bar{P}[\ \bar{R}(Ax[r|\{tall\}(x)])]\&\ \bar{Q}(Ax[[\bar{P}(Az[x\hat{}z])] \rightarrow \neg\eta\{\mathbf{tall}\}(\mathbf{x})])]$
x (AR(Ay[boy(y) $\rightarrow$**R(y)]))**

$A\bar{\bar{Q}}A\bar{\bar{P}}3TI[\bar{\bar{P}}[$ (Ay[boy(y) **-*T|{tall}(y)])]** & $\bar{\bar{Q}}$(Ax[[$\bar{\bar{P}}$(Az[x/z])] $\rightarrow$ $\neg\eta${**tall**}(**x**)])]

Next, we add the complement:

(64) tallest boy of all the boys

$\lambda\overline{Q}\lambda\overline{P}$^tP̄f (Ay[boy(y) -*T]{tall}(y)])]
& $\overline{Q}$(Ax[[$\overline{P}$(Az[x^z])] -+ -T!{tall}(x)])] x (AR[Vy[boy(y) ⇝ **R(y)]])**

and apply the result to the subject *J:*

(65) J is the tallest boy of all the boys
A$\overline{P}$3r|[$\overline{P}$[(Ay[boy(y) -^r|{tall}(y)])] &
(Vy[boy(y) -»([[$\overline{P}$(Az[y^z])] -> ^i{tall}(y)])]) (APi[P_t(J)])]

3n[[boy(J) -nj{tall}(J)] & [Vy[boy(y) ⇝ **([y≠J] → ¬η{tall}(y))]]]**

The end result is the formula we presented in the last chapter. Note that here it was obtainable because of the presence of a nominal head *boy* modified by the superlative attribute adjective. As we have mentioned, this nominal head is not always required:

(66) J is the tallest (boy) of all the boys.

Our formula can thus only apply to cases without an overt nominal head if we can assume that one does in fact exist at some deep semantic level. Fortunately, this is a common claim made in the case of the comparative.

For example, this is exactly what Ludlow [25] describes as "implicit comparison classes". In a sentence like:

That flea is big _and that elephant is small _.

Ludlow asserts that there are two different comparison classes, one for each of the nominals, which are interpreted by bound variables and which would appear in the gaps indicated. In fact, his approach, which uses variables for these operators, is designed to be built upon Klein-style semantics and was suggested by Larson. More importantly, if we accept Ludlow's notion of implicit comparison classes, we will not be violating the fundamental assumptions of an extent-based framework, which compares individuals rather than abstractions. Instead, with the approach we have just described, the nominal character of the comparands for superlatives is more apparent.

We have thus required an explicit NP after the superlative predicate adjective at the time that semantic interpretation rules apply; we may assume that it is copied during an

interpretive phase.

5.6. Applications

In this section we first unify the dichotomy between head-identical superlatives and head-superset superlatives described earlier. We then illustrate with a few examples how our account can describe the semantics of more complicated superlatives than we have seen so far. (Rather than give lengthy derivations, we will sketch how the constraints and rules would be invoked.)

We have shown that two of Larson's expressions can be useful in varying ways to represent the meaning of the superlative. First, we showed how head-identical superlatives can be analyzed by Larson's equative formula to obtain a semantically adequate interpretation. However, we also saw that this strategy does not work for head-superset superlatives, as the interpretation is too weak, not evoking appropriately the uniquess of the r|-variable related to the specified subject. To overcome this problem, we demonstrated that one could use Larson's *-er* formula for head-superset superlatives, when it is augmented with constraints. We will now illustrate how the notion of implicit comparison classes can be used to unify the two approaches. Specifically, when implicit comparison classes are used with head-identical superlatives, the formula we have derived also applies in these cases. In other words:

(67) J is the tallest (J-self) that he will ever be (an x-tall J-self).

where the implicit comparison class is the set containing himself. The membership and exclusion constraints hold trivially in such cases.

Next we consider another way in which comparatives and superlatives differ in behavior. As we have noted earlier, conjunction in comparative complements behaves differently than in other environments, as in this example repeated here for convenience:

(68) A is nicer than B or C.

A is nicer than B.
A is nicer than C.
A is nicer than B and A is nicer than C.

Interestingly, superlative complements behave in an even more unconventional manner. Note that in the following superlative sentences:

(69) J is the tallest of all the good or bad boys.

⊨

_J is the tallest of all the good boys.

_J is the tallest of all the bad boys.

#J is the tallest of all the good boys and J is the tallest of all the bad boys.

the ones preceded by an underscore could be # 'd assuming various background knowledge scenarios. For example, if we know that *J* is in fact a good boy, only the second sentence can be inferred from the first; the third sentence, like the fourth, would be starred. Alternatively, if he is a bad boy, the second and fourth sentences would be starred, but not the third. Only if *J* is both a good boy and a bad boy would all four sentences be correct. Again, this is because the superlative involves a membership relation between the specified subject and the class from which it is being individuated. Our membership constraint, assuming an appropriate deep-level assignment of the correct superset for the subject *J*, will reject those sentences inconsistent with the background assumptions.

The following sentences, superlative counterparts to ones commonly used in discussions about the comparative, serve as another example of this phenomenon:

(70) Ulm is the nicest of German or Dutch cities.

⊨

Ulm is the nicest of German cities.

#Ulm is the nicest of Dutch cities.

#Ulm is the nicest of German cities and Ulm is the nicest of Dutch cities.

Next we will consider a type of superlative which we shall call "tie" superlatives. Suppose that five students (A, B, C, D, and E) are rated according to their proficiency in some task, and the resulting ranking is expressed as follows:

A = B = C > D > E

In other words, students A, B, and C scored equally and at the top of the scale, student D was next, and student E was last.

Given such a ranking, we have variable felicitousness for the following sentences:

(71) a. These are my most competent students. (referring to A,B,C)

b. A is not my most competent student.

c.*Someone is my most competent student.

The first sentence, by straightforward application of the rule we have developed, would be interpreted by a formula which could be paraphrased as:

(72) There exists an extent to which, if A, B, and C are students then they are competent to that extent; furthermore, for any student not A, B, or C, that student is not competent to the extent mentioned.

This rendition does not conflict with the given assumptions, and therefore the sentence is valid.

The second sentence would be rendered (again via our rule and wide-scope negation):

(73) There does not exist an extent to which, if A is a student then s/he is competent to that extent, and for any student besides A, that student is not competent to the same extent.

Since this equation satisfies the given assumptions, the sentence is predicted to be acceptable.

Similarly, the third sentence, a more general case of the second one, can be shown to be false using wide-scope negation and an existential open predicate for the subject.

As a natural extension to tie superlatives, we next consider what we will call a multi-level tie superlative. Suppose we have the same scenario above (A = B = C > D > E), where a particular delineation exists for competency somewhere between D's and E's scores. Then for the sentence:

(74) These are my most competent students, (referring to A, B, C, and D)

our proposal works very naturally, as long as the meaning involving comparison with extents is taken to be "at least to the extent of... ". The sentence is acceptable since there is an extent to which all of A, B, C, and D are competent (ie. D's extent) and to which the others aren't. This example also illustrates how set-exclusion is a more natural operand than ^, which we have used for simplicity.

We list one more example, showing how our theory might account for a type of superlative which has widely variable acceptability judgments. Consider the following, where Joe is an adult ostrich:

(75) Joe is the tallest that any man could ever be.

For many, this sentence is infelicitous; for others, its status is justified by reasoning along the following lines:

(76) Joe is 8 feet tall.
8 feet is the tallest that any man could ever be.
h
Joe is the tallest that any man could ever be.

For those who accept the sentence, one could wonder, since we require that the head noun be supplied for each of the comparands, what they would be:

(77)*Joe is the tallest (ostrich) that any man could ever be (an x-tall man).
*Joe is the tallest (man) that any man could ever be (an x-tall man).

Our formulation would admit the former sentence, since it satisfies the membership and exclusion constraints. But Bresnan-style deletion could not happen, since there is no identity; similarly, Q-binding would preclude an interpretive resolution of the gapped constituents. The second sentence fails for obvious reasons.

Note, however, that if some class that includes both men and ostriches is used as the implicit class, the sentence is more acceptable:

Joe is the tallest (biped) that any man could ever be (an x-tall biped).

With an appropriate implicit comparison class, our proposal could account for the acceptability sentence in question; in the absence thereof, the sentence would not be judged grammatical.

6. Future Directions

The scope of this paper has not permitted us to pursue many issues, problems, and possibilities that arise from the approach that has been presented. In this section we give an overview of some of the questions that could be pursued in future work.

Our analysis has involved only examples from English. Others have discussed in some detail the comparative for other languages such as French (see Rivara [33]) and other

Romance languages (see Price [30]), Dutch, Bulgarian and other Slavic languages (see Jurkowski [17]), and Greek (see Biraud [5]). It would be interesting to see to what extent the claims made about the superlative here, especially the constraints proposed, are borne out in a cross-linguistic approach. Stenson [39], for example, poses a potential problem for our approach in her demonstration of how the Irish superlative admits no attributive adjectives.

The approach we have developed, though based on a theory for comparatives, adds constraints that are not entirely backwards-compatible to the comparative. In other words, we have spawned off a separate, related approach after disproving the standard assumptions that comparative theories can apply directly to the superlative. An investigation about how or whether to resolve the comparative/superlative dichotomy into a unified theory would seem in order.

We have only discussed the superlative for the adjective category, but as we have seen, other parts of speech such as adverbs and prepositional phrases can take a superlative meaning. This is also a common approach by those working on the comparative, with the assumption that the work carries over rather transparently to other categories. The testing of this assumption for our superlative approach would also be an interesting exercise.

Lexical decomposition has been shown to interact with the comparative in interesting ways. Klooster [20] shows how lexical items and their supposed decompositions need not have the same norm-relatedness (NR); the same would appear to hold for superlatives:

(78) This snowflake weighs the most. ^=It is heavy, (i.e. -NR)
This snowflake is the heaviest. f= ?It is heavy, (i.e. +NR)

The former -NR sentence is predicted be more readily acceptable than the latter. We have sidestepped the norm-relatedness issue with our decision not to pursue a difference variable approach, and it would be interesting to know to what extent Klooster's predictions prove relevant to superlatives.

Based on the notion of comparing extents, our approach might be extented in interesting ways to other measurement-dependent and extent-based phenomena. Time, for example, is a phenomenon which many have proposed can be analyzed on an extent-based semantics. This might allow for interesting applications of our approach to certain time-related superlative adjectives. Quirk and Greenbaum [31] for example, mention the *adjectives first* and *last.* Others have noted similarities with the time-extents associated with *before* and *after.*

Some authors have noted a similarity between the superlative adjectives we have dis-

cussed here and other types of words not commonly considered superlatives. Words like *only* and *sole, same* and *other* (see Pottier [29]), and *different* (see Brame [6]) have to some extent a superlative meaning component.

The theoretical syntactic and semantic underpinnings of the Klein/Larson approach has undergone a certain evolution since Larson's work, and it would be interesting to revisit some the assumptions we have made in the light of recent developments. For example, Pollard [28] describes a Cooper-store based mechanism for representing and propagating scopal properties of comparatives. In a more specialized work [27], Pollard presents further details for an overall theory of the comparative.

7. Conclusion

In this paper we have studied several aspects of the superlative construction in English. We have proposed an approach to describe the meaning of superlative, motivated by an appeal to existing theories of the comparative. Where possible, we illustrated how comparative theories can be leveraged to account for similar properties of the superlative. However, we also illustrated several properties of the superlative that comparative theories cannot account for as is, and which require a novel approach.

We showed how an extent variable description can be developed to account for several properties of the superlative, and formulated a higher-order account of them. We investigated several aspects of the superlative in view of our theory, which was then used to predict various aspects of the behaviour of superlatives.

Finally, we have proposed several related topics which would be interesting to pursue within the framework we have developed here.

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