In Reich, Ingo et al. (eds.), *Proceedings of Sinn & Bedeutung* 15,
pp. 565–579. Universaar – Saarland University Press: Saarbrücken, Germany, 2011.

How many *Most*s?*

Stephanie Solt
Zentrum für Allgemeine Sprachwissenschaft
solt@zas.gwz-berlin.de

Abstract. This paper investigates the various contexts in which the lexical item *most* can be used (e.g. *Fred has read most/the most/at most 15 Shakespeare plays; Fred bought the most expensive book*), with the goal of determining to what extent they can be reduced to a single underlying core semantics. It is shown that *most* across its uses can be analyzed as the superlative form of *many* or *much*, an approach that builds on work by Hackl (2009). However, the adequate treatment of *most* as a proportional quantifier requires also positing a role for pragmatic strengthening of semantic meaning.

1 Introduction

The English lexical item *most* occurs in a wide range of contexts that on the surface are difficult to connect. In (1), *most* is a proportional quantifier meaning (roughly) more than half (the majority reading). *Most* in (2) acts as the superlative of *many*: the preferred interpretation of (2) is that Fred has read more Shakespeare plays than has any other member of some contextually determined set of individuals (the relative reading). In (3), *most* seems merely to spell out the superlative morpheme. Finally, in (4), *most* forms part of what is commonly called a superlative quantifier.

(1)	Fred has read most Shakespeare plays	**majority**
(2)	Fred has read the most Shakespeare plays	**relative**
(3)	Fred bought the most expensive book	**adjectival superlative**
(4)	Fred has read at most 15 Shakespeare plays	**superlative quantifier**

Within the semantics literature, the *most*'s in (1)-(4) have typically been treated separately, and the possibility that they might have a common semantics has not received much serious attention (exceptions being Yabushita (1999)

* Support for this research was provided by the European Science Foundation (ESF) and the Deutsche Forschungsgemeinschaft (DFG) under the auspices of the EUROCORES Programme LogICCC. For very helpful comments and suggestions, I would like to thank Anton Benz, Uli Sauerland and Hubert Truckenbrodt, and especially the audiences of Sinn und Bedeutung 15 and of LENLS7, where this work was also presented.

and Hackl (2009), who each treat a subset of the data in (1)-(4)). The objective of the present paper is to investigate the connections between the four *most*'s exemplified above. Specifically, the question addressed is to what extent all of these occurrences of *most* can be reduced to a single underlying core meaning.

It will be shown that *most* across all of the uses exemplified here can be analyzed as the superlative form of *many* or *much*, an approach that builds on a recent proposal by Hackl (2009). However, majority *most* presents an additional complication that suggests we must also posit a role for a mechanism of pragmatic strengthening of semantic meaning.

2 Hackl (2009): Unifying Majority and Relative *Most*

Let us begin by considering the relationship between majority and relative *most*, as exemplified in (1) and (2). Note first that while these two sentences are superficially similar, they are truth-conditionally distinct. For example, if Fred has read 12 of the 37 attested Shakespeare plays, and no other contextually relevant individual has read more than 10, (2) is true but (1) is false. Conversely, if Fred has read 28 but Barney has read 30, (1) is true but (2) is false.

Yet despite their divergent truth conditions, Hackl (2009) proposes that majority and relative *most* can receive a unified analysis as superlative forms of *many*. Hackl relates the two readings to a well-known ambiguity in superlatives. For example, (5) can mean either that Fred climbed the highest mountain in existence (the so-called absolute reading) or that he climbed a higher mountain than any other contextually relevant individual (the relative reading).

(5) Fred climbed the highest mountain

Building on Heim's (1999) influential analysis of the superlative, Hackl proposes that the distinction between majority and relative *most* (like the distinction between absolute and relative readings of superlatives) derives from a difference in the LF scope of the superlative morpheme *-est*. On the majority reading of *most* (like the absolute reading of superlatives), *-est* has DP-internal scope (6a). On the relative reading of *most* (and of superlatives generally), *-est* has wider scope, at the VP level (6b):

(6) a. Majority:
Fred has read [$_{DP}$ [$_{NP}$ -est$_1$ [$_{NP}$ d_1-many Shakespeare plays]]]
b. Relative:
Fred [$_{VP}$ -est$_1$ [$_{VP}$ has read [$_{DP}$ the [$_{NP}$ d_1-many Shakespeare plays]]]]

The scope difference in turn corresponds to a difference in argument structure. On this approach, the superlative morpheme *-est* is analyzed as a degree operator that takes three arguments: an individual x, an expression relating individuals to degrees D, and a set of individuals C representing a comparison class.

(7) $[\![\text{-est}]\!]\left(C_{\langle et\rangle}\right)\left(D_{\langle d,et\rangle}\right)(x_e) = 1$ iff
$\forall y \in C\,[y \neq x \rightarrow \exists d\,[D(d)(x)\ \wedge\ \neg D(d)(y)]]$
... defined iff $x \in C$ and C has multiple members

When *-est* is interpreted DP-externally, as is the case with the relative reading of *(the) most*, the comparison class argument C is contextually provided, consisting of a set of individuals of which the individual argument is a member. For example, in (2), the comparison class might be as in (8a). This yields the logical form in (8b), which in simple terms states that Fred has read more Shakespeare plays than any other member of C:

(8) Fred has read the most Shakespeare plays
a. $C = \{Fred, Barney, Sue, Theresa, \dots\}$
b. $\forall x \in C[x \neq Fred \rightarrow \exists d[\exists y[S.play(y)\ \wedge\ read(Fred,y)\ \wedge |y| \geq d] \wedge\neg\exists y[S.play(y)\ \wedge read(x,y) \wedge |y| \geq d]]]$

On the other hand, when *-est* is interpreted DP-internally, as is the case with majority *most*, the comparison class C is equated with the denotation of the noun phrase. Thus in the case of (1), the comparison class is the set of pluralities of Shakespeare plays, as in (9a), and the resulting logical form is that in (9b):

(9) Fred has read most Shakespeare plays
a. $C = \{Hamlet \sqcap Lear, Othello \sqcap Lear \sqcap Macbeth, \dots\}$
b. $\exists x[S.play(x) \wedge read(Fred,x) \wedge \forall y : S.play(y)[x \neq y \rightarrow\ \ \exists d[|x| \geq d\ \wedge\ \neg\,|y| \geq d]]]$

The formula in (9b) states that Fred has read a plurality of Shakespeare plays that is larger than any other plurality of Shakespeare plays. Initially, this does not seem to be what we want (Fred does not need to have read the largest plurality of Shakespeare plays, i.e. all of them, for it to be true that he read 'most' Shakespeare plays). But Hackl argues that non-identity of pluralities ($x \neq y$) should in this case be interpreted as non-overlap ($x \sqcap y = \emptyset$). On this interpretation, (9b) means that Fred has read a plurality of Shakespeare plays that is larger than any non-overlapping plurality of such plays. That is, (9b) is equivalent to the simpler (10), which states that the number of Shakespeare plays that Fred has read is greater than the number he hasn't read, the appropriate interpretation for majority *most*.

(10) $|\text{S. plays Fred has read}| > |\text{S. plays Fred hasn't read}|$

The analysis of *most* as a superlative thus offers the possibility of uniting its majority and relative occurrences. Before considering in greater depth whether this analysis is fully adequate, in the next sections I will examine how other instances of *most* can also be brought into the fold.

3 Degree-Based Analysis of *Many/Much*

In extending the analysis to additional cases, I begin with a modification of Hackl's proposal, based on the degree-based account of adjectives of quantity developed in Solt (2009, 2010). I take *most* to be the superlative form of both *many* and *much* (Bresnan 1973). *Many* and *much* themselves I analyze not as quantifiers (as for example in Barwise & Cooper 1981) or adjectival elements (as assumed by Hackl), but rather as degree operators. This approach is motivated in particular by examples such as (11), in which *many* cannot be treated as either a quantifier or a cardinality predicate, but rather describes the difference between two points on a scale.

(11) <u>Many</u> fewer than 100 students attended the lecture

Specifically, I propose the following lexical entry:[1]

(12) $[\![\text{many}]\!] = [\![\text{much}]\!] = \lambda d \lambda P_{\langle d\alpha \rangle}.P(d)$

Here, *many* and *much* take as arguments a degree *d* and an expression *P* whose first argument is a degree argument, and apply *P* to *d*. In the quantificational uses of these terms, the role of linking degrees to individuals is played by a null measure function MEAS, introduced by a functional head of the same name (per Schwarzschild 2006); quantificational force arises via existential closure (see Solt 2009 for a more detailed presentation of this analysis).

With these elements in place, the previously discussed examples of majority and relative *most* receive analyses equivalent to those obtained under Hackl's proposal. For example, for relative *most* we have the LF structure in (13), where *many* has raised from its DP internal position to take VP scope,

[1] Here I do not address what distinguishes *many* from *much*. In Solt (2009), I argue the difference is one of dimension: *many* is specialized for the dimension of cardinality, while *much* is used for other dimensions.

and *-est* has subsequently raised out of the QP containing *many*:

(13) Fred $[_{VP}$ -est$_2$ $[_{VP}$ $[_{QP}$ d_2-many$_1]$ $[_{VP}$ has read $[_{DP}$ the d_1-MEAS Shakespeare plays]]]]

The lower VP in (13) has the interpretation in (14a), denoting an expression of type $\langle d, et \rangle$, the right type to serve as an argument of *many*. After application of d_2*-many* and lambda abstraction over the trace d_2 of *-est*, the resulting interpretation is that in (14b), equivalent (notation aside) from the earlier expression. Application of *-est* now yields the same results as in (8).

(14) a. $[\![$has read the d_1-MEAS Shakespeare plays$]\!] =$
$= \lambda d_1 \lambda x. \exists y[S.play(y) \wedge read(x,y) \wedge |y| \geq d_1]$

b. $[\![d_2\text{-many}]\!]([\![$has read the d_1-MEAS Shakespeare plays$]\!]) =$
$= \lambda d_2 \lambda x. \exists y[S.play(y) \wedge read(x,y) \wedge |y| \geq d_2]$

Majority *most* can be handled similarly.

While the degree-operator treatment of *many/much* does not offer immediate advantages in the analysis of relative and majority *most*, it proves crucial to extending the analysis, as described in the next sections.

4 Adjectival Superlative *Most*

Let us turn to *most* in its adjectival superlative use, as in (3), repeated below:

(3) Fred bought the most expensive book **adjectival superlative**

What is puzzling about examples such as this is that *most* seems only to spell out the superlative morpheme, without adding any additional semantic content. For example, (15a) and (15b) are parallel in interpretation, suggesting that *most* is semantically equivalent to *-est*.

(15) a. Fred is the smart est student
b. Fred is the most intelligent student

Note also that adjectival superlatives formed with *most* exhibit the same absolute/relative ambiguity as those formed with *-est*; for example, (3) can either mean that Fred bought the most expensive contextually relevant book (absolute) or that he bought a more expensive book than any other contextually relevant individual (relative).

The analysis presented in the preceding section is able to account for these patterns. With the entries in (12), *many* and *much* are essentially semantically empty. This is seen clearly in the derivation in (14), where *many* acts as an identity element, taking as argument an expression of type $\langle d, et\rangle$ and returning (after further lambda abstraction) the same expression. Adjectival superlative *most* can be analyzed as containing a similarly null *much*. Specifically, an example such as (3), on the relative reading, has the LF structure in (16), where there are again two stages of raising:

(16) Fred [$_{\text{VP}}$ -est$_2$ [$_{\text{VP}}$ [$_{\text{QP}}$ d_2-much$_1$] [$_{\text{VP}}$ bought [$_{\text{DP}}$ the d_1-expensive book]]]]

The lower VP has the interpretation in (17a). Just as in the previous example, application of *much* followed by lambda abstraction yields the same expression, as in (17b). The superlative morpheme *-est* may now take this expression as an argument, yielding the final logical form in (18), the identical result as would have obtained if *-est* had composed directly with the lower VP.

(17) a. $[\![\text{bought the } d_1\text{-expensive book}]\!] =$
$= \lambda d_1 \lambda x.\exists y[book(y) \wedge bought(x,y) \wedge COST(y) \geq d_1]$

b. $[\![d_2\text{-much}]\!]([\![\text{bought the } d_1\text{-expensive book}]\!]) =$
$= \lambda d_2 \lambda x.\exists y[book(y) \wedge bought(x,y) \wedge COST(y) \geq d_2]$

(18) $\forall x \in C[x \neq Fred \rightarrow$
$\exists d[\exists y[book(y) \wedge bought(Fred,y) \wedge COST(y) \geq d]$
$\wedge \neg\exists y[book(y) \wedge bought(x,y) \wedge COST(y) \geq d]]]$

The analysis of *most* as the superlative form of an essentially null degree operator *much* thus allows the unified analysis to be extended also to adjectival superlative *most*, which receives an interpretation that is fully parallel to that of superlatives with *-est*.

5 Superlative Quantifier *Most*

Modified numerals of the form *at most n* have been the subject of considerable study in the semantics literature (see for example Krifka 1999; Geurts & Nouwen 2007; Nouwen 2010). But while the term 'superlative quantifier' is now standard, there has to my knowledge been little attempt to connect their analysis to canonical examples of superlatives.[2] There is, in fact, considerable evidence that such a connection should be made.

First, superlative quantifiers can be paraphrased by explicit superlatives.

[2] Though see Krifka (2007) for relevant discussion, and especially Penka (2010) for an analysis similar to the one developed here.

For example, the original example (4), repeated below, can be paraphrased as 'the largest number of Shakespeare plays that Fred could have read is 15'.

(4) Fred has read at most 15 Shakespeare plays **superlative quantifier**

Beyond this, other superlatives have a very similar use in expressing a maximal value:

(19) a. Fred is 30 at the oldest
b. Fred will arrive by 11 at the latest

And it is not only in English that the meaning of a superlative quantifier is expressed with a transparently superlative form. German for example uses the superlative form not of *many*, but of *high* (*höchstens*, 'highest'), as in the following, the equivalent of (4):

(20) Fred hat höchstens 15 Stücke von Shakespeare gelesen

Perhaps most significantly, Nouwen (2010) points out that superlative quantifiers are necessarily interpreted relative to a range of values. For example, (21a) implies that the speaker does not know precisely how many people Fred has invited. It would be infelicitous if uttered by a speaker who knew the exact number of invitees (say, 27), but acceptable in the case where the speaker's knowledge was uncertain. By contrast, (21b) and (21c) are both felicitous even in the situation of full speaker knowledge.

(21) a. Fred invited at most 30 people
b. Fred is allowed to invite at most 30 people
c. Classes at our institute have at most 30 students

What distinguishes the acceptable uses is that there is a range of actual or possible values under consideration, and not just a single value. This constraint mirrors a restriction on the superlative to situations where the comparison class has multiple members. For example, (22a) would be infelicitous if Fred is the only student I have, and (22b) is odd for a similar reason.

(22) a. Fred is the smartest student I have
b. ?You're the best mother I have

I would like to propose that these restrictions derive from the same source. The semantics of superlatives inherently involve picking the extreme value out of a (non-singleton) set of values. In this respect, superlative quantifiers behave just like any other superlatives. In the approach to the superlative adopted in this paper, the non-singleton requirement is captured as a presupposition on *-est* that the comparison class it introduces have multiple members (per (7)). This suggests that superlative quantifier *most* – like other instances of *most* – should likewise be analyzed as based on a superlative morpheme that introduces a comparison class presupposed to have multiple members.

In Section 2 it was proposed that relative *most* invokes a comparison class of individuals, while majority *most* invokes a comparison class of pluralities. What sort of comparison class might we have in the case of superlative quantifier *most*? Here, the most obvious possibility is that it is a comparison class of numbers. Informally speaking, the comparison class C in (4) might be taken to be the set of numbers n such that Fred might have read n Shakespeare plays. The sentence could then be analyzed as conveying that 15 is larger than any other other member of this class or, to put it slightly differently, that 15 has more of the property 'large-ness' or 'many-ness' than does any other member of C. This implies that the primary descriptive content of the sentence serves somehow to provide the comparison class argument of *-est*.

In formalizing this, I assume to start the LF syntax in (23), where the superlative quantifier has raised from its base-generated position to take sentential scope (here I do not attempt to specify the structure of the QP *at many+-est 15*, nor do I discount the possibility that certain of its elements raise further out of the QP at LF):

(23) $[_{\text{IP}}\ [_{\text{QP}}$ at many+-est 15$]_1\ [_{\text{IP}}$ Fred has read d_1-MEAS Shakespeare plays$]]$

Turning to the interpretation of this structure, the semantics given previously for the superlative morpheme are those in (7), repeated below:

(7) $[\![\text{-est}]\!]\left(C_{\langle et\rangle}\right)\left(D_{\langle d,et\rangle}\right)(x_e) = 1$ iff
$\forall y \in C\,[y \neq x \rightarrow \exists d\,[D(d)(x)\ \wedge\ \neg D(d)(y)]]$
$\ldots$ defined iff $x \in C$ and C has multiple members

The preceding discussion suggests that in the case of superlative quantifiers, all of the arguments of *-est* must range over something in the domain of degrees. As a first attempt, suppose that all of the type e arguments in (7) are replaced with arguments of type d:

(24) $[\![\text{-est}]\!]\left(C_{\langle dt\rangle}\right)\left(D_{\langle d,dt\rangle}\right)(x_d)$

With this modification, the numeral occurring in the quantifier (in the above example, 15) could, as an expression of type d, saturate the 'individual' (i.e. x)

argument of *-est*. Putting aside for a moment the question of where the main degree predicate D comes from, we would then seem to have a good candidate for the comparison class argument C, namely the set of degrees formed by lambda abstraction over the trace of the quantifier in the lower IP of (23).[3]

(25) $C = \{d : \exists x[S.play(x) \wedge read(Fred,x) \wedge |x| \geq d]\}$

But here we have a problem. The comparison class as defined in (25) is well formed. In all but the trivial case in which Fred has read no Shakespeare plays, C has multiple members, a consequence of the semantics of the 'greater than or equal' operator $\geq$. And even if $\geq$ were replaced by $=$, the presence of the existential quantifier $\exists$ would still guarantee that C is not a singleton set: if there exists a plurality of 15 Shakespeare plays that Fred has read, there also exists a plurality of 14 such plays that he has read, a plurality of 13 that he has read, and so forth. Thus we have no account for the fact that an example like (4) is infelicitous in the situation where the speaker knows exactly how many Shakespeare plays Fred has read, and only felicitous when there is some sort of epistemic uncertainty.

A solution to this problem can be developed by drawing on the analysis of *many* and *much* introduced in Section 3. Recall that on the definition in (12), *many/much* has a flexible type, taking as arguments a degree d and an expression P whose first argument is of type d. Up to this point in the analysis, we have been working with a version of *many/much* in which P is of type $\langle d, \langle et \rangle\rangle$. But another possible instantiation of this schema is the following, where *many*'s second argument has the simpler type $\langle dt \rangle$:

(26) $[\![\text{many}_{\langle d,\langle dt,t\rangle\rangle}]\!] = \lambda d \lambda P_{\langle dt \rangle}.P(d)$

Returning to the semantics of *-est* in (7), if its type e arguments are replaced with arguments of type $\langle dt \rangle$, as shown below, then *many* as defined in (26) has the right type to saturate its degree predicate D argument.

(27) $[\![\text{-est}]\!] \left(C_{\langle dt,t\rangle}\right) \left(D_{\langle d,\langle dt,t\rangle\rangle}\right) \left(x_{\langle dt \rangle}\right)$

And this seems intuitively right, in that, as noted above, the interpretation of (4) seems to involve comparing the 'many-ness' of 15 with that of other members of the comparison class. Continuing along these lines, if we let the numeral 15 in this case denote not a single degree but rather the set $\{d : d \leq 15\}$, then it can satisfy the x argument.[4] For the comparison class C we then require a set

[3] Here and in what follows I alternate between lambda and set notation.

[4] In Solt (2009) I provide further evidence that numerals should sometimes be analyzed as denoting sets of degrees, or equivalently scalar intervals, rather than degrees.

of sets of degrees. The only set of degrees that seems to be available is that in (25), so perhaps C has the form in (28), where I is a variable that ranges over sets of degrees:

(28) $C = \{I : I = \{d : \exists x[S.play(x) \wedge read(Fred,x) \wedge |x| \geq d]\}\}$

But this is of course a singleton set, and hence would fail to satisfy the presupposition that C have multiple members.

However, there is a way to derive a well-formed comparison class. Following Nouwen (2010), I take examples such as (4) to be covertly modal, in that they incorporate a variable that ranges over (epistemically) accessible worlds. The comparison class can then be taken to be not (28) but rather the following:

(29) $C = \{I : \exists w \in Acc[I =$
$\{d : \exists x[S.play(x) \wedge read(Fred,x) \wedge |x| \geq d]_w\}]\}$

So long as there are epistemically accessible worlds that differ in the number of Shakespeare plays that Fred has read in them (that is, so long as there is uncertainty as to the number he has read), the set in (29) will have multiple members. For example, if the possible number he has read is between 6 and 8, the members of C are $\{d : d \leq 6\}$, $\{d : d \leq 7\}$ and $\{d : d \leq 8\}$. Epistemic uncertainty is thus required to satisfy the presupposition on *-est*, from which follows the implication of (4) that the speaker does not know the exact number.

Formally, (4) receives the following truth conditions, where C is defined as in (29):

(30) $[\![(4)]\!] = 1$ iff $[\![\text{-est}]\!](C)([\![\text{many}_{\langle d,\langle dt,t\rangle\rangle}]\!])(\lambda d.d \leq 15) = 1$
...iff $\forall I \in C[I \neq \lambda d.d \leq 15 \rightarrow \exists d'[d' \leq 15 \wedge \neg I(d')]]$

In simpler terms, the final formula in (30) says that the maximum number of Shakespeare plays that Fred has read in any accessible world is 15. This corresponds correctly to the intuitive interpretation of (4).

To conclude this section, I have argued here that superlative quantifier *most* can and should receive an analysis that aligns it to superlatives more generally. The elements that make this analysis possible are, once again, the decomposition of *most* into *many/much* plus the superlative morpheme, and the analysis of *many/much* itself as a type-flexible degree operator which, in this case, provides one of the arguments of *-est*. The benefits here are twofold: not only can we extend the unified account of *most* to the case of superlative quantifier *most* as well, but we also are able to derive constraints on the use of superlative quantifiers from an independently attested property of superlatives.

There are, to be certain, questions that remain to be explored. The analysis developed above is not fully compositional, particularly with respect to the derivation of the set that serves as the comparison class. And I have not addressed how the analysis might be extended to cases with overt modals (21b) and plural noun phrases (21c). I must leave these as topics for future work. But the results to this point are promising.

6 Majority and Relative *Most* Revisited

Having considered how adjectival superlative and superlative quantifier *most* can be analyzed, let us return to the relationship between majority and relative *most*, discussed in Section 2. There is a lot to be said in favor of the unified, scope-based account presented here. It first of all relates the identical form of the two *most*'s to an identical underlying meaning. Furthermore, these parallels are not limited to English. As discussed by Bošković & Gajewski (2008), it is common cross-linguistically for these two meanings to be conveyed by the superlative form of *many*, further evidence that the English facts are not a matter of coincidence. From a different perspective, Hackl demonstrates that the compositional analysis of majority *most* as the superlative of *many* provides an account for the absence of a corresponding 'minority' *fewest*: while *most* characterizes a subset of a set that is larger than all non-overlapping subsets, *fewest* would characterize a subset that is smaller than all non-overlapping subsets – an impossibility. In short, there are reasons to think that this approach is fundamentally correct.

But side by side with the points in favor of the unified account, there is also a significant issue with it, a divergence in the behavior of majority and relative *most* that it does not, on the surface, account for. The logical form derived in (9) renders majority *most* logically equivalent to *more than half*. But in fact, speakers find *most* infelicitous for proportions very close to 50%. For example, (1) would be inappropriate in the situation where Fred has read 19 Shakespeare plays, even though this number exceeds 18, the number he did not read; for felicity, we would require a more substantial difference in the size of these two sets. That is, the comparison in (9) is tolerant to small differences in set size. In this, majority *most* behaves quite differently from relative *most*, which allows precise comparisons; for example, if Fred read 19 Shakespeare plays and John read 18, (2) could be true.

This is a non-trivial characteristic that sets majority *most* apart from relative *most* (and the other *most*'s discussed here), and it seems to argue against the unified analysis, in favor of an account that treats majority *most* as a separate lexical item. But in light of the other points in favor of unification, it is worth exploring whether this aspect of its interpretation can be accounted for within the framework of the analysis developed so far. In the remainder of this section, I outline one possible way that this might be accomplished.

In Solt (2011), I argue that majority *most*'s typical 'tolerant' interpretation arises as a result of pragmatic strengthening to an interpretation relative to a more weakly ordered degree structure than the cardinal numerals. To see why this might be the case, note first that the strong tendency for the use of *most* to be restricted to situations where there is a significant difference between set sizes is reminiscent of cases of what Horn (1984) terms R-based implicature, where a more general predicate is pragmatically restricted or narrowed to stereotypical instances. Such implicatures derive from Horn's R-Principle 'say no more than you must'. Examples of R-based implicatures discussed by Horn include the strengthening of ability modals (such that 'John was able to solve the problem' R-implicates that he in fact solved it) and the restriction of lexical causatives such as *kill* to cases of direct causation.

For such an approach to be extended to *most*, we must have reason to think that the prototypical or stereotypical case of a 'greater than' relationship between two set sizes is the one where the difference is a significant one. Here, findings from research on numerical cognition provide relevant insights. It is now well established that in addition to the capacity to represent precise number, humans have a separate and more basic 'approximate number system' (ANS) that is involved in the representation and manipulation of quantity information (for an overview of research in this area, see especially Dehaene 1997). In this system, (approximate) quantities are thought to be represented as patterns of activation on the equivalent of a mental number line. These essentially analog representations are sufficient to support approximate arithmetic as well as, importantly, the comparison of quantities. The hallmark of the operation of the ANS is its ratio dependence: the differentiability of two values improves in proportion to the ratio between them, and two values insufficiently distant from each other (in terms of ratio) are indistinguishable, or perhaps distinguishable only in a noisy and error-prone way.

The ANS is evolutionarily and developmentally more basic than the ability to represent and compare number precisely, being present not just in literate adults but also in preverbal infants, members of societies without complex number systems, and even animals. That is, a mode of comparison that is sensitive only to 'significant' differences in values is a core component of our most primitive numerical capabilities. As such, it is a good candidate for a stereotypical interpretation of a 'greater than' relationship.

The sort of approximate representations of numerosity generated by the ANS can be modeled via a scale structure in which degrees are conceptualized not as points but rather ranges, with the 'greater than' relationship between two degrees requiring non-overlap of their ranges. Formally, such a degree structure corresponds to a semi-order (van Rooij 2011), an ordering structure in which the 'greater than' relationship is transitive but the indifference relationship is not. Turning back to the interpretation of majority *most*, when a logical form such as that in in (9b) is interpreted relative to a semi-ordered degree structure of this sort, truth will obtain only when the set in question is 'significantly' larger than any other non-overlapping subset of the domain. This in turn will be the case only if the proportion in question is significantly greater than 50%, exactly the situation in which *most* is typically used.

Pietroski et al. (2009) provide evidence that the verification of sentences containing *most* at least sometimes proceeds via the ANS. My claim here is that this system plays an even more fundamental role in the interpretation of majority *most*. Specifically, the logical form for *most* can be assessed relative to a scale whose structure mirrors the output of the ANS. Furthermore, since this corresponds to our most basic or primitive mode of quantity comparison, the interpretation of *most* tends to be pragmatically strengthened via R-based implicature to this type of interpretation even in the case where precise number is available, resulting in the tolerant interpretation discussed above.

We are then left with the question of why similar pragmatic strengthening does not occur in the case of relative *most*. While I have no conclusive explanation, one possibility relates to a subtle difference in logical form between the two *most*'s. The relevant portions of the logical forms are shown below:

(31) a. Fred has read <u>most Shakespeare plays</u> **Majority**
$\lambda x.S.play(x) \wedge \forall y : S.play(y)[y \neq x \rightarrow$
$\exists d[|x| \geq d \wedge \neg |y| \geq d]]$

b. Fred <u>has read the most Shakespeare plays</u> **Relative**
$\lambda x.\forall y \in C[y \neq x \rightarrow \exists d[\exists z[S.play(z) \wedge read(x,z) \wedge |z| \geq d]$
$\wedge \neg \exists z[S.play(z) \wedge read(y,z) \wedge |z| \geq d]]]$

The formula for majority *most* in (31a) is based on the pairwise comparison of pluralities (specifically, pluralities of Shakespeare plays) with respect to their cardinalities. It is this sort of comparison that I have argued tends to receive a strengthened stereotypical interpretation that corresponds to our basic capacities for approximate comparison of set sizes. But the corresponding formula for relative *most* in (31b) is different. Nowhere in this formula are two pluralities compared directly. Rather, it is individuals (readers) that are compared, the parameter of comparison being the number of Shakespeare plays each has read. I hypothesize that this sort of comparison does not stand in the same relationship to our approximate numerical capabilities as the previous one. Put differently, there is no stereotypical case of a comparison of this nature, and as such no potential for pragmatic strengthening. The interpretation thus remains that provided by the semantics.

The main point of this section is that the 'tolerant' interpretation of majority *most* can be given a pragmatic account, one that aligns it to other instances of R-based implicature, and which is motivated by insights into how numerosity is mentally represented. I have proposed one possible explanation for the absence of similar strengthening for relative *most*. This pattern would certainly benefit from more in-depth exploration, and here experimental work on speaker's interpretation of the various *most*'s could be useful. Provisionally, however, I conclude that the particular interpretative properties of majority *most* discussed here can be accommodated within the unified account.

7 Conclusions

Most occurs in a variety of contexts that have traditionally been analyzed separately. I have shown here that despite their surface differences, the various *most*'s share a common core meaning. A unified semantic analysis has been developed by drawing on two proposals which are independently motivated: i) the decomposition of *most* into *many* or *much* plus the superlative morpheme *-est*; ii) the analysis of *many/much* themselves as semantically inert degree operators. In closing, let me mention two possible extensions of the present analysis. The first involves the use of *most(ly)* as an adverbial element (e.g. *'the paper is mostly finished'*, *'the circle is mostly red'*), which shares with the cases discussed here an element of superlative meaning. The second is the previously discussed usage of other superlatives to express the maximum in a range (e.g. *'30 at the oldest'*). I leave these as topics for the future.

References

Barwise, John & Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4. 158–219.

Bošković, Željko & Jon Gajewski. 2008. Semantic correlates of the NP/DP parameter. In *Proceedings of the 39th Meeting of the North East Linguistic Society (NELS39)*, Ithaca, NY.

Bresnan, Joan. 1973. Syntax of the comparative clause construction in English. *Linguistic Inquiry* 4. 275–343.

Dehaene, Stanislas. 1997. *The number sense: How the mind creates mathematics*. Oxford: Oxford University Press.

Geurts, Bart & Rick Nouwen. 2007. *At least* et al.: The semantics of scalar modifiers. *Language* 83. 533–559.

Hackl, Martin. 2009. On the grammar and processing of proportional quantifiers: *Most* versus *more than half*. *Natural Language Semantics* 17. 63–98.

Heim, Irene. 1999. Notes on superlatives. Unpublished manuscript.

Horn, Laurence R. 1984. Toward a new taxonomy for pragmatic inference: Q-based and R-based implicature. In Deborah Shiffrin (ed.), *Meaning, form and use in context: Linguistic applications*, 11–89. Washington, D.C.: Georgetown University Press.

Krifka, Manfred. 1999. At least some determiners aren't determiners. In Ken Turner (ed.), *The semantics/pragmatics interface from different points of view*, 257–291. Oxford: Elsevier.

Krifka, Manfred. 2007. More on the difference between *more than two* and *at least three*. Paper presented at University of California, Santa Cruz.

Nouwen, Rick. 2010. Two kinds of modified numerals. *Semantics and Pragmatics* 3(3). 1–41.

Penka, Doris. 2010. A superlative analysis of superlative scalar modifiers. Paper presented at *Sinn und Bedeutung 15*.

Pietroski, Paul, Jeffrey Lidz, Tim Hunter & Justin Halberda. 2009. The meaning of 'most': semantics, numerosity and psychology. *Mind and Language* 24(5). 554–585.

van Rooij, Robert. 2011. Implicit versus explicit comparatives. In Paul Égré & Nathan Klinedinst (eds.), *Vagueness and language use*, New York: Palgrave Macmillan.

Schwarzschild, Roger. 2006. The role of dimensions in the syntax of noun phrases. *Syntax* 9. 67–110.

Solt, Stephanie. 2009. *The semantics of adjectives of quantity*: City University of New York Ph.D. dissertation.

Solt, Stephanie. 2010. *Much* support and *more*. *Amsterdam Colloquium 2009 (LNAI 6042)* 446–455.

Solt, Stephanie. 2011. On measurement and quantification: the case of *most* and *more than half*. Unpublished manuscript.

Yabushita, Katsuhiko. 1999. The unified semantics of *mosts*. In Sonya Bird, Andrew Carnie, Jason D. Haugen & Peter Norquest (eds.), *WCCFL 18: Proceedings of the West Coast Conference on Formal Linguistics*, Cascadilla Press.