All and *every* as quantity superlatives [*]

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Abstract Recent literature has pointed out similarities in the interpretation and distribution of *most* and *all* (Matthewson 2001; Crnič 2010). This literature takes both to be quantifiers. However, other literature analyzes the meaning of *most* as the regular composition of *much* (as a degree modifier) and the superlative morpheme *-st* (Bresnan 1973; Hackl 2009). But if *most* is a superlative and *all* is a quantifier, any similarities are unexpected. In this paper, I reconcile these views by analyzing *all* as a superlative term like *most*. Further, I claim that *every* is a type-lifted derivative of *all*. Similarities and differences between *most*, *all* and *every* emerge from this analysis.

Keywords: quantifiers, superlatives, distributivity, degree semantics

1 Introduction

The English quantifier *every* combines with a singular (count) noun, while *all* combines with a plural (or mass) noun, as illustrated in (1). This pattern suggests that *all* and *every* are number-conditioned allomorphs of an abstract universal quantifier (Winter 2001).

(1)   a. Every swan is white.

       b. All swans are white.

But unlike *every*, *all* bears some substantial distributional similarities to the English word *most*, discussed below. What is particularly puzzling about these similarities is that evidence supports an analysis of *most* that makes it the transparent result of combining the superlative morpheme *-st* with a degree predicate of quantity, typically identified with the quantity adjective *much* (Bresnan 1973; Hackl 2009). If *all* denotes essentially what *every* denotes, but *most* is a superlative, then similarities between *all* and *most* are unexpected. In this paper, I re-evaluate the interrelatedness of the terms *most*, *all* and *every* in English. I propose that *all* and *most* are both

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superlative terms, and differ only with respect to what they consider a distinct subpart of the plural individual their nominal complement denotes. *Every*, on the other hand, is a type-lifted derivative of *all*, that combines not with a plural individual but with a set, limiting its nominal complement to bare singulars.

Section 2 below reviews similiarities between *all* and *most*, and Section 3 summarizes some previous analyses. Section 4 spells out the superlative analysis of *all* alluded to above. Sections 5 and 6 then turn to the meaning of *every* from this perspective. Finally, Section 7 discusses some differences between *all* and *most* and evaluates their significance for the analysis presented here.

2   Similarities between *all* and *most*

Both *all* and *most* combine with a definite noun phrase supported by *of*, or with a bare plural noun phrase, as shown in (2a) and (2b) respectively. In contrast, *every* combines only with a bare singular and does not allow *of*, as (2c) shows.

(2)   a. All (of the) swans are white.

       b. Most (of the) swans are white.

       c. *Every (of the) swans are white.

Further, noun phrases built from *all* or *most* with a bare plural typically do not occur in 'episodic' contexts—those that do not support a generic interpretation for a bare plural noun phrase, such as the object of *leave behind*, as shown in (3).

(3)   a. *The bus nearly left behind all students.

       b. *The bus nearly left behind most students.

Noun phrases built from *all* or *most* with a bare plural prefer contexts in which a bare plural would receive a generic interpretation, such as the object of subject experiencer verbs like *admire*, seen in (4). The affinity of *all*+bare plural for generic contexts is noticed by Partee (1995) and Cooper (1996). The similarity to *most* is described by Matthewson (2001) and discussed in more detail by Crnič (2010).

(4)   a. Julie admires all linguists.

       b. Julie admires most linguists.

This restriction on the distribution of *all* and *most* does not hold when they combine with a definite noun phrase, in which case they are compatible with both kinds of contexts, as shown in (5). This suggests that *all/most*+bare plural may **only** receive a generic interpretation incompatible with an episodic context.

(5)   a. The bus nearly left behind all/most of the students.

      b. Julie admires all/most of the linguists.

The fact that a generic interpretation for *all* and *most* is mediated by the (in)definiteness of the nominal complement represents a commonality that *all* and *most* share with each other but that distinguishes them from other quantificational terms.

Another commonality between *all* and *most* that is critical for the proper analysis of both is that both support the collective reading of a collective predicate like *gather* (Brisson 2003). Verbs like *gather* hold only of pluralities. No singular individual can gather. As (6) shows, the expressions *all of the students* and *most of the students* fulfill this requirement of *gather*, while *every student* does not. This points to a difference in meaning between *all* and *every* that groups *all* together with *most*.

(6)   a. All of the students gathered in the hall.

      b. Most of the students gathered in the hall.

      c. *Every student gathered in the hall.

The fact that *all* and *most* show the same combinatorial possibilities and show the same interpretational quirk in combination with a bare plural noun phrase—that they only allow the generic interpretation of that noun phrase—suggests that they have some component of meaning in common that underlies this distributional pattern. Crnič (2010) reduces these distributional similarities to the sameness in the combinatorial type of *all* and *most*, as described in the following section.

3   Background

Matthewson (2001) claims that *all* and *most* combine with individual-denoting noun phrases. According to Carlson (1977) and Chierchia (1998), bare plurals in English may refer to 'kinds'—individuals that correspond to categories that other individuals may function as 'realizations' of. As individual-denoting expressions, names for kinds are expected to fall into the distribution of other referring expressions like definite noun phrases. Matthewson's claim that *all* and *most* combine directly with an individual-denoting noun phrase derives the observation that these occur either with a (kind-denoting) generic bare plural or an (individual-denoting) definite noun phrase.

Crnič (2010) formalizes Matthewson's claim, attributing roughly the meanings in (7) to *most* and *all* (here simplified slightly). These denotations reflect the claim that *most* and *all* combine with an individual and a predicate, and differ only in the proportion of the individual that they assert bears the property denoted by the

predicate. In (7), μ is a contextually supplied measure function that maps an entity to a degree corresponding to the extent of that entity. For pluralities, 'extent' is cardinality (see Schwarzschild 2006 on restrictions on μ). The denotation for *most* in (7a) maps an individual x and a predicate P to the claim that there is a subpart of x that has property P and whose cardinality is greater than half of the cardinality of x itself. The denotation for *all* in (7b) maps an individual x and a predicate P to the claim that there is a subpart of x that has property P and whose cardinality is the same as the cardinality of x itself; this subpart is itself the totality x.

(7)   a. $\llbracket \text{most} \rrbracket = \lambda x \lambda P \exists y \sqsubseteq x[\mu(y) > \frac{1}{2}\mu(x) \,\&\, P(y)]$
        b. $\llbracket \text{all} \rrbracket = \lambda x \lambda P \exists y \sqsubseteq x[\mu(y) = \mu(x) \,\&\, P(y)]$

This analysis makes *all* and *most* identical in logical type, predicting similarities in their distribution. The fact that both combine with an individual ensures they are found with individual-denoting definite nominal complements and with kind-denoting bare plural nominal complements. Crnič assumes that *of* morphologically supports a partitively interpreted definite DP but is itself vacuous, an assumption that I adopt here as well.

While the analysis in (7) correctly predicts that *all* and *most* behave similarly, it is not consistent with Hackl's (2009) analysis of *most*, drawing on Bresnan (1973) and others, that claims that *most* is the regular semantic composition of the superlative morpheme *-st* with the quantity adjective *much*. I describe Hackl's analysis in detail here, since it forms the basis for the analysis of *all* I propose in Section 4, making a few modifications to enhance its generality.

Hackl adopts Heim's (2001) analysis of the meaning of the superlative, stated in (8). It denotes a function that maps a degree relation R and an individual x to the claim that x bears R to a greater degree than any alternative to x does. C is a contextually supplied contrast set, containing x and various values for the alternative x'. The expression $\neg x' \circ x$ asserts that x' does not overlap with x. Superlative *-st* presupposes that the subject x is in the contrast set C and that every member of the contrast set bears the degree relation to some degree (Heim 1985, 1999, 2001).

(8) $\llbracket \text{-st} \rrbracket^C = \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda x_e \max(\lambda d\, R(x,d)) >$
$$\max(\lambda d' \exists x'[\neg x' \circ x \,\&\, x' \in C \,\&\, R(x',d')])$$

On Crnič's analysis sketched in (7), the function that measures out the cardinality of the nominal complement to *all* and *most* is incorporated in the meaning of the quantifier itself. On Hackl's view, there is no quantifier *most*, but only the superlative *-st*. The measure function is contributed by an adjectival modifier of the noun phrase. Following Cresti (1995), Hackl attributes the measure function to the superlative's morphological host *mo-*, an allomorph of *much*. See also Wellwood, Hacquard &

Pancheva 2012 and Wellwood 2015. Here, I adopt the view presented in Corver 1997 and Solt 2015 that the measure function itself is the denotation of a covert adjective MEAS defined in (9), while *mo-* is a default morphological host for the superlative. This assumption is necessary to accommodate the claim fleshed out in Section 4 that *all* is a superlative morpheme which combines with a degree relation like *-st* but does not occur with overt *much*.[1]

(9) $[\![\text{MEAS}]\!] = \lambda d_d \lambda x_e [\mu(x) \geq d]$

In Crnič's account sketched in (7) of an expression like *most of the swans*, it describes a subpart of the denotation of *the swans* whose cardinality is greater than half of the cardinality of the totality of swans. Like the measure function, the subpart relation is built into the meaning of *most*. On Hackl's analysis, where there is no quantifier *most*, the partitivity in *most of the swans* is, like the measure function, the contribution of some other component of the expression. While it is tempting to attribute partitivity to the preposition *of*, this preposition is not present in all the cases where partitivity is present, such as the corresponding generic expression with a bare plural nominal (*most swans*). I continue therefore to assume, as mentioned above, that *of* obligatorily accompanies a definite DP complement of *most* for morphosyntactic reasons and that partitivity is the contribution of the covert operator defined in (10). I return to the distribution of *of*, in particular its optionality with *all*, in Section 7.

(10) $[\![\text{PART}]\!] = \lambda y_e \lambda x_e [x \sqsubseteq y]$

I follow Link (1983), Lønning (1987) and others in analyzing plural nouns as predicates of algebraic sums of individuals, or 'plural' individuals. For a predicate of atomic individuals P, its plural $^*P$ denotes the closure of P under sum formation. I follow Krifka (1989), Schwarzschild (1996), Sauerland (2003), Spector (2007) and Zweig (2008, 2009) in including atomic individuals in the denotation of plurals. The bare noun *swan* has the denotation in (11a) and its plural *swans* the denotation in (11b). Drawing on the general equivalence between functions and the sets they are characteristic functions of, I abbreviate the denotation of the singular as **S** and the plural as ***S**.

(11)   a. $[\![\text{swan}]\!] = \lambda x_e [\text{swan}(x)] = \mathbf{S}$

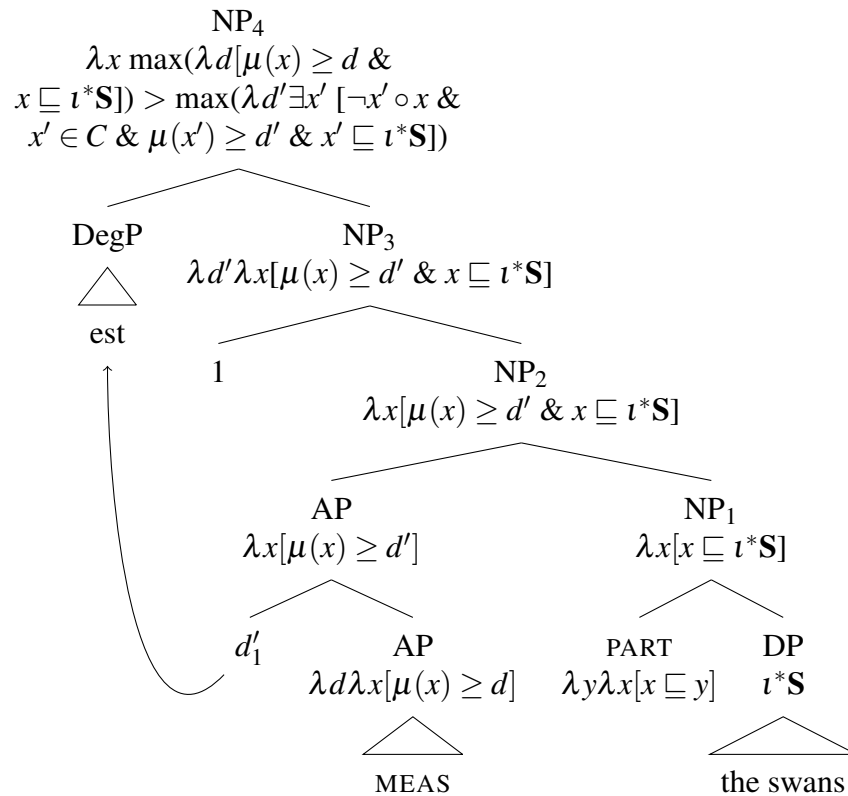b. $[\![\text{swans}]\!] = \lambda x_e [^*\text{swan}(x)] = {}^*\mathbf{S}$

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1 Wellwood (2015) follows Bresnan (1973) in postulating a *much*-deletion rule in some contexts that could be at work in the context of *all*, in which case Hackl's identification of the measure function with the denotation of *much* is salvageable in the cases discussed here. I leave this possibility open.

Following Link and many others, I define the definite article as a 'maximizing' iota operator, as in (12). The expression ιxPx refers to the unique individual that meets the description P. It is undefined if there is no such individual. Link's definition in (12) adds the condition that x is the maximal element of P. If P is a predicate of atoms (the denotation of a singular noun), then (12) requires that every P element be identical to x (which is a subcase of being part of x). As a result, *the swan* refers to the unique swan in the utterance context. If P is a (plural) predicate of sums, on the other hand, ιxPx must refer to that sum in P that every other sum in P is a part of. As a result, *the swans* refers to a sum that all swans in the utterance context are part of. Drawing on the abbreviations in (11), I abbreviate the denotation of *the swan* as $\iota\mathbf{S}$ and the denotation of *the swans* as $\iota^*\mathbf{S}$.

(12) $[\![\text{the}]\!] = \lambda P_{\langle e,t \rangle} \iota x_e [P(x) \;\&\; \forall y [P(y) \rightarrow y \sqsubseteq x]]$

With these ingredients in place, the composition of *most of the swans* looks like (13), and its denotation is the denotation of the node labeled NP_4. The superlative morpheme starts out as a modifier of AP, but moves to the left edge of the NP, leaving a degree-denoting trace that functions as argument of the degree relation that MEAS denotes. The resulting AP combines with NP_1 by predicate modification.[2] Movement of the superlative morpheme is accompanied by abstraction over the trace in its base position, forming a degree relation of the appropriate type to function as argument to the superlative morpheme. The index '1' is an abstraction operator (Heim & Kratzer 1998). The resulting denotation is stated under the NP_4 node. This NP describes an individual as being a part of the plurality that *the swans* denotes and having a greater cardinality than any non-overlapping part of the swans. As Hackl points out, for this description to hold of a plurality, it must comprise more than half of the swans, since if it didn't, the other half would constitute a non-overlapping subpart with greater cardinality.

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2 Predicate modification takes two predicates P and Q and derives the unification $\lambda x\, P(x) \;\&\; Q(x)$ (Heim & Kratzer 1998).

(13) ⟦most of the swans⟧ =

$$NP_4$$
$$\lambda x\,\max(\lambda d[\mu(x) \geq d\ \&$$
$$x \sqsubseteq \iota^*\mathbf{S}]) > \max(\lambda d' \exists x'\,[\neg x' \circ x\ \&$$
$$x' \in C\ \&\ \mu(x') \geq d'\ \&\ x' \sqsubseteq \iota^*\mathbf{S}])$$

DegP

est

$$NP_3$$
$$\lambda d' \lambda x[\mu(x) \geq d'\ \&\ x \sqsubseteq \iota^*\mathbf{S}]$$

1

$$NP_2$$
$$\lambda x[\mu(x) \geq d'\ \&\ x \sqsubseteq \iota^*\mathbf{S}]$$

AP
$$\lambda x[\mu(x) \geq d']$$

$$NP_1$$
$$\lambda x[x \sqsubseteq \iota^*\mathbf{S}]$$

$$d'_1$$

AP
$$\lambda d \lambda x[\mu(x) \geq d]$$

MEAS

PART
$$\lambda y \lambda x[x \sqsubseteq y]$$
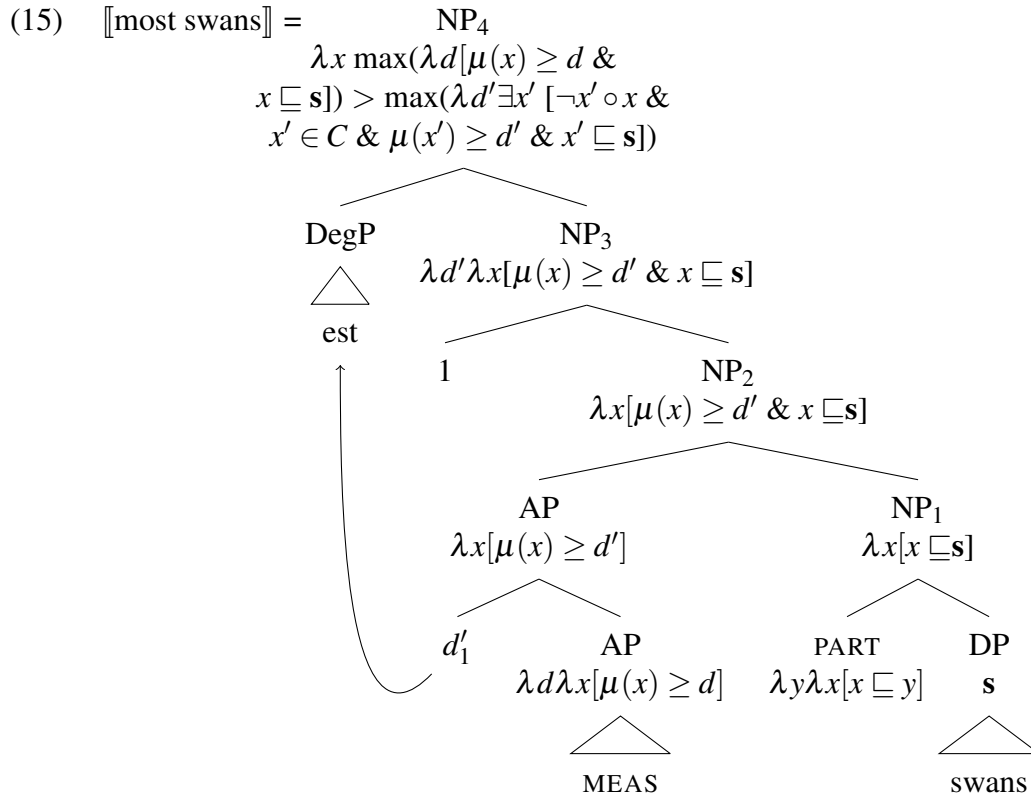
DP
$$\iota^*\mathbf{S}$$

the swans

I propose that the predicate that *most of the swans* denotes shown in (13) is integrated with a VP by predicate modification, and that the argument variable is then saturated by 'existential closure', default insertion of an existential quantifier (Heim 1983; Diesing 1992). On these assumptions, the sentence *Most of the swans gathered (in the middle of the lake)* has the logical form in (14). Since the x argument is a plural individual (the same kind of thing that definite plurals refer to), it may function as argument of a collective predicate such as *gather*.[3]

(14) $\exists x$ [most of the swans](x) & gathered(x)

Matthewson and Crnič claim that *most swans*, with a bare plural complement to *most*, involves a kind-level interpretation of *swans*, and, following Carlson (1977) and Chierchia (1998), that kinds are individuals. The interpretation of *most swans*, then, is composed in the same manner as (13) with the kind-level individual **s** in place of the specific plural individual $\iota^*\mathbf{S}$. See Chierchia 1998 on the relation between

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3 The example in (14) is intransitive. Chung & Ladusaw (2004) propose an extension of predicate modification to transitive predicates they call the 'restrict' operation. Restrict allows the expression in (13) to occur in VP-internal positions.

s and ι^***S** and Crnič 2010 for a method of integrating Chierarcia's insights into an analysis of *most*. Here, I simply assume that **s** and ι^***S** are formally related to each other and, crucially, that **s** has the same part structure as the definite plural counterpart. On this assumption, *most swans* composes on analogy to (13) as in (15).

(15) $[\![\text{most swans}]\!] = $

NP_4
$\lambda x \max(\lambda d[\mu(x) \geq d \ \& $
$x \sqsubseteq \textbf{s}]) > \max(\lambda d' \exists x' \ [\neg x' \circ x \ \& $
$x' \in C \ \& \ \mu(x') \geq d' \ \& \ x' \sqsubseteq \textbf{s}])$

DegP
est

NP_3
$\lambda d' \lambda x[\mu(x) \geq d' \ \& \ x \sqsubseteq \textbf{s}]$

1

NP_2
$\lambda x[\mu(x) \geq d' \ \& \ x \sqsubseteq \textbf{s}]$

AP
$\lambda x[\mu(x) \geq d']$

NP_1
$\lambda x[x \sqsubseteq \textbf{s}]$

d'_1

AP
$\lambda d \lambda x[\mu(x) \geq d]$

PART
$\lambda y \lambda x[x \sqsubseteq y]$

DP
s

MEAS

swans

The node NP_4 in the tree in (15) describes an individual, asserting that that individual is a subpart of the kind 'swans'. On the assumption that a subpart of a kind has whatever ontological status kinds themselves have, the phrase *most swans* describes a kind and is expected to be blocked from episodic contexts, as Partee (1995), Cooper (1996), Matthewson (2001) and others observe is the case.[4]

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4 The possibility that a part of a kind might actually have an ontologically somewhat more concrete status than the kind itself might account for the relative acceptability of *most*+bare plural in some episodic contexts, such as (ia) (mentioned by a reviewer), particularly when modified, as in (ib) (Matthewson 2001; Crnič 2010). Crnič claims in this connection that a generic operator may be contextually restricted to a particular temporal interval, masking the effect of genericity.

(i) a. Most boys were city lads with no farming experience.

   b. Most men who came to the party left early.

What precedes is an implementation of Hackl's analysis of *most* in combination with a definite and bare plural nominal. On this analysis, the meaning attributed by Crnič to *most* is broken down into the component parts *-st*, MEAS and PART. Hackl points out that this analysis of *most* is supported by the fact that it correctly predicts the behavior of its inverse *least/fewest*. If *most* were a quantifier that essentially means 'more than half', as defined in (7a), we would expect *least/fewest* to behave like a quantifier that means 'less than half', defined in (16).

(16) $[\![\text{least/fewest}]\!] = \lambda x \lambda P \exists y \sqsubseteq x\, [\mu(y) < \frac{1}{2}\mu(x)\, \&\, P(y)]$

But as Hackl shows, *least/fewest* does not have a use parallel to the putative quantifier *most*, as illustrated in (17a). If *fewest* had the meaning in (16) and *fewest of the swans* integrated with the VP the same way *most of the swans* does, then (17a) would be grammatical on the interpretation sketched in (17b), which asserts of a plurality of swans that fewer than half of them are white (here, *S is the set of swan pluralities and *W the pluralized property 'be white'). There appears to be no interpretation for *least/fewest* along these lines.

(17)   a. *Fewest (of the) swans are white.

      b. $\exists y \sqsubseteq \iota^*S\, [\mu(y) < \frac{1}{2}\mu(\iota^*S)\, \&\, {}^*W(y)]$

Hackl points out, though, that an analysis of *least/fewest* that makes it the inverse of *-st* makes sense of the ungrammaticality of (17a). On this approach, *fewest of the swans* has a denotation along the lines of (18), which asserts that an individual exists that is part of the plurality that *the swans* denotes and that has lesser cardinality than any other part. But the smallest parts of this plurality, the individual swans themselves, fail to have lesser cardinality than the other individual swans, meaning there is no subpart of the swans that is less numerous than every other subpart. As Hackl states, in concert with a principle that rules out logical triviality in natural language semantics, the denotation in (18) for *fewest of the swans* predicts the ungrammaticality of (17a), unlike the quantificational view of *least/fewest* stated in (16).[5]

(18) $\exists x\, \max(\lambda d[\mu(x) \geq d\, \&\, x \sqsubseteq \iota^*S]) <$
$\max(\lambda d' \forall x'\, [\neg x' \circ x\, \&\, x' \in C\, \&\, \mu(x') \geq d'\, \&\, x' \sqsubseteq \iota^*S])$

This consideration supports the view of *most* as a superlative. Now, if *all* is a quantifier but *most* is not, being instead the regular composition of *-st*, MEAS and

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5 As Hackl mentions, the composition of the expression in (18) from the meanings of *-st* and *less/few* is not trivial, nor is the expression in (18) entirely unproblematic in itself as the denotation for *least/fewest*, as Sharvit & Stateva (2002), Fitzgibbons, Sharvit & Gajewski (2009) and others have pointed out. I trust that these problems are less serious for the superlative analysis of *most* than the missing reading in (16) is for the quantificational analysis.
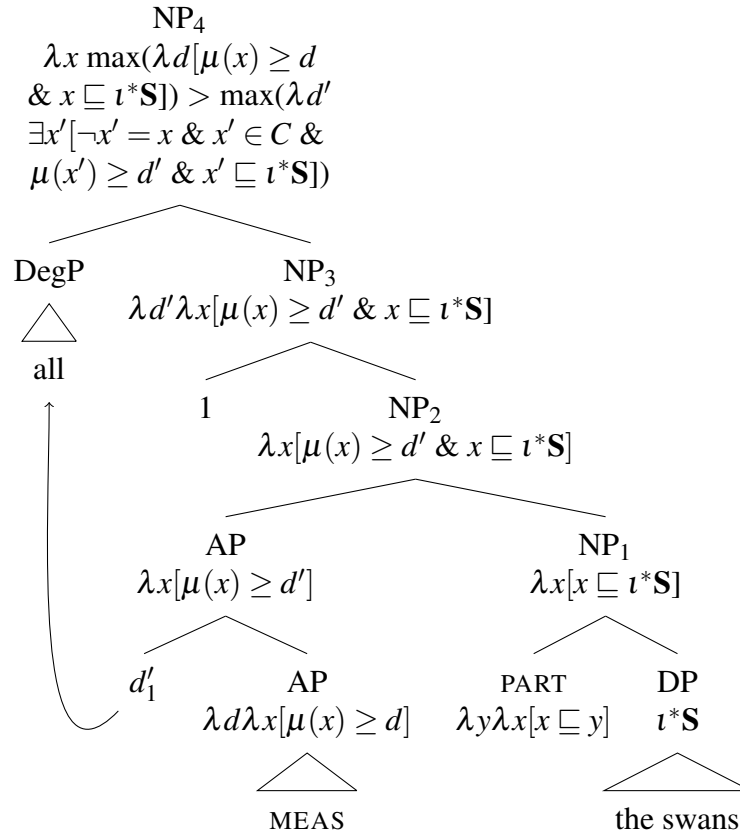
PART, then the parallels between *all* and *most* are puzzling. The option of capturing these parallels by analyzing both as quantifiers is militated against by the issues described above surrounding (17a). Another possibility, though, is to capture the parallels going in the other direction, analyzing both as superlatives rather than quantifiers. Hackl's superlative analysis of *most* is described above. The following section proposes an analogous analysis for *all*, and Section 5 extends it to *every*.

4   *All* as a superlative morpheme

In light of the evidence against a quantificational analysis of *most*, I suggest that it is probably not a coincidence that a minor variation on the meaning of superlative *-st* in English generates the universal force of *all*. In particular, if we replace the overlap symbol in (8) with the equals symbol, as in (19), we narrow the meaning of the superlative in the required way.

(19) $[\![\text{all}]\!]^C = \lambda R_{\langle d, \langle e, t \rangle \rangle} \lambda x_e \max(\lambda d\ R(x, d)) >$
$$\max(\lambda d' \exists x' [\neg x' = x\ \&\ x' \in C\ \&\ R(x', d')])$$

Given the meaning in (19) for *all*, an expression like *all of the swans* has the same semantic composition as *most of the swans*, but describes a subpart of the swans that is greater in cardinality than any **non-identical** subpart. If there are ten swans in total and we use the phrase *all of the swans* to describe a group of nine of them, the totality containing ten swans constitutes a subgroup that is not identical to the nine swans we are describing but that is **not** smaller, falsifying the description. The only subgroup of the ten swans that is greater in cardinality than any non-identical subgroup is the totality of the swans.

(20) ⟦all of the swans⟧ =

$$NP_4$$
$$\lambda x \max(\lambda d[\mu(x) \geq d$$
$$\& \, x \sqsubseteq \iota^*\mathbf{S}]) > \max(\lambda d'$$
$$\exists x'[\neg x' = x \, \& \, x' \in C \, \&$$
$$\mu(x') \geq d' \, \& \, x' \sqsubseteq \iota^*\mathbf{S}])$$

DegP

all

$$NP_3$$
$$\lambda d' \lambda x[\mu(x) \geq d' \, \& \, x \sqsubseteq \iota^*\mathbf{S}]$$

1

$$NP_2$$
$$\lambda x[\mu(x) \geq d' \, \& \, x \sqsubseteq \iota^*\mathbf{S}]$$

AP
$$\lambda x[\mu(x) \geq d']$$

$$NP_1$$
$$\lambda x[x \sqsubseteq \iota^*\mathbf{S}]$$

$$d'_1$$

AP
$$\lambda d \lambda x[\mu(x) \geq d]$$

MEAS

PART
$$\lambda y \lambda x[x \sqsubseteq y]$$

DP
$$\iota^*\mathbf{S}$$

the swans

As before, the expression in (20) integrates with a VP via predicate modification and existential closure, deriving the logical form in (21) for the sentence *All of the swans gathered (in the middle of the lake).*

(21) $\exists x$ [all of the swans](x) & gathered(x)

And as before, if we replace *the swans* with the kind-denoting bare plural *swans*, we derive a description of a part of this kind that is greater in cardinality than any non-identical part, which again can only be the kind itself in its entirety. This analysis for *all* makes it identical in logical type to *most*, predicting the similarity in distribution between *all* and *most*. The essential similarity is that both contain an individual-denoting DP in combination with the partitive operator PART and the degree-relation deriving operator MEAS. In combination with a kind-denoting bare plural, *all* and *most* are most natural in contexts that accept kind-denoting bare plurals, like those in (4), because both describe a subpart of that kind. This much is like Crnič's analysis sketched in (7). It differs in that it acknowledges the superlative

character of *most* and analyses *all* in the same manner. The following section turns to the issue of how *all* is related to *every*.

5 *Every* as a derivative of *all*

While *all* and *most* combine with individual-denoting definites and bare plurals, *every* combines with bare nouns. Bare nouns denote sets of individuals. Accordingly, the conventional definition for *every* in (22a) makes it a generalized quantifier that denotes a relation between sets (Barwise & Cooper 1981). In combination with a nominal restriction *swan* and the predicate *be white*, *every* asserts that everything in the set of swans is in the set of white things, spelled out in (22b).

(22)   a. $[\![every]\!] = \lambda P \lambda Q\ P \subseteq Q$
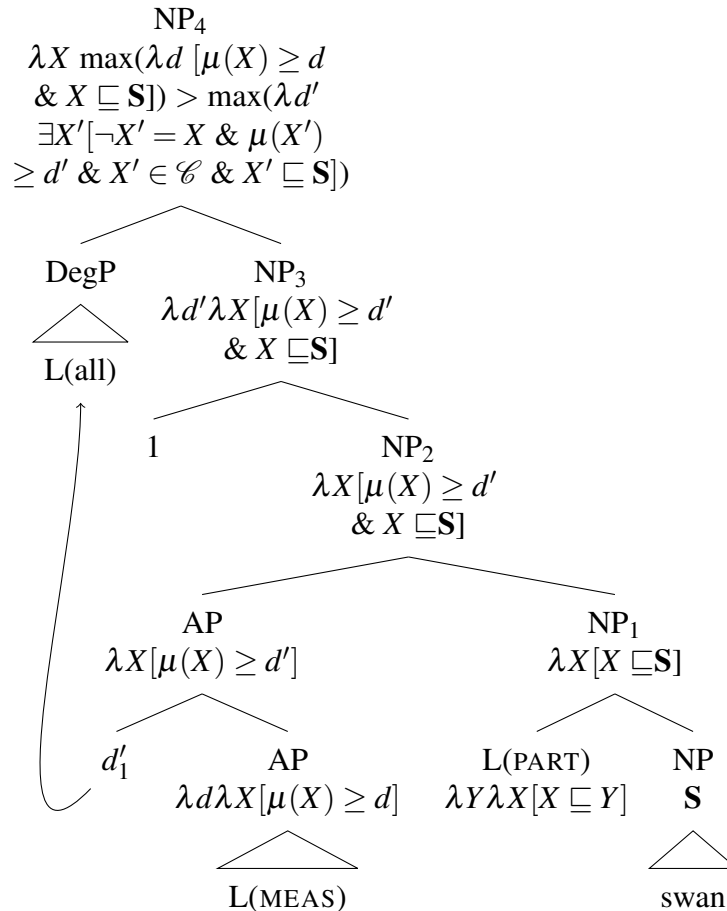   b. $[\![Every\ swan\ is\ white]\!] = \mathbf{S} \subseteq \mathbf{W}$

The fact that *all* (like *most*) occurs with PART and PART is typed to combine with an individual ensures the impossibility of combining *all* with a bare singular, since these denote sets, not individuals. Properties of sets (of type $\langle\langle e,t\rangle,t\rangle$, where e is the type of individuals and t the type of truth values) are one degree order higher in logical type than properties of individuals (of type $\langle e,t\rangle$). Lifting a predicate of a given type τ to type $\langle\tau,t\rangle$ raises its type by one degree order. Lifting *all* and the other components of its composition PART and MEAS one degree order will make them compatible with a nominal complement of type $\langle e,t\rangle$, the type of bare nouns in English. I assume that lifting a term in this manner effects all the arguments of the term except for degree arguments, which correspond to 'amounts' regardless of whether the material being measured constitutes a set or a (plural) individual. I also assume that the '$\sqsubseteq$' symbol represents the 'subpart of' relation or the 'subset of' relation according to what kind of things its relata are. The lifts described here for *all*, MEAS and PART are defined in (23), where L is a function that maps an *n*-ary predicate P to the counterpart that has, for each non-degree argument variable of P with some type τ, an argument variable of type $\langle\tau,t\rangle$ in its place.

(23)   a. $[\![L(\text{MEAS})]\!] = \lambda d_d \lambda X_{\langle e,t\rangle} [\mu(X) \geq d]$
        b. $[\![L(\text{PART})]\!] = \lambda Y_{\langle e,t\rangle} \lambda X_{\langle e,t\rangle} [X \sqsubseteq Y]$
        c. $[\![L(\text{all})]\!]^{\mathscr{C}} = \lambda \mathscr{R}_{\langle d,\langle\langle e,t\rangle,t\rangle\rangle} \lambda X_{\langle e,t\rangle}\ [\max(\lambda d\ \mathscr{R}(X,d)) >$
        $\max(\lambda d' \exists X'\ [\neg X' = X\ \&\ X' \in \mathscr{C}\ \&\ \mathscr{R}(X',d')])]$

My claim, now, is that L(all) defined in (23c) is the denotation of *every*, and the lifting procedure described above is the semantic connection between *every* and *all*. The proposed derivation for *every swan* is illustrated below, where again **S** stands for the denotation of *swan*, the set of swans. The denotation of *every swan* (=NP$_4$)

asserts of a set of individuals that it is a subset of the set of all swans (the denotation of *swan*) that has a greater cardinality than any non-identical subset, which here again must be the set of all swans itself.

(24) $[\![\text{every swan}]\!] =$

$$NP_4$$
$$\lambda X \max(\lambda d \, [\mu(X) \geq d$$
$$\& \, X \sqsubseteq \mathbf{S}]) > \max(\lambda d'$$
$$\exists X'[\neg X' = X \, \& \, \mu(X')$$
$$\geq d' \, \& \, X' \in \mathscr{C} \, \& \, X' \sqsubseteq \mathbf{S}])$$

DegP

L(all)

$$NP_3$$
$$\lambda d' \lambda X[\mu(X) \geq d'$$
$$\& \, X \sqsubseteq \mathbf{S}]$$

1

$$NP_2$$
$$\lambda X[\mu(X) \geq d'$$
$$\& \, X \sqsubseteq \mathbf{S}]$$

AP
$$\lambda X[\mu(X) \geq d']$$

$$NP_1$$
$$\lambda X[X \sqsubseteq \mathbf{S}]$$

$$d'_1$$

AP
$$\lambda d \lambda X[\mu(X) \geq d]$$

L(MEAS)

L(PART)
$$\lambda Y \lambda X[X \sqsubseteq Y]$$

NP
$$\mathbf{S}$$

swan

This attribution of meaning to *every* reductively ensures that *every* and *all* have more or less the same meaning and yet explains the salient difference between them, that *every* combines with a singular nominal complement and *all* with a plural. Since it gives *every* a different type than *all*, though, it in turn raises the question of how *every* integrates with its syntactic context. The next section turns to this issue.

6   Distributivity

I proposed in Sections 3 and 4 that NPs built with *most* and *all* are integrated into the main predicate by predicate modification. This process combines two predicates and unifies their arguments to form a larger predicate, whose argument is then saturated

by existential closure—default insertion of an existential quantifier. This process cannot integrate an expression like *every swan* into a predicate like *be white*, since the former is a predicate of sets but the latter a predicate of individuals.

I claim that this combinatorial issue is related to what Beghelli & Stowell (1997) call the 'strong' distributivity of *every*, which manifests itself in the fact that it licenses a bound use of *different* in examples like (25a). The adjective *different* has a deictic use according to which the book in question is different from some specific previously mentioned book. The bound use in (25a) says that each boy read a book that is different from any book any other boy read. This reading is available to *every* (and *each*) but not *all* or other specifiers of quantity, shown in (25b).[6]

(25)   a. Every boy read a different book.   [deictic/bound]

       b. All of the boys read a different book.   [deictic/*bound]

Beghelli and Stowell claim that strong distributivity is the effect of a null syntactic head they call 'DIST' that attracts an NP headed by *every* to its specifier. Unlike other quantifiers, *every* gets its quantificational force from strongly distributive DIST. Beghelli and Stowell do not define DIST explicitly, but the definition in (26a) is compatible with the claim I make about the meaning of *every*. This operator combines with a predicate of individuals (the VP) and a predicate of sets (*every NP*) and distributes the VP over members of a set that exemplifies *every NP*. As a result, a sentence like *#Every swan gathered* is infelicitous, since the collective predicate *gather* is predicated of individual swans rather than pluralities.

(26)   a. $[\![\text{DIST}]\!] = \lambda P_{\langle e,t \rangle} \lambda \mathcal{X}_{\langle \langle e,t \rangle, t \rangle} [\exists X \ \mathcal{X}(X) \ \& \ \forall x \ [x \in X \rightarrow P(x)]]$

       b. $[\![\text{Every swan DIST gathered}]\!] =$
                                $\exists X \ [\text{every swan}](X) \ \& \ \forall x \ [X(x) \rightarrow \text{gathered}(x)]$

In contrast, modification of the collective predicate *gather* by an NP built with *all* or *most* gives *gather* a plurality-denoting argument, as discussed in Sections 3 and 4 and illustrated in (27). Unlike *every*, therefore, *all* and *most* are compatible with collective predicates. On the other hand, they do not license strong distributivity, since they do not occur in the context of DIST, as the unavailability of the bound reading of *different* in (25b) demonstrates.

(27) $[\![\text{All/most of the swans gathered}]\!] = \exists x \ [\text{all/most of the swans}](x) \ \& \ \text{gathered}(x)$

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6 Space requirements prevent me from discussing *each* in detail but the consideration just mentioned indicates that *each* is also a set description like *every*. Fodor & Sag (1982) propose that it is a counterpart to *every* that favors wide scope and Gil (1992) that it has a definiteness feature that requires a discourse antecedent. On both accounts, *each* is basically *every* with some additional component of meaning, which is compatible with my analysis.

I offer here a final observation that supports the analysis of *every* provided here over the conventional generalized quantifier analysis illustrated in (22a). The observation is that *every* is not compatible with a plural NP restrictor, even though plural NPs also denote sets (of pluralities).

(28)   *Every swans are white.

At first glance, nothing in either the superlative analysis of *every* in (23c) nor the generalized quantifier analysis in (22a) explains why (28) is ungrammatical. According to the generalized quantifier analysis, (28) asserts that each member of the set **S (the set of pluralities of swans) is in the set *W (the set of pluralities of white things). The superlative analysis gives *every swans* the denotation in (29), which describes a set X as a subset of *S, that is, as a set of pluralities of swans. It asserts that X has a greater cardinality—that is, it contains more pluralities of swans—than any non-identical set of pluralities of swans. The DIST operator says every plurality in X is in the set *W.

(29) $[\![$every swans$]\!] = \lambda X \max(\lambda d \ [\mu(X) \geq d \ \& \ X \sqsubseteq {}^*\mathbf{S}]) > \max(\lambda d' \ \exists X'[\neg X' = X \ \& \ \mu(X') \geq d' \ \& \ X' \in \mathscr{C} \ \& \ X' \sqsubseteq {}^*\mathbf{S}])$

According to the superlative analysis, in order to evaluate the meaning of (28), we must count the pluralities of swans in X and compare this quantity to the number of pluralities in X's alternatives represented by X' in (29). But there are reasons to believe that natural language grammars cannot count plural individuals. The claim that there are seven swans on the lake cannot be understood to mean that there are seven pluralities of swans there, and therefore only three individual swans. And 'seven' is not a felicitous answer to the question *How many swans are on the lake* in this circumstance (as Landman 1989 points out), no more than the question *How much water is in the lake* can be understood to be asking how many subparts the body of water has. Such analogies between pluralities and undifferentiated masses is just what Link's analysis of plurality discussed in Section 3 is designed to capture. If languages cannot count plural individuals any more than they can count undifferentiated masses, no language can interpret the expression in (29). The generalized quantifier analysis of *every* shown in (22a), however, does not count the members of the set that *swans* denotes, but simply asserts that all of them are in the set of white things. Such a non-counting analysis provides no insight into what could be wrong with (28).

7   Differences between *all* and *most*

The analysis provided here does not explain everything about the behavior of *all* and *most*, particularly certain dissimilarities between them. One such difference is

that *all* may distribute as a 'floated' quantifier (Kayne 1975; Jaeggli 1982; Sportiche 1988), while *most* may not. The analysis presented here offers no obvious reason for the ungrammaticality of (30b).

(30) a. The children have all eaten lunch.

  b. *The children have most eaten lunch.

Another difference is that *of* is obligatory with *most* in the context of a definite complement but optional with *all*.

(31) a. All (of) the swans are white.

  b. Most *(of) the swans are white.

It seems likely that that these two differences are related. Notice that *of* does not occur with floated *all* in (30a). In light of this, if *all* in (31a) may be construed as floated *all*, or as the syntactic source for *all*-float, we do not expect *of* to appear. From this perspective, *of* is obligatory when *all* or *most* has a definite nominal complement, but floated *all* is essentially adverbial and does not have a nominal complement. The possibility for floated *all* to precede its semantic restrictor makes it look like *of* is optional with *all*. What the relationship is between floated *all* and its semantic restrictor remains unclear.

Another difference between *all* and *most* is that *all* is compatible with certain specifiers such as *almost* and *not* that *most* is not compatible with. The present analysis does not obviously explain why this difference should exist.

(32) a. Almost/not all of the swans are white.

  b. *Almost/not most of the swans are white.

The differences above are surprising on any analysis that seeks to explain the fundamental combinatorial similarity between *all* and *most* by giving them the same semantic type. In light of this, these dissimilarities are puzzling on alternative accounts such as Crnič's (2010) shown in (7), which also attributes the same logical type to *all* and *most*. But giving *all* and *most* the same combinatorial type seems necessary to account for the fact that both combine with an individual and 'pick out' some proportion of that individual. In light of this, the differences mentioned above are not specific to the superlative analysis of *all*, but are puzzling from the perspective of any analysis that successfully captures the pattern in (2)-(6). It seems likely, therefore, that any explanation for the differences discussed above will be meaningful in the context of both Crnič's analysis and the superlative analysis presented here, and therefore that these differences do not speak forcefully against or in favor of either analysis.

There are, however, two differences between *all* and *most* that are puzzling from the perspective of the superlative analysis in particular. One is that *most* has a 'quality superlative' use that *all* lacks. Example (33a) asserts that the swan in question is more beautiful than any non-overlapping swan. Since swans don't overlap anyway, (33b) should mean the same as (33a), namely that the swan in question is more beautful than any non-identical swan. The fact that (33b) is completely ungrammatical is unexpected and requires an explanation if *all* is a superlative with the same type of meaning as *most*.

(33)   a. This is the most beautiful swan.

b. *This is the all beautiful swan.

Another expectation that the present analysis gives rise to is that the lift of *all* that generates the meaning of *every* could be expected to apply to *most* as well. If it did, then this lift of *most*—call it *L(most)*—would combine with a bare singular nominal complement and trigger strong distributivity, since like *every*, it could only combine with a VP through the mediation of DIST. If this were so, (34) would be grammatical and mean that there is a *X* that constitutes most of the set that *boy* denotes and each member of *X* read a book different from any book any other member read.

(34)   L(most) boy read a different book.

Since nothing on the pattern of (34) is grammatical in English, *L(most)* apparently has no lexicalization in that language. If lifting *most* in this manner is in principle possible, this amounts to an accidental lexical gap. Matthewson (2001) reports that the Salish language St'át'imcets has a word corresponding to English *all* but no word corresponding to *every*. From the perspective of the analysis presented here, this means that the lift of *all* that generates the meaning of *every* is not associated with any lexical item in that language. The absence of *L(most)* in English may have a similar explanation. If no grammatical principle rules out (34) then we expect to find a counterpart to (34) in some language. Whether such a language exists is not known to me.

8   Conclusion

The analysis presented here makes *all* a superlative of quantity like *most*. *Every* is *all* lifted to apply to sets (bare singulars). According to this analysis:

- The partitive operator PART that occurs in the context of *all* and *most* combines with an individual-denoting term; its lifted counterpart that occurs in the context of *every* combines with a set-denoting term, generating the pattern in (2).

- *All/most*+bare NP describes a kind-level individual, excluding it from episodic contexts and generating the pattern seen in examples (3) through (5).

- The fact that *all* and *most* describe plural individuals makes them compatible with collective predicates, generating the facts in (6a) and (6b).

- The strong distributivity of *every* seen in (6c) comes from the DIST operator required for its composition with a predicate of individuals.

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