Non-maximality and homogeneity: Parallels between collective predicates and absolute adjectives[1]

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Abstract. Sentences with definite plurals such as *The kids laughed* are known to display non-maximality and homogeneity. This is manifested not only in distributive predication but also in collective predication. However, I observe that collective predicates differ with respect to these properties: predicates like *gather* are non-maximal and homogeneous, while predicates like *fit in the trunk* are maximal and non-homogeneous. I argue that this distinction is parallel to a distinction in absolute gradable adjectives with totally-closed scales: *gather* patterns with adjectives like *open*, which have both maximum and minimum standard, while *fit in the trunk* patterns with adjectives like *full*, which only have a maximum standard. I account for the observed parallelism by analyzing collective predication using proportional scales.

Keywords: non-maximality, homogeneity, definite plurals, collective predicates, summative, integrative, *gather*/*numerous*, degree semantics, measure function, proportional scale.

1. Introduction

Sentences with definite plurals are known to display non-maximality and homogeneity. NON-MAXIMALITY means these sentences often allow for exceptions (Brisson, 2003). For instance, suppose that a teacher told a joke in class. Sentences (1a) and (1b) seem to have a similar meaning, but only (1a) can be used in a scenario where most, but not all, of the kids laughed.

(1) a. The kids laughed.
b. All the kids laughed.

The term HOMOGENEITY has been used in the literature on plurals in different ways. I use it here to refer to cases where: (i) a sentence does not have complementary truth conditions with its negation; and (ii) the uncertainty regarding the truth value of the sentence is related to the proportion of the argument that satisfies the predicate (Löbner, 2000). For instance, suppose that when the teacher told the joke, half of the kids laughed, and the other half burst in tears. Neither (2a) nor (2b) is judged as true in this scenario. Also note that while (2a) is similar in meaning to *All the kids laughed* in most contexts, its negation in (2b) is roughly equivalent to (2b-i) rather than (2b-ii).

(2) a. The kids laughed.
b. The kids didn't laugh.
(i) $\approx$ No kids laughed.
(ii) $\not\approx$ Not all of the kids laughed.

From this point on, I set aside the discussion of distributive predicates like *laugh* and focus on collective and singular predicates. Dowty (1987) observes that some collective predicates are very liberal in their non-maximality. For example, (3) is judged as true in a scenario where just a few of the kids actually built the raft, and the others sat idly and watched. This is known as a

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team credit interpretation.

(3) The kids built a raft.

Križ (2016: 516-519) argues that some collective predicates are also homogeneous. In a scenario where half of the kids gathered in the schoolyard and the others gathered in the hall, neither (4a) nor (4b) is judged as true. Note, again, that (4b) is roughly equivalent to (4b-i) rather than (4b-ii).

(4) a. The kids gathered in the schoolyard.
b. The kids didn't gather in the schoolyard.
(i) $\approx$ No kids gathered in the schoolyard.
(ii) $\not\approx$ Not all of the kids gathered in the schoolyard.

I observe that both non-maximality and homogeneity are correlated with the *gather/numerous* distinction proposed in Dowty (1987). The *gather* type consists of predicates that are compatible with proportional quantifiers like *all* and *most of* (5b). On the other hand, *numerous*-type predicates are incompatible with such quantifiers (6b). The generalization proposed here is that *numerous*-type predicates are always non-homogeneous, i.e., they have complementary truth conditions with their negations (disregarding the vagueness of predicates like *numerous*, which is related to degree rather than proportion). For instance, the *numerous*-type predicate *elect Mary for president* is non-homogeneous since either (7a) or (7b) has to be true. The notion of non-maximality is not applicable to *numerous*-type predicates because it is related to proportion, and these predicates hold of an argument as an integral whole (see Section 2.2).

(5) a. The kids gathered in the schoolyard.
b. {All / most of} the kids gathered in the schoolyard.

(6) a. The kids were numerous.
b. ?{All / most of} the kids were numerous.

(7) a. The students elected Mary for president.
b. The students didn't elect Mary for president.

I further observe that collective predicates of the *gather* type differ in their non-maximality and homogeneity properties. As we have seen, the predicate *gather* is non-maximal and homogeneous (4). On the other hand, *fit in the trunk* (on its collective reading) is maximal and non-homogeneous. This predicate belongs to the *gather* type since it is compatible with proportional quantifiers (8). However, it is maximal since (9a) does not allow for exceptions—it is true only if all of the suitcases fit in the trunk. If at least one suitcases does not fit, then (9a) is false and its negation (9b) is true. This means that *fit in trunk* is non-homogeneous since the truth conditions of the opposing sentences are complementary. Also note that (9b) is equivalent to (9b-ii) rather than (9b-i), unlike the pattern that we have observed in the case of *gather* (4).

(8) {All / most of} the suitcases fit in the trunk.

(9) a. The suitcases fit in the trunk.
b. The suitcases don't fit in the trunk.
(i) $\not\approx$ No suitcases fit in the trunk.
(ii) $\approx$ Not all of the suitcases fit in the trunk.

Other predicates that pattern with *gather* include *look at each other*, *get along*, *scatter*, and *hold hands*. On the other hand, *be the same size* and *suffice for the guests* (with respect to its second argument) pattern with *fit in the trunk*. For example, (10a) can be judged as true even if some of the kids did not look at any other kids. In addition, (10b) is most naturally interpreted as (10b-i) rather than (10b-ii). In contrast, *be the same size* requires a maximal interpretation since one counterexample is enough to falsify (11a) and make its negation (11b) true.

(10) a. The kids looked at each other.
b. The kids didn't look at each other.
(i) $\approx$ No kids looked at each other.
(ii) $\not\approx$ Not all of the kids looked at each other.

(11) a. The squares are the same size.
b. The squares aren't the same size.
(i) $\not\approx$ No two squares are the same size.
(ii) $\approx$ Not all of the squares are the same size.

These data support the view in Malamud (2012) and Križ and Spector (2017) that non-maximality and homogeneity are two sides of the same coin. Predicates like *gather* are non-maximal and homogeneous, whereas predicates like *fit in the trunk* are maximal and non-homogeneous. To the best of my knowledge, there are no predicates that are maximal and homogeneous or non-maximal and non-homogeneous. The question, then, is what makes a predicate belong to one category or the other.

(12) *The puzzle*:
Why do *gather* and *fit in the trunk* pattern differently with respect to non-maximality and homogeneity?

This paper is structured as follows: in Section 2, I discuss non-maximality and homogeneity in singular predication. This discussion is important for two reasons: (i) it shows that the analysis needs to be general enough in order to apply both to collective and to singular predication; and (ii) I will use singular predication as the basic case since its semantics is less complex. Section 3 proposes an account for the puzzle in (12). I draw parallels between collective predicates like *gather* and *fit in the trunk* and absolute gradable adjectives with totally-closed scales like *open* and *full*, respectively. I argue that *gather* and *open*, which have both maximum and minimum standard, represent the general case, whereas *fit in the trunk* and *full*, which only have a maximum standard, behave differently due to their lexical semantics. Section 4 rejects an alternative analysis that treats this opposition as pragmatic rather than semantic. In Section 5, I briefly discuss the consequences of the proposed analysis for the distinction between gradable and non-gradable adjectives in terms of modification. Section 6 concludes.

2. Beyond plural predication

2.1. Non-maximality and homogeneity in singular predication

Löbner (2000) observes that non-maximality and homogeneity are not restricted to plural predication. A predicate like *be red* is non-maximal since (13a) can be judged as true even if some parts of the sofa are not red, e.g., the legs. *Be red* is also homogeneous because if half of the sofa is red and half of the sofa is green, neither (13a) nor (13b) is judged as true.

(13) a. The sofa is red.
b. The sofa isn't red.
(i) $\approx$ No part of the sofa is red.
(ii) $\not\approx$ Not all of the sofa is red.

Corblin (2008) argues that the *gather/numerous* distinction is also not unique to plural (collective) predication. Some singular predicates are compatible with proportional quantifiers, just like *gather* (14), and other predicates pattern with *numerous* in being incompatible with such quantifiers (15).

(14) a. Most of the kids gathered in the schoolyard.
b. The sofa is entirely red.
c. The dish is partly cold.

(15) a. ?All of the kids were numerous.
b. ?Most of the sofa is heavy.
c. ?Fido partly barked.

I observe that while *be red* patterns with *gather* in being non-maximal and homogeneous (13), there are also predicates like *fit through the door*, *be gluten-free* and *be evenly warm*, which are maximal and non-homogeneous, just like *fit in the trunk*. Clearly, (16a) is true only if all of the sofa fits through the door; otherwise, (16b) is true. This means that whatever analysis we propose for the contrast we have observed in collective predicates should also account for the same contrast in the case of singular predicates.

(16) a. The sofa fits through the door.
b. The sofa doesn't fit through the door.
(i) $\not\approx$ No part of the sofa fits through the door.
(ii) $\approx$ Not all of the sofa fits through the door.

2.2. Summative vs. integrative predicates

Löbner (2000) proposes a binary classification of predicates based on inferences to parts:[2]

(17) *Summative vs. integrative* (to be revised)
a. A summative predicate is true of an argument only if it is true of every part in it.
b. An integrative predicate is true of an argument as an integral whole.

For instance, *be red* is summative because *The sofa is red* is true just in the case that the parts of the sofa are red; *be heavy* is integrative because *The sofa is heavy* means that the sofa as a whole is heavy, not that its parts are heavy. Summative predicates are compatible with proportional quantifiers (14), but integrative predicates are not (15).

Classifying predicates based on inferences to parts is encumbered by certain difficulties (Landman, 2000: 164-173). For instance, (18a) allows inference to parts but is incompatible with proportional quantifiers (18b). In order to circumvent this problem, I will use the terminology in Löbner (2000) in a purely descriptive manner as an extension of the *gather/numerous* distinction (19).

[2]cf. Corblin (2008) for an alternative taxonomy.

(18) a. The sofa weighs less than 100 kg.
b. ?The sofa partly weighs less than 100 kg.

(19) *Summative vs. integrative* (revised)
a. A summative predicate is one that is compatible with proportional quantifiers.
b. An integrative predicate is one that is incompatible with proportional quantifiers.

One would certainly like to explain the semantic basis of the distinction between summative and integrative predicates, and, indeed, several proposals have been made in the literature regarding the *gather/numerous* distinction, which is part of the broader issue (see e.g., Champollion, 2015; Kuhn, 2020). However, nothing in the analysis proposed in this paper hinges on that question, so I will remain agnostic on this point.

2.3. Interim summary

We have seen that both singular and collective predicates can be divided into two major categories: summative and integrative. Summative predicates can be further divided into two subcategories: (i) predicates that are non-maximal and homogeneous; and (ii) predicates that are maximal and non-homogeneous. The emergent taxonomy is summarized in Table 1.

Table 1: Taxonomy of summative and integrative predicates

	Summative		**Integrative**
Singular predicate	*be red*	*fit through the door*	*be heavy*
Collective predicate	*gather*	*fit in the trunk*	*numerous*
Proportional modification	✓	✓	✗
Non-maximality	non-maximal	maximal	NA
Homogeneity	homogeneous	non-homog.	non-homog.

The goal of this paper is to account for the distinction between the two types of summative predicates and explain the non-maximality and homogeneity properties of each subcategory. In the next section, I will start with singular predicates and then return to collective predicates.

3. Analysis

This section is structured as follows: Section 3.1 presents the formal tools that will be used in the analysis: proportional measure functions and proportional scales, which were introduced in Solt (2018) for the purpose of analyzing proportional comparatives. Section 3.2 applies these tools to the positive form of summative predicates such as *be red* and *be wooden*. Section 3.3 discusses the question of what determines the standard of comparison for the positive form and argues that since proportional scales are totally closed by definition, summative predicates are similar to absolute gradable adjectives such as *open* and *full*. Section 3.4 discusses summative predicates that pattern with *open* in having both maximum and minimum standard. Section 3.5 discusses summative predicates that only have a maximum standard, just like *full*, and argues that their lexical semantics rules out a minimum standard interpretation. Section 3.6 summarizes the analysis.

3.1. Proportional measure functions

Sentences such as (20) are ambiguous between an absolute reading and a proportional reading. Probably, (20) is false under the absolute reading given that there are many more people living in New York City than in Ithaca, but it might be true under the proportional reading.

(20) More residents of Ithaca than New York City know their neighbors. (Solt, 2018)
   a. Absolute reading: There are more people in Ithaca who know their neighbors than there are people in New York City who know their neighbors.
   b. Proportional reading: The proportion of Ithaca residents who know their neighbors is higher than the proportion of New York City residents who know their neighbors.

Solt (2018) proposes that proportional readings of comparatives involve a proportional measure function, which maps parts of an entity to the proportion they represent of the totality.[3] For instance, in the case of (20), the proportional measure function maps pluralities of Ithaca residents to the proportion they represent of the totality of Ithaca residents. A formal definition of a proportional measure function is given in (21), taken from Solt (2018: 1128). The symbol $\sqsubseteq$ represents a part-of relation.

(21) A PROPORTIONAL MEASURE FUNCTION is a function of the following form:
For $y \sqsubseteq x$: $\mu^c_{DIM;x}(y) = \mu^c_{DIM-prop;x}(y) = \frac{\mu^c_{DIM}(y)}{\mu^c_{DIM}(x)}$

The proportional measure function is introduced by a null functional head *Meas* (for *measure*), whose denotation is given in (22). The symbol $\bigoplus P$ represents a generalized sum of the entities in the denotation of P. For example, $\bigoplus$*Ithaca-residents* is the sum of Ithaca residents.

(22) $[\![Meas_D]\!]^c = \lambda x \lambda d \lambda y.[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\bigoplus x}(y) = d]$

Solt (2018) focuses on plural distributive predicates, which are summative (Löbner, 2000), but her analysis can apply to summative predicates in general. For example, consider (23), which contains the summative (non-gradable) predicate *be wooden*. Its truth conditions can be derived in the same manner as (20), as shown in (24). Note that the dimension of the measure function is contextually determined. In distributive predication, the only possible dimension is cardinality, so (20) cannot be interpreted as "more residents as measured by weight". On the other hand, the dimension of the measure function in (23) can be weight, area, volume, etc.

(23) More of the brown door is wooden than of the red door.

(24) $\max\left\{d : \exists y[y \sqsubseteq \textit{brown-door} \wedge \mu^c_{DIM-prop;\bigoplus \textit{brown-door}}(y) = d \wedge \textit{wooden}(y)]\right\} \succ$
$\max\left\{d : \exists y[y \sqsubseteq \textit{red-door} \wedge \mu^c_{DIM-prop;\bigoplus \textit{red-door}}(y) = d \wedge \textit{wooden}(y)]\right\}$

3.2. The positive form

The notion of proportional scales invites a comparison between summative predicates and gradable adjectives—the former involve proportional scales, and the latter involve ordinary degree

[3] Solt (2018) considers proportional measure functions to be a subtype of a domain-restricted measure function. The latter also includes measure functions that are involved in non-proportional partitives such as *Twenty of the students wrote papers*.

scales. This paper is concerned with the positive form of summative predicates like *be wooden* (26b). Just like we can ask how tall John has to be in order to qualify as tall in a given context (25b), we can also ask how much of the door has to be wooden for the door itself to be considered wooden (26b).

(25) Gradable adjective
  a. John is 6 feet tall. (measure phrase)
  b. John is tall. (positive form)

(26) Summative predicate
  a. This door is 80% wooden. (proportion phrase)
  b. This door is wooden. (positive form)

According to the standard analysis, gradable adjectives like *tall* are predicates of type $\langle d, \langle e,t\rangle\rangle$ (Cresswell, 1976). They introduce a degree argument as part of their semantics, and this argument can be filled by a measure phrase (27a). In the absence of a measure phrase, a phonologically null *pos* operator fills this position (27b) and introduces a standard of comparison (Bartsch and Vennemann, 1972).

(27) a. John is [$_{DegP}$ six feet [$_{AP}$ tall]].
  b. John is [$_{DegP}$ *pos* [$_{AP}$ tall]].

On the other hand, non-gradable adjectives like *wooden* are predicates of type $\langle e,t\rangle$. The standard analysis of sentences like (26b) does not involve a *pos* operator since non-gradable adjectives do not lexicalize a degree argument. Rather, *wooden* combines with *this door* by Functional Application (FA). Nothing in the semantics says how much of the door is in fact wooden. However, since *wooden* is summative, it can also be associated with a proportion phrase (26a). In this case, the degree argument is introduced by *Meas* (28).

(28) This door is [$_{MeasP}$ 80% *Meas* [$_{AP}$ wooden]].

Solt (2018) suggests, following Schwarzschild (2006), that *Meas* is the covert instantiation of partitive *of*, e.g., in *Many of the students*. I will assume two types of *Meas*: one that modifies the DP (29a) and one that occurs inside the VP (29b). I will call the former $Meas_D$ (determiner *Meas*) and the latter $Meas_A$ (adverbial *Meas*). Adverbial quantifiers do not contain an overt partitive, so $Meas_A$ does not seem to have an overt instantiation.

(29) a. 80% of this door is wooden.
  b. This door is 80% wooden.

Since $Meas_D$ first combines with the DP and $Meas_A$ first combines with the predicate, we need a slightly different denotation for $Meas_A$ from the one we had for $Meas_D$ in (22). The crucial difference between the two denotations is the order in which they take their arguments.

(30) $[\![Meas_A]\!]^c = \lambda P_{\langle et\rangle}\lambda d\lambda x.\exists y[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\oplus x}(y) = d \wedge P(y)]$

The semantic derivation of (28) is the following:

(31) $[\![Meas_A\ wooden]\!]^c = ([\![Meas_A]\!]^c)([\![wooden]\!]^c)$
$= (\lambda P_{\langle et\rangle}\lambda d\lambda x.\exists y[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\oplus x}(y) = d \wedge P(y)])(\lambda x.wooden(x))$
$= \lambda d\lambda x.\exists y[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\oplus x}(y) = d \wedge wooden(y)]$ (by FA)

$$[\![80\%\ Meas_A\ wooden]\!]^c = ([\![80\%]\!]^c)([\![Meas_A\ wooden]\!]^c)$$
$$= (80\%)(\lambda d \lambda x.\exists y[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\oplus x}(y) = d \wedge wooden(y)])$$
$$= \lambda x.\exists y[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\oplus x}(y) = 80\% \wedge wooden(y)] \quad \text{(by FA)}$$

$$[\![This\ door\ is\ 80\%\ Meas_A\ wooden]\!]^c = ([\![this\ door]\!]^c)([\![is\ 80\%\ Meas_A\ wooden]\!]^c)$$
$$= (this\ door)(\lambda x.\exists y[y \sqsubseteq x \wedge \mu^c_{DIM-prop;\oplus x}(y) = 80\% \wedge wooden(y)])$$
$$= \exists y[y \sqsubseteq this\text{-}door \wedge \mu^c_{DIM-prop;\oplus this-door}(y) = 80\% \wedge wooden(y)] \quad \text{(by FA)}$$

One can view *Meas* merely as a type shifter that is needed for the proportion phrase to combine with the summative predicate. In this case, *Meas* is not part of the structure in the absence of a proportion phrase. I will take a different approach and assume that *Meas* is present whenever the predication is summative. In the positive form—i.e., when there is no proportion phrase—a null *pos* morpheme saturates the degree argument introduced by *Meas*, as in (32). This will allow us to derive non-maximality and homogeneity.[4]

(32) This door is [$_{MeasP}$ *pos* $Meas_A$ [$_{AP}$ wooden]].

There are two possibilities for the position of *Meas* in the positive form: as a sister of the DP ($Meas_D$) or inside the VP ($Meas_A$). I choose the second option. The argument comes from the way conjunction of a summative and an integrative predicate works. I assume that *Meas* cannot combine with an integrative predicate like *heavy*:[5]

(33) ?This door is [$_{MeasP}$ 80% $Meas_A$ [$_{AP}$ heavy]].

Now, one can conjoin a summative and an integrative predicate in the positive form (34a), but not when there is a proportion phrase that attaches to a shared argument (34b). On the other hand, the proportion phrase can attach to the summative predicate as long as its scope is limited to the first conjunct (34c). I conclude that $Meas_A$ is at play in the positive form.

(34) a. This door is wooden and heavy.
b. ?80% of this door is wooden and heavy.
c. This door is 80% wooden and heavy.

The same analysis applies to summative collective predicates (35b).

(35) a. The kids gathered in the schoolyard.
b. The kids [$_{MeasP}$ *pos* $Meas_A$ [$_{VP}$ gathered in the schoolyard]].

I follow Kuhn (2020), who argues that collective predicates like *gather* denote events which can be divided into subevents that are also gathering events. Evidence for this comes from their compatability with *same*, which requires a plurality of events (Carlson, 1987). For example, (36a) cannot describe a single event of Mary selling a book to John but requires two distinct buying and selling events. According to Kuhn, the fact that (36b) is acceptable supports the view that *gather* can be divided into a plurality of subevents.

[4]Bochnak (2013) proposes a similar analysis for sentences with an incremental theme argument such as *Cathy ate the apple*. However, he assumes that the standard of comparison is always the maximum, which makes different predictions compared to the analysis proposed in this paper.

[5]I remain agnostic regarding the mechanism that rules out a structure such as (33)

(36) a. John bought and Mary sold the same book. (Barker, 2007)
b. For the first time in history, the main parties to the conflict have gathered in the same room.

3.3. The standard of comparison

We have yet to explain what determines the standard of comparison for being wooden or for having gathered. Summative predicates are associated with proportional scales, which are totally closed by definition. In this sense, summative predicates are similar to absolute gradable adjectives, which also have (partially or totally) closed scales.[6] Kennedy (2007) argues that while the standard of comparison for relative adjectives like *tall* is relative to a comparison class, in absolute adjectives like *dry* the standard is relative to a scalar endpoint (cf., McNally, 2009; Toledo and Sassoon, 2011). For instance, (37b) does not mean that the towel is dry compared to other towels, but that it has a maximum standard of dryness. Kennedy ascribes this choice of standard to a principle of Interpretive Economy, articulated in (38), which favors a scalar-endpoint standard over a context-dependent, relative standard of comparison.

(37) a. John is tall. (for a boy his age)
b. The towel is dry. (≈ completely dry)

(38) *Interpretive Economy* (Kennedy, 2007)
Maximize the contribution of the conventional meanings of the elements of a sentence to the computation of its truth conditions.

An absolute adjective can have a partially closed scale, in which case only one member of the antonym pair has a maximum standard (39a), or a totally-closed scale, in which case both antonyms have a maximum standard (39b).

(39) a. The rod is perfectly {straight / ?bent}.
b. The glass is completely {full / empty}.

Kennedy (2007) distinguishes two types absolute adjectives with totally-closed scales: the *open* type and the *full* type. The *open* type has both maximum and minimum standard (40a), whereas the *full* type only has a maximum standard (40b).

(40) a. The window is {completely / slightly} open.
b. The glass is {completely / ?slightly} full.

I argue that this distinction is parallel to the one we have observed for summative predicates. A predicate like *be wooden* has both maximum and minimum standard with respect to a proportional scale. It is easy to show that is has a maximum standard (41), but the minimum standard is trickier. English does not have a proportional modifier that is parallel to *slightly*, which is the diagnostic that is used in the literature for the existence of a minimum standard. However, Hebrew has such a proportional modifier. While *bemikcat* 'slightly' is a degree modifier (42a), it can be turned into a proportional modifier by attaching a clitic personal pronoun to it (42b),

[6]The similarity between plural predication and absolute adjectives has been suggested before in Burnett (2017: 151-155). Burnett compares sentences with definite plurals to maximum standard adjectives and argues that non-maximality is a case of imprecision. On the other hand, this paper argues that non-maximality is a result of having both maximum and minimum standard, so it is not an instance of imprecision. See Section 4 for discussion.

e.g., *bemikcat-o* (lit. 'in its slightly'). Note that this adverb can also have a proportional reading when modifying a plural distributive predicate (42c).

(41) The door is {completely / entirely / 100%} wooden.

(42) Modern Hebrew

a. ha-seret mafxid bemikcat.
the-movie scary slightly
'The movie is slightly scary.' (scariness scale)

b. ha-seret mafxid bemikcat-o.
the-movie scary slightly-3SG.M
'A small part of the movie is scary.' (proportional scale)

c. ha-srat-im mafxid-im bemikcat-am.
the-movie-PL scary-PL slightly-3PL.M
'A few of the movies are scary.' (proportional scale)

I observe that the *open* type and the *full* type interact differently with negation. In the *open* type, negation denies that the argument possesses a minimal degree. As a result, (43b) is similar in meaning to (43b-i). On the other hand, in the *full* type, negation denies that the argument possesses a maximal degree, so (44b) is similar in meaning to (44b-ii).

(43) a. The window is open.
b. The window isn't open.
(i) $\approx$ The window is closed.
(ii) $\not\approx$ The window isn't completely open.

(44) a. The glass is full.
b. The glass isn't full.
(i) $\not\approx$ The glass is empty.
(ii) $\approx$ The glass isn't completely full.

Note that the *open* type patterns with *gather* (4), repeated here as (45), while the *full* type patterns with *fit in the trunk* (9), repeated here as (46).

(45) a. The kids gathered in the schoolyard.
b. The kids didn't gather in the schoolyard.
(i) $\approx$ No kids gathered in the schoolyard.
(ii) $\not\approx$ Not all of the kids gathered in the schoolyard.

(46) a. The suitcases fit in the trunk.
b. The suitcases don't fit in the trunk.
(i) $\not\approx$ No suitcases fit in the trunk.
(ii) $\approx$ Not all of the suitcases fit in the trunk.

Following Kennedy (2007), I am assuming that the default for predicates with totally-closed scales is having both maximum and minimum standard, like *open*. Predicates like *full*, which only have a maximum standard, are the exception rather than the rule.

3.4. Summative predicates that are like the *open* type

Kennedy (2007) argues that out of context, *open*-type adjectives have a preference for a maximum standard interpretation in affirmative sentences (47a) and a minimum standard interpretation in negative sentences (47b). However, even in affirmative sentences, a minimum standard interpretation can be made salient by the context (47c). Kennedy ascribes these preferences to a Strongest Meaning Hypothesis (SMH) mechanism. Originally conceived for reciprocals, SMH states that stronger meanings are preferred, as long as they are consistent with world knowledge and the context (Dalrymple et al., 1998). In Upward-Entailing (UE) contexts, the maximum standard interpretation entails the minimum standard interpretation (47a). On the other hand, in Downward-Entailing (DE) contexts, the minimum standard interpretation is stronger (47b).

(47) a. The window is open. (maximum standard preferred)
b. The window isn't open. (minimum standard preferred)
c. The window is almost closed, but not quite. It's still open.

Interestingly, this is exactly the analysis that Krifka (1996) proposes for plural predication. Krifka (1996: 146) proposes that "[i]f a predicate P applies to a sum individual x, grammar does not fix whether the predication is universal ($\forall y[y \sqsubseteq x \rightarrow P(y)]$) or rather existential ($\exists y[y \sqsubseteq x \rightarrow P(y)]$), except if there is explicit information that enforces one or the other interpretation." Given SMH, in UE contexts there is a preference for universal (=maximum standard) interpretation (48a), while in DE contexts there is a preference for existential (=minimum standard) interpretation (48b).

(48) a. The kids laughed. (maximum standard preferred)
b. The kids didn't laugh. (minimum standard preferred)

In Krifka (1996), plural distributive predication is stipulated to be underspecified between universal and existential quantification. I argue that we can ground this stipulation in scale structure. Summative predicates (e.g., plural distributive predicates) are associated with a proportional scale. Such scales are totally closed by definition, and by default, predicates with totally-closed scales can have both maximum and minimum standard. One may argue that we have just replaced one stipulation for another—i.e., Krifka's stipulation of underspecification for Kennedy's Interpretive Economy principle. However, I believe that unifying these two seemingly unrelated phenomena lends support to both of these analyses.

Summative predicates like *be red* pattern with the *open* type. This is demonstrated in (13), repeated here as (49). In (49a), the maximum standard is preferred, and we get the meaning that a maximal proportion of the sofa is red. In (49b), the minimum standard is preferred, so negation denies that a minimal (non-zero) proportion of the sofa is red. This results in homogeneity.

(49) a. The sofa is red. (maximum standard preferred)
b. The sofa isn't red. (minimum standard preferred)
(i) $\approx$ No part of the sofa is red.
(ii) $\not\approx$ Not all of the sofa is red.

Non-maximality is due to the possibility of choosing between maximum and minimum standard. Consider the following scenario: Bill is making mashed potatoes. His roommate, Sue,

notices that one of the potatoes has some green spots on it. Sue knows that green potatoes might be poisonous, so she utters (50a) to warn Bill. This sentence is felicitous even though only a small part of the potato skin is in fact green. Non-maximality is also possible under negation, but apparently more difficult to get. For instance, suppose that Bill is making a dish that calls for a bright red tomato. Sue hands him a tomato that has some green spots on it but is otherwise red. Then, Bill utters (50b). Again, this sentence is felicitous even though some, and possibly most, of the tomato is red.

(50) a. Don't use this potato, it's green. (minimum standard interpretation)
b. I can't use this tomato, it's not red. (maximum standard interpretation)

These examples show that non-maximality can be rather extreme given the right context. This is also true for summative collective predicates like *gather*. The proposed analysis predicts that *gather* can have a minimum standard, where only a small subset of the plural entity denoted by the argument is actually involved in the gathering event. The following example has been suggested to me by Jeremy Kuhn (p.c.): In a Paris university, students protest by blocking the entrance to the elevator. There are 200 students involved in these protests, and they take turns in blocking the elevator. Marie, a professor at the university, walks into the building and sees five students in front of the elevator. Then, Marie says (51) to her colleague. In this scenario, *gather* allows for extreme non-maximality due to a team credit interpretation.

(51) The students are gathering in front of the elevator again. We'll have to take the stairs.

3.5. Summative predicates that are like the *full* type

I argue that summative predicates that only have a maximum standard are the exception rather than the rule. They can be divided into two subcategories:

- *evenly/equally/the same*: universal quantification is built into their semantics
- *fit/suffice*: involve (indirect) comparison of degrees

Consider the contrast in (52). Adding *evenly* enforces a maximal interpretation—i.e., makes the minimum standard unavailable. As a result, *evenly warm* is non-homogeneous: either (53a) or (53b) has to be true since both sentences have a maximum standard interpretation.

(52) a. The room is warm, but it's chilly by the window. (non-maximal)
b. #The room is evenly warm, but it's chilly by the window. (maximal)

(53) a. The room is evenly warm. (maximum standard)
b. The room isn't evenly warm. (maximum standard)

Such examples are instances of the internal reading of *same*, e.g., (54). Most analyses posit universal quantification as part of the semantics of *same* (e.g., Carlson, 1987; Dowty, 1985; Barker, 2007). Given that universal quantification is built into the semantics of predicates like *be the same height*, only the maximum standard is available, so the predicate is maximal and non-homogeneous.

(54) a. The boys are equally tall.
b. The boys are the same height.

The other subcategory includes predicates like *fit*, with respect to its first argument, and *suffice*, with respect to its second argument. Both of these predicates are maximal and non-homogeneous (55)-(56).

(55) a. The suitcases fit in the trunk. (false if one suitcase doesn't fit)
b. The suitcases don't fit in the trunk.
(i) $\not\approx$ No suitcases fit in the trunk.
(ii) $\approx$ Not all of the suitcases fit in the trunk.

(56) a. The chairs sufficed for the guests. (false if one guest didn't have a chair)
b. The chairs didn't suffice for the guests.
(i) $\not\approx$ The chairs didn't suffice for any of the guests.
(ii) $\approx$ The chairs didn't suffice for all of the guests.

Note that *fit* and *suffice* are mirror images of each other in several ways. First, we have seen that the first argument of *fit* patterns with the second argument of *suffice*. Second, *fit* and *suffice* are integrative on their first and second arguments, respectively (57). Finally, as suggested to me by Ashwini Deo (p.c.), both predicates seem to involve an indirect comparison of degrees. They are mirror images also in this respect: (58a) conveys that the suitcases (taken together) are smaller in size than the trunk; (58b) conveys that there were more chairs than guests. Note that I am not suggesting that these are the truth conditions of these sentences. For instance, I take the truth conditions of (58a) to be that there is a root possibility of the suitcases being in the trunk. However, I suggest that we assess the truth or falsity of such statements by a comparison of some sort. This account also applies to absolute adjectives like *full* (58c).

(57) a. ?The suitcases fit in most of the trunk.
b. ?Most of the chairs sufficed for the guests.

(58) a. The suitcases fit in the trunk. [size(suitcases) $\leq$ size(trunk)]
b. The chairs sufficed for the guests. [number(chairs) $\geq$ number(guests)]
c. The glass is full. [volume(liquid) $\geq$ volume(glass)]

Given that the comparative meaning is not part of the basic meaning of these predicates, I cannot offer a compositional analysis. However, if one accepts that comparison is somehow involved in the evaluation of propositions with *fit* and *suffice*, we can explain why these predicates only have a maximum standard. According to von Stechow (1984), comparatives are interpreted using a maximality operator. Since size is additive, the maximal size of the sum of the suitcases is the size of *all* the suitcases taken together. Therefore, *fit in the trunk* requires a maximal interpretation.

3.6. Summary of this section

The analysis proposed in this section is summarized in Table 2.

Table 2: Partial taxonomy of predicates

	Summative / absolute gradable adjective		**Integrative / non-gradable**
Standard of comparison	Max + Min	Max	Non-scalar
Scale introduced by Adj.	*open*	*full*	*odd*
Scale introduced by *Meas*	*be red*	*fit through the door*	*be heavy*
Scale introduced by *Meas*	*gather*	*fit in the trunk*	*be numerous*
Degree/proportional mod.	✓	✓	✗
Non-maximality	non-maximal	maximal	NA
Homogeneity	homogeneous	non-homog.	non-homog.

Table 2 suggests a similarity between integrative predicates and non-gradable adjectives, which has not been discussed so far in this paper. Integrative predicates are non-scalar with respect to a proportional scale, just like non-gradable adjectives are non-scalar with respect to a degree scale. Note that these two properties are independent of each other: Integrative predicates can be gradable, e.g., *The door is very heavy*, and non-gradable adjectives can be summative, e.g., *Robocop is partly human*. Integrative predicates are incompatible with proportional modifiers (59a), and non-gradable adjectives are incompatible with degree modifiers (59b). Also, just like we cannot really talk about non-maximality with respect to integrative predicates, it makes no sense to say that loosely speaking, 7 is odd. Finally, non-gradable adjectives give rise to complementary truth conditions with their negations (60).

(59) a. ?The door is entirely heavy.
b. ?7 is fully odd.

(60) a. 7 is odd.
b. 7 is not odd.

4. Against a pragmatic account

In the previous section, I argued that the difference between predicates like *gather* and predicates like *fit in the trunk* is due to their lexical semantics. In this section, I reject an alternative analysis, which takes this distinction to be pragmatic. The idea goes as follows: *fit in the trunk* requires a maximal interpretation not because there is anything special about its semantics, but because it is difficult to come up with a context that would allow us to ignore exceptions in a sentence such as (61).

(61) The suitcases fit in the trunk.

I have two objections to this analysis. First, it is unclear why out of the blue, a sentence like *The squares are the same size* strongly favors a maximal interpretation (11a), whereas *The kids looked at each other* does not (10a). Second, I argue that a semantic analysis better explains why certain predicates are more liberal than others in the proportion of exceptions they allow.

A consequence of the analysis proposed in this paper is that (contra Lasersohn, 1999) non-maximality is not a case of imprecision. Imprecision, also known as pragmatic slack or loose talk, is a pragmatic phenomenon that is relevant for expressions that have a fixed, precise se-

mantic meaning. For instance, (62) has a precise meaning, but in most contexts it can be used felicitously even if Mary arrived a few minutes before or after the said time.

(62) Mary arrived at three o'clock. (Lasersohn, 1999: 522)

Similarly, adjectives that have a fixed maximum standard allow for imprecision—e.g., (63a) can be used in certain contexts to describe a glass that is 95% full (Kennedy, 2007). On the other hand, it is not pragmatic slack to use (63b) to describe a partially open window. (63b) is perfectly compatible with the semantics of *open* since this adjective has both maximum and minimum standard. This is a difference not only of quality but also of degree—(63b) can be used even if the window is only 5% open (e.g., if the air conditioning is on), but (63a) can never be used to described a glass that is only 5% full.

(63) a. The glass is full.
b. The window is open.

I argue that the same holds for imprecision and non-maximality that are related to proportion. Summative predicates that are like the *full* type (see Section 3.5) can exhibit imprecision but not non-maximality since they have a fixed maximum standard. On the other hand, summative predicates that are like the *open* type (see Section 3.4) can exhibit non-maximality since they have both maximum and minimum standard. Just like in the domain of absolute gradable adjectives, non-maximality is more extreme than imprecision. For instance, *shake hands* has both maximum and minimum standard, so (64a) can be used in certain contexts even if, say, only six out of twenty-two players shook hands with other players. On the other hand, *look at the same direction* only has a maximum standard. (64b) might allow for imprecision in certain contexts, e.g., if one of the players is looking at the ground. However, it is definitely false if only six players looked at the same direction while the remaining sixteen looked at their feet.

(64) a. After the game was over, the players shook hands.
b. The players looked at the same direction in anticipation.

I conclude from these observations that there are good grounds to treat the distinction between the two types of summative predicates as semantic rather than as purely pragmatic.

5. Consequences for gradable vs. non-gradable opposition

According to the standard analysis, a non-gradable adjective like *wooden* cannot combine with degree modifiers like *very* because of type mismatch—*wooden* does not have a degree argument that *very* can combine with. Under the current analysis, once *wooden* combines with $Meas_A$, the resulting function has a type of $\langle d, \langle e,t \rangle \rangle$, just like a gradable adjective. The question, then, is why sentences such as (65) are unacceptable.

(65) a. ?This door is very wooden.
b. ?This door is so wooden!
c. ?This is the most wooden door that you will find.

I argue that these sentences are bad not due to type mismatch but due to a syntactic restriction on these modifiers. Some gradable adjectives are also summative, and one can stack a proportional modifier and a degree modifier in the same clause (66a). This is predicted since these modifiers occupy different structural positions (66b).

(66) a. The lagoon is partly very deep.
b. The lagoon is [$_{MeasP}$ partly $Meas_A$ [$_{DegP}$ very [$_{AP}$ deep]]].

Some adverbs are ambiguous between being a degree modifier and a proportional modifier, but others are restricted to one of these functions. For instance, (67) can mean that half of the area of the towel is dry, but it is also possible that all of the towel is somewhat damp. On the other hand, (68) is true only in the former scenario since Hebrew *bexelka* 'partly' is only a proportional modifier. In contrast, the adverb *very* can only occur in a structural position below $Meas_A$ (66b).

(67) The towel is half dry. (degree/proportion)

(68) Modern Hebrew
ha-magevet yeveš-a be-xelk-a.
the-towel dry-SG.F in-part-3SG.F
'The towel is partly dry.' (only proportion)

Comparatives pose another challenge for the proposed analysis. Non-gradable adjectives cannot occur in an ordinary comparative construction (69a). When a gradable adjective that is also summative occurs in this construction, only a degree reading is available. For example, (69b) cannot mean that a larger area of the red sofa is soft compared to the green sofa.

(69) a. ?The brown door is more wooden than the red door.
b. The red sofa is softer than the green sofa. (only degree)

I suggest that this restriction is syntactic, just like the restriction on degree modifiers. Proportional comparatives in English are possible when *more* is attached to the argument, e.g., (23), repeated here as (70a) (see §3.1 for discussion). Bresnan (1973: 276) proposes that *more* is the comparative form of *much* and *many*. Note that *much* also must attach to the argument (70b)-(70c). It is conceivable that (69a) is bad for the same syntactic reason that (70c) is bad with *much(ly)*. The prediction is that in languages that have an adverb like *much(ly)*, comparatives like (69a) would also be acceptable. Unfortunately, I am not aware of such a language.

(70) a. More of the brown door is wooden than of the red door.
b. {Most of/part of/80% of/much of} this door is wooden.
c. This door is {mostly/partly/80%/*much(ly)} wooden.

Note, however, that there are cases of proportional comparatives where *more* can attach to the predicate. This is possible when the comparison is not between individuals but within an individual. For example, (71a) means that in terms of area, a larger proportion of Vermilion Parish is water than land (compare with (71b)). Adverbial *much(ly)* cannot occur in this position (71c), and (71d) is used instead (compare with (71e)).[7] I have no explanation for these facts.

(71) a. Vermilion Parish is more water than land.
b. ?Snails are more water than humans (are).
c. ?Vermilion Parish is much(ly) water.
d. Much of Vermilion Parish is water.
e. Vermilion Parish is mostly water.

[7]Note that *much* is a Negative Polarity Item in some of its uses. However, the negative counterpart of (71c) is just as bad: ?*Vermilion Parish isn't much water*. I thank the anonymous SuB24 editor for this comment.

6. Conclusion

The starting point of this paper was a distinction between two subtypes of collective predicates that belong to the *gather* type: predicates like *gather*, which are non-maximal and homogeneous, and predicates like *fit in the trunk*, which are maximal and non-homogeneous. I then observed that this distinction is not restricted to collective predicates but also found in summative singular predicates such as *be red* and *fit through the door*. I argued that summative predicates do not combine directly with their arguments—instead, they are mediated by a phonologically null functional head *Meas*, which introduces a proportional measure function.

Since proportional scales are totally closed by definition, summative predicates are similar to absolute gradable adjectives with totally-closed scales. Following Kennedy (2007), I assume that predicates with totally-closed scales have by default both maximum and minimum standard. This category includes summative predicates like *gather* (collective) and *be red* (singular) and absolute adjectives like *open*. On the other hand, some predicates with totally-closed scales only have a maximum standard due to their lexical semantics. This category includes summative predicates like *fit in the trunk* (collective) and *fit through the door* (singular) and absolute adjectives like *full*. The existence of a minimum standard is responsible for non-maximality and homogeneity—non-maximal interpretations arise when the context makes the minimum standard salient; homogeneity is a result of a preference for maximum standard in UE contexts and minimum standard in DE contexts.

Extending this analysis to distributive predication is left for future research. The main open question is how *Meas* interacts compositionally with the covert distributivity operator proposed in Link (1991). However, two points can already be made. First, plural distributive predicates are summative by definition (Löbner, 2000). Second, as far as I can tell, distributive predicates are always non-maximal and homogeneous—i.e., have both maximum and minimum standard. For instance, *These suitcases don't fit in the overhead compartment* is homogeneous in its distributive reading since it conveys that none of the suitcases fit in the overhead compartment. In other words, the distinction that was observed in collective and singular predication is apparently not found in distributive predication. If this is true, an account of these facts will need to explain why the lexical semantics of a predicate like *fit* does not affect the availability of a minimum standard in distributive predication.

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