

Universals in superlative semantics*

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Abstract

This paper reports on the results of a broad crosslinguistic study on the semantics of quantity words such as *many* in the superlative (e.g. *most*). While some languages use such a form to express both a relative reading (as in *Gloria has visited the most continents*) and a proportional reading (as in *Gloria has visited most continents*), the vast majority do not allow the latter, though all allow the former. It is argued that a degree-quantifier analysis of quantity words is best suited to explain why proportional readings typically do not arise for quantity superlatives. Based on morphosyntactic evidence, two alternative diachronic pathways through which proportional quantifiers may develop from quantity superlatives are identified.*

Keywords: quantity words, superlatives, measurement, universals, typology, fieldwork, semantics

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1. INTRODUCTION. Proportional *most* got its first big break in linguistics with its starring role in Barwise & Cooper's (1981) demonstration that first-order logic is not sufficient to represent it.¹ No clever use of universal and/or existential quantifiers provides an adequate paraphrase of the following in first-order logic:

- (1) Gloria has visited **most** continents. PROPORTIONAL
 ≈ 'Gloria has visited the majority of continents.'

The remedy Barwise & Cooper (1981) proposed was to treat natural language quantifiers as binary relations among sets, viz. as generalized quantifiers. Then (1) can be paraphrased as: 'The set of continents Gloria has visited outnumbers the set of continents Gloria hasn't visited'. On this view, proportional *most* is a lexical item whose meaning cannot be further decomposed (Keenan 1997; Ariel 2004; Horn 2006; Dobrovie-Sorin & Giurgea 2015). Barwise & Cooper's (1981) framework has stimulated a rich discussion regarding semantic universals (Bach, Jelinek, Kratzer & Partee 1995; von Stechow & Matthewson 2008; Steinert-Threlkeld & Szymanik 2019, i.a., and references therein).

As Barwise & Cooper (1981) themselves noted, though, generalized quantifiers are not necessary to remedy this deficiency of first-order logic. A logic without generalized quantifiers that allows for talk of plural individuals could also represent proportional *most*. This observation opens the door to a view of proportional *most* not as a lexical item but instead as the superlative form of *much* or *many*, a view that Hackl (2009) advocates.

Certain uses of the English word *most* seem to be clearly superlative:

- (2) [Gloria]_F has visited the **most** continents. RELATIVE
 ≈ 'Gloria has visited more continents than anybody else has.'

¹The following abbreviations are used in glossed examples: ADV: adverbializer, CL: classifier, CMPR: comparative marker, COP: copula, DAT: dative, DEF: definite, DEM: demonstrative, EZ: ezafe, FEM: feminine, FOC: focus, GEN: genitive, INDF: indefinite, INT: intensifier, LOC: locative, MASC: masculine, MODIF: modificational marker, NEG: negation, NEUT: neuter, NMLZ: nominalizer, NOM: nominative, OBJ: object, OM: object marker, PAST: past, PERF: perfective, PL: plural, POSS: possessive, PRES: present, REL: relativizer, SBJV: subjunctive, SG: singular, STND: comparative standard marker, SPRL: superlative marker, WK: weak inflection.

For these kinds of cases, it looks like *most* can be decomposed into the quantity word *many* and a superlative (*-est*), as proposed by Bresnan (1973) among others. Translating this sentence into other languages typically yields superlative forms, and this use of *most* exhibits the same focus sensitivity that superlatives exhibit on so-called RELATIVE READINGS. Here, the focus, Gloria, is compared to the focus alternatives (making up the comparison class) along the dimension ‘number of continents visited’. In (2), there is only one plausible placement of focus, but a sentence like *Gloria visited the most continents in 2018* is ambiguous, with different readings arising under different placements of focus. If focus is placed on *Gloria*, then again we have a comparison among Gloria and alternative continent-visitors, but if focus is placed on *2018*, then the sentence means that Gloria visited more continents in 2018 than in any other appropriately contrasting time period.

In the world of superlatives, relative readings stand in contrast to ABSOLUTE READINGS (Szabolcsi 1986; Heim 1999). The superlatives of ordinary gradable adjectives (e.g. *tallest*) are ambiguous between these two kinds of readings:

(3) Ben put **the tallest plant** on [the bookcase]_F.

Absolute: ‘... the plant that was taller than any other plant...’

Relative: ‘Ben put a taller plant on the bookcase than anywhere else.’

On the absolute reading, *the tallest plant* just picks out the plant that is taller than all other (contextually-relevant) plants in the comparison class. Relative readings are driven by focus. Here, on the relative reading, at some level, it is bookcases and other locations that are being compared, via the height of the plants that Ben put on them.²

Examples like (2) show that quantity superlatives have relative readings. Do quantity superlatives have anything analogous to an absolute reading? As we discuss in Section 4, under certain generic assumptions, the analogue of the absolute reading would be a TOTALITY READING, where *Gloria*

²The contrast between absolute and relative readings was discussed early on by Szabolcsi (1986) for Hungarian, and is the focus of much subsequent research, mainly for English (Gawron 1995; Heim 1999; Hackl 2000; Sharvit & Stateva 2002; Hackl 2009; Teodorescu 2009; Krasikova 2012; Szabolcsi 2012; Wilson 2016; Bumford 2017), but also with reference to German (Hackl 2009), Swedish (Coppock & Josefson 2015), other Germanic languages (Coppock 2019), Hungarian (Farkas & É. Kiss 2000), Romanian (Teodorescu 2007), Spanish (Rohena-Madrado 2007), Arabic (Hallman 2016a), and Slavic languages including Macedonian, Czech, Serbian/Croatian and Slovenian (Pancheva & Tomaszewicz 2012).

has visited (the) most continents means *Gloria has visited all (seven) continents*. Clearly, no such reading is available. As discussed in more detail in Section 4, Hackl (2009) proposes instead that the proportional reading paraphrased in (1) is the analogue of the absolute reading in the quantity domain, and gives a way of deriving it compositionally in a manner analogous to how absolute readings are derived in the quality domain.

If proportional readings were indeed the analogue to absolute readings in the quantity domain, then the naive expectation would be that in any language where superlatives can have absolute readings, proportional readings would also be available for quantity superlatives. But we find that this is far from the case. Based on a study of 92 languages from 28 families, we show that regardless of the morphosyntactic strategy used to express superlative meaning, it is very much the exception rather than the rule that the superlative of *MANY* has a proportional reading. By contrast, in all languages surveyed, the superlative of *MANY* allowed relative readings. It has previously been observed that proportional readings are sometimes absent, including by Hackl (2009:68), Živanović (2007b), Bošković & Gajewski (2008), Pancheva (2015), and Dobrovie-Sorin & Giurgea (2015). Slovenian illustrates:

- (4) **Naj-več** ljudi pije pivo.
 SPRL-many people drink beer
 ‘More people drink beer than any other beverage.’
 (*Unavailable*: ‘More than half the people drink beer.’)

But our study is sufficiently exhaustive as to give evidence for the following generalizations:

- (5) a. **Universal**: Quantity superlatives have relative readings.
 b. **Tendency**: Quantity superlatives do not have proportional readings.

The proportional meaning is expressed using other means in most languages, using a range of strategies, including nouns meaning *majority*, positive or comparative quantity words (‘many’, ‘more’), and expressions like *the greater part*. We conclude that the proportional meaning is not the product of straightforward composition between quantity words and *EST*.

In Section 4, we undertake a critical review of existing theories of superlatives and quantity words, in light of this finding. In Section 5, we propose that the typological generalizations above

can be explained under the following three assumptions. First, and most centrally, quantity words denote *degree quantifiers* (type $\langle d, \langle dt, t \rangle \rangle$), as argued by Solt (2009, 2015) (cf. Heim's (2006a) theory of *little*). In virtue of its semantic type, MUCH/MANY must take scope. Second, and less crucially, we adopt a 'vanilla' treatment of superlatives. With these two assumptions, only relative readings are generated for the superlatives of quantity words. But to rule out the possibility of a superlative marker 'going rogue' and generating proportional readings in the absence of a quantity word, we assume, thirdly, that superlatives are functional heads in the extended lexical projection of an appropriate lexical category (Grimshaw 1991; Abney 1987; Corver 1997; Kennedy 1997).

Section 5.2 addresses the question of how proportional readings might arise in the minority of languages in which they are attested. We outline two historical pathways by which quantity superlatives might acquire proportional meanings, and suggest that different paths may operate in different languages. The picture that emerges is more conservative than the one painted by Hackl (2009). While proportional readings are in the 'zone of proximal development' for quantity superlatives, insofar as they *almost* can be compositionally derived, a gentle nudge from grammaticalization is required.

2. TYPOLOGICAL STUDY. We undertook a crosslinguistic study covering 92 languages from 28 language families, drawn from every continent. Diverse morphosyntactic strategies for forming superlatives were represented.

Descriptive grammars generally include examples of constructions that might be described as quality superlatives. However, there is generally little information about their structure and interpretation. To fill these descriptive gaps, we employed a method that we term **TARGETED COMPARATIVE FIELDWORK**, characterized by the study of a targeted issue (here, quantity superlatives) through elicitation on a very broad sample of languages. Comparative fieldwork on a medium-sized language sample (14 languages) was previously used by Beck, Krasikova, Fleischer, Gergel, Hofstetter, Svaelsberg, Venderelst & Villalta (2010) to study a number of issues relating to degree constructions. While our study is similar in spirit to theirs, our methodology is characterized by elicitation of data from a much larger language sample with a narrower investigative focus. We designed our tools to be distributed over the Internet, in order to collect data from more languages than we could access in person.

2.1. METHODOLOGY. Our main elicitation tool was a translation questionnaire structured as a short story consisting of 17 sentences.³ Participants were asked to translate the sentences into their native language. The majority of participants completed the questionnaire online with English prompts, while a subset saw the questionnaire in Swedish, Swahili, Persian, Russian, or Spanish. Online distribution allowed us to gather data efficiently from languages that were not represented in previous work and which would have otherwise been inaccessible. We primarily recruited participants recommended to us by linguists with significant research experience in the language of interest. In a limited number of cases, we recruited participants through social media groups focused on individual languages. The number of questionnaire respondents varied from language to language; we aimed for five, but the actual number varied between one and 15.

The questionnaire sentences were designed to elicit structures and meanings including quantity superlatives, quality superlatives, comparatives, and quantity words. The full story and instructions can be found in the online supplement. Two representative examples are given here:

(6) PROPORTIONAL

Most of the kids who go to my school like to play music.

(For example, there are 100 kids in my school and 65 of them like to play music.)

(7) RELATIVE

Of all the kids in my school, I'm the one who plays the most instruments.

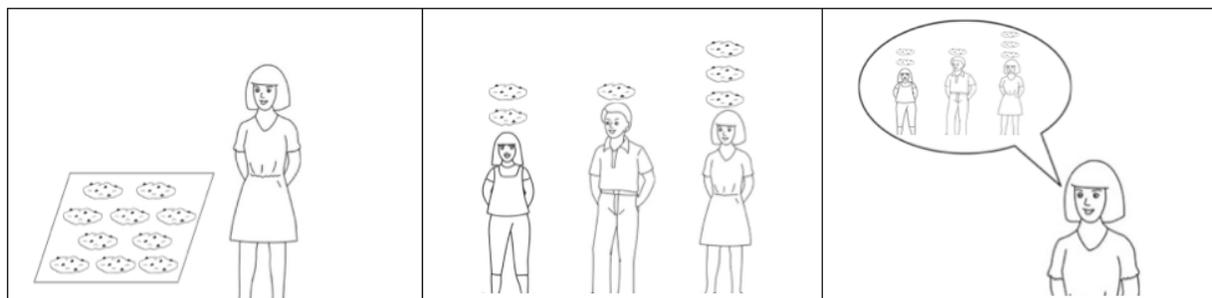
(For example, I play 7 instruments, two of my friends play 6 instruments, and lots of people play one or two instruments, but nobody else plays more than 4.)

Translation questionnaire responses were not sufficient on their own, since the absence of a structure from the translation of a particular prompt does not prove its impossibility. It is also not guaranteed that all participants were sufficiently fluent in English to perceive the crucial semantic distinctions between prompts. Therefore, we conducted brief follow-up elicitation sessions whenever possible. In cases where the superlative of MUCH or MANY was used to translate prompts

³For three languages (Okanagan Salish, Kaqchikel, Cherokee) we were unable to work with consultants directly. In this small number of cases, we relied on published materials and assistance from linguists with expertise in each language.

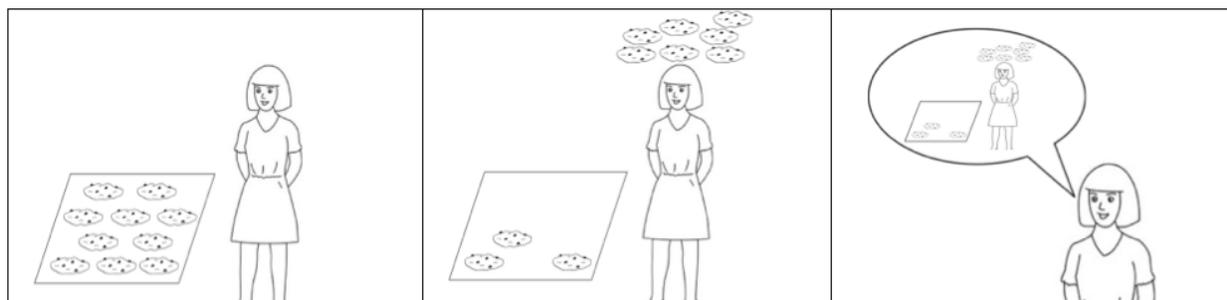
with relative but not proportional readings, follow-up elicitation allowed us to determine whether a proportional reading was truly unavailable for quantity superlatives.

The follow-up materials used for individual languages varied but the following images were used often. Each context only admits one reading which is established without total reliance on written prompts. Speakers were asked whether a superlative structure accepted in Figure 1 could also be used in Figure 2.



You bake 10 cookies to share with your siblings. You eat three cookies, your little sister eats two, and your older brother eats one. Later you tell me...

Figure 1: Quantity superlative, relative reading.



You are home alone one weekend and you bake 10 cookies. You are very hungry, so you eat 7 of them. Only three are left. Later you tell me...

Figure 2: Quantity superlative, proportional reading.

2.2. LANGUAGES AND CODING OF SUPERLATIVE STRATEGIES. Our language sample consisted of 92 languages distributed across all continents, 27 language families, and 57 genera. Table 1 lists one language per genus, as categorized by WALS (Dryer & Haspelmath 2013), and arranged

by continent. This table also indicates superlative translation strategy and coding for quantity superlative readings as discussed below. We give codes for all languages in the online supplement, along with selected glosses.

Macro-area	Family	Genus	Language	Strategy	Prop-Rel	
Eurasia	Altaic	Turkic	Kazakh	PERIPH	NO-YES	
		Tungusic	Evenki	M	NO-YES	
	Austro-Asiatic	Viet-Muong	Vietnamese	PERIPH	NO-YES	
	Basque	Basque	Basque	M	YES-YES	
	Dravidian	Southern Dravidian	Malayalam	PERIPH	NO-YES	
		South-Central Dravidian	Telugu	VERY	NA-NA	
	Indo-European	Albanian	Albanian	CMPR	NO-◇	
		Armenian	Armenian	CMPR	NO-◇	
		Celtic	Irish	CMPR	NO-◇	
		Germanic	Swedish	M	YES-YES	
		Greek	Greek	CMPR+DEF	YES-YES	
		Indic	Hindi	CMPR+ALL	NO-YES	
		Iranian	Persian	M	NO-YES	
		Romance	French	CMPR+DEF	NO-YES	
		Slavic	Macedonian	M	NO-YES	
		Japanese	Japanese	Japanese	PERIPH	NO-YES
	Kartvelian	Kartvelian	Georgian	CMPR+ALL	NO-YES	
	Korean	Korean	Korean	PERIPH	NO-YES	
	Nakh-Daghestanian	Lezgif	Lezgian	CMPR+ALL	NO-YES	
	Sino-Tibetan	Bodic	Tibetan	M	NO-YES	
		Burmese-Lolo	Burmese	M	NO-YES	
		Dhimalic	Dhimal	CMPR+ALL	NO-YES	
		Mahakiranti	Newar	CMPR+ALL	NO-YES	
		Chinese	Mandarin	PERIPH	NO-YES	
		Tai-Kadai	Kam-Tai	Thai	PERIPH	NO-YES
		Uralic	Finnic	Estonian	PERIPH	NO-YES
			Ugric	Hungarian	M	YES-YES
Africa		Afro-Asiatic	Lowland East Cushitic	Somali	PERIPH	NO-YES
			Semitic	Hebrew	PERIPH	NO-YES
	West Chadic		Hausa	CMPR	◇ - ◇	
	Niger-Congo	Bantoid	Kagulu	VERY	NA-NA	
		Defoid	Yoruba	CMPR	◇ - ◇	
		Kwa	Ga	CMPR+ALL	NO-YES	
		Northern Atlantic	Wolof	CMPR	◇ - ◇	
	Eastern Sudanic	Nilotic	Luo	CMPR	NO-◇	
		Nubian	Kenuzi-Dongola	CMPR+ALL	NO-YES	
	Mande	Western Mande	Vai	CMPR+ALL	NO-YES	
Papunesia	Austronesian	Barito	Malagasy	PERIPH	NO-YES	
		Chamorro	Chamorro	PERIPH	NO-YES	
		Greater Central Philippine	Tagalog	M	NO-YES	
		Javanese	Javanese	PERIPH	NO-YES	
		Malayo-Sumbawan	Indonesian	PERIPH	NO-YES	
		Oceanic	Maori	VERY	NA-NA	
		Yapese	Yapese	PERIPH	NO-YES	
	Gunwinyguan	Gunwinygic	Gunbarlang	VERY	NA-NA	
	N. America	Algic	Algonquian	Passamaquoddy	M	NO-YES
		Iroquoian	Southern Iroquoian	Cherokee	M	NO-YES
Mayan		Mayan	Kaqchikel	CMPR+ALL	NO-YES	
Na-Dene		Athapaskan	Navajo	CMPR+ANY	NO-YES	

We coded each language in the database for the morphosyntactic strategy used to translate superlative prompts.

- (8) Structures used in translations of superlative prompts
- a. **M:** Morphological superlative marker
 - b. **PERIPH:** Analytic (periphrastic) superlative marker
 - c. **CMPR+DEF:** Definiteness marker with comparative structure
 - d. **CMPR:** Comparative structure
 - e. **CMPR+ALL:** Comparative with universal standard of comparison
 - f. **CMPR+ANY:** Comparative with existential standard of comparison
 - g. **VERY:** Gradable expression modified by intensifier

The codes assigned to each language were generally consistent with previous typological literature (Bobaljik 2012; Gorshenin 2012), but were occasionally overridden by our own fieldwork. The code is intended to represent the language's *primary* manner of translating superlatives. For languages like Russian with multiple ways of translating superlative prompts, the 'primary' label is somewhat arbitrary, but we made sure that the strategy assigned to a language is the one whose application to quantity words was assessed for relative and proportional readings.

Since material from the comparative construction often appears in superlative constructions, languages were also coded for comparative strategy.⁴

- (9) Comparative strategies
- a. **M/STND:** Morphological expression of comparative marker on gradable predicate.
 - b. **PERIPH/STND:** Comparative is expressed analytically (periphrastically) with a free element associated with gradable predicate.
 - c. **∅/STND:** Comparative is not marked on gradable predicate. Comparative meaning is overtly indicated by the standard marker.
 - d. **EX:** The comparative relation is expressed with a verb translating as 'exceed' or

⁴For languages without an overt comparative element, or with an optional one, one might posit a covert comparative element. Our categorizations rely solely on the overt morphosyntax, so we use the code $CMPR_{\emptyset/STND}$ to classify languages of these types.

‘surpass.’

- e. **CNJ:** The comparative relation is expressed via conjunction.

The following sentences exemplify each strategy. All sentences were volunteered to translate quantity superlatives with relative readings.

- (10) Jas izedov **naj-mnogu** kolači.
1SG 1SG.eat.PERF.PAST SPRL-many cookies
‘I ate the most cookies.’ (Macedonian; M)
- (11) Wo chi le **zui duo** de binggan.
1SG eat PERF SPRL many MODIF cookie
‘I ate the most cookies.’ (Mandarin; PERIPH)
- (12) Jean a lu **le plus** de livres.
Jean has read DEF CMPR of book.PL
‘Jean has read the most books.’ (French; CMPR_{PERIPH/STND}+DEF)
- (13) Ci xale yu nekk sama ekkol yép, man ma ci tëgg lu **gën bëre** ci
LOC child REL COP 1POSS all school 1SG 1SG LOC play REL surpass be.many LOC
sabar.
drum
‘Of all the kids in my school, I’m the one who plays the most drums.’ (Wolof; CMPR_{EX})
- (14) **Q’vela-ze met’-i** nacxvr-eb-i me ševčame.
all-STND_{on} many.CMPR-NOM cookie-PL-NOM 1SG 1SG.ate.3OBJ
‘I ate the most cookies.’ (Georgian; CMPR_{∅/STND}+ALL)⁵
- (15) (Shí) bááh hikaní **’a-láah-go** yíyáá’.
1SG cookie INDF.OBJ-STND_{beyond}-ADV 3OBJ.1SG.eat.PERF
‘I ate the most cookies.’ (Navajo; CMPR_{∅/STND}+ANY)
- (16) Ikaka hakadiya ubwabwa mwingi-**si**.
1POSS.brother PAST.eat rice many-INT
‘My brother ate the most rice.’ (Kagulu; VERY)

⁵Gorshenin (2012) describes CMPR+ALL strategy as potentially co-primary with a synthetic morphological strategy, where the adjective is marked by the circumfix *u...es*, as in *u-lamaz-es-i* [*u-pretty-es-NOM*]. But while such expressions are sometimes translated into English as superlatives (‘prettiest’), authors also describe them as expressing simply high degree (‘very pretty’) (Aronson 1990; Hewitt 1995; Harris 2000). Further elicitation confirmed that the *u...es* circumfix does not convey the uniqueness that characterizes true superlative meaning (N. Amiridze, p.c.).

2.3. WHAT COUNTS AS A QUANTITY SUPERLATIVE?. Every language surveyed used at least one of the strategies in (8) to translate at least some of the superlative prompts. However, we can only evaluate the proposed universals if we compare languages that all have *quantity superlatives* in a meaningfully comparable sense. Translations may not fully match the original prompt in certain key aspects of meaning (Matthewson 2004; von Stechow & Matthewson 2008), so we must be clear which aspects of meaning we take as definitional. We adopt the definitions in (17).

- (17) a. **SUPERLATIVE STRATEGY:** A construction that conveys that a gradable property holds of an entity to a uniquely high extent among elements of an explicit or implicit comparison class.⁶
- b. **QUANTITY SUPERLATIVE:** A construction involving (only) a superlative strategy that stands in the same paradigmatic relation to a word for **MANY** or **MUCH** as a quality superlative stands in to its positive form.

The definition of ‘superlative strategy’ frames superlatives in terms of a ‘comparative concept’ in the sense of Haspelmath (2010), such that we appeal to broadly applicable semantic concepts (gradability, uniqueness) instead of specific structural criteria. This allows us to test the proposed universals against languages whose superlative structures differ from English or other well-studied languages. For instance, we consider structures where the superlative forms a constituent with the noun as in French (18) as well as probable adverbial superlatives as in Navajo (19).

The definitions in (17) also include languages whose quantity superlatives lack an overt **MANY**, provided its absence is consistent with the language’s broader quantity comparative-superlative paradigm. In French and Navajo, the same structures characterize quantity and quality superlatives: **CMPR+DEF** in French (18) and **CMPR+ANY** in Navajo (19). However, only quality superlatives contain an overt gradable predicate. Yet we still say that French and Navajo quantity superlatives instantiate each language’s superlative strategy, since quantity comparatives also lack overt gradable predicates ((18c), (19c)). Thus, quantity superlatives in both languages occupy the superlative cell in the comparative-superlative paradigm for **MANY**.

⁶See Gorshenin (2012:58-60) for a similar operational definition of superlatives that also takes uniqueness as one of the semantic components crucial to superlative meaning.

- (18) a. Jean a lu **le plus** de livres.
Jean has read DEF CMPR of book.PL
'Jean has read the most books.'
- b. Je ne suis pas celui de la famille qui a la taille **la plus fine**.
1SG NEG COP NEG that.one of DEF family REL has DEF waist DEF CMPR thin
'I'm not the one in the family with the thinnest waist.'
- c. Jean a lu **plus** de livres que moi.
Jean has read CMPR of book.PL STND 1SG
'Jean has read more books than me.'
- (19) a. Anna bááh likaní '**a-láah-go** yiyíyáá'.
Anna cookie INDF.OBJ-STND_{beyond}-ADV 3OBJ.3SUBJ.eat.PERF
'Anna ate the most cookies.'
- b. Anna tsin '**a-láah-go** 'ánílnééz-ígíí yaah haas'na'.
Anna tree INDF.OBJ-STND_{beyond}-ADV 3SUBJ.tall-NMLZ 3OBJ.up 3OBJ.3SUBJ.climb.PERF
'Anna has climbed up the tallest tree.'
- c. Anna bááh likaní **shi-láah-go** yiyíyáá'.
Anna cookie 1SG.OBJ-STND_{beyond}ADV 3OBJ.3SUBJ.eat.PERF
'Anna ate more cookies than me.'

The definitions in (17) exclude certain structures from the set of quantity superlatives. First, structures like (20) used to translate proportional prompts in French do not count as quantity superlatives because this construction does not involve *only* a superlative strategy. There is additional material, namely *part*.

- (20) La **plupart** des cygnes sont blancs.
DEF majority of.DEF.PL swan.PL 3PL.COP white
Prompt: 'Most swans are white.'

The VERY translation strategy was also excluded by the definitions in (17). Kagulu illustrates. Both quality and quantity superlative prompts were translated with an intensifying 'augmentative' suffix *-si* (Petzell 2008).

- (21) a. Hachiwendaga kutega samaki ing'hulu-**si**.
PAST.1PL.want catch fish big-INT
Prompt: 'I wanted to catch the biggest fish.'
- b. Ikaka hakadiya ubwabwa mwingi-**si**.
1POSS.brother PAST.eat rice many-INT

Prompt: ‘My brother ate the most rice.’

The Kagulu intensifier construction does not count as a true superlative strategy according to (17) because it does not convey that the gradable property holds to a uniquely high extent. The Kagulu consultant volunteered the following *si*-construction in a context where the speaker’s mango is just as large as the addressee’s. Each character can describe her respective mango as *ikulu-si* ‘big-INT’:

- (22) Aniye nani nibawa iyembe ikulu-**si**!
 1SG also 1SG.pick mango big-INT
 ‘I also picked a very big mango!’ (cf. #the biggest mango)

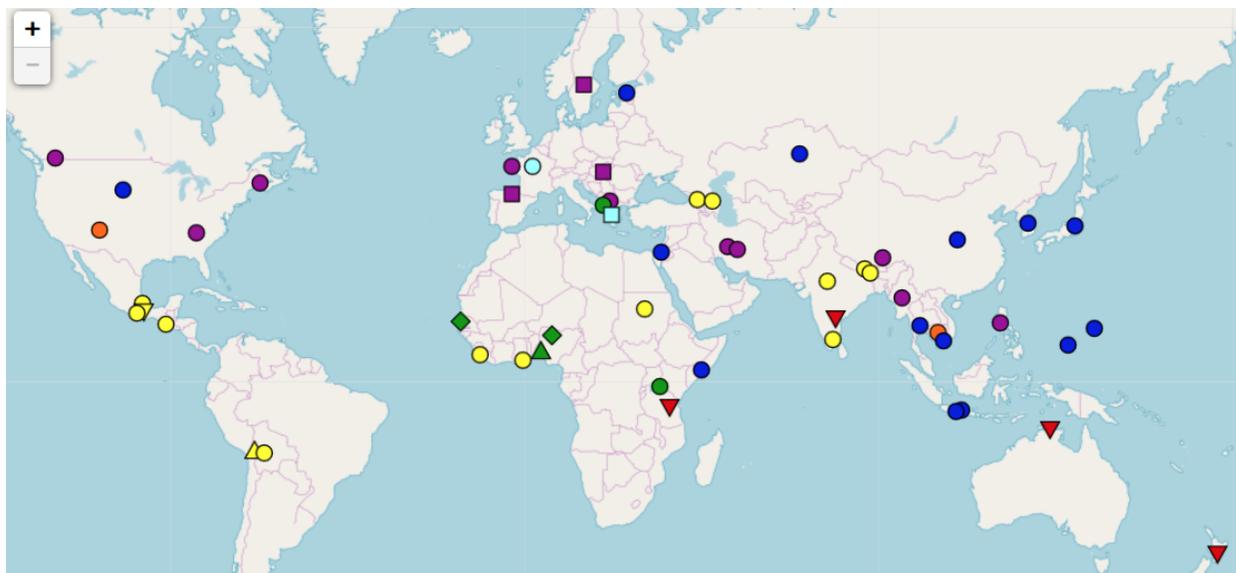
Finally, it is difficult to be certain whether CMPR languages express a superlative meaning. In CMPR languages, the same string can be translated either as a superlative or as a comparative without a standard of comparison. Wolof illustrates:

- (23) Kofi mo (len) **gën** gaaw.
 Kofi FOC 3PL surpass be.fast
 ‘Kofi is the fastest’ or ‘Kofi is faster.’ (Diop 2012)

CMPR languages are therefore treated with some uncertainty in the categorizations below.

3. RESULTS.

3.1. RELATIVE READINGS UNIVERSAL; PROPORTIONAL READINGS RARE. Languages were classified as to whether quantity superlatives express (i) a proportional interpretation and (ii) a relative interpretation. For both questions, there were four possible values: YES, NO, NA, and \diamond . The value ‘NA’ indicates that the language lacks quantity superlatives. The value \diamond represents ‘possible’; this is used for CMPR languages for reasons discussed above.



Legend for primary superlative strategy (colors)

- M: Morphological superlative marker
- PERIPH: Periphrastic superlative marker
- CMPR+DEF: Comparative plus definiteness marker
- CMPR: No formal distinction between comparative and superlative
- CMPR+ALL: Comparative plus 'of/than all'
- CMPR+ANY: Comparative plus 'of/than some/any'
- VERY: Intensifier
- OTHER/NONE

Legend for quantity superlative interpretations (shapes)

- YES-YES: Both relative and proportional readings available
- NO-YES: Proportional readings are not available but relative readings are
- ▼ NA-NA: Quantity superlatives do not exist in the language
- ◆ ◇-◇: Unable to distinguish superlative and comparative

Figure 3: Representative sample of languages investigated. One language per genus.

Figure 3 visually summarizes our findings for the representative sample of languages (one per genus) in Table 1. The colors represent superlative strategy and the shapes represent quantity superlative interpretation(s). The set of **YES-YES languages** (square) consisted of all Germanic languages along with Arabic (M), Basque (M), Finnish (M), Hungarian (M), Romanian (CMPR+DEF),

and Greek (CMPR+DEF). Greek illustrates:

- (24) Éfaga **ta perissotera** biskóta.
 ate.1SG DEF much.CMPR cookie.PL
 ‘I ate most of the cookies,’ ‘I ate the most cookies.’

Although the Greek sentence is ambiguous, quantity superlatives in some other YES-YES languages took a different shape depending on their interpretation.

The majority of languages surveyed were **NO-YES languages** (circle). We illustrate with Persian.⁷

- (25) Man **biš-tar-in** cookie ra khord-am.
 1SG much-CMPR-SPRL cookie OM eat.PAST-1SG
 ‘I ate the most cookies.’

(Unavailable: ‘I ate most of the cookies.’)

Proportional superlative prompts in NO-YES languages were translated by a variety of nonsuperlative strategies, including phrases translated as ‘almost all,’ nominal expressions translated as ‘majority,’ phrases translated as ‘the biggest part,’ bare quantity words, and comparative structures as in Persian:

- (26) Man **biš-tar-e** cookie-ha ra khord-am.
 1SG much-CMPR-EZ cookie-PL OM eat.PAST-1SG
 ‘I ate most of the cookies.’

Quality superlatives are always ambiguous between relative and absolute readings in these languages. In Persian, for example, the following sentences were used with visual prompts that established the intended absolute (27) and relative (28) interpretations.

- (27) Un aval say kard-ø az **boland-tar-in** deraxt-e baq bala be-re ...
 3SG first effort do.PAST-3SG from tall-CMPR-SPRL tree-EZ garden up SBJV-go.3SG
 ‘First he tried to climb the tallest tree in the garden...’

⁷We use a green circle for languages that employ a CMPR strategy to translate superlative prompts with relative meanings only (Albanian, Armenian, Irish, Luo). These languages could be more accurately called ‘NO-◇’ languages.

- (28) Bein-e se ta bache un barande shod-ø chon un az
 among-EZ three CL kid 3SG winner become.PAST-3SG because 3SG from
boland-tar-in deraxt bala raft-ø.
 tall-CMPR-SPRL tree up go.PAST-3SG
 ‘Of the three kids, he won because he climbed the tallest tree.’

The set of **NA-NA languages** (upside-down triangle) consists of VERY languages, including Kagulu discussed above.

Finally, the set of \diamond - \diamond **languages** (filled diamond) consists of languages in which both relative and proportional prompts were translated using the CMPR strategy. Wolof illustrates:

- (29) a. Ci xale yu nekk sama ekkol yép, man ma ci tegg lu **gën bëre** ci
 LOC child REL be 1POSS all school 1SG 1SG LOC play REL surpass be.many LOC
 sabar.
 drum
 ‘Of all the kids in my school, I’m the one who plays the most drums.’
- b. Xale yu **gën bëre** ci sama ekkol bëgg na ñu tegg mízík.
 child REL surpass be.many LOC 1POSS school like PERF 3PL play music
 ‘Most of the kids who go to my school like to play music.’

As discussed above, these languages’ classification hinges on whether CMPR structures express true superlative meaning. In the absence of other considerations, we do not count such languages as YES-YES languages.

Crucially, two shapes are missing from Figure 3. First, no shape is needed to represent hypothetical **YES-NO languages**, in which the quantity superlative is used for proportional but not relative readings. Second, there is no need for a shape corresponding to **NO-NO languages** in which quantity superlatives exist but express only meanings other than proportional or relative.

Hence, the following universal was supported:

- (30) **Universal:** Quantity superlatives have relative readings.

The following tendency was supported as well.

- (31) **Tendency:** Quantity superlatives do not have proportional readings.

We can furthermore estimate the rate at which proportional readings occur by dividing the number

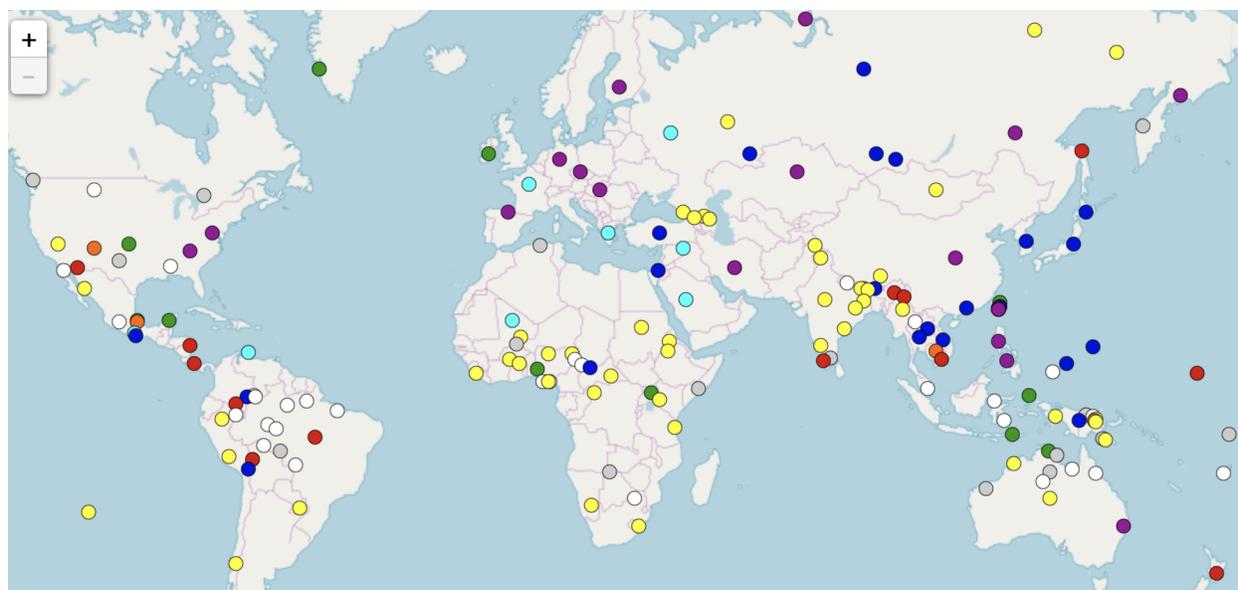
of language families in which proportional readings are found by the number in which quantity superlatives are found. Out of 27 language families with quantity superlatives, the YES-YES pattern is exhibited by at least one language in 3 families (Afro-Asiatic, Indo-European, Uralic). By this estimate, 10.7% of the families surveyed exhibit proportional readings. For a more accurate estimate, we calculate the rate of YES-YES languages within a given family. To do so, we first determine for each genus whether the YES-YES pattern is attested in any language within it. For example, we find the YES-YES pattern in 3 of the 7 Indo-European genera surveyed. The rate of proportional reading occurrence within Indo-European is then estimated at 3/7. By this method, we find that the probability of proportional readings is as low as 7.5% across the sample. Note that there is great uncertainty surrounding both estimates because there are approximately 400 language families but only 28 are represented in our sample. Nevertheless, these findings indicate that proportional readings are crosslinguistically rare.

3.2. DISTRIBUTION OF PROPORTIONAL READINGS. We can make two generalizations about the distribution of proportional readings in our sample. First, all clear cases are European, with the single exception being Arabic. In Standard Arabic, proportional meaning is expressed using *ʔakθar*, a combination of the quantity adjective *kaθīr* with superlative templatic morphology *ʔaCCaC* (Hallman 2016b). The same expression can also have a relative interpretation according our results from Standard, Lebanese, and Syrian Arabic; see also Hallman 2016a. However, many Arabic varieties are spoken in close proximity to other YES-YES languages.

Second, the majority of languages with proportional readings exhibit a morphological (M) superlative strategy. The only YES-YES languages in Europe to employ another strategy were Romanian and Greek, both of which use CMPR+DEF superlative structures. By contrast, the set of NO-YES languages includes every superlative strategy. In other words, proportional readings tend to be absent in languages with more structurally complex superlative strategies.

We should not put too much stock into this latter observation since geographical and structural factors are not clearly separable. Superlative strategies are unevenly distributed across the globe, as shown in Figure 4 (data combined from Gorshenin (2012) and Bobaljik (2012)).⁸ We nevertheless return to a possible explanation briefly in sec. 5.2.2.

⁸The dataset underlying this map is published at Harvard Dataverse (Coppock 2016).



Legend

- M: Morphological superlative marker
- PERIPH: Periphrastic superlative marker
- CMPR+DEF: Comparative plus definiteness marker
- CMPR: No formal distinction between comparative and superlative
- CMPR+ALL: Comparative plus 'of/than all'
- CMPR+ANY: Comparative plus 'of/than some/any'
- VERY: Intensifier
- OTHER/NONE

Figure 4: Geographical distribution of superlative strategies.

4. EXISTING ANALYSES. An adequate theory of quantity superlatives will capture their similarities with quality superlatives while by default only generating the relative reading, and not the proportional one. This section takes as its starting point a ‘vanilla’ theory of superlative meaning, based on Heim 1999, and puts it together with a theory of quantity words on which they are entirely parallel to ordinary gradable adjectives. We then discuss modifications to this theory that previous authors have proposed in order to block potential correlates of the absolute reading for quantity superlatives: the proportional reading, and the ‘totality’ reading (where *Gloria visited the most continents* is predicted to mean that Gloria visited the plurality of continents more numerous than any other – that is, all the continents). We argue that none of the theories we review in this section gives a satisfactory account of our typological findings, although they do provide insights that we build upon in section 5, where we develop a proposal that centers around Solt’s (2009) analysis of

quantity words as degree quantifiers.

4.1. THE VANILLA THEORY.

4.1.1. QUALITY SUPERLATIVES. Let us begin by considering a ‘vanilla’ theory of superlatives (Heim 1999). In simple cases, quality superlatives describe a TARGET as greatest with respect to some MEASURE in a COMPARISON CLASS. For example, in the following case, *Lucy* is the target, the girls in fifth grade make up the comparison class, and height is the measure.

(32) Lucy is the tallest girl in fifth grade.

Gradable adjectives like *tall* are assumed to denote relations between entities and degrees, type $\langle d, \langle e, t \rangle \rangle$, as in the following lexical entry, where d is a variable that ranges over degrees (Cresswell 1977; von Stechow 1984; Heim 1985, 2000; Kennedy & McNally 2005:i.a.).

(33) $tall \rightsquigarrow \lambda d \lambda x . HEIGHT(d) \geq d$

The meaning of (32) can be captured using the following lexical entry for the superlative morpheme *-est* from Heim 1999, according to which it combines first with a comparison class C , then with a gradable predicate G of type $\langle d, \langle e, t \rangle \rangle$, and finally with a target x , returning true if the target is greatest in C according to G .

(34) $-est \rightsquigarrow \lambda C_{\langle e, t \rangle} \lambda G_{\langle d, \langle e, t \rangle \rangle} \lambda x_e . \partial(C(x) \wedge \forall y [C(y) \rightarrow \exists d [G(d)(y)]]) \wedge \exists d [G(d)(x) \wedge \forall y \neq x [C(y) \rightarrow \neg G(d)(y)]]$

We use the ∂ symbol (the ‘partial symbol’, read ‘presupposing’) to represent presupposition, following Beaver & Kraemer (2001). If the formula in the scope of the partial operator is not true, then the truth value of the formula is ‘undefined’. We assume that this undefinedness is inherited by the conjunction. So in accordance with Heim (1999), this lexical entry stipulates two presuppositions: (i) that the target is in the comparison class, and (ii) that every member of the comparison class bears the property to some degree.

Heim assumes further that the LF for (32) is as follows:

(35) Lucy is [_{DP} the [-est_C λd [d-tall girl in fifth grade]]]

This assumption captures the fact that it is necessarily among girls in fifth grade that the comparison is made, and not, say, among people in general.

The question of what the comparison class is becomes a bit more interesting in sentences like the following, where focus is indicated using a subscript *F*:

(36) Ben put the tallest plant on [the bookcase]_F. (adapt. Heim 1999)

This sentence is ambiguous between an absolute reading ('Ben put the plant that was taller than any other plant on the bookcase') and a relative reading ('Ben put a taller plant on the bookcase than anywhere else'). The relative reading, with focus on *the bookcase*, is true in the scenario depicted in Figure 5. Is it locations or plants that are being compared in this case? At some level, the comparison is between locations, rather than plants, but certainly the comparative height of plants is involved.

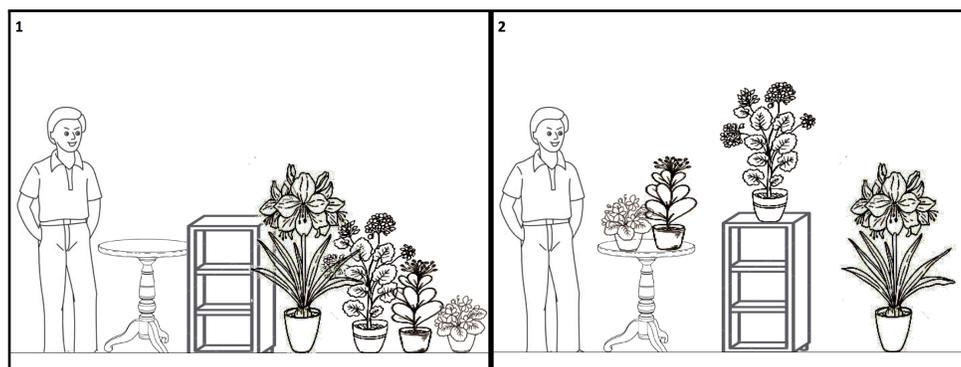


Figure 5: *Ben put the tallest plant on [the bookcase]_F*

This question is controversial, as it turns out. SCOPE THEORIES of superlatives invoke movement of *-est* (Heim 1985, 1999; Szabolcsi 1986; among others) to a position near the focus, which also fronts. Let us first illustrate fronting of *the bookcase*:

(37) [the bookcase]_F [λx [Ben put [_{DP} the tall-est plant] on x]]

The superlative ending *-est* also moves so that it can apply to the focused element, as in (38). The definite article is not interpreted at LF on this view; this is why it is struck out.

(38) [the bookcase]_F [-est_C [λd [λx [Ben put [_{DP} the *d*-tall plant] on *x*]]]]

On scope theories, it is really locations rather than plants that are being compared in cases like this; the comparison class *C* is made up of focus alternatives to the bookcase. An absolute reading would arise instead if *-est* remained within the DP and *C* would consist of plants.

(39) Ben put [_{DP} the [-est_C [λd [*d*-tall plant]]]] on the bookcase

On PRAGMATIC THEORIES, it is always plants that are being compared, even on relative readings. The LF in (39) underlies both readings and the comparison class *C* consists of plants on both readings (Farkas & É. Kiss 2000; Sharvit & Stateva 2002; Teodorescu 2009). *C* can be further constrained via focus, so that only plants that have been moved are compared in height.

To avoid any confusion or controversy that may arise in conjunction with different uses of the term COMPARISON CLASS in scope and pragmatic theories, we propose to distinguish between the OUTER COMPARISON CLASS and the INNER COMPARISON CLASS (corresponding to Coppock & Beaver's (2014) 'contrast set' and 'measured entities', respectively). The outer comparison class in a case like (36) is made up of locations; the inner comparison class is made up of plants. Figure 6 schematizes the situation.

of, assuming that x could be a plurality of individuals (Link 1983).

On a scope theoretic version of the vanilla view, EST can raise to associate with focus, just as it did with quality superlatives. We illustrate with (41), where *bookcase* is focused. Just like a quality superlative on a relative reading, this sentence is only licit in a discourse context in which there are salient alternative locations where plants have been placed.

(41) Ben put the most plants on [the bookcase]_F.

The relative reading is derived when $-est_C$ moves at LF to associate with focus (which we assume has also moved), like so:

(42) [the bookcase]_F $-est_C \lambda d \lambda x$ [Ben put [_{DP} the [d -many plants]] on x]

This LF says, ‘Ben put more plants on the bookcase than anywhere else’.

Alternatively, $-est_C$ can remain within the DP, as in (43).

(43) Ben put [_{DP} [$-est_C \lambda d$ [d -many plants]]] on the bookcase

An LF comparable to this one generated absolute readings for quality superlatives. For quantity superlatives, however, the reading that is produced would be better termed a TOTALITY READING. The truth conditions for (43) are: ‘Ben put the plurality of plants that was more numerous than any other plurality of plants on the bookcase.’ Unless the comparison class of plant-pluralities is contextually restricted, the largest plurality of plants is the one consisting of all plants. In the absence of relevant restrictions, then, we expect *Ben moved the most plants* to be equivalent to *Ben moved all the plants*.

This is not a good result. It is well known that this reading is missing for quantity superlatives in English (Szabolcsi 1986; Gawron 1995; Farkas & É. Kiss 2000; Schwarz 2004; Hackl 2009; Teodorescu 2009), and is not available in any other language that we know of.

4.2. BLOCKING TOTALITY READINGS.

4.2.1. BLOCKING BY ‘ALL’? Teodorescu proposes to rule out the totality reading by appealing to the following general pragmatic principle:

- (44) If two expressions α, β are (i) both applicable, and (ii) α is more specific than β , (iii) α is not more complex than β , then choose α .

(Teodorescu 2009:(125), after Horn 1972 and Atlas & Levinson 1981)

Under a totality reading, *most plants* will pick out the same plurality as *all plants*. However, Teodorescu argues that the latter structure is more specific, since it can only be interpreted as denoting the maximal plurality of plants in the context. (It has no alternative, relative reading.) Since *all plants* is not more complex than *most plants*, we should use *all plants* in any situation where we wish to pick out the maximal plant plurality.

The lack of a totality reading for forms like *the most* does not behave as an implicature, however:

- (45) You are home alone one weekend and you bake 10 cookies. You are very hungry, so you eat all of them. Later you tell me:
#I ate the most cookies. {In fact / That is}, I ate all of them.

In a context where there is only one cookie-eater, *I ate the most cookies* is unrescuably infelicitous. Analogous judgments hold for Swedish *flest* ‘the most’, a quantity superlative that is specialized for relative readings. With these kinds of forms, the set of cookie-pluralities under consideration must be defined by an external comparison class, such as the set of cookie-eaters, and this requirement cannot be cancelled in the way that implicatures can be.

Moreover, it is not clear that the principle in (44) is reliable; Swanson (2010) points out a number of counterexamples to it. *Going to confessional is permitted*, for example, does not conversationally implicate that *Going to confessional is optional* is false, even though the latter is more specific and equally short. Similarly, Geurts (2011) discusses the fact that, for example, *I saw a dog on the lawn this morning* does not signal that the speaker was not in a position to use a stronger form, such as *I saw a poodle on the lawn this morning*. These are by no means the only cases where more and less specific forms of equal complexity co-exist in the grammar.

4.2.2. QUANTITY WORDS AS DETERMINERS?. Schwarz (2004) gives an explanation for missing totality readings based on Hackl's (2000) semantics for *many*, on which it is a 'parameterized quantificational determiner': a generalized quantifier that also has a degree argument.

$$(46) \quad \textit{many} \rightsquigarrow \lambda d \lambda P \lambda Q . \exists x [P(x) \wedge Q(x) \wedge |x| \geq d]$$

Hackl (2000) shows that this style of lexical entry has a number of interesting virtues in comparison with other treatments of quantity words.⁹ In addition, it provides an explanation for the ungrammaticality of English quantity words in certain predicative positions, including the complement to *look*: **The guests look many* (vs. *The guests look tall*). More importantly for us, however, it blocks the totality reading due to uninterpretability of the LF. The superlative *-est_C* expects an expression of type $\langle d, et \rangle$, but ' λd *d*-many plants' is not of that type:

$$(47) \quad \text{Ben put}_{\text{DP}} [\text{-est}_C [\lambda d [d\text{-many plants}]]] \text{ on the bookcase}$$

(uninterpretable)

When *-est_C* raises to be adjacent to the focus-marked element, however, the resulting structure can be interpreted. The phrase [*d*-many plants] denotes a quantifier, type $\langle \langle e, t \rangle, t \rangle$; let us assume that it undergoes QR in order to be interpreted:

$$(48) \quad [\text{the bookcase}]_F \text{-est}_C \lambda d \lambda x [[d\text{-many plants}] \lambda y \text{ Ben put } y \text{ on } x]$$

This structure delivers truth conditions corresponding to a relative reading with focus on *the bookcase*: 'Ben put more plants on the bookcase than anywhere else.'

As promising as this theory appears, it will not suffice to block the totality reading. As many authors have discussed (Schwarzschild 2006; Nakanishi 2007a; Solt 2009, 2015; Rett 2008, 2018), quantity words have a variety of uses:

- quantificational, as in *Many/few students attended the lecture*
- predicative, as in *John's good qualities are many/few*

⁹Among other things, such a meaning for quantity words avoids generating a problematic 'at least' reading for *few* (van Benthem 1986, Herburger 1997, McNally 1998, among many others; see discussion in Solt 2009).

- attributive, as in *The many/few students that we invited enjoyed the lecture*
- differential, as in *Many/few more than 100 students attended the lecture*
- VP-modificational, as in *Ben does not read books much*
- PP-modificational, as in *The camp is not much beyond the tree line*

The quantificational treatment of quantity words handles the quantificational use, but none of the others.

Furthermore, quantity words have the semantics of determiners on this view, but quantity words sometimes behave syntactically more like adjectives than determiners. Teodorescu (2009) observes that Romanian quantity words can appear in post-nominal position, like adjectives but unlike determiners. Teodorescu also shows that like adjectives, Romanian quantity words can appear in predicative positions, a position which is off-limits to determiners. If we wish to accommodate these data, we will be forced at minimum to posit homophony for quantity words on their different uses. But once we add other meanings for *many* (e.g. type $\langle d, et \rangle$), the unattested totality reading re-emerges.

4.2.3. DISTINCT AS NON-OVERLAPPING. A more robust way of ruling out the totality reading is proposed by Hackl (2009). Hackl modifies Heim's semantics in two ways to block totality readings and, at the same time, generate proportional readings. This is good news for sentences like (49), which have proportional readings.

(49) Gloria visited most continents.

Like Heim (1999), Hackl assumes that *-est* combines with a gradable predicate G and a comparison class C . But Hackl replaces 'distinct' with 'non-overlapping': A superlative produces a predicate that holds of a given potential target x if x 's degree of G -ness exceeds the G -ness of any *non-overlapping* (as opposed to *distinct*) y in C . Two plural individuals are only *non-overlapping* if they have no common sub-individuals.¹⁰

¹⁰Hackl (2009) treats quantity words not as expressions of type $\langle d, et \rangle$ but instead as attributive modifiers of type $\langle d, \langle et, et \rangle \rangle$. The same problematic LF (43) is generated if this attributive meaning is assumed.

In addition to the change to *-est*, Hackl (2009) assumes that C (normally) consists of a sum-lattice; for example, it could contain the plurality of all continents, along with all its sub-parts (e.g. Africa, Asia, Africa+Asia, ...). If *-est* furthermore remains within the DP, as in (50), proportional truth conditions are derived.

(50) Gloria visited $[_{DP} \exists [-est_C \lambda d [d\text{-many continents}]]]$

This LF delivers truth conditions that can be paraphrased, ‘Gloria visited some continent-plurality x more numerous than all other continent-pluralities y in the comparison class C which do not overlap at all with x ’. This holds for any x that constitutes more than half of the continent-atoms, so the desired truth conditions are derived.

A relative reading can be derived by letting *-est* move and adjoin to the focused constituent, as in the vanilla theory. Hackl’s (2009) theory therefore derives both relative and proportional readings while avoiding totality readings. But while this is a good result for languages like English where both readings for *most* are attested, our typological investigation demonstrates that most languages lack proportional readings. Several proposals have been made to rein in Hackl’s account to avoid overgeneration of proportional readings. We review these next.

4.3. BLOCKING PROPORTIONAL READINGS.

4.3.1. DP-LAYER APPROACH. Bošković & Gajewski (2008) ask how Hackl’s (2009) theory can be modified to limit the generation of proportional readings. Their key ingredient is Bošković’s (2008) hypothesis that the presence of a DP layer is a parametric setting. Bošković & Gajewski (2008) tie the presence of a DP layer to the availability of an LF in which EST is interpreted DP-internally. As we have already discussed, EST can either move out of DP or it can be interpreted in DP-internal position. The latter option is only available in languages with DP: Otherwise, EST must seek higher ground, yielding a relative reading.¹¹

Bošković & Gajewski predict that MANY+EST should have a proportional reading in any language with a DP layer. Using presence of a definite determiner as a proxy for ‘has a DP layer’, it is possible to operationalize this prediction. Živanović (2007a,b) argues that it is borne out, but

¹¹Bošković & Gajewski (2008) assume Hackl’s (2009) attributive entry; see fn. 10.

Pancheva (2015) observes that it fails upon encounter with other languages including Bulgarian, French, Italian, and Spanish, with definite articles but no proportional reading.¹²

We add Kurdish Sorani to this list; consider the following examples of relative and proportional readings, respectively. The definite marker *aka* is visible in the first example.

- (51) La nevaan tawaw-i mndalaan-i qutaabxaan-**aka**-m mn taaqe kas-eka-m ka
 from between whole-EZ child.PL-EZ school-DEF-1POSS 1SG only person-INDF-1SG REL
zor-tar-in aamer-i musiqaa dazaan-em wa dajan-em.
 much-CMPR-SPRL instrument-EZ music know.PRES-1SG and play.PRES-1SG
 ‘Of all the kids in my school, I’m the one who plays the most instruments.’
- (52) **Zorba**-i mndalaan awanaí va dena qutaabxaana-i mn pe-yan xosh-a
 majority-EZ child.PL those such come.PRES school-EZ 1SG to-3PL pleasant-COP
 musiqa bezhan-in.
 music play.PRES-3PL
 ‘Most of the kids who go to my school like to play music.’

¹²Pancheva (2015) makes an alternative proposal to limit the distribution of proportional readings by positing pseudopartitive structure in superlatives. Quantity superlatives derive from individuating or measure pseudopartitive structures (Doetjes 1997; Landman 2004; Rothstein 2009; Alexiadou, Haegeman & Stavrou 2007) containing an abstract measure noun NUMBER. Languages in which quantity superlatives have the structure of measure pseudopartitives only allow relative readings. In languages with individuating pseudopartitive structures, both proportional and relative readings are allowed.

We highlight several challenges for Pancheva’s proposal. First, although quantity superlatives arise through the spell-out of an underlying structure involving the adjective LARGE and the noun NUMBER, there is no trace of this underlying structure on the surface. Relatedly, Wilson (2016:17) points out that if there is a silent NUMBER noun in combination with LARGEST, then we might expect LARGEST to realize a structure excluding NUMBER, yielding a reading for something like ‘He ate the largest (of) cookies’ as ‘He ate the largest number of cookies.’ Moreover, Pancheva stipulates that MANY is the spell-out of ‘LARGE NUMBER’ only in superlatives. It is not clear why EST cannot combine with MANY in the measure pseudopartitive structure, when this is possible for positives and comparatives. Finally, there are languages in which quantity superlatives with relative readings have structures distinct from pseudopartitives in the same language. In Italian, pseudopartitives are marked with *di* while *di* is absent from quantity superlatives (de Boer 1986), which unambiguously express relative readings. In Mandarin, the presence of the attributive modificational particle *de* in pseudopartitives forces a measure reading (Cheng & Sybesma 1998, Rothstein 2017:156). Yet superlatives with *de* were accepted in relative-only contexts (11), suggesting that relative readings need not reflect individuating pseudopartitives.

Hebrew is also notable here: The regular superlative of *MANY*, *haxi harbe*, lacks a proportional interpretation, though Hebrew has a definite article. Proportional readings are expressed by *rov* ‘most, majority’, which is not the superlative form of *harbe* (Hadas Kotek, p.c.). If Bulgarian, French, Italian, and Spanish, Kurdish Sorani, and Hebrew all have DPs, then the absence of a DP layer cannot explain missing proportional readings in these languages. There must be some other explanation.

4.3.2. PART-WHOLE BAN. Dobrovie-Sorin & Giurgea (2015) are interested both in blocking the totality reading and in explaining the absence of the proportional reading in many languages. They propose the following constraint on comparison classes, which we call the ‘part-whole ban’. As they point out, this can be seen as an even stronger version of Hackl’s (2009) non-overlap constraint.

(53) **Part-whole ban**

The members of a comparison class should not have part-whole relations
here $<$ denotes the proper individual-part relation)

This means that, for example, a and $a \oplus b$ (the sum of a and b) should not both be in a given comparison class, because a is a part of $a \oplus b$. This principle could be implemented as a presuppositional constraint on the C argument of *-est* to the following effect:

$$\forall x, y \in C : x \not< y$$

where $<$ denotes the proper part-of relation.

Dobrovie-Sorin & Giurgea (2015) adopt a scope theory of superlatives, so their C argument corresponds to the *outer* comparison class. Hence, when *-est* is interpreted near the focus, as on a relative reading of *Gloria visited the most continents*, the part-whole ban will apply to the focus alternatives. In this case, C here is made up of focus alternatives to Gloria (alternative visitors), and the part-whole ban requires that they not overlap. The part-whole ban says nothing about the pluralities of continents they visit; it may well be that Gloria visited North America, South America, and Europe, while everyone else visited only North America and South America. The overlap would be in the inner comparison class. On a non-movement analysis of superlatives, the

part-whole ban implemented as a constraint on C would apply to the inner comparison class, and such a situation would be incorrectly ruled out. A theory-neutral way of stating the part-whole ban that properly captures the insight is as follows:

(54) **Part-whole ban (reformulated)**

If C is the outer comparison class, and x and y are both in C , then $x \not\prec y$.

When *-est* is interpreted inside the DP, the outer and inner comparison classes are identified, so the constraint on C applies to the inner comparison class (as well as the outer comparison class, since they are identical). In a case like *Gloria visited most continents*, the (inner/outer) comparison class C is made up of continents. It is in this type of situation where a totality reading is in danger of being generated.

The part-whole ban will prevent a totality reading as follows. If the sum of all of the continents is in C , then no smaller sum of continents can be in C at the same time. But that means that C contains only one element, and comparison classes must contain at least two (preferably three) elements. Ergo, the sum of all continents must not be in C .

Hackl's route to the proportional reading depends on a comparison class that is made up of all sums of continents. Such a comparison class violates the part-whole ban, as it contains pairs x and y such that x is a proper part of y . Thus, in the context of the movement theory of superlatives, the ban on part-whole relations in comparison classes correctly rules out both totality readings and Hackl's route to proportional readings.

As Dobrovie-Sorin & Giurgea note, the part-whole ban is not implausible as a general constraint on quantification. Discussing quantification over spatiotemporal locations, Kratzer (1995:169) writes, "Quite generally, any sort of quantification seems to require that the domain of quantification is set up in such a way that its elements are truly distinct", where 'truly distinct' means 'not related to each other by the part-whole relation.'" If there is a general ban against domains containing parts and wholes in natural language quantification, then it follows that proportional readings should not be available in languages that use a CMPR+ALL strategy for expressing superlative meaning.

So far, so good. But there is another purported route to proportional readings not immediately ruled out by the part-whole ban, articulated by Hoeksema (1983b). In Dutch, *de meeste boeken*, lit. 'the most books' is ambiguous between a relative and proportional reading (Hoeksema 1983b):

- (55) Anton heeft **de meeste** boeken gelezen.
 Anton has DEF many.SPRL book.PL read
 ‘Anton has read {the most, most of the} books.’

Hoeksema proposes that the proportional reading arises when the comparison class consists of two particular pluralities, in this case the books Anton has read, and the books he hasn’t. The superlative contributes a predicate that holds of the larger of these two.

Hoeksema’s analysis requires the listener to accommodate a comparison class comprising a pair of pluralities that partitions the relevant domain. Interestingly, Romanian does have a construction in which it appears that such a comparison class is invoked. According to Dobrovie-Sorin & Giurgea (2015), in Romanian, prenominal quantity superlatives give rise to a proportional reading, but postnominal quantity superlatives give rise to a ‘predefined groups’ interpretation.

- (56) a. **Cele mai multe lebede** sunt albe
 DEF CMPR many swans COP white
 ‘Most swans are white’
- b. **Lebede-le cele mai multe** sunt albe
 SWANS-DEF DEF CMPR many COP white
 ‘The more numerous group of swans are white.’

Dobrovie-Sorin & Giurgea (2015) write that the postnominal version is used when there are some contextually given groups of swans. A comparison class consisting of such groups would not violate the part-whole ban, as they point out.

But generally, quantity superlatives do not have this kind of reading. Even when such ‘predefined groups’ are available in context, quantity superlatives seem not to be able to pick them up—not even in English, where proportional readings are available. For example, in the following context, *(the) most swans* could not be used to refer to the larger group of swans.

- (57) [Context: There are two groups of swans, on the north and south ends of the pond, respectively. The swans on the north end form a larger group.]
 #(The) most swans are white.

Under this proposal, it is unclear why this kind of ‘predefined groups’ reading is not available, even in a context where such groups are explicitly introduced.

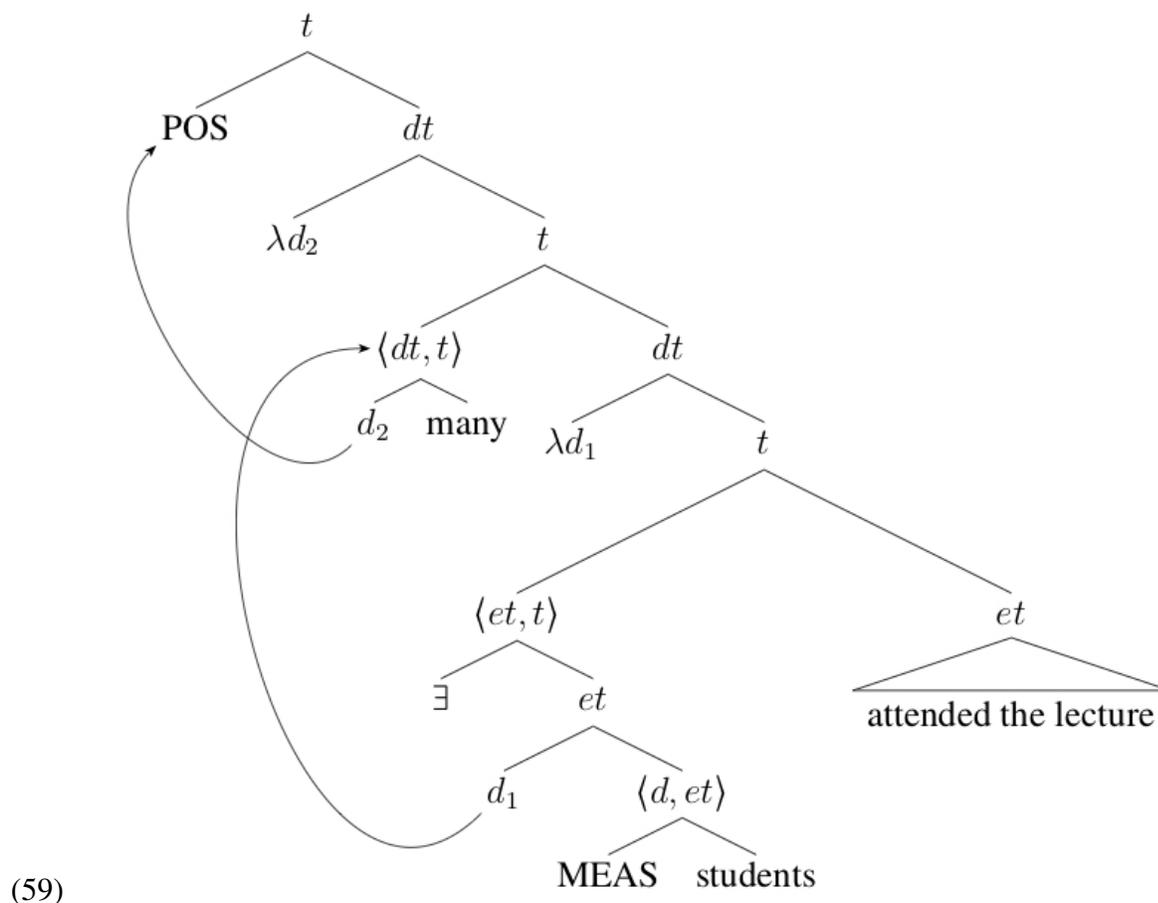
5. PROPOSAL: QUANTITY WORDS AS DEGREE QUANTIFIERS. We are now in a position to present our own proposal to explain why only relative readings are universally available for quantity superlatives. Our central claim is that quantity words denote degree quantifiers (type $\langle d, \langle \langle d, t \rangle, t \rangle \rangle$), as argued by Solt (2009). Paired with a ‘vanilla’ semantics for superlatives, this theory correctly derives only relative readings for the superlatives of quantity words. Quantity words will be forced to take scope, which will in turn force EST to take sentential scope, making it impossible for proportional readings to arise. This account for the lack of proportional readings is in the spirit of Schwarz 2004, but it avoids the problems identified for that proposal identified above. In order to prevent superlatives from going rogue and generating proportional readings on their own, without any quantity word in the structure at all, we assume that superlatives are functional elements that must be hosted by an appropriate lexical projection. Our proposal thus comprises (i) a Solt-style analysis of the semantics of quantity superlatives; (ii) a ‘vanilla’ analysis of the semantics of superlatives; and (iii) a syntactic requirement that superlatives must have an appropriate host. We now demonstrate how the interaction of these three claims allows us to derive relative readings for quantity superlatives while blocking both totality and proportional readings.

5.1. CORE THEORY. Solt (2009) shows that a unified account of the diverse uses of quantity words—quantificational, predicative, attributive, differential, and modificational—can be obtained under such an analysis. Specifically, she assumes that quantity words are of type $\langle d, \langle dt, t \rangle \rangle$, that is, generalized quantifiers over degrees of type $\langle dt, t \rangle$, with an initial degree argument. This type was advocated for *little* by Heim (2006a). (Rett (2008, 2014) proposes a similar analysis, with the first two inputs reversed, type $\langle dt, dt \rangle$.) Solt’s lexical entry for *much/many* (glossing over the distinction between the two) is as follows:

$$(58) \quad \textit{much/many} \rightsquigarrow \lambda d. \lambda D_{dt}. D(d) \qquad \langle d, \langle dt, t \rangle \rangle$$

Because of its type, this *many* cannot remain within its enclosing DP; it must take sentential scope.

Solt assumes that the LF for *Many students attended the lecture* is as follows (modulo how existential quantification is introduced; for convenience, here we use Partee’s (1987) A-shift, written \exists):



In this derivation, MEAS is a functional head that readies nominal constituents for composition with degree expressions by introducing a degree argument. Here, we adopt the MEAS head from Solt (2009:105).¹³

$$(60) \quad \text{MEAS} \rightsquigarrow \lambda x \lambda d. \mu_D(x) \geq d$$

where μ_D is a measure function that maps an individual to a set of degrees (interval) on a scale associated with dimension D .

MEAS and its nominal complement compose via ‘Variable Identification’ (see Solt 2009 for details).¹⁴

¹³For precedent, see Cresswell 1977; Krifka 1989; Kayne 2005; Schwarzschild 2006; Nakanishi 2007a,b; Cornilescu 2009; Solt 2009, 2015; Scontras 2013; and references therein).

¹⁴Our proposal does not hinge on the availability of Variable Identification or the entry for MEAS defined precisely as in (60). While we keep this entry in later discussion, we could have instead give MEAS the attributive meaning shown below. This meaning for MEAS is used in Rett 2014. So defined, MEAS would take the noun as its first

$$(61) \quad \text{MEAS } \textit{students} \rightsquigarrow \lambda d \lambda x . * \text{STUDENT}(x) \wedge \mu_D(x) \geq d$$

At both of the type *dt* nodes, the meaning can be represented as

$$\lambda d . \exists x [* \text{STUDENT}(x) \wedge \mu_{\#}(x) \geq d \wedge \text{ATTENDED}(x)]$$

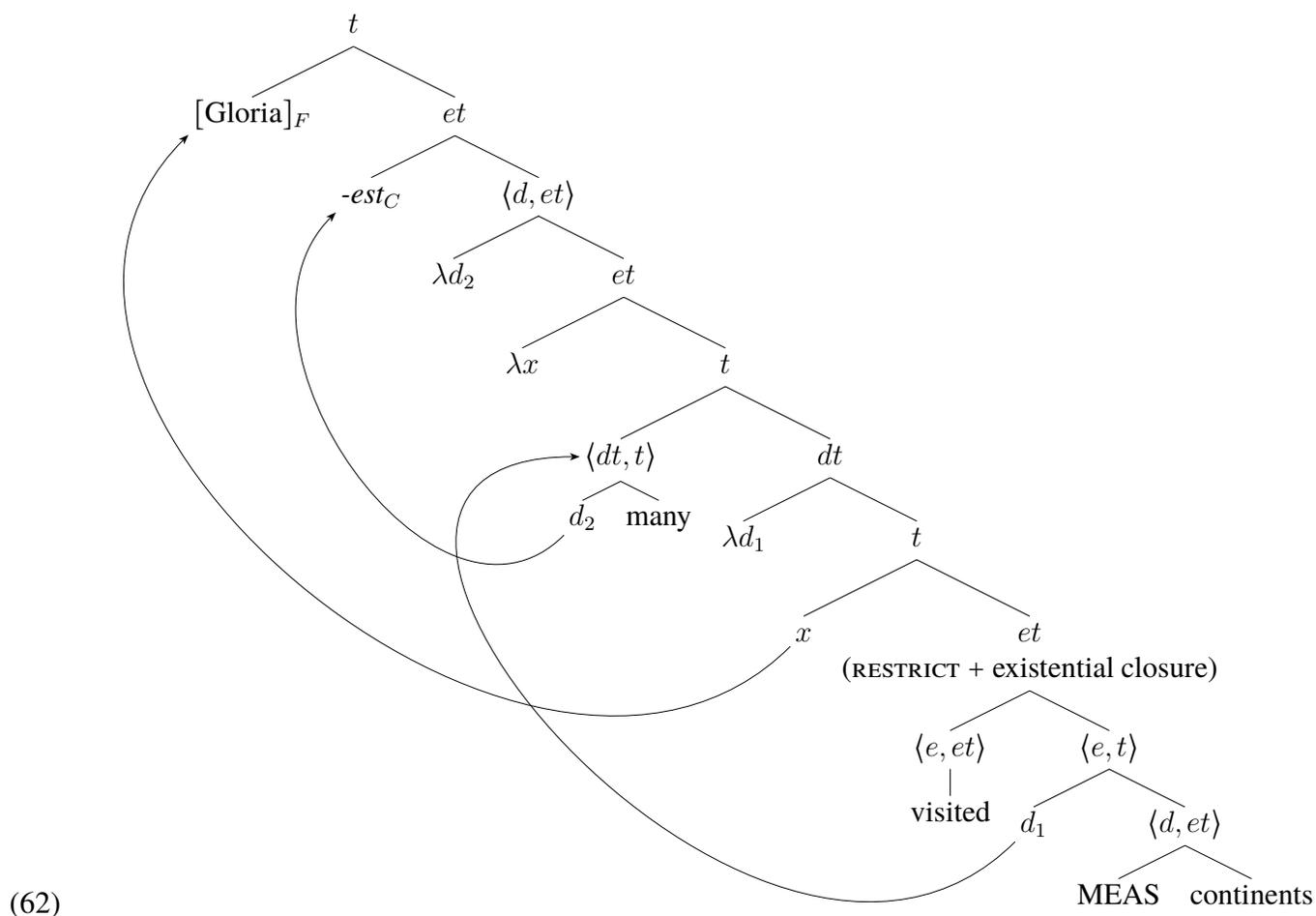
where $\mu_{\#}(x)$ denotes the number of atoms in x .

The node labelled POS is the hypothesized morpheme that occurs in the positive form (Cresswell 1977; von Stechow 1984; Kennedy 2007b); Solt (2009) follows von Stechow (2005) and Heim (2006b) in treating POS as a null degree quantifier that effectively pushes the relevant degree outside what Sapir (1944) called the ‘zone of indifference’; see references cited for details; they are not of central importance here.

Let us consider what happens when this meaning for *many* is combined with a vanilla treatment of *-est*. A relative reading obtains when *-est* replaces POS, and a focused argument is extracted, as in [*Gloria*]_F *visited the most continents*:

argument, rather than requiring composition through Variable Identification.

$$(i) \quad \text{MEAS}_{\textit{attrib}} \rightsquigarrow \lambda P \lambda d \lambda x . P(x) \wedge \mu_D(x) \geq d$$



(When the verb combines with the object, we assume that Chung & Ladusaw’s (2004) ‘restrict’ operation applies, followed by existential closure. This allows a predicate-denoting object noun phrase to acquire existential force without undergoing scope movement.) The derivation in (62) can be viewed as the result of several movement steps, schematized as follows:

- (63)
- [Gloria [visited [[-est_C many] [MEAS continents]]]]
 - [-est_C many] λd₁ [Gloria [visited [d₁ [MEAS continents]]]]
 - Gloria λx [-est_C many] λd₁ [x [visited [d₁ [MEAS continents]]]]
 - Gloria -est_C λd₂ λx [d₂ many] λd₁ x visited [d₁ MEAS continents]

First, [-est_C many] undergoes Quantifier Raising from its original position by [MEAS continents], leaving the trace d₁. Next, the focused constituent *Gloria* undergoes QR, creating a predicate of type

et, which paves the way for *-est*. At this point, *-est* leaves *many* and inserts itself between *Gloria* and λx , yielding the structure in (63d), shown in tree form in (62). Thus the scope of *-est* is ‘parasitic’ on the scope of the focused constituent, *Gloria*, in Barker’s (2007) sense. To paraphrase Barker, what makes this ‘parasitic scope’ is that the scope target for *-est* (namely ‘ λx ... continents’) does not even exist until *Gloria* has taken scope. Within the literature on degree semantics, parasitic scope configurations have been posited for phrasal comparatives by Heim (1985), Bhatt & Takahashi (2007, 2011) and Kennedy (2007a), and for superlatives (implicitly) by Heim (1985) and Heim (1999), and more recently by Bumford (2018). While the order of scope-taking operations is not completely fixed by the semantic type requirements of the various elements involved, two features of this derivation are crucial: (i) *many* must take sentential scope, and (ii) *est* cannot take scope until the focused constituent has done so.

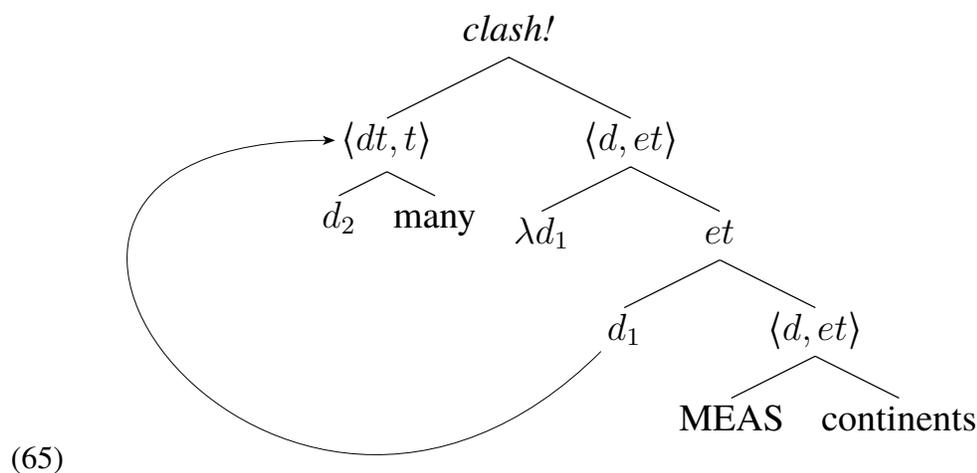
The truth conditions we derive for (62)/(63d) are as in (64):

$$(64) \quad \exists d[G(d)(\text{GLORIA}) \wedge \forall y \neq \text{GLORIA} [C(y) \rightarrow \neg G(d)(y)]]$$

where $G = \lambda d \lambda x \exists y . *_{\text{CONT}}(y) \geq d \wedge \text{VISITED}(x, y) \wedge \mu_D(y)$

Assuming that the dimensional parameter D is resolved as ‘number of atomic individuals’, this formula says that Gloria has visited more continents than anyone else in C has. These are relative truth conditions.

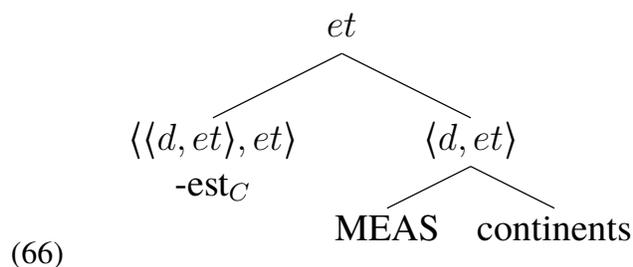
As under the parameterized determiner analysis, the superlative of *many* cannot be interpreted within the DP: If [d_2 *many*] were interpreted within the DP, there would be a type clash, as its sister is of type $\langle d, et \rangle$ rather than dt .



As we saw in the previous section, if scope within the DP were possible, then we would derive an absolute-like reading (either ‘totality’, ‘proportional’, or ‘predefined groups’, depending on the exact assumptions). When the quantity word takes sentential scope, only a relative reading is available (cf. (64)). Hence the requirement for sentential scope rules out any potential correlate of the absolute reading, including a proportional reading.

Insofar as the degree quantifier analysis rules out both proportional and totality readings via a sentential scope requirement, this analysis is similar to the solution proposed by Schwarz (2004), which treated quantity words as quantificational determiners following Hackl (2000). It nevertheless avoids the difficulties for that account identified by Teodorescu (2009), concerning the flexibility of use that quantity words exhibit. Solt (2009) shows how the degree quantifier treatment of quantity adjectives accounts for a wide diversity of uses. Differential uses are analyzed as involving sentential scope for the quantity word, just as in the derivation shown above. As Solt points out, the predicative uses are extremely limited, so she does not assume that quantity words can be predicates of individuals even after type-shifting. Rather, predicative uses of quantity words can only be generated by applying MEAS to the subject DP, to yield a property of degrees, which the degree quantifier can operate on. Attributive uses are generated using this process in combination with a multidimensional composition mechanism that generates nonrestrictive modifiers (Potts 2005). Crucially, none of the derivations she posits opens the door to a proportional reading; a quantity word modifying a noun must move to take sentential scope.

So far we have been restricting our attention to *quantity superlatives*, which are by definition the superlatives of quantity words. Let us now consider what would happen if there were no quantity word in the structure at all. In that case, could a superlative combine directly with [MEAS NP]?



Such a derivation is indeed possible given only the semantic assumptions we have made. (We thank *Language* Associate Editor Chris Kennedy for bringing this structure to our attention.) It seems

particularly plausible for languages without overt quantity words, for example French (18a) and Navajo (19a). In these languages, we have assumed that the operative structure is one involving a phonologically null quantity word. But this assumption of course does nothing to prevent a parse of the same string without the quantity word. Such a parse would incorrectly allow proportional readings to be derived.

We propose that this kind of parse is unavailable due to syntactic constraints on the distribution of superlatives. In particular, we adopt Grimshaw's (1991) Extended Projection Hypothesis, according to which functional heads must be part of the extended projection of some particular lexical head (cf. also Jackendoff 1977). We assume further that superlatives head a functional category that must occur in the extended projection of an appropriate lexical head, which can be either a gradable adjective or a quantity word (Abney 1987; Corver 1997; Kennedy 1997). For concreteness, let us assume that gradable adjectives are of category A and quantity words are of category Q. A superlative lexeme is of category Deg, and Deg is functional category that may appear in the extended projection of A or Q. Let us assume further that *MEAS continents* is headed by *continents*, so it is category N. We assume that Deg cannot appear in the extended functional projection of N. As a consequence, the derivation in (66) is ruled out on syntactic grounds, and this otherwise easy path to proportional and totality readings is blocked.

In languages where superlative meaning is expressed through a combination of comparative morphology and another element (definiteness-marking, a universal standard, or a pure superlative marker, as in Persian's *-tar-in* 'CMPR-SPRL'), proportional readings are blocked for analogous reasons, this time involving the comparative as opposed to the superlative. Comparative lexemes are also of category Deg, and Deg cannot be projected above N. If Bobaljik (2012) is right, then superlatives are always syntactically projected over a comparative, in which case the *only* necessary assumption is that comparatives are of category Deg. In any case, this proposal is flexible enough to accommodate a wide range of strategies for expressing superlative meaning.

With these syntactic assumptions in hand, the degree quantifier analysis succeeds in explaining the predominant pattern crosslinguistically, where relative readings are the only readings that quantity superlatives can have. In fact, as far as we can see, it is the only existing theory that provides a satisfactory account.

Given that the quantificational semantics of quantity words is an important piece of our proposal,

it is important to note that there are languages like Russian (Krasikova & Champollion 2011) and Dutch (Ruys 2014), which have multiple morphologically distinct quantity words, with slightly different properties. In Russian, the two forms appear to track the distinction between cardinal and proportional *many* famously discussed by Partee (1989); in Dutch, the distinction appears to be a bit more subtle. Solt (2009) argues that the cardinal/proportional distinction is rooted in scale structure; if that is so, then the degree-quantificational nature of quantity words—the semantic type, in other words—may be universal despite diversity among them. This is an issue to be investigated further.

In addition, we have very little to say about why the definite article is present in the English example (*Gloria visited **the** most continents*).¹⁵ Wilson (2016) and Loccioni (2018) both argue that the definite article is interpreted within DegP in these kinds of cases, rather than at the DP level. This type of approach is not compatible with the degree quantifier analysis, because there is no DegP constituent denoting a predicate on this view. Another approach is Bumford’s (2017) ‘split-scope’ approach, which succeeds in explaining the presence of the definite article with superlatives on relative readings, while enjoying the advantages of scope-based approaches. If the degree quantifier analysis could be implemented in Bumford’s (2017) framework, then the presence of the definite article might be explainable in that way. This is another open question.

5.2. HOW PROPORTIONAL READINGS ARISE WHEN THEY DO. We have identified a set of assumptions on which quantity superlatives are not expected to have proportional readings. What about languages in which they do? What is different about these? In this section, we describe historical pathways through which proportional readings might develop.

5.2.1. PREDICATE-FOCUS PATHWAY. One pathway involves relative readings on which a predicate is in focus. As Hackl (2009) points out, the following sentence could be analyzed as having a relative reading on which the outer comparison class is made up of focus-alternatives to the focused predicate *männlich*.

¹⁵If the existential quantifier is replaced by a definite article in the tree, then we run into the problem that Coppock & Beaver (2014) identified for scope theories: effectively, ‘the d_1 MEAS continents’ is only defined when there is only one number of continents and d_1 is it. To the extent that such a number exists, the semantic value at the lowest sentential node is ‘undefined’, for anyone who did not visit that number of continents.

- (67) Die meisten Studenten sind [männlich]_F.
 DEF many.SPRL student.PL 3PL.COP male
 ‘More students are male than female.’

If there are only two focus alternatives, ‘male’ and ‘female’ (or ‘male’ and ‘non-male’), and they jointly partition the domain, then a proportional reading arises. On the theory we have developed so far, the LF for this kind of relative reading is as in (68a), yielding the truth conditions in (68b) (ignoring presuppositions):

- (68) a. $\text{male}_F\text{-est}_C \lambda d_2 \lambda P d_2\text{-many} \lambda d_1 [[\exists d_1 \text{MEAS students}] \text{ are } P]$
 b. $\exists d [G(d)(\text{MALE}) \wedge \forall y \neq \text{MALE} [C(y) \rightarrow \neg G(d)(y)]]$
 where $G = \lambda d \lambda P \exists y . * \text{STUDENT}(y) \geq d \wedge P(y) \wedge \mu_D(y)$
 and $C = \{ \text{MALE}, \overline{\text{MALE}} \}$

Simplifying further, and rewriting $\mu_D(x) \geq d$ as $|x| \geq d$, we find that (68b) is equivalent to:

- (69) $\exists d \exists x [\text{MALE}(x) \wedge \text{STU}(x) \wedge |x| \geq d] \wedge \neg \exists x [\overline{\text{MALE}}(x) \wedge \text{STU}(x) \wedge |x| \geq d]$

which in turn is equivalent to:

- (70) $|\text{STU} \cap \text{MALE}| > |\text{STU} \cap \overline{\text{MALE}}|$

In other words, there are more male students than non-male students. These are just the truth conditions Barwise & Cooper (1981) assign to *most*; according to that analysis, ‘most As are Bs’ says $|A \cap B| > |A \cap \overline{B}|$. Thus, although the interpretation just described is a relative reading insofar as it involves comparison among focus alternatives, the truth conditions are those of a proportional reading, the kind that Barwise and Cooper would assign.¹⁶

We suggest that these constructions form a historical link between relative readings and propor-

¹⁶Hackl (2009) points out that there is no comparable proportional reading for *die wenigsten*, and offers an explanation: When the comparison class is a sum-lattice over the relevant domain, there is no plurality that is smaller than all non-overlapping pluralities (assuming there are multiple atoms in the domain), because all of the atoms are equally small. But this explanation does not carry over to the case where C is made up of predicates, as in the predicate focus case. Why such a reading is absent for *die wenigsten* when focus is on the predicate is mysterious under all accounts, as far as we can see.

tional readings. In particular, we suggest that the focused predicate is reinterpreted as an argument of the superlative form, yielding a generalized quantifier:

$$(71) \quad \textit{many-est} \rightsquigarrow \lambda A \lambda B . \exists d [G(d)(B) \wedge \neg G(d)(\overline{B})]$$

where $G = \lambda d \lambda P \exists y . A(y) \wedge P(y) \wedge |y| \geq d$

The above entry is what we derive compositionally using predicate focus, assuming that $C = \{B, \overline{B}\}$, where B is the predicate. As just shown, the result is equivalent to Barwise and Cooper's proportional *most*.

The kinds of constructions that would form the basis of this reanalysis are ones in which the quantity superlative is in subject position. Relative readings in subject position are degraded, as both Farkas & É. Kiss (2000) and Kotek, Sudo, Howard & Hackl (2011b) observe:

(72) ??The most/fewest voters voted for JOHN.

Similarly, bare quantity superlatives in Mainland Scandinavian languages (e.g. Swedish/Norwegian *flest*), which only permit relative readings, are degraded in subject position (example from Swedish):

(73) ??Flest studenter är män.
 many.SPRL student.PL COP men
 'The most students are men.'

However, such uses are attested. They seem to occur in contexts where the line between relative and proportional readings is blurred, where comparison is being made between two groups. We give a representative example from Norwegian:

(74) a. USA har soleklart flest, med over 2500 sangere. Det er flest
 USA has clearly many.SPRL with over 2500 singer.PL DEM.NEUT COP many.SPRL
 kvinnelige sangere, 2265, og **flest** er sopraner.
 female.PL singer.PL 2265 and many.SPRL COP soprano.PL
 'The USA has the most, with over 2500 singers. They are largely female singers,
 2265, and most are sopranos [as opposed to altos].'

In these kinds of constructions, the meaning is just what would be obtained if *flest* were Barwise & Cooper's (1981) generalized quantifier *most*, taking the modified noun as a RESTRICTOR and the

verb phrase as the SCOPE, to use the terminology from the literature on generalized quantifiers. Since the scope part is expressed in a single constituent, it is possible for focus to be placed on it. If the quantity superlative were in object position, the scope would be the result of abstracting over the object, leaving the subject and the verb. This is not a constituent that could bear focus. Only when focus goes on the predicate can the comparison class consist of the predicate and its negation, yielding the effect of a proportional reading.

English *most* is directly cognate with its Scandinavian counterparts, such as Swedish *mest* (the superlative of ‘much’). As we have mentioned, these bare quantity superlatives in Scandinavian languages (e.g. *flest*) have relative readings; it is definite quantity superlatives (e.g. *de flesta*) that have proportional readings (Coppock & Josefson 2015; Coppock 2019). From this perspective, bare *most*, unaccompanied by the definite article, is the form that would be expected if the proportional reading developed through reanalysis of a predicate-focus construction.

We found a similar ‘fake’ proportional reading in Georgian as well. While most proportional prompts were translated using a structure other than the language’s primary CMPR+ALL superlative strategy, there was one exception:

(75) Prompt: Most milk comes from cows, but goat milk is best.

q’vela-ze bevri rdze modis drokhisgan, magram tkhis rdze sa-u-ket-es-*oa*.
all-STND_{on} much milk come cow.from but goat milk SPRL-CMPR.good.CMPR

Here, comparison is between two milk sources: cow and goat. If it is true that the largest quantity of milk from these sources comes from cows, then it is also true that the majority of milk comes from cows. Follow-up elicitation on Georgian demonstrated that the CMPR+ALL structure seen above does not allow proportional readings in object position. Georgian thus appears to represent an intermediate stage on the historical pathway, where proportional (or quasi-proportional) readings are visible in subject but not object position.

5.2.2. DP-INTERNAL PATHWAY. The predicate-focus pathway is not as plausible for Scandinavian proportional quantity superlatives like Swedish *de flesta* (lit. ‘the many.SPRL’; proportional only), because the presence of the definite article would be entirely mysterious on such a view, without any predicate for it to attach to. For cases like Swedish (along with other mainland Scandinavian

languages, German, and Dutch), we find it rather more plausible that the degree quantifier analysis is generalized in the manner that Solt (2011) envisions, from $\langle d, \langle dt, t \rangle \rangle$ to $\langle d, \langle d\alpha, \alpha \rangle \rangle$:

$$(76) \quad \text{much/many} \rightsquigarrow \lambda d. \lambda P_{\langle d, \alpha \rangle}. P(d) \quad \langle d, \langle \langle d, \alpha \rangle, \alpha \rangle \rangle$$

where α is any type.

One possible LF for *Gloria has visited the most continents* on this analysis is as follows:

$$(77) \quad \text{Gloria} [\text{-est}_2 \lambda d_2 [d_2\text{-many} \lambda d_1 [\text{has visited} [\text{the } d_1 \text{ MEAS continents}]]]]$$

This LF yields a relative reading: Gloria has visited more continents than anyone else. Another possible LF on this theory is as follows:

$$(78) \quad \text{Gloria has visited} [\text{the} [\text{-est}_C \lambda d [d\text{-many} [\text{MEAS continents}]]]]$$

As ‘MEAS continents’ is type $\langle d, et \rangle$, this constituent can combine directly with *d-many* if α is instantiated as *et*. Then ‘*d-many* MEAS continents’ has type *et*, which becomes $\langle d, et \rangle$ after lambda abstraction over *d*; this is the right type for *-est* to combine with.

This LF yields a totality reading, given the vanilla lexical entry for *-est* that we have given above. The compositional derivation for *most continents* is as follows:

$$(79) \quad \text{-est} \lambda d [d\text{-many} [\text{MEAS continents}]] \rightsquigarrow$$

$$\lambda x. \exists d [[\mu_D(x) \geq d \wedge *CONT(x)] \wedge \forall y \neq x [C(y) \rightarrow \neg [\mu_D(x) \geq d \wedge *CONT(x)]]]$$

This lambda expression describes a predicate that holds of a continent-plurality that is larger than all other continent-pluralities in *C*: the set of all continents, assuming all continent pluralities are in *C*.

In principle, this totality reading could be replaced by a proportional reading either through (i) the adoption of Hackl’s (2009) analysis of superlative *-est*, or (ii) Dobrovie-Sorin & Giurgea’s (2015) part-whole ban. The former solution would render the predicate in (79) non-unique and therefore leave the presence of the definite article unexplained. Furthermore, it would seem only to be applicable to languages in which superlative meaning is expressed in a single morpheme, because it relies crucially on a lexical assumption about superlatives.

The latter approach, using the part-whole ban, would rule out a totality reading, and would be applicable to languages in which superlative meaning is expressed using a complex construction. If we assume that there are no overlapping members of C , the predicate in (79) is unique, so it satisfies the requirements of the definite article. Hence we compositionally derive the following meaning for *the most continents*:

$$(80) \quad \iota x . \exists d [[\mu_D(x) \geq d \wedge *_{\text{CONT}}(x)] \wedge \forall y \neq x [C(y) \rightarrow \neg[\mu_D(x) \geq d \wedge *_{\text{CONT}}(x)]]]$$

‘the continent plurality greater than all others’

What we have so far is essentially Hoeksema’s analysis of *de meeste* in Dutch, as long as C is a partition of the continents whose cells are divided according to the predicate that applies to the noun phrase containing the quantity superlative. For example, if the sentence is *Gloria has visited most continents*, then the predicate B is the property of being visited by Gloria, and C is a binary partition of the continents: those that Gloria visited, and those that she didn’t.

$$C = \{ *_{\text{CONT}} \cap B, *_{\text{CONT}} \cap \overline{B} \}$$

But what ensures that C is set up this way? Nothing, given only what we have specified so far.

Furthermore, expressions like Swedish *de flesta* ‘most’ are not referential; they are quantificational, just like English *most*. *De flesta svaner* ‘most swans’ could not be used to pick out the largest of two predefined groups of swans. (Note that the head noun *svaner* lacks definiteness marking, in contrast to the usual double-definiteness pattern, showing that *de flesta* is behaving syntactically like a quantifier as well.) Similarly, as we saw above, Romanian *cele mai multe* has a referential, ‘predefined groups’ reading only when it is used postnominally. When used prenominaly, it behaves like a quantifier.

We speculate that a quantificational meaning becomes attached to forms like *de flesta* through a process in which the comparison class variable C becomes existentially bound and constrained in the manner envisioned by Hoeksema:

$$(81) \quad \lambda A \lambda B . \exists C [C = \{A \cap B, A \cap \overline{B}\} \wedge B(\iota x . \exists d [[\mu_D(x) \geq d \wedge A(x)] \wedge \forall y \neq x [C(y) \rightarrow \neg[\mu_D(x) \geq d \wedge A(x)]]])]$$

The result is a Barwise & Cooper (1981)-style quantifier. Given scope predicate *A* and restrictor predicate *B*, it says that *B* holds of the largest element of *C*, where *C* is made up of the *As* that are *B* and the *As* that are not *B*. This boils down to the claim that most *As* are *B*.

Stepping back, our claim is that proportional readings require some form of grammaticalization in order to arise, and there are multiple grammaticalization pathways that can yield them, with slightly different outcomes. This view predicts that quantity superlatives with proportional readings should vary in their structure from language to language, and such variation is indeed attested.

6. SUMMARY AND OUTLOOK. Let us summarize. Using targeted comparative fieldwork, we have supported the proposed universal and tendency, repeated in (82).

- (82) a. **Universal:** Quantity superlatives have relative readings.
 b. **Tendency:** Quantity superlatives do not have proportional readings.

Together, these produce an implicational universal: If a proportional interpretation is available for a quantity superlative, then a relative interpretation is too. In other words, no language uses quantity superlatives to express a proportional but not a relative reading.

In more concrete terms, we found languages where the superlative of *MANY* or *MUCH* had a relative reading but no proportional reading (NO-YES languages), and languages where both readings were attested (YES-YES languages), languages where there is no superlative of *MANY* (NA-NA languages), but no languages where the superlative of *MANY* or *MUCH* had a proportional reading but no relative reading (YES-NO languages). As we have seen, there exists great diversity in the morphosyntactic strategies used to express superlative meanings crosslinguistically, and quantity superlatives are even more richly diverse. It is remarkable that in the midst of all of this diversity, a linguistic universal could emerge. But this appears to be what we have found. Relative readings appear not to require any extra ingredients beyond a quantity word and a way of indicating a superlative interpretation, while proportional readings require something more.

After surveying available theories of superlatives and quantity words, we concluded that the universal is best explained by a proposal centered around the claim is that quantity words are degree quantifiers, as argued by Solt (2009). This semantic type forces quantity words to take scope; as a result, only relative readings are predicted to be available for quantity superlatives.

Combined with a ‘vanilla’ semantics for superlatives, the theory predicts only relative readings for quantity superlatives. We suppose further that superlatives occupy functional projections that require an appropriate host, lest they go rogue and license proportional readings on their own.

Although proportional readings are in the ‘zone of proximal development’ as it were for raw quantity superlatives, we conjecture that some kind of historical change must take place in order for them to come into being. Thus, although we are sympathetic with the project of deriving proportional readings compositionally, we suggest that compositional semantics requires a nudge from historical change.

We described two alternative historical pathways by which proportional readings might evolve: a predicate-focus configuration, and a DP-internal configuration. So there are different ways that a language could deviate from the three default assumptions given above to get to proportional readings. This predicts that we should see a certain amount of crosslinguistic variation in how proportional readings of quantity superlatives are derived, and the facts bear this prediction out. Both pathways appear to be attested.

Synchronically, then, the generalized quantifier analysis of Barwise & Cooper (1981) is not wrong. This claim stands in tension with experimental findings by Kotek, Sudo, Howard & Hackl (2011a); Kotek, Sudo & Hackl (2015), who show that proportional *most* in English exhibits what they call ‘fragile superlative readings’. They compare *most* to *more than half*, in sentences like the following:

- (83) a. Most of the dots are blue.
 b. More than half of the dots are blue.

According to their results, English speakers are more likely to judge (83a) than (83b) to be true in scenarios where fewer than half of the dots are blue, as long as there are more blue dots than dots of any other color. They take this to support a view of bare *most* in subject position as morphologically decomposed into *many* and a superlative component.¹⁷ If this assessment

¹⁷It remains unclear how to interpret these results. Solt (2016) offers an alternative view on the difference between *most* and *more than half*, in terms of ordinal vs. ratio scales. Furthermore, Coppock & Ganem (2018) failed to replicate the effect, but they did show that ‘fragile superlative readings’ also occur with *the majority*, and nonsuperlative proportional quantifiers in other languages.

is correct, then the grammaticalization process may not have gone entirely to completion, and a decompositional route may exist alongside a compositional route, perhaps in the ‘dual-route’ manner envisioned by Hay (2003). This is a matter for future investigation.

Another open question is how to explain relative readings in embedded descriptions such as *the rabbit with the most carrots*, as discussed by Bumford (2017). At first glance, there appears to be no sentence to take scope over in these examples. Either the theory must be refined to take these examples into consideration, or these examples must be viewed as allowing sentential scope in some relevant sense. A similar problem arises with examples like Heim’s (1999) *How do you win this contest? By putting the most plants on the table*. It is not clear whether there is an adequate host for the quantity word in this type of example. We hope that this question will be addressed in future research.

Another question that arises in light of these conclusions is whether quantity words in every language can be treated as degree quantifiers. As mentioned above, languages differ in their inventory of quantity words (Krasikova & Champollion 2011; Ruys 2014). If these differences are rooted in scale structure rather than semantic type, as Solt (2009) argues for the cardinal/proportional distinction, then our hypothesized explanation for the universal can be maintained.

Finally, *why* should it be universal that quantity words are degree quantifiers? It may be related to the fact that quantity words are quite low in semantic content. Words that are highly semantically bleached can sometimes serve as relative pronouns; see for example Tonhauser 2003 on Yucatec Maya. Effectively, on this analysis, quantity words are behaving as degree-theoretic relative pronouns, combining with a sentence containing a degree-sized gap. We hope future research will provide more insight into this question.

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