Universals in superlative semantics

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UNIVERSALS IN SUPERLATIVE SEMANTICS

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This article 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

1. Introduction. Proportional *most* got its first big break in linguistics with its starring role in Barwise and Cooper's (1981) demonstration that first-order logic is not sufficient to represent it. 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 and Cooper 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 and Cooper's (1981) framework has stimulated a rich discussion about semantic universals (Bach et al. 1995, von Fintel & Matthewson 2008, Steinert-Threlkeld & Szymanik 2019, inter alia, and references therein).

As Barwise and 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.

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

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.[1]

Examples like 2 show that quantity superlatives have relative readings. Do quantity superlatives have anything analogous to an absolute reading? As we discuss in §4 below, under certain generic assumptions, the analogue of the absolute reading would be a TOTALITY READING, where *Gloria has visited (the) most continents* means *Gloria has visited all (seven) continents*. Clearly, no such reading is available. As discussed in more detail in §4, Hackl (2009) proposes instead that the proportional reading paraphrased in 1 is the analogue of the absolute reading in the quantity domain, and he 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 ninety-two languages from twenty-eight 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 allows relative readings. It has previously

[1] The contrast between absolute and relative readings was discussed early on by Szabolcsi (1986) for Hungarian, and it 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-Madrazo 2007), Arabic (Hallman 2016a), and Slavic languages including Macedonian, Czech, Serbian/Croatian, and Slovenian (Pancheva & Tomaszewicz 2012).

been observed that proportional readings are sometimes absent, including by Živanović (2007b), Hackl (2009:68), Bošković and Gajewski (2011), Dobrovie-Sorin and Giurgea (2015), and Pancheva (2015). Slovenian illustrates.[2]

(4) Slovenian
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 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, via 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 §4, we undertake a critical review of existing theories of superlatives and quantity words, in light of this finding. We then propose in §5 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, third, that superlatives are functional heads in the extended lexical projection of an appropriate lexical category (Abney 1987, Grimshaw 1991, 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 ninety-two languages from twenty-eight 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

[2] The following abbreviations are used in glossed examples: ADV: adverbializer, CL: classifier, CMPR: comparative marker, COP: copula, DEF: definite, DEM: demonstrative, EZ: ezafe, FOC: focus, INDF: indefinite, INT: intensifier, LOC: locative, MODIF: modificational marker, N: neuter, NEG: negation, NMLZ: nominalizer, NOM: nominative, OBJ: object, OM: object marker, PFV: perfective, PL: plural, POSS: possessive, PRS: present, PST: past, REL: relativizer, SBJ: subject, SBJV: subjunctive, SG: singular, STND: comparative standard marker, SPRL: superlative marker, WK: weak inflection.

we term TARGETED COMPARATIVE FIELDWORK, characterized by the study of a targeted issue (here, quantity superlatives) through elicitation from a very broad sample of languages. Comparative fieldwork on a medium-sized language sample (fourteen languages) was previously used by Beck et al. (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 seventeen 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 ranged from one to fifteen.

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.[4] 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 sixty-five 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 seven instruments, two of my friends play six instruments, and lots of people play one or two instruments, but nobody else plays more than four.)

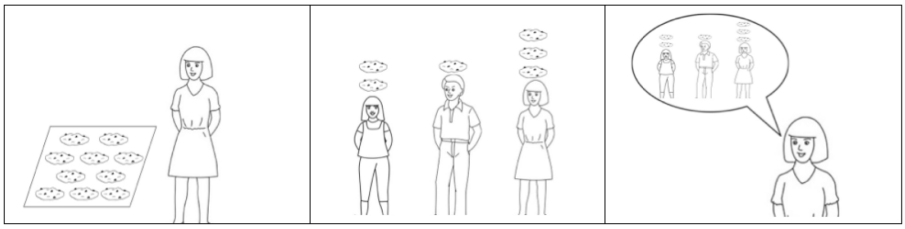
Translation questionnaire responses were not sufficient on their own, since the absence of a structure from the translation of a particular prompt does not prove its impossibility. It is also not guaranteed that all participants were sufficiently fluent in English to perceive the crucial semantic distinctions 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 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 images in the following figures were used often. Each context admits only one reading that is estab-

[3] For 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.

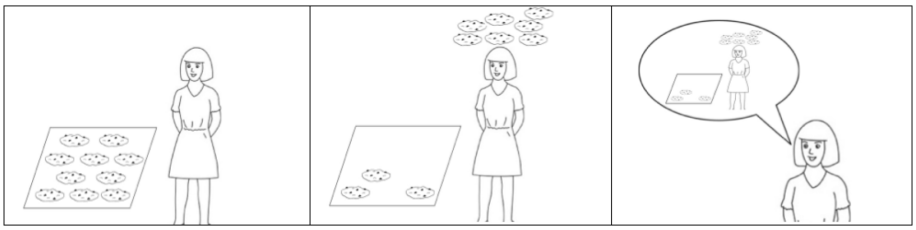
[4] The online supplement can be accessed at http://muse.jhu.edu/resolve/101.

lished 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 ninety-two languages distributed across all continents, twenty-eight language families, and fifty-seven 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	Romanian	CMPR+DEF	YES-YES
		Slavic	Macedonian	M	NO-YES

(TABLE 1. *Continues*)

MACRO-AREA	FAMILY	GENUS	LANGUAGE	STRATEGY	PROP-REL
Eurasia	Japanese	Japanese	Japanese	PERIPH	NO-YES
(cont.)	Kartvelian	Kartvelian	Georgian	CMPR+ALL	NO-YES
	Korean	Korean	Korean	PERIPH	NO-YES
	Nakh-Daghestanian	Lezgic	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	Arabic (Modern Standard)	M	YES-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
	Otomanguean	Chinantecan	Chinanteco	VERY	NA-NA
		Mixtecan	Mixtec	CMPR+ALL	NO-YES
		Zapotecan	Chatino	VERY	NA-NA
	Salishan	Interior Salish	Okanagan Salish	M	NO-YES
	Siouan	Core Siouan	Lakota	PERIPH	NO-YES
	Uto-Aztecan	Aztecan	Huasteca Nahuatl	CMPR+ALL	NO-YES
S. America	Aymaran	Aymaran	Central Aymara	CMPR+ALL	NO-YES
	Quechuan	Quechuan	Cochabamba Quechua	CMPR+ALL	NO-YES

TABLE 1. Language sample (one language per genus).

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.[5]

(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. Ø/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 that translates as 'exceed' or '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.PFV.PST SPRL-many cookies
'I ate the most cookies.' (Macedonian; M)

(11) Wo chi le **zui duo** de binggan.
1SG eat PFV 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**
LOC child REL COP 1POSS all school 1SG 1SG LOC play REL surpass
bëre ci sabar
be.many LOC 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; $CMPR_{Ø/STND}$+ALL)[6]

[5] For 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 $CMPR_{Ø/STND}$ to classify languages of these types.

[6] Gorshenin (2012) describes the 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

(15) (Shí) bááh łikaní **'a-láah-go** yíyą́ą́'.
1SG cookie INDF.OBJ-STND$_{beyond}$-ADV 3OBJ.1SG.eat.PFV
'I ate the most cookies.' (Navajo; CMPR$_{Ø/STND}$+ANY)

(16) Ikaka hakadiya ubwabwa mwingi-**si**.
1POSS.brother PST.eat rice many-INT
'My brother ate the most rice.' (Kagulu; VERY)

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 evaluate the proposed universals only 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 Fintel & Matthewson 2008), so we must be clear about 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.[7]
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 those of 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.

(18) French
a. Jean a lu **le** **plus** de livres.
Jean has read DEF CMPR of book.PL
'Jean has read the most books.'

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.).

[7] See 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.

b. Je ne suis pas celui de la famille qui a la taille **la**
1SG NEG COP NEG that.one of DEF family REL has DEF waist DEF
plus fine.
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) Navajo

a. Anna bááh łikaní **'a-láah-go** yiyíiyą́ą'.
Anna cookie INDF.OBJ-STND$_{beyond}$-ADV 3OBJ.3SBJ.eat.PFV
'Anna ate the most cookies.'

b. Anna tsin **'a-láah-go** **'ánílnéézí**-ígíí yaah
Anna tree INDF.OBJ-STND$_{beyond}$-ADV 3SBJ.tall-NMLZ 3OBJ.up
haas'na'.
3OBJ.3SBJ.climb.PFV
'Anna has climbed up the tallest tree.'

c. Anna bááh łikaní **shi-láah-go** yiyíiyą́ą'.
Anna cookie 1SG.OBJ-STND$_{beyond}$-ADV 3OBJ.3SBJ.eat.PFV
'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) French
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) Kagulu

a. Hachiwendaga kutega samaki ing'hulu-**si**.
PST.1PL.want catch fish big-INT
Prompt: 'I wanted to catch the biggest fish.'

b. Ikaka hakadiya ubwabwa mwingi-**si**.
1POSS.brother PST.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)

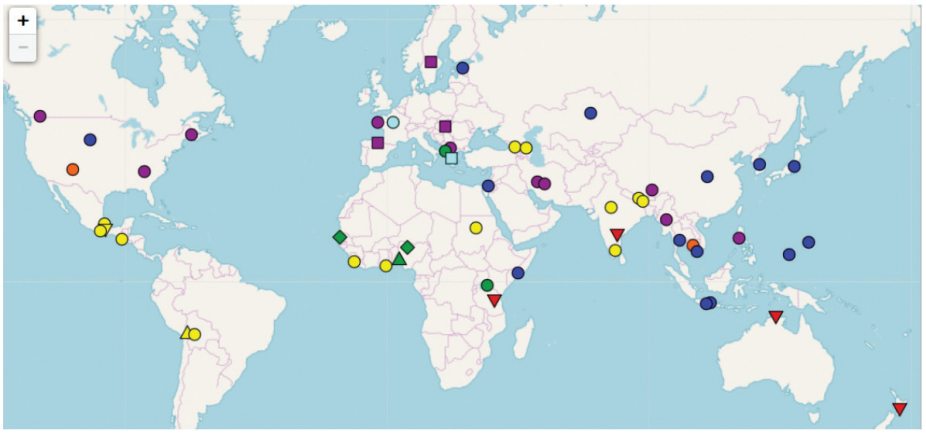
Finally, it is difficult to be certain whether CMPR languages express a superlative meaning. In CMPR languages, the same string can be translated either as a superlative or as a comparative without a standard of comparison. Wolof illustrates.

(23) Wolof
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 ◇. The value 'NA' indicates that the language lacks quantity superlatives. The value ◇ 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) Greek
Éfaga **ta** **perissotera** biskóta.
ate.1SG DEF much.CMPR cookie.PL
'I ate most of the cookies.' *or* '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.[8]

(25) Persian
Man **biš-tar-in** cookie ra khord-am.
1SG much-CMPR-SPRL cookie OM eat.PST-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).

(26) Man biš-**tar**-e cookie-ha ra khord-am.
1SG much-CMPR-EZ cookie-PL OM eat.PST-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 az **boland-tar-in** deraxt-e baq bala
3SG first effort do.PST.3SG from tall-CMPR-SPRL tree-EZ garden up
be-re …
SBJV-go.3SG
'First he tried to climb the tallest tree in the garden … '

(28) Bein-e se ta bache un barande shod chon un az
among-EZ three CL kid 3SG winner become.PST.3SG because 3SG from
boland-tar-in deraxt bala raft.
tall-CMPR-SPRL tree up go.PST.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 ◇-◇ LANGUAGES (filled diamond) consists of languages in which both relative and proportional prompts were translated using the CMPR strategy. Wolof illustrates.

(29) Wolof
a. Ci xale yu nekk sama ekkol yép, man ma ci tëgg lu **gën**
LOC child REL be 1POSS all school 1SG 1SG LOC play REL surpass
bëre ci sabar.
be.many LOC drum
'Of all the kids in my school, I'm the one who plays the most drums.'

[8] We 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.

b. Xale yu **gën bëre** ci sama ekkol bëgg na ñu tëgg mízik.
child REL surpass be.many LOC 1POSS school like PFV 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 Fig. 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. Of the twenty-eight language families we surveyed, twenty-seven include at least one language with quantity superlatives (the Gunwinyguan family being the exception), and the YES-YES pattern is exhibited by at least one language in four families (Afro-Asiatic, Basque, Indo-European, Uralic). By this estimate, 14.8% (4/27) 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. Let us define the 'family-internal rate' as the proportion of genera within a given language family that exhibit proportional readings. For example, we find the YES-YES pattern in three of the nine Indo-European genera surveyed. The family-internal rate for Indo-European is then estimated to be 3/9. For Uralic, the family-internal rate is 2/2, because both genera (Finnic and Ugric) that we investigated included a language with proportional readings (Finnish and Hungarian, respectively). In the Afro-Asiatic family, the family-internal rate is either 1/3 or 2/3, depending on how ◇-languages are treated. Similarly, the rate is either 0/4 or 2/4 for the Niger-Congo family. The rate is 0 for all other language families. Using the average family-internal rate as an operational measure, the probability of proportional readings is between 8% and 11%, depending on whether the ◇-languages are counted. Note that there is great uncertainty surrounding both estimates because there are approximately 400 language families but only twenty-eight 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 to 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 an-

other 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 in 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 below (data combined from Bobaljik 2012 and Gorshenin 2012).[9] We nevertheless return to a possible explanation briefly in §5.2.

4. EXISTING ANALYSES. An adequate theory of quantity superlatives will capture their similarities with quality superlatives while by default generating only 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 give a satisfactory account of our typological findings, although they do provide insights that we build upon in §5, where we develop a proposal that centers around Solt's (2009) analysis of quantity words as degree quantifiers.

4.1. THE VANILLA THEORY.

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, inter alia).

(33) $tall \rightsquigarrow \lambda d \lambda x\,.\,\textsc{height}(d) \geq d$

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

We use ∂ (the 'partial' symbol, read 'presupposing') to represent presupposition, following Beaver and Krahmer (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.

[9] The data set underlying this map is published at Harvard Dataverse (Coppock 2016).

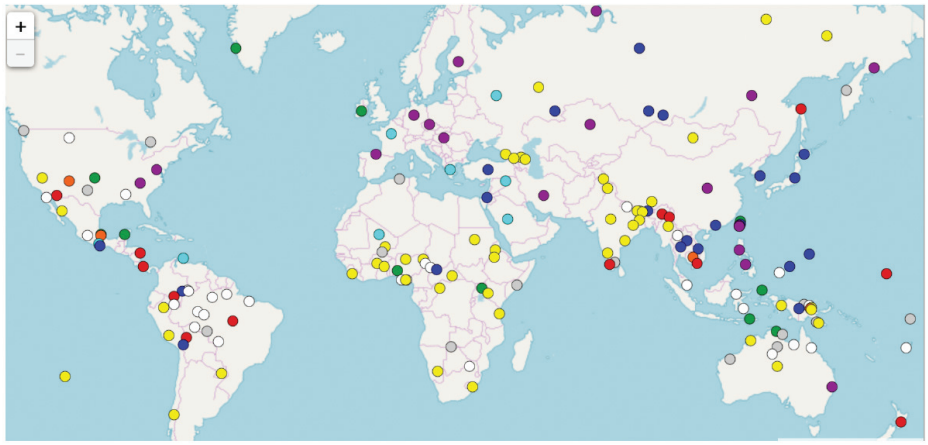


FIGURE 4. Geographical distribution of superlative strategies.

Heim assumes further that the LOGICAL FORM (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]$_F$. (adapted from 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.

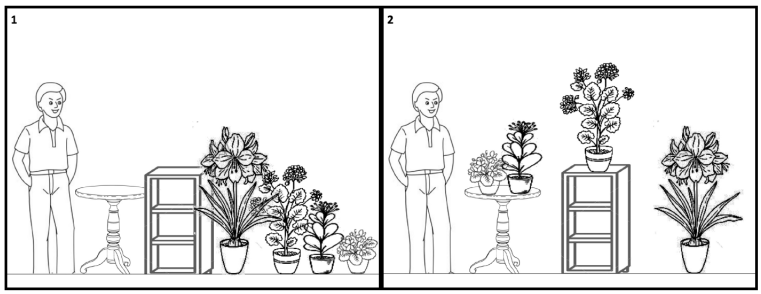


FIGURE 5. *Ben put the tallest plant on* [*the bookcase*]$_F$.

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 [$_{\text{DP}}$ 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 [$_{\text{DP}}$ ~~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 [$_{\text{DP}}$ 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 and 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.

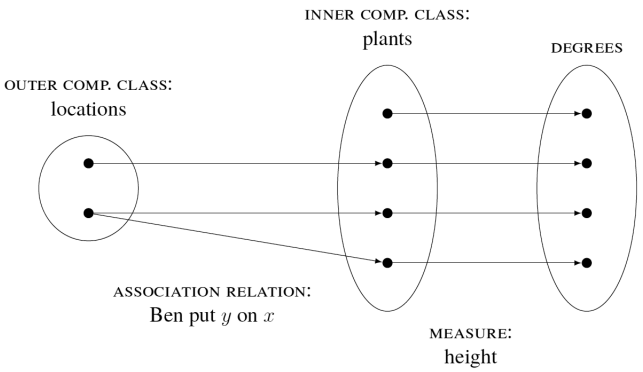


FIGURE 6. Schematic representation: *Ben put the tallest plant on* [*the bookcase*]$_F$.

On absolute readings, however, there is no distinction between the inner and the outer comparison class; they are the same object (regardless of which theory one adopts). To the extent that it makes sense to talk about the 'outer comparison class', it is identical to the inner comparison class in the case of an absolute reading. The fundamental difference between absolute and relative readings, then, is whether the inner and outer comparison classes are distinct, regardless of whether one adopts a scope or a pragmatic approach.

QUANTITY SUPERLATIVES. Now let us consider quantity superlatives. Much has been written on the semantics of quantity words (Hoeksema 1983a, Partee 1989, Romero 1998, 2017, Hackl 2000, 2009, Rett 2006, 2008, 2014, 2018, Solt 2009, 2011, 2015,

Wellwood 2014, 2015, among many others). To start, let us consider what happens if quantity words are just like predicative gradable adjectives (e.g. Hoeksema 1983a, Teodorescu 2009).

(40) *much* $\rightsquigarrow \lambda d \lambda x \,.\, \mu(x) \geq d$ $\langle d, \langle e, t \rangle \rangle$

For *many*, we assume that $\mu(x)$ is a measure of the number of atomic individuals that x is made up 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 licit only 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$_C$ λd λx [Ben put [$_{\text{DP}}$ ~~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 [$_{\text{DP}}$ [-est$_C$ λd [d-many plants]]] on the bookcase

An LF comparable to this one generates 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 it is not available in any other language that we know of.

4.2. BLOCKING TOTALITY READINGS.

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, (ii) α is more specific than β, and (iii) α is not more complex than β, then choose α.
(Teodorescu 2009:100, 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) [Context: You are home alone one weekend and you bake ten 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 superla-

tive 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 canceled 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 coexist in the grammar.

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) $many \rightsquigarrow \lambda d \lambda P \lambda Q \, . \, \exists x[P(x) \wedge Q(x) \wedge |x| \geq d]$

Hackl (2000) shows that this style of lexical entry has a number of interesting virtues in comparison with other treatments of quantity words.[10] 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) Ben put [$_{\text{DP}}$ [-est$_C$ [λd [*d*-many plants]]]] 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 quantifier raising (QR) in order to be interpreted.

(48) [the bookcase]$_F$ -est$_C$ λd λx [[*d*-many plants] λy Ben put *y* 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, Rett 2008, 2018, Solt 2009, 2015), 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.*
- 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.

[10] Among 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).

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 postnominal position, like adjectives but unlike determiners. Teodorescu also shows that, like adjectives, Romanian quantity words can appear in predicative positions, a position that 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 ⟨*d*, *et*⟩), the unattested totality reading reemerges.

DISTINCT AS NONOVERLAPPING. 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 'nonoverlapping': 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 NONOVERLAPPING (as opposed to DISTINCT) *y* in *C*. Two plural individuals are nonoverlapping only if they have no common subindividuals.[11]

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 of its subparts (e.g. Africa, Asia, Africa+Asia, …). If *-est* furthermore remains within the DP, as in 50, proportional truth conditions are derived.

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

This LF delivers truth conditions that can be paraphrased as '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.

DP-LAYER APPROACH. Bošković and Gajewski (2011) 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 and Gajewski (2011) 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 either can move out of DP or it can be interpreted in DP-internal position. The latter option is available only in languages with DP: otherwise, EST must seek higher ground, yielding a relative reading.[12]

[11] Hackl (2009) treats quantity words not as expressions of type ⟨*d*, *et*⟩ but instead as attributive modifiers of type ⟨*d*, ⟨*et*, *et*⟩⟩. The same problematic LF (43) is generated if this attributive meaning is assumed.

[12] Bošković and Gajewski (2011) assume Hackl's (2009) attributive entry; see n. 11.

Bošković and Gajewski predict that MANY+EST should have a proportional reading in any language with a DP layer. Using the 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 Pancheva (2015) observes that it fails upon encounter with other languages, including Bulgarian, French, Italian, and Spanish, that have definite articles but no proportional reading.[13]

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) Kurdish Sorani
La nevaan tawaw-i mndalaan-i qutaabxaan-**aka**-m mn taaqe
from between whole-EZ child.PL-EZ school-DEF-1POSS 1SG only
kas-eka-m ka **zor-tar-in** aamer-i musiqaa
person-INDF-1SG REL much-CMPR-SPRL instrument-EZ music
dazaan-em wa dajan-em.
know.PRS-1SG and play.PRS-1SG
'Of all the kids in my school, I'm the one who plays the most instruments.'

(52) **Zorba**-i mndalaan awanái va dena qutaabxaana-i mn pe-yan
majority-EZ child.PL those such come.PRS school-EZ 1SG to-3PL
xosh-a musiqa bezhan-in.
pleasant-COP music play.PRS-3PL
'Most of the kids who go to my school like to play music.'

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, 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.

PART-WHOLE BAN. Dobrovie-Sorin and 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

[13] Pancheva (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, Alexiadou, Haegeman, & Stavrou 2007, Rothstein 2009) containing an abstract measure noun NUMBER. Languages in which quantity superlatives have the structure of measure pseudopartitives allow only 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.

we call the 'part-whole ban'. As they point out, this can be seen as an even stronger version of Hackl's (2009) nonoverlap constraint.

(53) PART-WHOLE BAN: The members of a comparison class should not have part-whole relations.

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.

(54) $\forall x, y \in C : x \nprec y$,
where $\prec$ denotes the proper part-of relation.

Dobrovie-Sorin and 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 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 nonmovement 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.

(55) PART-WHOLE BAN (REFORMULATED): If C is the outer comparison class, and x and y are both in C, then $x \nprec y$.

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 to 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 and 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).

(56) Dutch
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 has not read. 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 and Giurgea (2015), in Romanian, prenominal quantity superlatives give rise to a proportional reading, but postnominal quantity superlatives give rise to a 'predefined groups' interpretation.

(57) Romanian
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 and 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.

(58) [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 above for that proposal. 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 superla-

tives 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.

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

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 in Figure 7 (modulo how existential quantification is introduced; for convenience, here we use Partee's (1987) A-shift, written $\exists$).

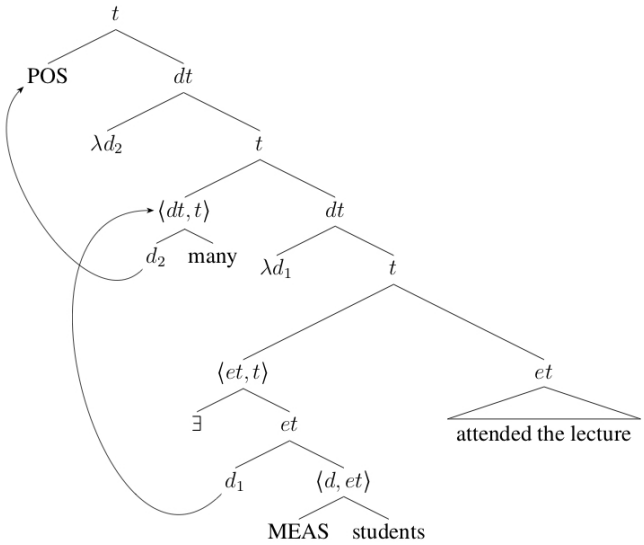


FIGURE 7. LF for *Many students attended the lecture* (adapted from Solt 2009:113).

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).[14]

(60) 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.

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

MEAS and its nominal complement compose via VARIABLE IDENTIFICATION (see Solt 2009 for details).[15]

(61) MEAS *students* $\rightsquigarrow \lambda d \lambda x$. *STUDENT(x) $\wedge$ $\mu_D(x) \geq d$

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

(62) λd . $\exists x$[*STUDENT(x) $\wedge$ $\mu_{\#}(x) \geq d$ $\wedge$ ATTENDED(x)],
where $\mu_{\#}(x)$ denotes the number of atoms in x.

The node labeled '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 of what Sapir (1944) called the 'zone of indifference'; see references cited for details, which 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*; see Figure 8.

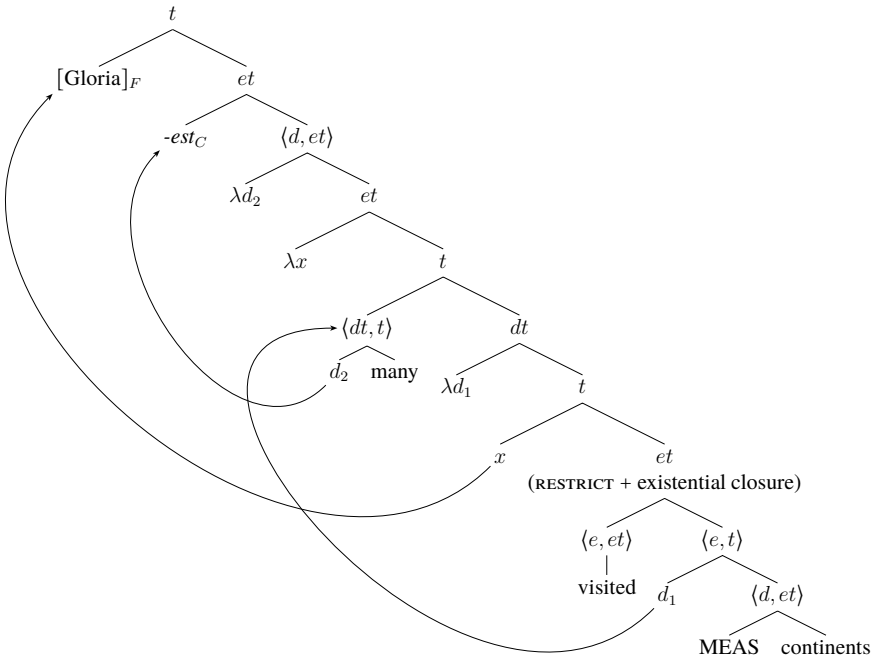


FIGURE 8. LF for [*Gloria*]$_F$ *visited the most continents*.

(When the verb combines with the object, we assume that Chung and 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 Fig. 8 can be viewed as the result of several movement steps, schematized as follows.

[15] Our 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 given 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 argument, rather than requiring composition through variable identification.

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

(63) a. [Gloria [visited [[-est$_C$ many] [MEAS continents]]]]
b. [-est$_C$ many] λd_1 [Gloria [visited [d_1 [MEAS continents]]]]
c. Gloria λx [-est$_C$ many] λd_1 [x [visited [d_1 [MEAS continents]]]]
d. Gloria -est$_C$ $\lambda d_2 \lambda x$ [d_2 many] λd_1 x visited [d_1 MEAS continents]

First, [*-est$_C$ many*] undergoes QR from its original position by [MEAS *continents*], leaving the trace d_1. 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 Fig. 8. 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 and Takahashi (2007, 2011), and Kennedy (2007a), and for superlatives (implicitly) by Heim (1985, 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.

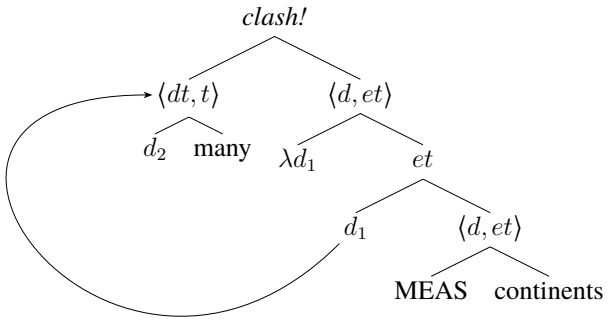
The truth conditions we derive for Fig. 8/63d are as in 64.

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

(65)



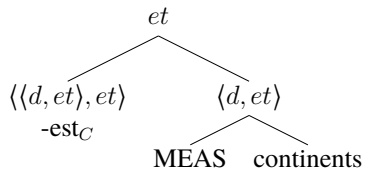
As we saw in the previous section, if scope within the DP were possible, then we would derive an absolute-like reading (either 'totality', 'proportional', or 'predefined groups', depending on the exact assumptions). When the quantity word takes sentential scope, only a relative reading is available (cf. 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 be generated only 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]?

(66)



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 a 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) that 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*).[16] 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.

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*.

(67) German
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 'nonmale'), 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).

[16] If the existential quantifier is replaced by a definite article in the tree, then we run into the problem that Coppock and Beaver (2014) identified for scope theories: effectively, 'the d_1 MEAS continents' is defined only 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.

(68) a. male$_F$ -est$_C$ λd_2 λP d_2-many λd_1 [[$\exists$ d_1 MEAS students] are P]
b. $\exists d[G(d)(\text{MALE}) \wedge \forall y \neq \text{MALE}\ [C(y) \rightarrow \neg G(d)(y)]]$,
where $G = \lambda d \lambda P \exists y\ .\ P(y) \wedge *\text{STUDENT}(y) \wedge \mu_D(y) \geq d$
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.

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

This in turn is equivalent to 70.

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

In other words, there are more male students than nonmale students. These are just the truth conditions Barwise and Cooper (1981) assign to *most*; according to that analysis, 'most As are Bs' says $|A \cap B| > |A \cap \bar{B}|$. 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.[17]

We suggest that these constructions form a historical link between relative readings and proportional readings. In particular, we suggest that the focused predicate is reinterpreted as an argument of the superlative form, yielding a generalized quantifier.

(71) *many-est* $\rightsquigarrow \lambda A \lambda B\ .\ \exists d[G(d)(B) \wedge \neg G(d)(\bar{B})]]$,
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 $C = \{B, \bar{B}\}$, 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 and É. Kiss (2000) and Kotek et al. (2011b) observe.

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

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

(73) Swedish
??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.

[17] Hackl (2009) points out that there is no comparable proportional reading for *die wenigsten* 'the fewest' 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 nonoverlapping 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.

(74) Norwegian
USA har soleklart flest, med over 2500 sangere. Det er
USA has clearly many.SPRL with over 2500 singer.PL DEM.N COP
flest kvinnelige sangere, 2265, og **flest** er sopraner.
many.SPRL female.PL singer.PL 2265 and many.SPRL COP soprano.PL
'The USA has the most, with over 2,500 singers. They are largely female singers, 2,265, 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 and 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) Georgian
q'vela-ze **bevri** rdze modis drokhisgan …
all-STND$_{on}$ much milk come cow.from
Prompt: 'Most milk comes from cows (… but goat milk is best).'

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.

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 Solt (2011) envisions, from $\langle d, \langle dt, t\rangle\rangle$ to $\langle d, \langle d\alpha, \alpha\rangle\rangle$.

(76) *much*/*many* $\rightsquigarrow \lambda d \lambda P_{\langle d,\alpha\rangle} . P(d)$, $\langle d, \langle d\alpha, \alpha\rangle\rangle$
where α is any type.

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

(77) Gloria [-est$_2$ λd_2 [d_2-many λd_1 [has visited [the d_1 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) Gloria has visited [the [-est$_C$ λd [d-many [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 gave above. The compositional derivation for *most continents* is as follows.

(79) -est λd [d-many [MEAS continents]] ⇝
λx . $\exists d[[\mu_D(x) \geq d \wedge$ *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 and Giurgea's (2015) part-whole ban. The former solution would render the predicate in 79 nonunique and therefore leave the presence of the definite article unexplained. Furthermore, it would seem to be applicable only 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) ιx . $\exists d[[\mu_D(x) \geq d \wedge$ *CONT$(x)] \wedge \forall y \neq x[C(y) \rightarrow \neg[\mu_D(x) \geq d \wedge$ *CONT$(x)]]]$
'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 did not.

(81) $C = \{$*CONT $\cap B$, *CONT $\cap \bar{B}\}$

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* 'most' has a referential, 'predefined groups' reading only when it is used postnominally. When used prenominally, 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.

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

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 *A*s that are *B* and the *A*s that are not *B*. This boils down to the claim that most *A*s 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 83.

(83) 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), languages where both readings were attested (YES-YES languages), and 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 that quantity words are degree quantifiers, as argued by Solt (2009). This semantic type forces quantity words to take scope. 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 and Cooper (1981) is not wrong. This claim stands in tension with experimental findings by Kotek, Sudo, Howard, and Hackl (2011a) and Kotek, Sudo, and 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.

(84) 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 84a than 84b 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.[18] If this assessment 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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[18] It 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 and 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.

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