

Universals in superlative semantics

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Abstract

This paper reports on the results of a broad cross-linguistic 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, and all allow the former. Absolute readings for the superlatives of ordinary gradable adjectives, in contrast, are universal. We offer an explanation for this cross-linguistic generalization, centered around two main claims: (i) quantity words denote predicates of degrees rather than individuals and (ii) superlatives have a layered structure where comparatives are nested inside superlatives. We argue that our explanation improves on existing potential explanations for these results.

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

1 Introduction

Proportional *most* got its first big break on the stage of formal semantics with its starring role in Barwise & Cooper's (1981) demonstration that first-order logic is not sufficient to represent quantification in natural language.¹ For instance, no clever

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use of universal and/or existential quantifiers can provide an adequate paraphrase of the following sentence in first-order logic:

- (1) Gloria has visited **most** continents. [proportional]

The remedy proposed by Barwise & Cooper (1981) was to treat natural language quantifiers as denoting binary relations among sets, viz. as generalized quantifiers. Using this strategy, the meaning of (1) can be paraphrased along the following lines: ‘The size of the set of continents Gloria has visited exceeds the size of the set of continents Gloria hasn’t visited’. This framework for the analysis of quantifiers has stimulated a rich discussion regarding semantic universals (Bach et al. 1995; von Stechow & Matthewson 2008; Steinert-Threlkeld & Szymanik to appear, i.a., and references therein).

As Barwise & Cooper (1981) themselves noted, though, the introduction of generalized quantifiers is not necessary in order to remedy this deficiency of first-order logic. A representation language without generalized quantifiers that allows for talk of plural individuals (such as the plurality consisting of the authors of this article), and the number of atomic individuals contained within them (three, in this case) could also serve to represent the meaning of proportional *most*, as Hackl (2009) emphasizes. This is a natural set of resources to draw upon for the analysis of *most* if it is to be seen as the superlative form of *many* (Bresnan, 1973). Indeed, it is uncontroversial that the form *most* can serve as the superlative of *many*, whether or not its use in (1) involves a superlative. There are uses of *most* in which it clearly has a superlative meaning, such as the following:

- (2) *Gloria* has visited the **most** continents. [relative]
‘Gloria has visited more continents than anybody else has’

Hackl (2009) argues that even in a case like (1), *most* should be decomposed into *many* and *-est*, just as *highest* should be decomposed into *high* and *-est*.

The relationship between (1), where *most* has a *proportional reading*, and (2), where *most* has a *relative reading*, is, according to Hackl, parallel to the relationship

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We use the following abbreviations in glosses: ABL: ablative, ACC: accusative, ADD: additive, ADV: adverbializer, AREAL: areal (Navajo), ATTRIB: attributive (Aymara), AUX: auxiliary, CL: classifier, CMPR: comparative, DECL: declarative, DEF: definite, DEM: demonstrative, DL: delimitative (Aymara), ERG: ergative, EVID: evidential, EZ: ezafe (Persian), FEM: feminine, FOC: focus, GEN: genitive, INCL: inclusive (Aymara), INDEF: indefinite, INT: intensifier, IPFV: imperfective aspect, LOC: locative, MASC: masculine, NEG: negation, NMLZ: nominalizer, NOM: nominative, OBJ: object, OM: object marker (Persian), PAST: past, PERF: perfective aspect, PL: plural, POSS: possessive, PRES: present, REL: relativizer, SBJV: subjunctive, SIM: simple tense (Aymara), SG: singular, SPRL: superlative, SUBJ: subject, TOP: topic.

between *absolute* and *relative* readings of quality superlatives such as *highest*.² An absolute reading is preferred in (3); a relative reading is preferred in (4).

- (3) Gloria climbed the **highest** mountain in Arizona. [absolute]
‘Gloria climbed a mountain higher than all other mountains in Arizona’
- (4) *Gloria* counted to the **highest** number on Friday. [relative]
‘Gloria counted to a higher number than anyone else did on Friday’

On an absolute reading (3), reference is made to a particular entity that instantiates the relevant gradable property to a greater degree than any other entity in the relevant comparison class. On a relative reading (4), by contrast, reference is not being made to some number higher than all others, unless there is some salient, restricted set of numbers in the context. More likely is a relative reading, where the superlative serves to place Gloria above her competitors in regard to their respective counting accomplishments. Relative readings are focus-sensitive; whichever constituent bears the focus is the one that determines the alternatives that will be compared. If emphasis is shifted from *Gloria* to *on Friday*, the reading is that Gloria counted to a higher number on Friday than on any other day.

Hackl (2009) observes certain parallels among quantity and quality superlatives. On relative readings of both, comparison is made among a set of salient alternatives: Neither (2) nor (4) is felicitous in contexts where there are no alternatives under comparison (e.g. competitors to Gloria). On the other hand, proportional (1) and absolute (3) superlatives are felicitous in contexts where Gloria has no competitors.

Given this, proportional readings might be seen as a type of absolute reading. If proportional *MOST* can be compositionally derived, then one of Barwise and Cooper’s key motivations for positing generalized quantifiers as semantic primitives is eliminated. It would no longer be for the sake of analyzing proportional *most* that generalized quantifiers need to be introduced as semantic primitives.

But is Hackl’s decompositional analysis of proportional *most* really viable? On the basis of a broad typological survey of quantity words and their superlative forms, we argue that certain refinements are in order, at the minimum. *Prima facie*, a view on which proportional readings are a species of absolute reading predicts that absolute readings for quality superlatives and proportional readings for quantity superlatives should be equally prevalent cross-linguistically. Both arise from the

²The contrast between absolute and relative readings, and their respective analyses, was discussed early on by Szabolcsi (1986) with reference to Hungarian, and has been taken up in a fair amount of recent cross-linguistic research, mainly focused on English (Gawron, 1995; Heim, 1999; Hackl, 2000; Sharvit & Stateva, 2002; Hackl, 2009; Teodorescu, 2009; Krasikova, 2012; Szabolcsi, 2012; Bumford, 2016; Wilson, 2016), but also with reference to German (Hackl, 2009), Swedish (Coppock & Josefson, 2015), other Germanic languages (Coppock, to appear), Hungarian (Farkas & É. Kiss, 2000), Romanian (Teodorescu, 2007), Spanish (Rohena-Madrado, 2007), Arabic (Hallman, 2016a), and Slavic languages including Macedonian, Czech, Serbian/Croatian and Slovenian (Pancheva & Tomaszewicz, 2012).

combination of *-est* and a quantity word or adjective that denotes a relation between degrees and individuals. But while we know of no languages in which the superlatives of ordinary gradable adjectives lack absolute readings, the proportional reading is frequently missing, as we document extensively in this paper. Previous observations in this vein have been made by Hackl (2009, 68), Živanović (2007b), Bošković & Gajewski (2008), Pancheva (2015), and Dobrovie-Sorin & Giurgea (2015). Slovenian illustrates:

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

Relatedly, many languages have been argued to lack a word for proportional *most*, however it is formed morphologically. Indeed, another role on the stage of formal semantics for which proportional *most* has gained notoriety is the one it has played in discussions about inter-translatability among languages. Everett (2005, 624) notes that in Pirahã (Muran), *We ate most of the fish* could be expressed by a sentence that he glosses literally as *My bigness ate [at] a bigness of fish, nevertheless there was a smallness we did not eat*. This is offered as an example of a case where a word in one language (namely English *most*) cannot be translated into another. von Stechow & Matthewson (2008) question whether the Pirahã sentence genuinely expresses a different proposition, and emphasize that a translation need not be word-for-word in order for the same proposition to be expressed. Regardless of whether this constitutes a case of non-inter-translatability, it is another case in which proportional *most* is not expressed as the superlative of a quantity word.

The focus of the present paper is on the question of exactly how rare proportional readings are for superlatives of quantity words, and under what circumstances they arise. Based on a study of 92 languages from 28 different families, we show that regardless of the morphosyntactic strategy used to express superlative meaning, it is very much the rule rather than the exception that the superlative of *many* lacks a proportional reading. In particular, we provide evidence for the following generalizations:

- (6) a. **Universal**: Quantity superlatives have relative readings.
 b. **Tendency**: Proportional readings for quantity superlatives are absent.

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

From a perspective on which proportional readings of *most* are a species of absolute reading, then, there are two puzzling asymmetries. The first is the asymmetry

between quantity and quality superlatives: Only quantity superlatives lack one of their readings. The second is the asymmetry between proportional and relative readings of quantity superlatives: Only proportional readings are missing.

One response to these findings might be to conclude that the superlative of *MANY* never has a proportional reading, and English and other languages merely exhibit accidental homophony with a separate word that denotes a generalized quantifier. Such a position is advocated by Dobrovie-Sorin (2015) following Barwise & Cooper (1981). However we argue that we can maintain a compositional view of proportional *MOST* if we say that under normal circumstances, the superlative of *MANY* is not semantically qualified to serve as a proportional quantifier, but that a proportional reading can arise compositionally under special circumstances.

Specifically, we argue that while ordinary gradable predicates (e.g. *tall*) denote gradable properties of individuals, quantity words (*many*, *much*) instead by default denote gradable properties of degrees, contra Hackl (2009) and Hoeksema (1983). This proposed meaning for quantity words has precedent in independent proposals (Rett, 2008; Solt, 2009, 2011). Together with Bobaljik's (2012) layered morphosyntax for superlatives in which all superlatives contain a layer of comparative morphology between the adjective and superlative marker, this assumption allows us to explain the markedness of proportional readings for quantity superlatives. We propose further that when proportional readings do arise compositionally, the quantity word has undergone a change in meaning so that it comes to denote a predicate of individuals.

Our proposal is not the first attempt to capture the markedness of proportional readings of quantity superlatives (Živanović, 2007a,b; Bošković & Gajewski, 2008; Pancheva, 2015; Dobrovie-Sorin, 2015). However we argue that alternative accounts cannot handle the full range of data we collected. Our proposal further captures two subtler generalizations about the morphosyntax of relative and proportional *MOST*, first observed for Germanic by Coppock (to appear) and demonstrated here to hold somewhat more broadly:

(7) **Number-marking generalization**

Quantity superlatives never disagree in number with the associated noun on proportional readings, but on a relative reading, the superlative may show default agreement, disagreeing with the noun.

(8) **Adverbial-relative connection** When quantity superlatives disagree in number with the substance noun, they have the morphological shape of an adverbial superlative.

Stepping back, the picture that emerges is broadly in line with the one painted by Hackl (2009), insofar as it involves a decompositional treatment of proportional *MOST*, including a *MANY* element and a superlative element. The main difference is that the compositional route to proportional *most* is full of obstacles, very much

unlike the straightforward route to absolute readings for the superlatives of ordinary gradable adjectives.

2 Typological study

We undertook a cross-linguistic study covering 92 languages from 28 language families, drawn from every continent. Diverse morphosyntactic strategies for forming superlatives were represented as well.

Descriptive grammars generally include examples of constructions that might be described as quality superlatives. However, there is substantially less description of the structure and interpretation of quantity superlatives, outside of a small number of European languages. To address these descriptive gaps, we employed a method that we term TARGETED COMPARATIVE FIELDWORK, characterized by the study of a targeted issue (here, quantity superlatives) through elicitation on a very broad sample of languages. Comparative fieldwork on a medium-sized language sample (14 languages) was previously used by Beck 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 much narrower investigative focus. We additionally designed our tools to be distributed over the Internet, in order to collect data from more languages than we could access in person.

2.1 Methodology

Our main elicitation tool was a translation questionnaire structured as a short story consisting of 17 sentences.³ Participants were asked to translate the sentences into their native language. The vast majority of participants completed the questionnaire online with English prompt sentences, while a subset saw the questionnaire in Swedish, Swahili, Persian, Russian, or Spanish. The online format allowed us to gather data efficiently from languages that were not represented in previous work and which would have otherwise been hard to access. We primarily recruited participants who were 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 particular languages of interest. The number of questionnaire respondents varied from language to language; we aimed for five, but the actual number varied between one and 15.

The questionnaire sentences were designed to elicit particular structures and meanings, including relative and proportional quantity superlatives, relative and

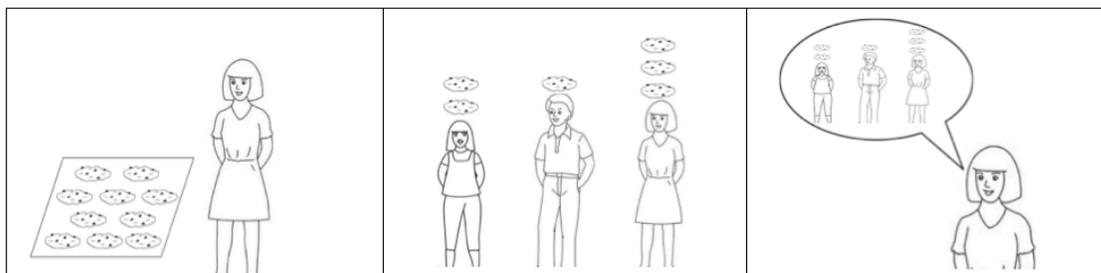
³For three languages (Okanagan Salish, Kacchikel, Cherokee) we were unable to work with consultants directly. In this small number of cases, we relied on published materials and assistance from linguists with expertise in each language.

absolute quality superlatives, comparatives, and quantity words. The full story and instructions can be found in the online supplement. Example prompts for proportional and relative readings of quantity superlatives are shown here:

- (9) **Most of the kids who go to my school** like to play music.
 [For example, there are 100 kids in my school and 65 of them like to play music.]
- (10) Of all the kids in my school, I'm the one who plays **the most instruments**.
 [For example, I play 7 instruments, two of my friends play 6 instruments, and lots of people play one or two instruments, but nobody else plays more than 4.]

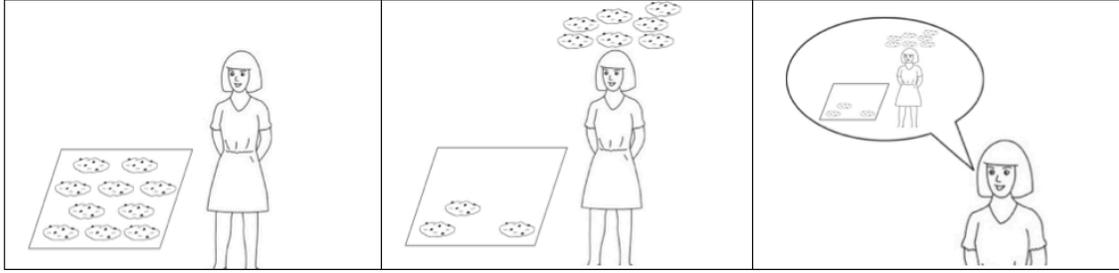
However, questionnaire responses were not sufficient on their own since the absence of a structure from the translation of a particular prompt does not prove its impossibility. It is also not guaranteed that all participants were sufficiently fluent in English to perceive the crucial semantic distinctions between prompts. Therefore, we conducted brief follow-up elicitation sessions whenever possible. In cases where the superlative of MANY was used to translate prompts with relative readings but not proportional readings, follow-up elicitation allowed us to determine whether this reading was truly unavailable.

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



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

Figure 1: Relative quantity superlative



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: Proportional quantity superlative

2.2 Languages and coding of superlative strategies

Our language sample consisted of 92 languages distributed across all continents, 27 language families, and 57 genera. Table 1 lists one language per genus, as categorized by WALS (Dryer & Haspelmath, 2013), and arranged by continent. Each genus is represented by a language for which we were able to provide the most complete glosses for all respondents. 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.

We coded each language in the database for the morphosyntactic strategy used to translate superlative prompts. The coding scheme in (11) combines categories from Bobaljik (2012) and Gorshenin (2012).

- (11) **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, but were occasionally overridden by our own fieldwork. The code is intended to represent the language’s *primary* manner of translating superlatives, which is the structure discussed in descriptive work on the language and/or most frequently volunteered by consultants. 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.

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

- (18) (Shí) bááh hikaní 'a-láah-go yíyáá'.
 1SG cookie INDEF.OBJ-beyond-ADV 3OBJ.1SG.SUBJ.eat.PERF
 'I ate the most cookies.' (Navajo; CMPR_{∅/STND}+ANY)
- (19) Ikaka hakadiya ubwabwa mwingi-si.
 1POSS.brother PAST.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 (11) to translate at least some of the superlative prompts. However, we can only evaluate the proposed universals if we compare languages that all have QUANTITY SUPERLATIVES in a meaningfully comparable sense. Translations may not fully match the original prompt in certain key aspects of meaning (Matthewson, 2004; von Stechow & Matthewson, 2008), so we must be clear which aspects of meaning we take as definitional. We adopt the definitions in (20).

- (20) a. **Superlative strategy:** A construction that conveys that a gradable property holds of an entity to a uniquely high extent, when comparison is made among all entities within a relevant set that may be explicit or implicit.⁶
- b. **Quantity superlative:** A construction involving (only) a superlative strategy that stands in the same paradigmatic relation to a word for MANY or MUCH as a quality superlative stands in to its positive form.

The definition of 'superlative strategy' frames superlatives in terms of a 'comparative concept' in the sense of Haspelmath (2010), such that we appeal to broadly applicable semantic concepts (gradability, uniqueness) instead of specific structural criteria. This allows us to test the proposed universals against languages whose superlative structures differ from English or other well-studied languages. For instance, we consider structures where the superlative forms a constituent with the noun as in French (21) as well as probable adverbial superlatives as in Navajo (22).⁷

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

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

⁷From the perspective of the current study, one reason to exclude adverbial structures is that, given that it is not in construction with a noun, there is no reason to expect that it might give rise to a proportional reading. If the question is how proportional readings are constructed on

The definitions in (20) are also inclusive of 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 (21) and CMPR+ANY in Navajo (22). 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 ((21-c), (22-c)). Thus, quantity superlatives in both languages occupy the superlative cell in the comparative-superlative paradigm for MANY.

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

The definitions in (20) exclude certain structures from the set of quantity superlatives. First, structures like (23) used to translate proportional prompts in

the basis of superlative constructions, then these cases are not particularly relevant. However we frequently lacked a principled and feasible way of reliably distinguishing adverbial from adnominal uses. Indeed, relative superlatives are often morphosyntactically similar to adverbial superlatives (Coppock to appear; Coppock & Strand to appear, and sec. 3.3 of this paper). Our estimation of the rate at which proportional readings arise should therefore be read with the understanding that adverbial cases are included.

French do not count as quantity superlatives because this construction does not involve *only* a superlative strategy. Instead, there is additional material (*part*) which is not otherwise part of the superlative strategy.

- (23) La **plupart** des cygnes sont blancs.
 DEF majority of.DEF.PL swans 3PL.be white
Prompt: ‘Most swans are white.’

The VERY translation strategy was also excluded by the definitions in (20). Kagulu illustrates, where both quality and quantity superlative prompts were translated with an intensifying ‘augmentative’ suffix *-si* (Petzell, 2008).

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

The Kagulu intensifier construction does not count as a true superlative strategy according to (20) because it does not necessarily convey that the gradable property holds to a *uniquely high extent*. We found that *si* was felicitous in contexts where the marked property does not hold of the subject 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’:

- (25) 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 languages that use the CMPR translation strategy 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:

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

When the comparison set is covert, the sentence might express superlative meaning — comparison *among* members of an implicit set including Kofi — or comparative meaning — comparison *between* Kofi and members of the implicit set.⁸ We take

⁸We can contrast Wolof with Italian. Like other Ibero-Romance languages, Italian is classified

CMPR languages into account below but view them as inconclusive with respect to the distribution of readings of quantity superlatives.

3 Results

This section summarizes the empirical results of the typological study. We present evidence in support of the markedness of proportional readings before presenting additional generalizations.

3.1 Relative readings universal; proportional readings rare

Languages were classified as to whether quantity superlatives express (i) a proportional interpretation and (ii) a relative interpretation. For both questions, there were four possible values: YES, NO, NA, and \diamond . The value ‘NA’ indicates that the language lacks quantity superlatives. The value \diamond indicates that the language uses a CMPR superlative translation strategy; as discussed earlier, we remain agnostic as to whether the CMPR strategy expresses true superlative meaning and thus do not reduce it to either YES or NO values.

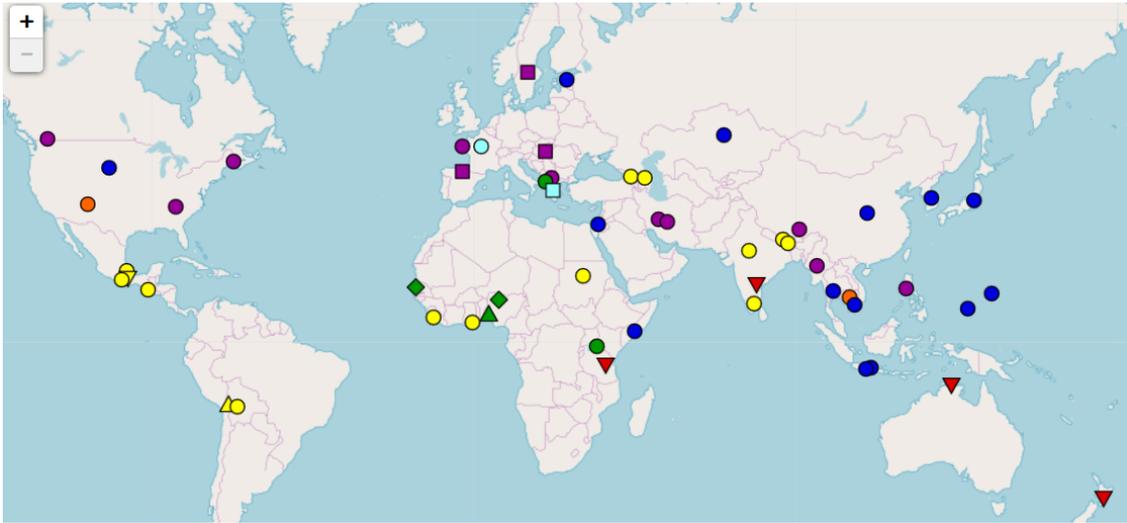
Figure 3 visually summarizes our findings for the representative sample of languages (one per genus) in Table 1. The colors represent superlative strategy and the shapes represent classification with respect to quantity superlative interpretation(s). The set of clear **YES-YES languages** (square) consisted of all Germanic languages along with Arabic (M), Basque (M), Hungarian (M), Romanian (CMPR+DEF), and Greek (CMPR+DEF) (27).

- (27) $\acute{\epsilon}$ faga ta perissotera biskóta.
 ate.1SG DEF much.CMPR cookies
 ‘I ate most of the cookies,’ ‘I ate the most cookies.’
 (Greek; CMPR_{M/STND}+DEF)

Although the Greek sentence is ambiguous, quantity superlatives in certain other YES-YES languages took slightly different shape depending on their interpretation. Section 3.3 discusses generalizations regarding systematic morphological differences between relative and proportional superlatives.

as CMPR+DEF but the definite article systematically disappears in adverbial superlatives and quantity superlatives on relative readings as in (i). Still, we can be confident that this sentence expresses superlative meaning by virtue of the overt comparison class: Luigi is a member of this group so the interpretation is clearly superlative not comparative.

- (i) Dei nostri amici Luigi è quello che ha più (*di) soldi.
 of.DEF 1PL.POSS friends Luigi 3SG.be the.one REL has CMPR of money
 ‘Of our friends, Luigi is the one who has **the most money**.’



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.

The majority of languages surveyed were **NO-YES languages** (circle). The set of NO-YES languages included representatives of every true superlative strategy; we illustrate with Persian, which employs morphological superlatives.⁹

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

⁹We 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.

Proportional superlative prompts in NO-YES languages were translated by a variety of non-superlative 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:

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

The set of **NA-NA languages** (upside-down triangle) consists of VERY languages, including Kagulu discussed above. As discussed earlier, unlike true superlatives, intensifiers do not necessarily convey that the gradable property holds to a uniquely high extent. Because VERY languages lack a true superlative structure, these languages do not bear on the distribution of proportional and relative readings.

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

- (30) a. Ci xale yu nekk sama ekkol yép, man ma ci tégg lu
 LOC child REL be 1POSS all school 1SG 1SG LOC play REL
gën bère ci sabar.
 surpass be.many LOC drum
 b. Xale yu **gën bère** ci sama ekkol bëgg na ñu tégg
 child REL surpass be.many LOC 1POSS school like PERF 3PL play
 mízik.
 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 ES-YES languages.

Crucially, two shapes are missing from Figure 3. First, no shape is needed to represent hypothetical **YES-NO languages**, in which the quantity superlative is used for proportional but not relative readings. Second, there is no need for a shape corresponding to **NO-NO languages** in which quantity superlatives exist but express only meanings other than proportional or relative meaning.¹⁰

¹⁰A reviewer correctly observes that the questionnaire alone could not distinguish between NA-NA and NO-NO languages since neither would use a quantity superlative structure to translate relative or proportional prompts, for different reasons. However, there is reason to believe that none of the sampled languages are NO-NO languages. Any language that used a superlative strategy to translate quality superlative prompts also used it to translate (at least) relative quantity prompts. That is, we found no languages with access to a superlative strategy which was not used to translate relative prompts, which would be the case for NO-NO languages.

We propose the following universal in light of our findings:

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

In contrast with ubiquitous relative readings, proportional readings were cross-linguistically rare:

- (32) **Tendency:** Proportional readings for quantity superlatives are absent.

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

3.2 Only proportional readings were missing

We have seen for quantity superlatives that while proportional readings were rare, relative readings were ubiquitous. By contrast, quality superlatives were always ambiguous between relative and absolute readings. We illustrate with Persian, which we have already seen lacked proportional readings for quantity superlatives. The following sentences were used with visual prompts that established the intended absolute (33) and relative (34) interpretations.

- (33) Un aval say kard- \emptyset az **boland-tar-in** deraxt-e baq bala
3SG first effort do.PAST-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...'
- (34) Bein-e se ta bache un barande shod- \emptyset chon un
among-EZ three CL kid 3SG winner become.PAST-3SG because 3SG

az **boland-tar-in** deraxt bala raft- \emptyset .
 from tall-CMPR-SPRL tree up go.PAST-3SG
 ‘Of the three kids, he won because he climbed the tallest tree.’

3.3 Morphosyntactic generalizations

Looking more closely at YES-YES languages, we find certain systematic differences in the morphosyntax of quantity superlatives expressing these two readings. One consistent pattern is the following:

- (35) **Number-marking generalization**
 Quantity superlatives never disagree in number with the associated noun on proportional readings, but on relative readings, default agreement is attested. (Coppock, to appear)

In languages with default agreement on relative readings of quantity superlatives, the same default agreement marking is characteristic of adverbial superlatives (Roelandt, 2016b; Coppock, to appear). The following generalization holds across all languages in our sample:

- (36) **Adverbial-relative connection** When quantity superlatives disagree in number with the substance noun, they have the morphological shape of an adverbial superlative in the language.

Relevant data were first discussed for particular Germanic languages by Roelandt (2016b). Flemish Dutch quantity superlatives have only proportional readings when the determiner agrees in number with a plural substance noun.

- (37) Jan heeft **de meeste bergen** beklommen.
 John has the.PL many.SPRL mountain.PL climbed
 John has climbed most (of the) mountains.’

When the same plural substance noun is instead preceded by the singular determiner *het*, only a relative reading arises:

- (38) Jan heeft **het meeste bergen** beklommen.
 John has the.NEU.SG many.SPRL mountain.PL climbed
 ‘John has climbed the most mountains.’

The same determiner *het* is also found in adverbial superlatives:

- (39) Mijn zus kan **het hardst** lopen.
 1POSS sister can DEF.NEU.SG fast.SPRL run
 ‘My sister can run the fastest.’ (Roelandt 2016a)

Coppock (to appear) demonstrates that both generalizations are borne out in the Scandinavian languages Faroese, Icelandic, Swedish, Norwegian, and Dalecarlian.

These generalizations are not only relevant for Germanic languages. Etxeberria (2005, 91) observes for Basque that the distribution of the plural determiner *-ak* is tied to the reading that a quantity superlative allows. This observation was confirmed by our own investigation. In (40), the superlative expression bears plural determiner *-ak* to agree with the substance noun *liburu* ‘books.’ This sentence only has a proportional reading.

- (40) Liburutegi horrek ditu **liburu gehi-en-ak**.
 library that.ERG has book much-SPRL-DEF.PL
 ‘That library has most of the books.’

If plural determiner *-ak* is removed despite the plurality of the substance noun, the resulting structure is grammatical but only permits a relative reading:

- (41) Liburutegi horrek ditu **liburu gehi-en**.
 library that.ERG has book much-SPRL
 ‘That library has the most books.’

The plural determiner *-ak* is also absent from adverbial superlatives:

- (42) Gurasoek sufritu dutu **gehi-en**.
 parent.PL.ERG suffer AUX much-SPRL
 ‘The parents suffered the most.’ (Hualde & de Urbina 2003, 2051)

The formulation of the number-marking generalization in (35) leaves open the possibility that relative readings of quantity superlatives may show non-default agreement in some languages. Examples include Greek (27), German, and Romanian. In each, the definite determiner is plural when the substance noun is plural on relative as well as proportional readings. We return to these cases in sec. 4.3.

3.4 Distribution of proportional readings

We can make two generalizations about the distribution of proportional readings across languages in our sample. First, all clear cases are languages from Europe, with the single exception being Arabic. Speakers of Standard Arabic express proportional superlative meaning by means of *ʔakθar*, which is the result of combining the quantity adjective *kaθīr* with superlative templatic morphology *ʔaCCaC* (Hallman, 2016b). The same expression can also have a relative quantity superlative meaning, as evidenced by our questionnaire results and supported by Hallman (2016a). However, we note that Arabic is in relatively close proximity to other YES-YES languages, so it is not a dramatic exception to the geographic generalization.

Second, the majority of languages with proportional readings exhibit a morphological (M) superlative strategy. The only YES-YES languages in Europe to employ another strategy were Romanian and Greek, both of which use CMPR+DEF superlative structures. By contrast, the set of NO-YES languages includes every superlative strategy. Another way to state this generalization is that proportional readings tend to be absent in languages with more structurally complex superlative strategies.¹¹

It may not be appropriate to put stock into this latter observation, however, since geographical and structural factors are not clearly separable. Morphological superlative strategies are unevenly distributed across the globe. Figure 4 shows the geographical distribution of superlative strategies used with ordinary gradable adjectives (data combined from Gorshenin (2012) and Bobaljik (2012)). There are relatively few languages with morphological superlatives outside of Europe. As such, it is difficult to distinguish between the potential impacts of geography and superlative strategy.¹²

4 Toward an explanation

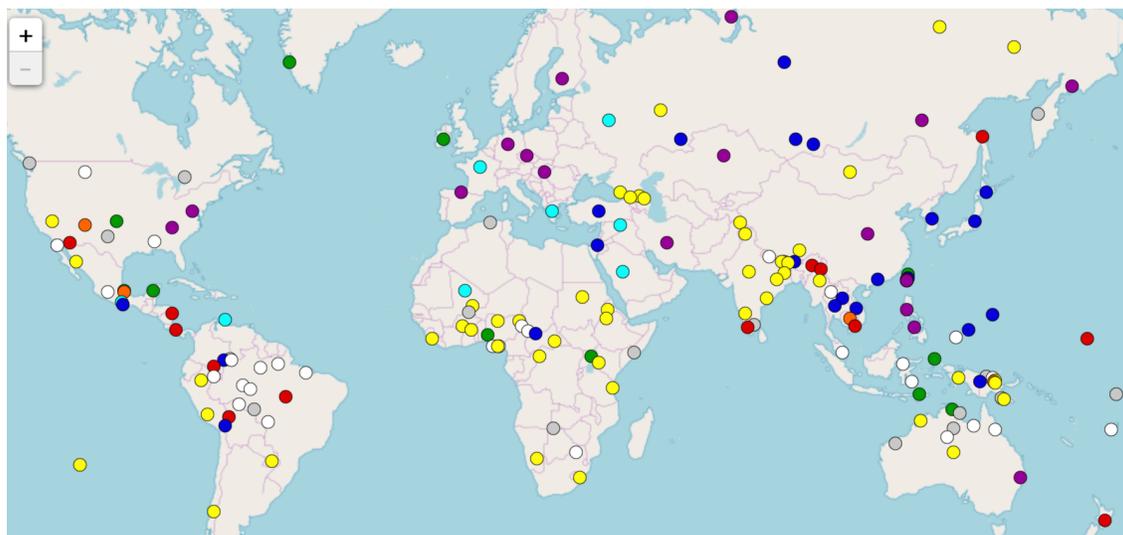
We are now in a position to consider possible explanations for the universals in (6). An explanation must answer two questions: What is the source of proportional MOST? And why is proportional MOST cross-linguistically rare while relative MOST is ubiquitous? We begin by reviewing previously proposed routes to proportional meaning. We then propose an account for why these routes are normally blocked.

4.1 Routes to proportional *most*

One route to proportional MOST is the direct one: The proportional meaning is simply directly assigned to the form, as proposed by Barwise & Cooper (1981) and taken up by many subsequent authors, including Dobrovie-Sorin & Giurgea (2015). On this view, proportional MOST is not decomposable into MANY+EST but instead is an unanalyzed lexical item, which language tend to lack. On its own, such an account sheds no light on why proportional MOST should have the same basic shape as relative MOST in quite a few languages. Furthermore, it does not offer a clear explanation for the systematic morphosyntactic differences in the expression of proportional and relative superlative meaning. We return to this latter point in section 4.3.

¹¹During the course of our research, we considered two CMPR+ALL languages — Georgian and Aymara — that initially appeared to permit proportional readings. However, further investigation of both languages revealed that neither structure could reliably express proportional meaning across a broader sample of speakers.

¹²The dataset underlying this map is published at Harvard Dataverse (Coppock, 2016).



Legend

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

Figure 4: Geographical distribution of superlative strategies

Hackl (2009) and Hoeksema (1983) propose compositional paths to a proportional meaning based on a decomposition into MANY+EST. Hackl’s (2009) path is based on an analogy between the relative vs. proportional contrast for quantity superlatives and the absolute vs. relative contrast for quality superlatives. Support for this analogy comes from the fact that relative readings of quality and quantity superlatives impose similar requirements on the discourse context. With focus as indicated by italics, the sentences in (43) require there to be people other than Gloria in the domain of discourse who have climbed mountains or visited continents.

- (43) a. *Gloria* climbed the **highest** mountain. [relative, quality]
 b. *Gloria* has visited the **most** continents. [relative, quantity]

In contrast, both sentences in (44) on the intended readings are felicitous even if Gloria is the only person in the domain of discourse.

- (44) a. Gloria climbed the **highest** mountain. [absolute, quality]

- b. Gloria has visited **most** continents. [proportional, quantity]

Building on the ‘scope theory’ of the absolute/relative contrast (Heim 1985, 1999; Szabolcsi 1986; i.a), Hackl assumes that -EST may occupy one of two different scope positions at logical form, one inside the DP (yielding an absolute reading) and one outside the DP (yielding a relative reading). On relative readings, -EST moves out of the DP to be adjacent to the focus (*Gloria*). The definite article present in the DP cannot be interpreted, so it is deleted at LF, as indicated by strikethrough notation; a null existential quantifier (\exists) takes its place. The result is the following LF for (43-b):

$$(45) \quad \textit{Gloria} \ [\textit{-est} \ \lambda d \ \textit{visited} \ [_{\text{DP}} \ \exists \ \textit{the} \ [\textit{d-many continents}]]]]$$

In absolute and proportional readings, -EST is instead interpreted internal to the DP. The LF in (46) corresponds to (44-b):

$$(46) \quad \textit{Gloria visited} \ [_{\text{DP}} \ \exists \ [\textit{-est} \ \lambda d \ [\textit{d-many continents}]]]]$$

Hackl assumes an -EST that takes as arguments a gradable predicate G (relation between individuals and degrees, type $\langle d, \langle e, t \rangle \rangle$) and an individual x presupposed to be a member of a contextually-supplied comparison class C (Heim, 1999). The scope of -EST determines G and helps to determine the contents of C . $\text{-EST}(G)(x)$ returns ‘true’ if and only if the maximal degree to which G holds of x exceeds the maximal degree to which G holds of any *non-overlapping* y in C .

Hackl’s (2009) assumes further that C can consist of a sum-lattice; for example, it could contain a plural individual such as the plurality of all continents, along with all its sub-parts (e.g. Africa, Asia, Africa+Asia, ...). These assumptions yield truth conditions for (46) whereby Gloria visited some continent-plurality x more numerous than all other continent-pluralities y in the comparison class C which do not overlap with x . (Two plural individuals are *non-overlapping* if they have no common sub-individuals.) This holds for any x that constitutes more than half of the continent-pluralities, so the ‘more than half’ truth conditions—proportional truth conditions—are derived.

Hoeksema’s (1983) route to the proportional reading does not involve scope of -EST, but instead relies on the make-up of the comparison class C . The proportional reading arises when the comparison class consists of *two* non-overlapping pluralities, i.e. when a binary partition can be made over the members of C . For example, continents which Gloria has visited, and continents which she hasn’t. The two pluralities are compared with respect to size.

It may be that both routes to proportional readings are available in different languages or under different circumstances, although we will present tentative arguments in favor of Hoeksema’s strategy. It may also be that other routes to proportional meaning also exist. But what is clear is that any theory that allows any of

these routes predicts proportional readings to be available, so we must find a way to block these routes in most languages.

4.2 Proposal

We propose to block the routes to proportional meanings for MOST using three key assumptions. The first concerns the semantic type of quantity words. First, we treat quantity words as by default denoting gradable predicates of *degrees* ($\langle d, \langle d, t \rangle \rangle$). Precedent for this kind of meaning for MANY/MUCH comes from Rett (2008, 2014) and Solt (2009, 2015). It is justified in part by their use as differentials in comparative constructions, as in *Martha is much taller than Sue*.

Second, we adopt Bobaljik’s (2012) ‘Containment Hypothesis’, according to which superlatives are always built on comparatives. A similar structure is used by Hoeksema (1983).

$$(47) \quad [[[\text{ADJECTIVE}] \text{COMPARATIVE}] \text{SUPERLATIVE}]$$

In some languages, superlative forms transparently reflect a layered structure, e.g. Persian *boland-tar-in* (tall-CMPR-SPRL) ‘tallest’. Bobaljik provides typological evidence that this structure is universally valid, even for languages like English where comparative morphology is not overtly represented in superlatives. Bobaljik’s layered structure has the potential to model superlative meaning in the many languages in our sample that build superlatives from comparative morphology and an additional expression. It also plays a key role in our assumption for why proportional readings are generally ruled out.

4.2.1 General schema

As an aide to explanation of our proposal, we introduce a schema for describing the various meaning components in a superlative sentence. Consider first a relative reading of the following example, represented schematically in Figure 5.

$$(48) \quad \text{John climbed the highest mountain on Tuesday}_F.$$

In Figure 5, each oval represents a set: *days* (focal alternatives), *mountains*, and *degrees*. *Days* and *mountains* are sets of individuals, while *degrees* is a set of degrees. Members of set *days* are mapped onto members of set *mountains* by the relation *John climbed y on x* . Members of set *mountains* are mapped onto members of set *degrees* by the relation *y is d -high*.

Following the terminology of Coppock & Beaver (2014), the *contrast set* consists of *days* in this case. The *measurand set* consists of *mountains*. Members of the contrast set are mapped onto members of the measurand set by the *association relation*. Measurands are mapped onto degrees by a *measure relation*.

- (50) Lexical entry for phrasal comparative marker
 $-er \rightsquigarrow \lambda G_{\langle d, \langle \tau, t \rangle \rangle} \lambda \beta_{\tau} \lambda \alpha_{\tau} . \max(\lambda d . G(d)(\alpha)) > \max(\lambda d' . G(d')(\beta))$

A comparative morpheme that composes with two entities is appropriate for analyses of phrasal comparatives as in *She is taller than me* where the standard of comparison (*me*) is a phrase rather than a clause (cf. ... *than I am ~~tall~~*), and denotes an individual. Although we assume that clausal comparison is possible elsewhere in many languages, it is not used in our superlative derivations.¹³

The entry in (50) composes with a gradable predicate G before composing with two entities. The order of composition in this entry follows Kennedy (1997).¹⁴ This distinguishes it from other analyses of phrasal comparatives in which $-er$ composes first with the entity denoted by the standard of comparison (e.g. *me*). This entry is necessary since our superlative takes as input the product of the phrasal comparative applied to a gradable predicate: A relation between two individuals, or between two entities of the same type in any case. Furthermore, the morphosyntactic constituency suggested by this denotation is consonant with Bobaljik’s (2012) layered structure for superlatives in (47).¹⁵

Now, a question that arises under any account of superlatives is why, for example, *the tallest mountain* is necessarily tallest among some set of mountains; it doesn’t suffice to be a mountain that is tallest among any arbitrary set of things. Generally, attributive superlatives involve comparison among entities of the sort described by the modified noun. In Heim’s (1999) theory, short movement of $-est$ within the noun phrase is posited in order to account for this sort of observation. One possible way of accounting for this fact within the present approach is by introducing an attributive variant of the superlative morpheme that takes the modified noun as an argument and requires that the measurand set (the range of the association relation) be a subset of its denotation, as follows:

- (51) Lexical entry for superlative marker (attributive version)
 $-t \rightsquigarrow \lambda T_{\langle \tau, \langle \tau, t \rangle \rangle} \lambda P_{\langle \tau, t \rangle} \lambda \alpha_{\tau} . \partial(\text{range}(\mathbf{R}) \subseteq P) \wedge \text{sup}(\alpha, \mathbf{R} \star T, \mathbf{C})$

If it could be enforced that this attributive variant is used whenever there is a modified noun, then the observation would be accounted for. One possible way of

¹³For discussion of phrasal comparison in English and other languages, see Heim (1985); Kennedy (1997); Lechner (2004); Kennedy (2007); Bhatt & Takahashi (2011), and references therein.

¹⁴The entry in (50) is not identical to Kennedy’s (1997), which treats gradable adjectives as measure functions (type $\langle e, d \rangle$) rather than as gradable properties.

¹⁵We are not the first to offer a compositional analysis of superlatives consistent with Bobaljik’s (2012) layered structure. Szabolcsi (2012) was perhaps the first to offer a detailed analysis in this style. However, Szabolcsi’s (2012) analysis allows for proportional readings to be derived straightforwardly through (simulated) movement of $-est$ to a higher position within the DP. It is important for us to block easy routes to proportional readings. Our compositional account differs from Szabolcsi’s (2012) in requiring the input relation to $-est$ to be the meaning of a phrasal comparative, which helps to block proportional readings (sec. 4.2.3).

enforcing this is to assume that the attributive variant in (51) is the only variant. This would explain the tendency for superlatives to behave attributively (Matushansky, 2008), although the tendency may not be as universal as Matushansky claims (cf. e.g. Croitor & Giurgea 2016). If so, then something must be said about non-attributive superlatives, including predicative superlatives and quantity superlatives under our analysis. For such cases, we may assume that the argument is trivially saturated implicitly, yielding our original entry for *-t*. We will not show this implicit saturation operation in our derivations below, but we take it to be a reasonable assumption regarding the relation between the two variants.

4.2.2 Examples

Quality/absolute: The derivation for *the highest mountain* is shown in Figure 6. We adopt the usual assumption that *high* expresses a relation between individuals and degrees to which they are high, which includes all degrees below their actual height (Heim, 1999). The comparative makes reference to the maximum degree to which the gradable predicate holds, which is just the height. On an absolute reading, the association relation **R** is identity, so the distinction between the contrast set and the measurand set collapses, yielding a straightforward situation involving a single comparison class. This means that the domain and range of **R** are the same, so the constraint that the range consist of mountains amounts to a constraint that **C** consist of mountains. The meaning derived can thus be expressed as follows:

$$(52) \quad \lambda x. \partial(\mathbf{C} \subseteq \text{mountain}) \wedge \text{sup}(x, \text{higher}, \mathbf{C})$$

The expression in (52) denotes a property that holds of an individual *x* if *x* is highest among some contextually given set of mountains.

Quality/relative: Figure 6 lies behind relative readings of *John climbed the highest mountain* as well. In the case of a relative reading, the association relation is not identity; the contrast set is John and alternatives to John, while the measurand set consists of mountains. **R** associates individuals with the mountains they climbed. As with the absolute reading, the measure relation is determined by the gradable predicate marked by *-er*, here *high*. With these pieces filled in, the truth conditions for *John climbed the highest mountain* that are derived are just as expected: John climbed a higher mountain than any alternative to John did.

When the association relation is not identity, the contrast set and the association relation are determined in part by a licenser. Several possible types of licensors are possible, including focus, as in (48), *wh-* (Szabolcsi, 1986), as in *Who put the tallest plant on the table?*, and PRO, as in *A: How do you win this contest? B: By putting the tallest plant on the table* (Heim, 1999). Without focus-marking, a relative reading would no longer be available due to the absence of an appropriate licenser. Although

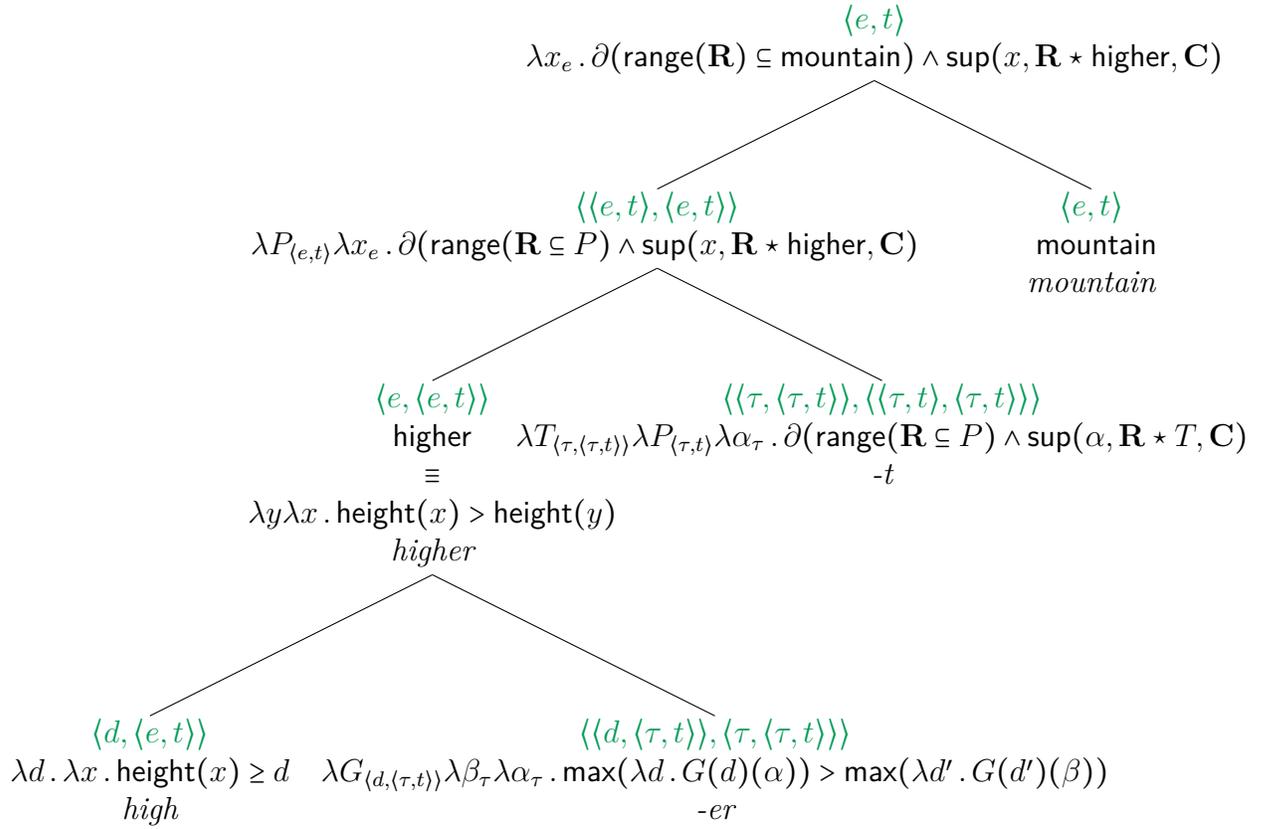


Figure 6: Derivation for *the highest mountain*. On an absolute reading, \mathbf{R} is identity; on a relative reading, \mathbf{R} is non-trivial.

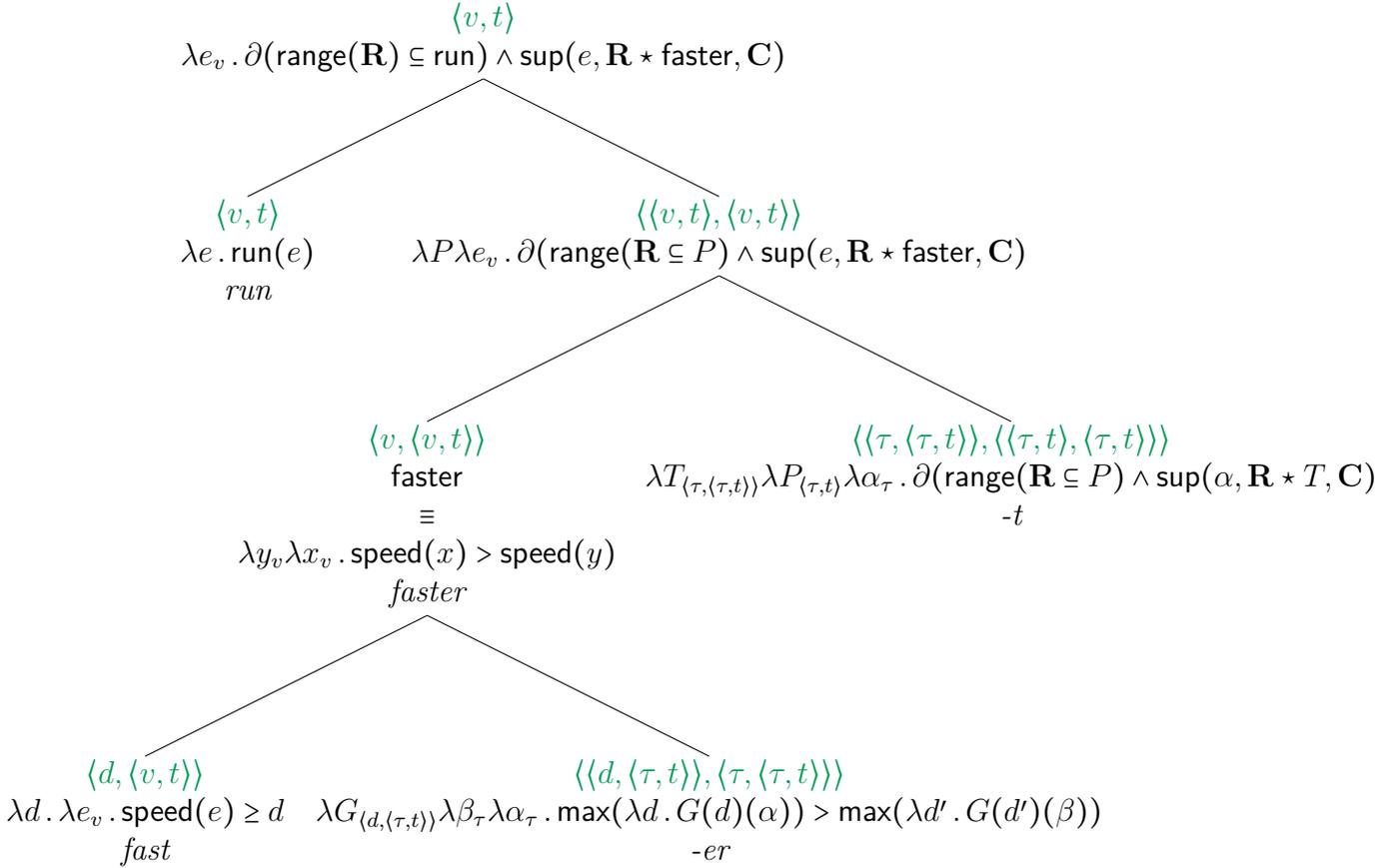


Figure 7: Derivation for *run fastest*

we do not offer a theory of why just *these* elements are appropriate licensors, we do assume that the contrast set must be identified either through identity or through one of these. Thus, whenever the contrast set and the association relation are not identical, we expect to find one of these licensors, such as focus, in the sentence.

Quality/adverbial: In the case of the adverbial quality superlative in (53), we assume that the contrast set consists of alternatives to Pam, while the measurand set consists of events, not individuals as in previous examples.

- (53) *Pam* ran **the fastest**.
 ‘Pam ran faster than anyone else’

The association relation associates individuals with running events in which they participated, and the measure is speed; see Figure 7.

Note that sentence (53) only allows an interpretation in which Pam is contrasted with other runners (i.e. a relative reading). Could there be an absolute reading

of an adverbial superlative? It would be paraphrased, ‘Pam was the agent of a running event that is faster than any other running event’, and would not require that there be multiple runners. As a matter of fact, this example is intuitively nonsensical if Pam is the only runner. The same holds for parallel examples in French, German, Italian, and Hebrew. Thus it appears that adverbial superlatives cannot have absolute readings.

But if it is given that Pam is the only runner, then the sentence asserts that Pam is the agent of a running event that is already presupposed to have Pam as its agent, so such a reading would not be expected to arise for independent reasons. So, while adverbial superlatives and quantity superlatives seem to share a lack of absolute readings, it is not clear that any additional assumptions are needed in order to rule them out in the case of adverbial superlatives.

Quantity/relative: Like adverbial superlatives, quantity superlatives typically have only relative readings, as in the following example:

- (54) We read **the most books** *on Friday*.
‘We read more books on Friday than on any other day’

For a relative reading of a quantity superlative (adverbial or adnominal), we take the measurands to be degrees (or ‘quantities’). This follows from our more basic claim that quantity words measure the size of quantities, rather than the size of individuals (or pluralities thereof). This claim has precedent in the proposals of Rett (2008) and Solt (2009, 2011), who treat quantity words as gradable properties of degrees or intervals, rather than individuals. These authors observe that quantity words are unlike ordinary gradable adjectives in a number of respects, including serving as differentials (*She is much taller than me; He has many more books than me*, etc.).

- (55) $much \rightsquigarrow \lambda d . \lambda d' . \mu(d') \geq d$ $\langle d, \langle d, t \rangle \rangle$
where μ is a salient extensive measure function

An extensive measure function of a degree is just an identity function, so the meaning of quantity words is quite light. But the treatment in (55) brings out the parallel between quantity words and other gradable predicates. Moreover, this treatment is consonant with the fact that in many languages, comparative and superlative counterparts to MANY do not contain any overt trace of MANY (sec. 2.3). Consider Italian, where MANY is *molto* but MORE and MOST are *più*, not **più molto*.

Some sort of compositional glue will be needed in order to connect quantity expressions to the meaning of the noun, when a nominal complement is taken. To compose a quantity expression with a noun, we assume a silent measure head. There is significant precedent for a meaning of this sort in work on quantity and measurement in the nominal projection, although individual proposals vary as to whether the meaning of this operator is built into nominal meaning or expressed

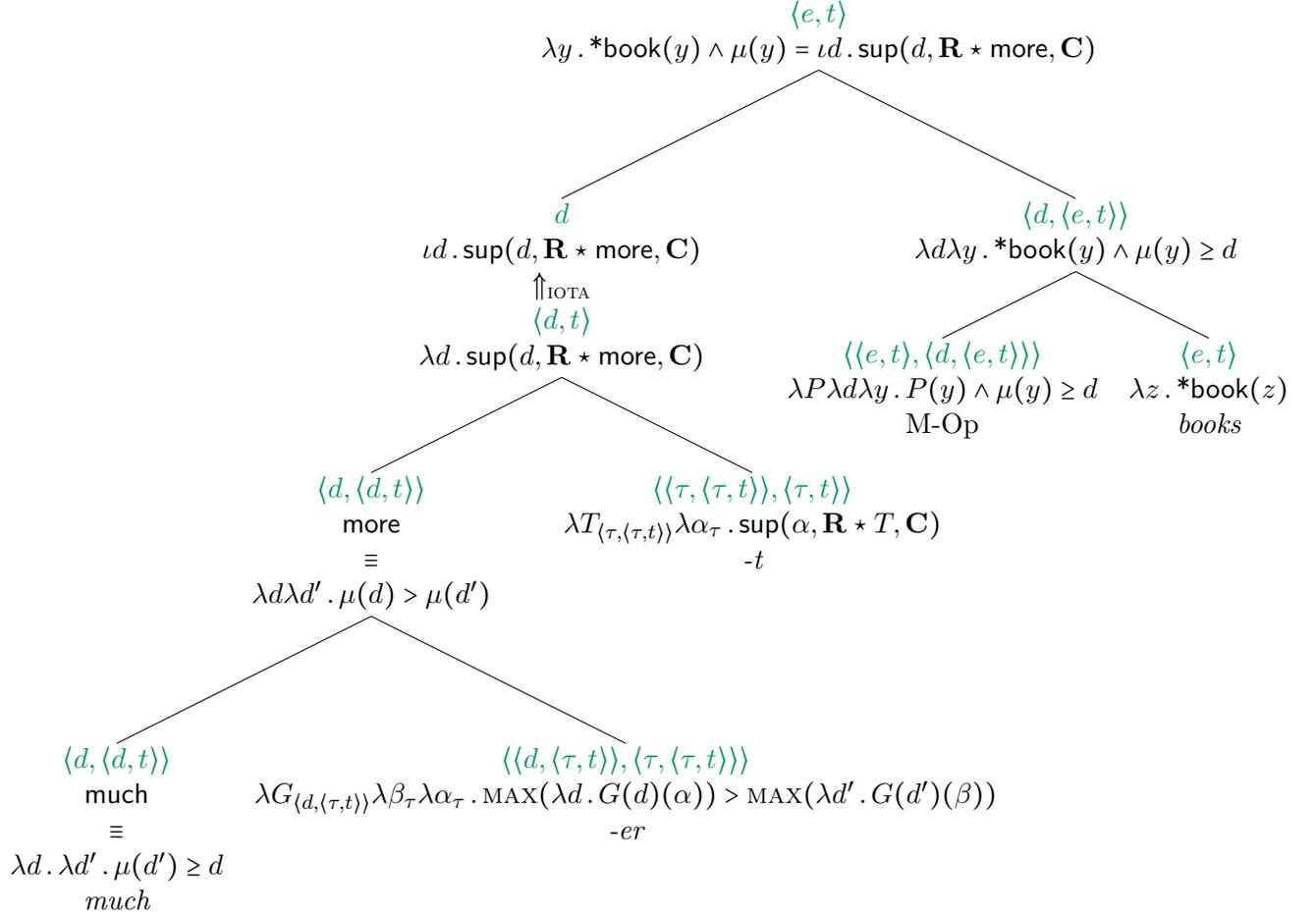


Figure 8: Derivation for *(the) most books* on relative reading (note: attributive *-t* not used here)

by a separate head (Cresswell 1977; Krifka 1989; Kayne 2005; Schwarzschild 2006; Nakanishi 2007a,b; Cornilescu 2009; Solt 2009, 2015; Scontras 2013; and references therein). Here, we assume a separate head, namely Rett’s (2014) M-Op.¹⁶

$$(56) \quad \text{M-Op} \rightsquigarrow \lambda P \lambda d \lambda x. P(x) \wedge \mu(x) = d$$

where μ is a salient extensive measure function

¹⁶M-Op presumably can in principle figure in constructions with numerals and pseudopartitives. In a case like *two books*, the numeral *two* could saturate the *d* argument, as Schwarzschild (2006) proposes, in the spirit of Krifka (1989); see also Scontras (2013) for a proposal in the same spirit on which a cardinality head synonymous with our M-Op head mediates between the numeral and the noun. We take no stand on the analysis of numerals here, though; numerals may as well combine directly with the noun as argued by Bale et al. (2011). In pseudopartitives such as *two ounces of gold*, M-Op is plausibly realized as *of* (Schwarzschild 2006, 106).

The derivation in Figure 8 yields a relative reading for an adnominal quantity superlative such as *(the) most books*. When used in (54), the measurand set consists of quantities of books. The contrast set consists of the days of the week. The association relation relates days to quantities of books. The measure relation *many* measures the quantities. The upward-pointing arrow subscripted with IOTA indicates the IOTA type-shifting operation (57), converting a predicate to an individual.

- (57) Type-shifting operation: IOTA
 $P \mapsto \iota x . P(x)$
 (Converts a predicate P to the unique satisfier of P)

If the definite article appears in the string, the article could take the place of IOTA.¹⁷

This derivation produces a predicate-type meaning $\langle\langle e, t \rangle\rangle$ for *the most books*, which can be adjusted to an argument-type meaning through a type-shifting operation that produces an existential quantifier (Partee & Rooth, 1983). Following Coppock & Beaver (2015), we call it EX:

- (58) Type-shifting operation: EX
 $P \mapsto \lambda Q . \exists x . P(x) \wedge Q(x)$
 (Converts a predicate to an existential quantifier)

This existential type-shift yields appropriate truth conditions for *John read the most books*: ‘There is a plurality of books that John read, whose cardinality is greater than any other contextually-relevant cardinality.’¹⁸

¹⁷This treatment of *the most* correctly predicts that it should be able to function in place of a measure phrase with degree achievement verbs, as in (i), assuming that the measure phrase denotes a degree and that verbs like *widen* have meanings as in Kennedy & Levin 2008. *The most* here would come to denote a degree following the path in Fig. 8.

- (i) The Ohio River widened **{(by) 20ft/(by) the most}**.

However we do not have a ready explanation for the following contrast between the acceptability of measure phrases and the awkwardness of *the most* below:

- (ii) John is **{six inches/??the most}** taller than Bill.

Our judgments, and those of native English speakers that we asked, vary on the unacceptability of *the most* above.

We also observe that *the most* improves when *the most* no longer directly precedes *taller*:

- (iii) a. John is taller than Bill by **the most**.
 b. ?Fred is taller than Bill, as is Bob, but John is **the most** so.

¹⁸According to the principles laid out by Coppock & Beaver (2015), the IOTA shift is preferred wherever it is usable, and it should be usable with *the most books* as long as there is a unique plurality of books that meets the description. It is not clear, however, that an IOTA interpretation is available for *the most books*; see Coppock & Beaver (2014) for discussion of this point. We leave

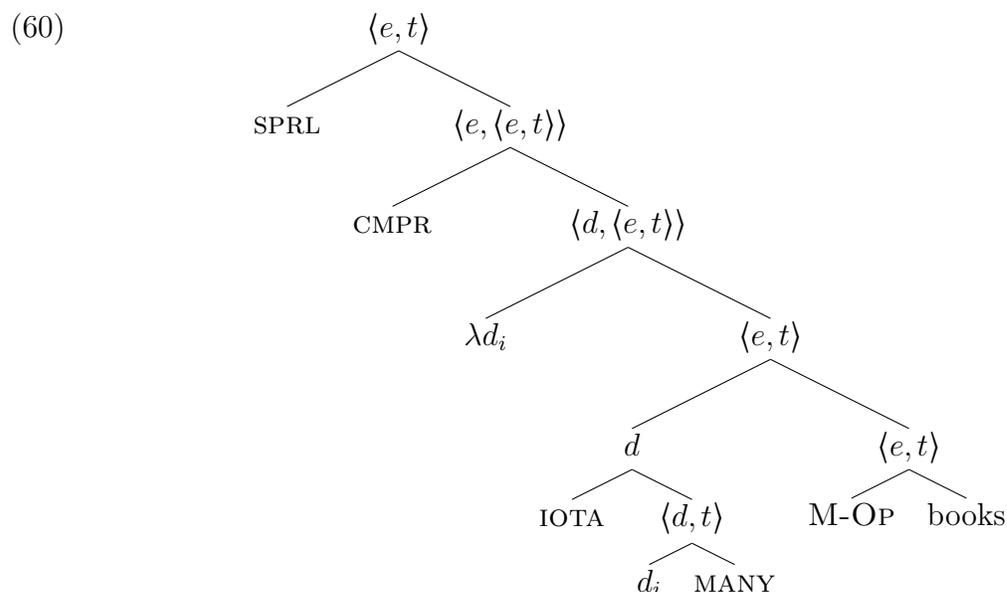
4.2.3 Why proportional readings are normally blocked

To review, we have proposed that quantity words denote gradable properties of degrees rather than entities, and shown how to derive relative readings in a framework that adopts Bobaljik’s Containment Hypothesis. What we must show now is that neither Hackl’s (2009) nor Hoeksema’s (1983) route to proportional meaning is left open under our assumptions. Neither route will be replicable in its original form since each involves composition between -EST and an expression denoting a relation between degrees and entities.¹⁹ But what if we minimally adapt each account to accommodate type $\langle d, \langle d, t \rangle \rangle$ quantity words?

Recall that under Hackl’s (2009) analysis, *most books* has a structure like the following:

$$(59) \quad [-est \lambda d [d\text{-many}_{\langle d, t \rangle} \text{books}_{\langle e, t \rangle}]]$$

Let us consider a variant of Hackl’s (2009) analysis that includes the assumptions we have made: An attributive measurement operator (56), an IOTA type-shift operator, and Bobaljik’s Containment Hypothesis. On Hackl’s original path to proportional MOST, -EST undergoes a short movement within DP to compose with a type $\langle d, \langle e, t \rangle \rangle$ constituent. We might imagine that the comparative element (e.g. *-er*) is what does this instead, and the superlative operator attaches outside of it:



The resulting structure would have what it takes to produce a proportional reading.

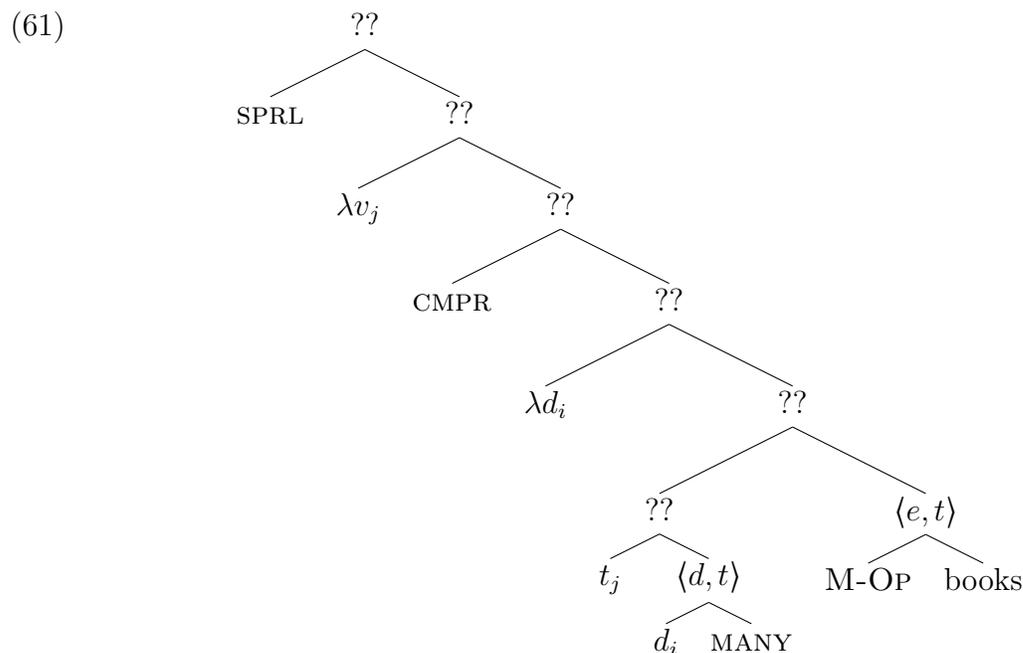
it as an open question why this kind of reading is absent.

¹⁹For instance, on Hackl’s (2009) actual path to proportional MOST, MANY denotes a gradable modifier (type $\langle \langle e, t \rangle, \langle d, \langle e, t \rangle \rangle \rangle$) that takes *mountains* as argument. If MANY is instead type $\langle d, \langle d, t \rangle \rangle$, the noun and quantity word cannot compose.

If the association relation is identity, then the meaning that would be derived for (60) would be ‘the individual x that is greatest in \mathbf{C} with respect to the property of the numerosity of books that it constitutes’. With Hackl’s assumption that \mathbf{C} can consist of a sum lattice, and the assumption that members of \mathbf{C} are compared with other non-overlapping rather than distinct members, Hackl’s route to proportional readings can be reproduced from this structure.

Hackl’s route does depend on additional assumptions, which can be left out. We might opt for the traditional assumption that members of \mathbf{C} are compared with other *distinct* members, and disallow sum-lattice comparison classes. But these assumptions still would not block Hoeksema’s route to proportional readings based on the structure in (60), on which *most books* simply refers to the larger of the two book-pluralities in \mathbf{C} .

We propose that this structure is not generated because the superlative must originate in its surface position, from which it would leave a trace, like so:



Let us assume that a trace is interpreted as a variable with some simple type, as usual. Whether the trace is type d or type e , there will be a type clash. If the type of the trace is e , then there will be a type clash immediately, as d_i MANY is of type $\langle d, t \rangle$. If it is of type d , then the result will be of type t , and the result will not be able to combine with M-OP *books*. The reasoning here is similar to the reasoning given by Beck et al. (2012) to explain why phrasal comparatives (as analyzed by Kennedy 1997) are scopally inert: The standard argument cannot be integrated properly into the derivation.

So, assuming that comparatives and superlatives are base-generated in their sur-

face positions and leave interpreted traces there if they ever undergo movement, the Bobaljik structure cannot support Hackl or Hoeksema’s route to proportional readings. Now, we should note that Szabolcsi (2012) re-creates a Hackl-style derivation of proportional meanings for quantity superlatives in the context of a Bobaljik-style analysis of superlatives. But Szabolcsi’s proposal relies on a more powerful suite of composition operations allowing the superlative to take scope over a phrase consisting of a comparative which itself takes scope over a gradable adjective and a noun (see pp. 16 and 20). As long as these additional composition operations are not incorporated into the theory, Hackl’s route to proportional readings can still be ruled out in the manner just discussed.

Could a proportional reading arise through some other means? Under our assumptions, an absolute reading of a quantity superlative, where the association relation is identity, will be one in which the contrast set is made up of degrees. Could a proportional reading arise through such an absolute reading? For example, in a case like *Most swans are white*, the contrast set might consist of two degrees, the number of swans that are white and the number of swans that are not white. If these degrees were somehow imbued with sufficient intensional content, then a proportional reading could arise under our assumptions through this route. The contrast set would have to constitute a set of salient degrees in such a scenario. There appears to be no absolute ban on have a contrast set consisting of degrees; consider *How big an apartment gives you the best value for your money?* Nor does it seem impossible for degrees to be discourse-salient; consider *Chris is 6’3”*. *Nick is taller than that*. However, it does seem as if degrees are not as easily made salient as individuals. For example, if Chris leaves the room, we can say, *He is writing a paper with Nick*, but not *Nick is taller than that*. We suggest that degrees’ need for assistance in being raised to salience is what prevents proportional readings from arising through such a route.

4.2.4 How proportional readings arise

Our account thus far predicts that quantity superlatives should only ever have relative readings. How, then, do proportional readings come about when they do? We propose that proportional readings arise when quantity words undergo reanalysis and become attributive, taking on the meaning of the measurement operator M-Op:

$$(62) \quad much_{M-OP} \rightsquigarrow \lambda P \lambda d \lambda x . P(x) \wedge \mu(x) = d \quad \langle d, \langle e, t \rangle \rangle$$

where μ is a salient extensive measure function

This shift in meaning means that *much* is more like a quantifier, insofar as it expects a nominal complement.

In order for *-er* and *-t* to combine with this version of *much*, their types must be adjusted. This can be accomplished through the Geach rule, which allows an extra argument (the nominal predicate in this case) to be threaded up the tree, as

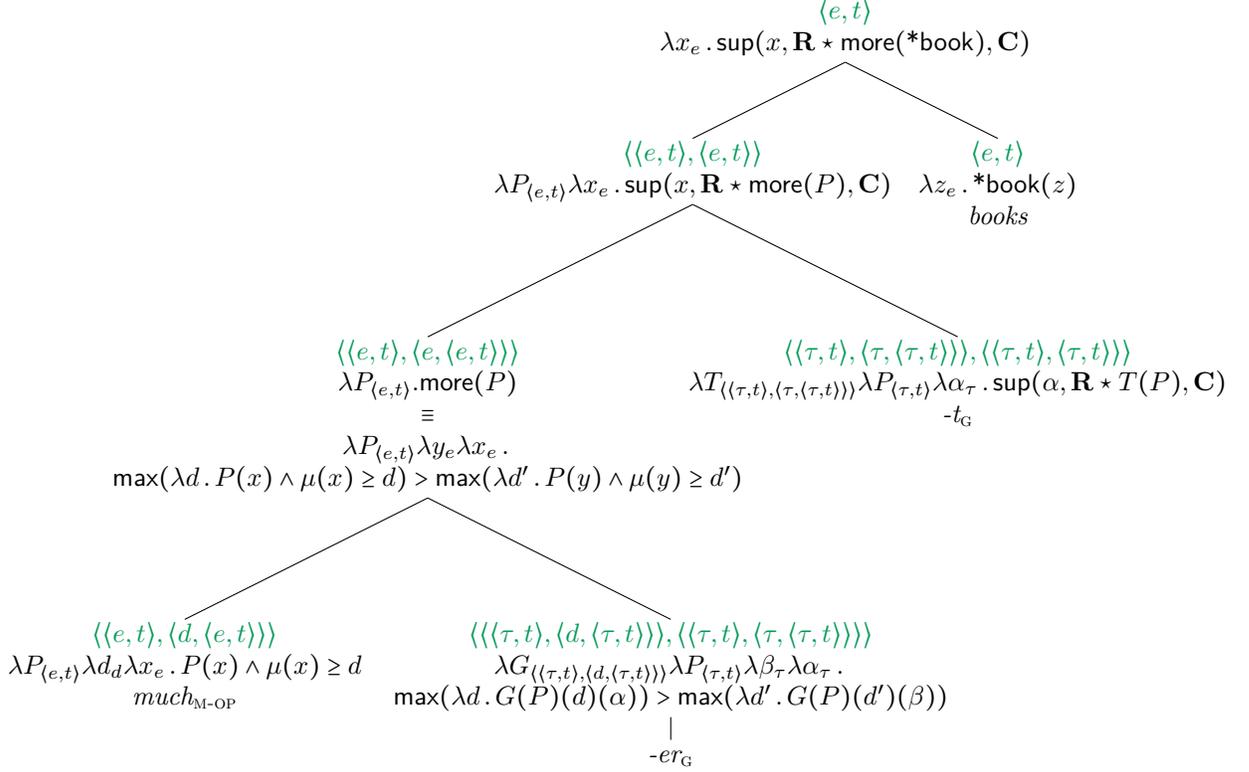


Figure 9: Derivation for *most books* on a proportional reading.

it were. Technically, it converts a function f with type $\langle a, b \rangle$ into a function f' with type $\langle \langle c, a \rangle, \langle c, b \rangle \rangle$ of the form $\lambda R . \lambda x . f(R(x))$, where R has type $\langle c, a \rangle$. The result of applying the Geach rule to the comparative and the superlative, where c is $\langle \tau, t \rangle$, is as follows:

$$(63) \quad -er_G \rightsquigarrow \lambda G_{\langle \langle \tau, t \rangle, \langle d, \langle \tau, t \rangle \rangle \rangle} \lambda P_{\langle \tau, t \rangle} \lambda \beta_\tau \lambda \alpha_\tau . \\ \text{MAX}(\lambda d . G(P)(d)(\alpha)) > \text{MAX}(\lambda d' . G(P)(d')(\beta))$$

$$(64) \quad -t_G \rightsquigarrow \lambda T_{\langle \langle \tau, t \rangle, \langle \tau, \langle \tau, t \rangle \rangle \rangle} \lambda P_{\langle \tau, t \rangle} \lambda \alpha_\tau . \text{sup}(\alpha, \mathbf{R} * T(P), \mathbf{C})$$

(Note that the result of Geaching the non-attributive superlative is similar to but distinct from the attributive version of the superlative given above.)

These lexical entries allow for the derivation in Figure 9 for *most books*. The measurand set and contrast set both consist of quantities of books. The association relation is identity; in this respect proportional and absolute readings have a deep similarity (cf. Hackl 2009)

Once the quantity word takes on the meaning of M-Op, a proportional reading in principle becomes available through both Hackl and Hoeksema's routes. But there is at least one tentative reason to prefer Hoeksema's. The idea that proportional readings involve a binary partition over the extension of the noun resonates with

the fact that many languages express proportional meaning with comparative morphology alone. For example, Persian expressions of proportional meaning contain the comparative marker *-tar* but not the superlative marker *-in*:

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

Proportional meaning is also expressed with (historic or synchronic) comparative structures in Hindi (Bhatt & Takahashi, 2011; Gorshenin, 2012) and many Slavic languages. Romance languages give further support to a Hoeksema-style decomposition of proportional readings into two partitions, since they include a noun translated as ‘part’ in addition to a comparative, e.g. French *la plupart*.

In sum, we propose that proportional meaning is only available if the quantity word undergoes a reanalysis so that the semantic contribution of the “glue” linking a measure expression to a noun is attributed to the quantity word. With the assumption that this semantic reanalysis of quantity words is not common, we can explain why relative readings are ubiquitous while proportional readings are rare.

4.3 Accounting for morphosyntactic generalizations

Our analysis also casts light on the morphosyntactic patterns discussed in sec. 3.3. Under the schema above, adverbial and quantity superlatives with relative interpretations involve measurands that are not individuals but rather events or degrees. With this as our starting point, we can explain the two morphosyntactic generalizations if we also assume that agreement patterns reflect the semantic type of the measurand. Coppock (to appear) offers the following *Target-Domain Hypothesis*, according to which the grammatical features exhibited by a superlative reflect the domain from which the target argument is drawn.

- (66) **Target-Domain Hypothesis**
 The agreement features of a superlative are determined by the domain from which the target are drawn: If the target is drawn from a domain other than the set of individuals, then default agreement is expected in the absence of overriding factors.

Thus we expect ordinary number agreement only if the target is an individual. When the target is instead an event or a degree, we expect disagreement in principle. It is also not especially surprising that we should find morphosyntactic similarities between adverbial superlatives and quantity superlatives on relative readings given their shared non-individual measurand type.

There are, of course, languages where quantity superlatives on relative readings can agree in number with the substance noun. Romanian, German, and Greek

are three examples. In Greek (27), adnominal quantity superlatives with relative (and proportional) readings show number agreement between the noun and the obligatory definite article. We conjecture that agreement arises due to overriding syntactic factors. Coppock & Strand (to appear) discuss one such factor in Greek. Thus syntactic factors can conflict with the semantic agreement principle proposed here, yielding full agreement with quantity superlatives even on relative readings.²⁰

Observe that unlike the compositional view we have developed here, a lexical view of proportional MOST has no obvious explanation for the systematic morphosyntactic patterns that distinguish proportional and relative MOST. Yet we find consistent agreement patterns even across unrelated languages. This suggests that the existence of proportional readings for quantity superlatives is the product of a compositional process.

4.4 Alternative proposals

Our proposal is not the first attempt to capture the markedness of proportional readings. While previous approaches contribute valuable insights, each faces certain difficulties. Pancheva (2015) already identified difficulties faced by two of these approaches: We summarize her observations and then discuss challenges for her own account.

4.4.1 DP layer?

Bošković (2008) proposed that the existence of a DP layer is parameterized in natural language. Bošković & Gajewski (2008) tie the availability of proportional readings to the presence of a DP layer. Building on Hackl (2009), a proportional reading arises when -EST undergoes a short movement within DP to resolve a type-incompatibility. This option is only available in languages with DP: Otherwise, -EST must seek higher ground, yielding a relative reading.

Bošković & Gajewski predict that in any language with overt definite determiners (and hence a DP layer), the superlative of MANY will have a proportional reading. While generalization holds true for languages identified by Živanović (2007a,b), Pancheva (2015) observes that this prediction fails to account for other languages including Bulgarian, French, Italian, and Spanish, where there is a definite article but no proportional reading. We add Kurdish Sorani to this list. It seems that DP structure is not sufficient to determine the distribution of the proportional reading.

²⁰Such factors may also be at work beyond superlatives. Indeed, Schwarzschild (2006), building on Giusti (1997), argues on the basis of agreement between *molti* ‘many.PL.MASC’ and *ragazzi* ‘boys’ in Italian that quantity words should project a phrase that occupies a specifier position of Schwarzschild’s MonP. In this specifier position, quantity words would be expected to show agreement with the Mon head, and hence the noun, as Mon is a functional projection that inherits its agreement features from the dominated nominal projection.

4.4.2 Cardinal vs. proportional *many*?

Another previous approach places the blame on the quantity word, building on the observation that languages can differ with respect to the focus-sensitivity of their quantity words. English *many* has been claimed to have both cardinal and proportional readings in (67) (Milsark 1977; Westerståhl 1985; Partee 1989; Büring 1996; Herburger 1997; Krasikova & Champollion 2011; Romero 2017; and references therein).

- (67) Many aspens died.
A large number of aspens died.
A large proportion of aspens died.

Not all quantity words permit both readings, as Krasikova & Champollion (2011) show for Russian. Could a language's inventory of quantity words determine the availability of the proportional reading? Pancheva (2015) considers and rules out this possibility. It would be the non-focus-sensitive MANY that underlies proportional readings, rather than the focus-sensitive one. As she notes, given the broad availability of proportional, non-focus-sensitive uses of MANY in languages that lack proportional readings, it is not clear how this distinction can explain the distribution of the proportional reading.

4.4.3 Underlying pseudopartitive structure?

On Pancheva's (2015) proposal, quantity superlatives always derive from an underlying pseudopartitive structure containing an abstract measure noun NUMBER, but different interpretations emerge depending on whether a *measure* or *individuating* pseudopartitive is involved. This distinction can be illustrated with the following contrast:

- (68) a. John broke two glasses of water. [individuating]
b. John added two glasses of water to the soup. [measure]

In *individuating* pseudopartitives, as in (68-a), the container or measure noun (*glass*) is the head, whereas in *measure* pseudopartitives, as in (68-b), the substance noun (*water*) is the head (Doetjes, 1997; Landman, 2004; Rothstein, 2009; Alexiadou et al., 2007). Pseudopartitive structures may contain an abstract noun meaning 'number' or 'amount', as in the following example from Italian with (only) a relative reading.

- (69) **il maggior numero** di articoli
DEF large.CMPR number of articles
'the most articles'

Pancheva proposes that in Slavic-type languages, the superlative of MANY spells

out a combination of a special degree-oriented form of *large* (*large_d*) and an abstract NUMBER noun specialized for individuating pseudopartitives (NUMBER_{*i*}) as in (69), along with -EST. (This is the underlying structure only for the *superlative* of MANY, as positive and comparative forms of MANY in Slavic are compatible with measure pseudopartitives as well.) Pancheva posits a different abstract NUMBER noun (NUMBER_{*m*}) specialized for measure pseudopartitives. Languages with this structure (such as English) permit both relative and proportional readings.

Our proposal has a key similarity to Pancheva’s: Her individuating pseudopartitive structure found in languages with only relative readings involves measurement of degrees (numbers), rather than individuals. But 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; they are not morphologically related to either LARGE or NUMBER. Relatedly, Wilson (2016, 17) points out that if there is a silent NUMBER noun in combination with LARGEST, then we might expect just 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 the context of superlatives*. It is hard to see how this could be grounded in universal principles, and it is not clear why -EST could not combine with MANY in the presumed measure pseudopartitive structure, when this is possible for positives and comparatives.

Another challenge is posed by languages in which quantity superlatives with relative readings have structures distinct from pseudopartitives in the same language. In Italian, pseudopartitives are marked with *di* (69) while *di* is absent from quantity superlatives (de Boer, 1986), which unambiguously express relative readings. In Mandarin, the presence of the modificational particle *de* in pseudopartitives forces a measure reading (Cheng & Sybesma 1998, Rothstein 2017, 156). However, superlatives with *de* were accepted in relative-only contexts (14), suggesting that the relative reading need not reflect an individuating structure.

5 Summary and conclusion

As we have seen, there exists great diversity in the morphosyntactic strategies used to express superlative meanings cross-linguistically, 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. We found languages where the superlative of MANY or MUCH had a relative reading but no proportional reading, and languages where both readings were attested, but no languages where the superlative of MANY or MUCH had a proportional reading but no relative reading.

We have proposed to explain the markedness of proportional readings on the basis of two main assumptions: (i) That quantity words denote gradable predicates of degrees, and (ii) Bobaljik’s Containment Hypothesis. Together, these assumptions force a relative interpretation for quantity superlative under ordinary circumstances. Our assumptions also explain certain subtle facts about agreement: Quantity superlatives exhibit neuter singular agreement, and often mirror adverbial superlatives in their morphosyntax. We have suggested that proportional readings arise when (i) quantity words are reanalyzed so that the contribution of the “glue” connecting a noun with a measure expression is attributed to them, so that a superlative attaches to a gradable predicate of individuals, and (ii) the comparison class is construed as a binary partition over the domain, determined on the basis of a predicate identified in the sentence.

One finding that our proposal does not account for is the fact that proportional readings were only found in languages that use a morphological strategy for expressing superlative meaning. Given how few languages overall use superlatives of MANY to express a proportional reading, it is not clear that this finding is not a statistical accident. But if it is a real tendency, then it would be. If indeed this finding is real, then perhaps proportional readings for MOST are facilitated by analogical pressure from other word-like quantifiers in the lexicon. In that case, the compositional route to a proportional reading might be complemented and strengthened by a direct route, perhaps along the lines envisaged in Hay’s (2003) dual-route model of morphology.

Where does all of this leave us with respect to the question of what sorts of logics are necessary to capture proportional quantifiers? Barwise & Cooper showed that first order logic does not suffice, and proposed Generalized Quantifier Theory instead. Hackl (2009) argued that a different remedy was preferable on the grounds that MOST is MANY plus -EST, as Bresnan (1973) suggested. Our results show that proportional readings do not arise straightforwardly as a combination of the meanings of these two elements, and suggest that a process of lexicalization may be at work in their development. But the meaning that has been solidified is the composition of a number of pieces that are not generalized quantifiers. So even if we ultimately find that proportional quantifiers arise through a historical process of lexicalization, the result does not require generalized quantifiers as semantic primitives. Thus, in terms of this larger discussion, our findings are consistent with Hackl’s core contribution to this discussion, but urge us to refine our view of the situation.

References

- Alexiadou, Artemis, Liliane Haegeman & Melita Stavrou. 2007. *Noun phrase in the generative perspective*, vol. 71 Studies in Generative Grammar. Berlin: Mouton de Gruyter.

- Aronson, Howard I. 1990. *Georgian: A reading grammar*. Slavica Publishers, Inc. corrected edition edn.
- Bach, Emmon, Eloise Jelinek, Angelika Kratzer & Barbara H. Partee (eds.). 1995. *Quantification in natural languages* (Studies in Linguistics and Philosophy 54). Kluwer: Kluwer.
- Bale, Alan, Michaël Gagnon & Hrayr Khanjian. 2011. Cross-linguistic representations of numerals and number marking. In *Proceedings of Semantics and Linguistic Theory (SALT) 20*, 582–598.
- Barwise, Jon & Robin Cooper. 1981. Generalized quantifiers and natural language. *Linguistics and Philosophy* 4. 159–219.
- Beaver, David & Emiel Krahmer. 2001. A partial account of presupposition projection. *Journal of Logic, Language and Information* 10. 147–182.
- Beck, Sigrid, Vera Hohaus & Sonja Tiemann. 2012. A note on phrasal comparatives. In Anna Chereches (ed.), *Proceedings of SALT 22*, 146–165.
- Beck, Sigrid, Sveta Krasikova, Daniel Fleischer, Remus Gergel, Stefan Hofstetter, Christiane Svaelsberg, John Venderelst & Elisabeth Villalta. 2010. Crosslinguistic variation in comparison constructions. In Jeroen van Craenenbroeck & Johan Rooryck (eds.), *Linguistic variation yearbook*, 1–66. Amsterdam: John Benjamins.
- Bhatt, Rajesh & Shoichi Takahashi. 2011. Reduced and unreduced phrasal comparatives. *Natural Language and Linguistic Theory* 29. 581–620.
- Bobaljik, Jonathan David. 2012. *Universals in comparative morphology: Suppletion, superlatives, and the structure of words*. Cambridge, MA: MIT Press.
- Bošković, Željko. 2008. What will you have, DP or NP? In *Proceedings of NELS 37*, 101–114.
- Bošković, Željko & Jon Gajewski. 2008. Semantic correlates of the NP/DP parameter. In *Proceedings of the 39th meeting of the North East Linguistic Society (NELS39)*, GSLA, University of Massachusetts.
- Bresnan, Joan. 1973. Syntax of the comparative clause construction in English. *Linguistic Inquiry* 4(3). 275–343.
- Bumford, Dylan. 2016. Split-scope definites: Relative superlatives and haddock descriptions. Ms., New York University.
- Bumford, Dylan. 2017. Split-scope definites: Relative superlatives and Haddock descriptions. *Linguistics and Philosophy* 40(6). 549–593.
- Büring, Daniel. 1996. A weak theory of strong readings. In T. Galloway & J. Spence (eds.), *Proceedings of semantics and linguistic theory (salt) 6*, 17–34. Ithaca, NY: CLC Publications.
- Cheng, Lisa L.-S. & Rint Sybesma. 1998. Yi-wan Tang, yi-ge Tang: classifiers and massifiers. *Tsing Hua Journal of Chinese Studies* 3(28). 385–412.
- Coppock, Elizabeth. 2016. Typological database of superlative constructions. Har-

- vard Dataverse.
- Coppock, Elizabeth. to appear. Quantity superlatives in Germanic, or, life on the fault line between adjective and determiner. *Journal of Germanic Linguistics* (to appear).
- Coppock, Elizabeth & David Beaver. 2014. A superlative argument for a minimal theory of definiteness. In Todd Snider (ed.), *Proceedings of SALT 24*, 177–196. Ithaca, NY: CLC Publications.
- Coppock, Elizabeth & David Beaver. 2015. Definiteness and determinacy. *Linguistics and Philosophy* 38(5). 377–435.
- Coppock, Elizabeth & Christian Josefson. 2015. Completely bare Swedish superlatives. In Eva Csipak & Hedde Zeijlstra (eds.), *Proceedings of Sinn und Bedeutung 19*, 179–196. University of Göttingen.
- Coppock, Elizabeth & Linnea Strand. to appear. *Most* vs. *the most* in languages where *the more* means *most*. In Ana Aguilar-Guevera, Julia Pozas Loyo & Violeta Vázquez Rojas Maldonado (eds.), *Definiteness across languages*, Language Science Press.
- Cornilescu, Alexandra. 2009. Measure phrases and the syntax of romanian nouns and adjectives. *Bucharest Working Papers in Linguistics* 11(1). 35–66.
- Cresswell, Max J. 1977. The semantics of degree. In Barbara Partee (ed.), *Montague grammar*, 261–292. New York: Academic Press.
- Croitor, Blanca & Ion Giurgea. 2016. Relative superlatives and Deg-raising. *Acta Linguistica Hungarica* 63(4). 411–442.
- de Boer, Minne Gerben. 1986. Il superlativo italiano. *Revue romane* 21(1). 53–64.
- Diop, Bamba. 2012. *Aay naa ci wolof! aay naa ci wolof! trainee wolof manual*. Peace Corps Senegal.
- Dobrovie-Sorin, Carmen. 2015. Two types of *most*. In Sarah D’Antonio, Mary Moroney & Carol Rose Little (eds.), *Proceedings of SALT 25*, 394–412.
- Dobrovie-Sorin, Carmen & Ion Giurgea. 2015. Quantity superlatives vs. proportional quantifiers: A comparative perspective. Abstract for 25th Colloquium on Generative Grammar, Bayonne.
- Doetjes, Jenny Sandra. 1997. *Quantifiers and selection*: Leiden University dissertation.
- Dryer, Matthew S. & Martin Haspelmath (eds.). 2013. *The world atlas of language structures online*. Leipzig: Max Planck Institute for the Science of Human History.
- Etxeberria, Urtzi. 2005. *Quantification and domain restriction in basque*: University of the Basque Country (UPV/EHU) dissertation.
- Everett, Daniel. 2005. Cultural constraints on grammar and cognition in Pirahã: Another look at the design features of human language. *Current Anthropology* 46(4). 621–646.

- Farkas, Donka & Katalin É. Kiss. 2000. On the comparative and absolute readings of superlatives. *Natural Language and Linguistic Theory* 18. 417–455.
- Gawron, Jean Mark. 1995. Comparatives, superlatives, and resolution. *Linguistics and Philosophy* 18. 333–380.
- Giusti, Giuliana. 1997. The categorial status of determiners. In Lilliane Haegeman (ed.), *The new comparative syntax*, 95–124. Longman London edn.
- Gorshenin, Maksym. 2012. The crosslinguistics of the superlative. In Cornelia Stroh (ed.), *Neues aus der Bremer Linguistikwerkstatt – aktuelle Themen und Projekte*, 55–159. Bremen: Brockmeyer.
- Hackl, Martin. 2000. *Comparative quantifiers*. Cambridge, Mass.: MIT dissertation.
- Hackl, Martin. 2009. On the grammar and processing of proportional quantifiers: *most* vs. *more than half*. *Natural Language Semantics* 17. 63–98.
- Hallman, Peter. 2016a. Superlatives in Syrian Arabic. *Natural Language and Linguistic Theory* 34. 1281–1328.
- Hallman, Peter. 2016b. Universal quantification as degree modification in Arabic. *Glossa* 1(1). 1–31.
- Harris, Alice. 2000. Word order harmonies and word order change in Georgian. In R. Sornicola, E. Poppe & A. Sisha-Halevy (eds.), *Stability, variation, and change of word order patterns over time*, 133–163. Amsterdam: John Benjamins.
- Haspelmath, Martin. 2010. Comparative concepts and descriptive categories in crosslinguistic studies. *Language* 32(86). 663–687.
- Hay, Jennifer. 2003. *Causes and consequences of word structure*. New York: Routledge.
- Heim, Irene. 1985. Notes on comparatives and related matters. Ms., Semantics Archive.
- Heim, Irene. 1999. Notes on superlatives. Ms., MIT.
- Herburger, Elena. 1997. Focus and weak noun phrases. *Natural Language Semantics* 5. 53–78.
- Hewitt, George B. 1995. *Georgian: A structural reference grammar*. Amsterdam: John Benjamins.
- Hoeksema, Jack. 1983. Superlatieven. *TABU* 13(101-106).
- Hualde, José Ignacio & Jon Ortiz de Urbina. 2003. *A grammar of Basque*, vol. 26 Mouton Grammar Library. De Gruyter Mouton.
- Kayne, Richard S. 2005. Some notes on comparative syntax, with special reference to English and French. In *Oxford handbook of comparative syntax*, Oxford University Press.
- Kennedy, Chris. 2007. Modes of comparison. In Malcolm Elliot, James Kirby, Osamu Sawada, Eleni Staraki & Suwon Yoon (eds.), *Proceedings of CLS 43*, .
- Kennedy, Christopher. 1997. *Projecting the adjective: The syntax and semantics of*

- gradability and comparison*: UC Santa Cruz dissertation.
- Kennedy, Christopher & Beth Levin. 2008. Measure of change: The adjectival core of degree achievements. In Louise McNally & Christopher Kennedy (eds.), *Adjectives and adverbs: Syntax, semantics and discourse*, Oxford University Press.
- Krasikova, Sveta. 2012. Definiteness in superlatives. In Maria Aloni, Vadim Kimmelman, Floris Roelofsen, Galit W. Sassoon, Katrin Schulz & Matthijs Westera (eds.), *Logic, language and meaning*, 411–420. Dordrecht: Springer.
- Krasikova, Sveta & Lucas Champollion. 2011. Two *many* modifiers? Paper presented at *Workshop on Modification (with and without modifiers)*, Madrid, December 15–16, 2011.
- Krifka, Manfred. 1989. Nominal reference, temporal constitution and quantification in event semantics. In Renate Bartsch, Johan van Benthem & Peter van Emde Boas (eds.), *Semantics and contextual expression*, 75–115. Dordrecht, Netherlands: Foris.
- Landman, Fred. 2004. *Indefinites and the type of sets*. Malden, MA: Blackwell.
- Lechner, Winfried. 2004. *Ellipsis in comparatives*. Berlin: Mouton de Gruyter.
- Matthewson, Lisa. 2004. On the methodology of semantic fieldwork. *International Journal of American Linguistics* 70(4). 369–415.
- Matushansky, Ora. 2008. On the attributive nature of superlatives. *Syntax* 11. 26–90.
- Milsark, Gary. 1977. Toward an explanation of certain peculiarities of the existential construction in English. *Linguistic Analysis* 3. 1–29.
- Nakanishi, Kimiko. 2007a. *Formal properties of measurement constructions*. Berlin: Mouton de Gruyter.
- Nakanishi, Kimiko. 2007b. Measurement in the nominal and verbal domains. *Linguistics and Philosophy* 30(2). 235–276.
- Pancheva, Roumyana. 2015. Quantity superlatives: The view from Slavic and its cross-linguistic implications. In *Proceedings of CLS 49*, The Chicago Linguistics Society.
- Pancheva, Roumyana & Barbara Tomaszewicz. 2012. Cross-linguistic differences in superlative movement out of nominal phrases. In Nathan Arnett & Ryan Bennett (eds.), *Proceedings of WCCFL 30*, 292–302. Somerville, MA: Cascadilla Press.
- Partee, Barbara H. 1989. Many quantifiers. In Joyce Powers & Kenneth de Jong (eds.), *ESCOL 89: Proceedings of the Eastern States Conference on Linguistics*, 383–402. Department of Linguistics, The Ohio State University.
- Partee, Barbara H. & Mats Rooth. 1983. Generalized conjunction and type ambiguity. In Rainer Bäuerle, Christoph Schwarze & Arnim von Stechow (eds.), *Meaning, use and interpretation of language*, Berlin: De Gruyter.
- Petzell, Malin. 2008. *The Kagulu language of Tanzania: Grammar, texts and vocab-*

- ulary*. Cologne: Rüdiger Köppe Verlag.
- Rett, Jessica. 2008. *Degree modification in natural language*: Rutgers University dissertation.
- Rett, Jessica. 2014. The polysemy of measurement. *Lingua* 143. 242–266.
- Roelandt, Koen. 2016a. *Most or the art of compositionality*: University of Leuven dissertation.
- Roelandt, Koen. 2016b. Relative *most* compared. Slides for KrowFest 2016.
- Rohena-Madrazo, Marcos. 2007. Superlative movement in Puerto Rican Spanish and General Spanish. In *NYU Working Papers in Linguistics, volume 1, spring 2007*, New York: NYU.
- Romero, Maribel. 2017. Attributive uses of *many*. In *Proceedings of SALT 27*, 480–503. eLanguage.
- Rothstein, Susan. 2009. Individuating and measure readings of classifier constructions: evidence from Modern Hebrew. *Brill's Annual of Afroasiatic Languages and Linguistics* 1. 106–145.
- Rothstein, Susan. 2017. *Semantics for counting and measuring*. Cambridge: Cambridge University Press.
- Schwarzschild, Roger. 2006. The role of dimensions in the syntax of noun phrases. *Syntax* 9(1). 67–110.
- Scontras, Gregory. 2013. Accounting for counting: A unified semantics for measure terms and classifiers. In *Proceedings of Semantics and Linguistic Theory (SALT) 23*, 549–569.
- Sharvit, Yael & Penka Stateva. 2002. Superlative expressions, context, and focus. *Linguistics and Philosophy* 25. 453–505.
- Solt, Stephanie. 2009. *The semantics of adjectives of quantity*: The City University of New York dissertation.
- Solt, Stephanie. 2011. How many *most*'s? In Ingo Reich, Eva Horsch & Dennis Pauly (eds.), *Sinn und Bedeutung*, vol. 15, 565–580. Saarland University Press.
- Solt, Stephanie. 2015. Q-adjectives and the semantics of quantity. *Journal of Semantics* 32. 221–273.
- Stassen, Leon. 1985. *Comparison and universal grammar*. Oxford: Blackwell.
- Steinert-Threlkeld, Shane & Jakub Szymanik. to appear. Learnability and semantic universals. *Semantics & Pragmatics* .
- Szabolcsi, Anna. 1986. Comparative superlatives. In Naoki Fukui, Tova Rapoport & Elizabeth Sagey (eds.), *Papers in theoretical linguistics*, 245–265. Cambridge, MA: MITWPL.
- Szabolcsi, Anna. 2012. Compositionality without word boundaries: *(the) more* and *(the) most*. In Anca Chereches, Neil Ashton & David Lutz (eds.), *Semantics and Linguistic Theory (SALT) 22*, 1–25. Ithaca, NY: CLC Publications. doi:

10.3765/salt.v22i0.2629.

- Teodorescu, Alexandra. 2007. Attributive superlatives in Romanian. In L. Avram, G. Alboiu, A. Avram & D. Isac (eds.), *Pitar Mos: A building with a view. Papers in honor of Alexandra Cornilescu*, Bucharest, Romania: Bucharest University Press.
- Teodorescu, Viorica Alexandra. 2009. *Modification in the noun phrase: the syntax, semantics, and pragmatics of adjectives and superlatives*: University of Texas at Austin dissertation.
- von Stechow, Kai & Lisa Matthewson. 2008. Universals in semantics. *The Linguistic Review* 139–201.
- Westerståhl, Dag. 1985. Logical constants in quantifier languages. *Linguistics and philosophy* 8. 387–413.
- Wilson, E. Cameron. 2016. Deriving the most internal reading. In *Proceedings of sinn und bedeutung 20*, .
- Živanović, Sašo. 2007a. *Kvantifikacijski vidiki logi ne oblike v minimalisti ni teori-jijezika (quantificational aspects of lf)*: University of Ljubljana dissertation.
- Živanović, Sašo. 2007b. Varieties of *most*: On different readings of superlative determiners. In *Proceedings of of the 2006 Formal Description of Slavic Languages (FSDL 6.5) conference*, 337–354. University of Nova Gorica.