Universals in superlative semantics

Elizabeth Coppock, Elizabeth Bogal-Allbritten, and Golsa Nouri-Hosseini

June 21, 2019

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, though 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 core assumptions: quantity words denote gradable predicates of degrees, while proportional readings involve a comparison class of individuals. We argue that proportional readings arise in rare cases when the former assumption is violated.

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

1 Introduction

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

¹We thank all language consultants and linguists who helped us to gather and understand the data presented here. Any errors are our own. We thank in particular Teofilo Laime Ajacopa, Edwin Banegas-Flores, Matt Coler, and Roger Gonzalo Segura (Aymara), Nima Nasjian (Azeri), Jon Ander Mendia (Basque), Kevin Cruz Cruz (Chatino), Alicia Gregorio Velasco (Chinanteco), Nino Amiridze, Lena Borise, Alice Harris, Medea Kikapidze Beal, Aleksandre Maskharashvili, Nana Shavtvaladze, and Mariam Tsiskarishvili (Georgian), Umma Aliyu Musa (Hausa), Malin Petzell (Kagu, Talsin Osmani (Kurdish), Bernadine Red Bear (Lakota), Jeyhun Amirkhanrin (Lezgian), Lawrence Were (Lu, Liljana Mitkovska (Macedonian), Hsin-Lun Huang (Mandarin), Lety Hernandez and Miguel Ángel Ramírez Ramírez (Nahuatl), Ellavina Perkins (Navajo), Lobsang Shastri and Shoko Mekata (Tibetan), Neil Myler (Quechua), Mamadou Bassene (Wolof), and
(1) Gloria has visited **most** continents.  

The remedy [Barwise & Cooper](1981) proposed was to treat natural language quantifiers as binary relations among sets, viz. as generalized quantifiers. Then [1] can be paraphrased as: ‘The set of continents Gloria has visited outnumbers the set of continents Gloria hasn’t visited’. Their framework has stimulated a rich discussion regarding semantic universals ([Bach et al.] 1995; [von Fintel & Matthewson] 2008; [Steinert-Threlkeld & Szymanik] to appear, i.a., and references therein).

As [Barwise & Cooper](1981) themselves noted, though, generalized quantifiers are not necessary to remedy this deficiency of first-order logic. A logic without generalized quantifiers that allows for talk of plural individuals could also represent proportional **most** ([Hackl] 2009). This is a natural idea to draw upon for the analysis of **most** if it is to be seen as the superlative form of **many** ([Bresnan] 1973).

The decomposition of **most** into **many** and **-est** is morphologically transparent in crosslinguistic counterparts to sentences like the following:

(2) **Gloria** has visited the **most** continents.  

While the analysis of **most** in sentences like [2] as a superlative has been widely assumed since [Bresnan] 1973, [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 between absolute and relative readings of quality superlatives such as **largest**.

Superlative meaning is typically characterized in terms of a TARGET and a COMPARISON CLASS. For example, in [3], **Lucy** is the target and the people in her class make up the comparison class.

Adebimpe Adegbite (Yoruba).

The following abbreviations are used in glossed examples below: **ADV:** adverbializer, **ATTRIB:** attributive, **AUX:** auxiliary, **CLF:** classifier, **CMPR:** comparative, **COP:** copula, **DEF:** definite, **DEM:** demonstrative, **ERG:** ergative, **EZ:** ezafe, **FEM:** feminine, **FOC:** focus, **GEN:** genitive, **INDF:** indefinite, **INT:** intensifier, **LOC:** locative, **MASC:** masculine, **NEG:** negation, **NEU:** neuter, **NMLZ:** nominalizer, **NOM:** nominative, **OBJ:** object, **OM:** object marker, **PAST:** past, **PFV:** perfective, **PL:** plural, **POSS:** possessive, **PRES:** present, **REL:** relativizer, **SBJV:** subjunctive, **SG:** singular, **SPRL:** superlative, **WH:** wh-word.

Lucy is the tallest girl in her class.

With an absolute reading, this is all there is to it, but with relative readings, things are not quite so simple. Consider the following sentence:

Kim put the tallest plant on the bookcase. (adapt. Heim 1999)

On a relative reading, with focus on bookcase, this sentence is true in the scenario depicted in Figure 1. At some level, the comparison is between pieces of furniture, rather than plants, albeit via the height of the plants on them, so it does not matter that the absolute tallest plant is not on the bookcase.

Figure 1: Kim put the tallest plant on the bookcase.

Relative readings are focus-sensitive. If focus is shifted from bookcase to Kim, the sentence implies that Kim put a taller plant on the bookcase than anyone else.

As Hackl (2009) observes, relative readings of both quality and quantity superlatives are focus-sensitive, while both absolute readings of quality superlatives and proportional readings of quantity superlatives are not. Given this, proportional readings might be seen as a type of absolute reading. If proportional most can be compositionally derived, then one of the key motivations for generalized quantifier theory is undermined.

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. Prima facie, a view on which proportional readings are a species of absolute reading predicts that they should occur wherever absolute readings for quality superlatives do. But while we know of no languages in which quality superlatives lack absolute readings, the proportional reading is frequently missing for quantity superlatives, as we document extensively here. Previous observations in this vein have been made by Hackl (2009, 68), Zivanović (2007b), Bošković & Gajewski (2008), Pancheva (2013), and Dobrovie-Sorin & Giurgea (2015). Slovenian illustrates:
Naj-več ljudi pije pivo.

‘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. 

Everett (2005, 624) notes that in Pirahã, *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. In response, von Fintel & Matthewson (2008) emphasize that a faithful translation need not be word-for-word. In any case, proportional meaning is certainly not expressed as the superlative of a quantity word here.

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

(6)

a. **Universal**: Quantity superlatives have relative readings.

b. **Tendency**: Quantity superlatives do not have proportional readings.

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

From a perspective on which proportional readings of *most* are a species of absolute reading, then, there are two puzzling asymmetries: (i) between quantity and quality superlatives: only quantity superlatives lack one of their readings; (ii) 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, as advocated by Barwise & Cooper (1981), Keenan (1997), Ariel (2004), Horn (2005), and Dobrovie-Sorin & Giurgea (2013). We argue that under normal circumstances, the superlative of *many* is not semantically qualified to serve as a proportional quantifier, but 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 (1983d). This proposed meaning for quantity words has precedent in independent proposals (Reti, 2008; Solt, 2009, 2011). Together with several additional rather mild assumptions laid out in §4, this explains the markedness of proportional readings. Proportional readings may arise under departures from those assumptions.

Our proposal further captures two subtler generalizations about the morphosyntax of relative and proportional most, first observed for Germanic by Coppock (2019) and demonstrated here to hold somewhat more broadly:

- **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.

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

Ours 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, 2017). We argue, however, that alternative accounts have important drawbacks.

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. 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 quality superlatives.

## 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.

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

2.1 Methodology

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

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

(7) **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.]

(8) 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

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

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 2: 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 3: 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. 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.
<table>
<thead>
<tr>
<th>Macro-area</th>
<th>Family</th>
<th>Genus</th>
<th>Language</th>
<th>Strategy</th>
<th>Prop-Rel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eurasia</td>
<td>Altaic</td>
<td>Turkic</td>
<td>Kazakh</td>
<td>PERIPH</td>
<td>NO-YES</td>
</tr>
<tr>
<td></td>
<td>Tungusic</td>
<td>Evenki</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Austro-Asiatic</td>
<td>Viet-Muong</td>
<td>Vietnamese</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Basque</td>
<td>Basque</td>
<td>Basque</td>
<td>M</td>
<td>YES-YES</td>
<td></td>
</tr>
<tr>
<td>Dravidian</td>
<td>Southern Dravidian</td>
<td>Malayalam</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>South-Central Dravidian</td>
<td>Telugu</td>
<td>VERY</td>
<td>NA-NA</td>
<td></td>
</tr>
<tr>
<td>Indo-European</td>
<td>Albanian</td>
<td>Albanian</td>
<td>CMPR</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Armenian</td>
<td>Armenian</td>
<td>CMPR</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Celtic</td>
<td>Irish</td>
<td>CMPR</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Germanic</td>
<td>Swedish</td>
<td>M</td>
<td>YES-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greek</td>
<td>Greek</td>
<td>CMPR+DEF</td>
<td>YES-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Indic</td>
<td>Hindi</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iranian</td>
<td>Persian</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Romance</td>
<td>French</td>
<td>CMPR+DEF</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Slavic</td>
<td>Macedonian</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Japanese</td>
<td>Japanese</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kartvelian</td>
<td>Kartvelian</td>
<td>Georgian</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
</tr>
<tr>
<td></td>
<td>Korean</td>
<td>Korean</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nakh-Daghestanian</td>
<td>Lezgic</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Sino-Tibetan</td>
<td>Bodic</td>
<td>Tibetan</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Burmese-Lolo</td>
<td>Burmese</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dhimalic</td>
<td>Dhimal</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mahakiranti</td>
<td>Newar</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chinese</td>
<td>Mandarin</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tai-Kadai</td>
<td>Kam-Tai</td>
<td>Thai</td>
<td>PERIPH</td>
<td>NO-YES</td>
</tr>
<tr>
<td></td>
<td>Uralic</td>
<td>Finnish</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ugric</td>
<td>Hungarian</td>
<td>M</td>
<td>YES-YES</td>
<td></td>
</tr>
<tr>
<td>Africa</td>
<td>Afro-Asiatic</td>
<td>Lowland East Cushitic</td>
<td>Somali</td>
<td>PERIPH</td>
<td>NO-YES</td>
</tr>
<tr>
<td></td>
<td>Semitic</td>
<td>Hebrew</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>West Chadic</td>
<td>Hausa</td>
<td>CMPR</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Kwa</td>
<td>Ga</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Northern Atlantic</td>
<td>Wolof</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Eastern Sudanic</td>
<td>Nilotic</td>
<td>Luo</td>
<td>CMPR</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Nubian</td>
<td>Kenuzi-Dongola</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Mande</td>
<td>Western Mande</td>
<td>Vai</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Papunesia</td>
<td>Austronesian</td>
<td>Barito</td>
<td>Malagasy</td>
<td>PERIPH</td>
<td>NO-YES</td>
</tr>
<tr>
<td></td>
<td>Chamorro</td>
<td>Chamorro</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Greater Central Philippine</td>
<td>Tagalog</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Javanese</td>
<td>Javanese</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Malayo-Sumbawan</td>
<td>Indonesian</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Oceanic</td>
<td>Maori</td>
<td>VERY</td>
<td>NA-NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Yapese</td>
<td>Yapese</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gunwinygu</td>
<td>Gunwinygic</td>
<td>Gumbarlang</td>
<td>VERY</td>
<td>NA-NA</td>
</tr>
<tr>
<td>N. America</td>
<td>Algonquian</td>
<td>Passamaquoddy</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Iroquoian</td>
<td>Southern Iroquoian</td>
<td>Cherokee</td>
<td>M</td>
<td>NO-YES</td>
</tr>
<tr>
<td></td>
<td>Mayan</td>
<td>Kaqchikel</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Na-Dene</td>
<td>Athapaskan</td>
<td>Navajo</td>
<td>CMPR+ANY</td>
<td>NO-YES</td>
</tr>
<tr>
<td>Otomanguean</td>
<td>Chimantecan</td>
<td>Chinanteco</td>
<td>VERY</td>
<td>NA-NA</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mixtecan</td>
<td>Mixtecan</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zapotecan</td>
<td>Chatino</td>
<td>VERY</td>
<td>NA-NA</td>
<td></td>
</tr>
<tr>
<td>Salishan</td>
<td>Interior Salish</td>
<td>Okanagan Salish</td>
<td>M</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Siouan</td>
<td>Core Siouan</td>
<td>Lakota</td>
<td>PERIPH</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>Uto-Aztecan</td>
<td>Aztecan</td>
<td>Huasteca Nahuatl</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td>S. America</td>
<td>Aymaran</td>
<td>Aymaran</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quechuan</td>
<td>Quechuan</td>
<td>CMPR+ALL</td>
<td>NO-YES</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Language sample (one language per genus)
We coded each language in the database for the morphosyntactic strategy used to translate superlative prompts.

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

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

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

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

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

(11) Jas izedov naj-mnogu kolači.
    1SG 1SG.eat.PFV.PAST SPR1-many cookies
    ‘I ate the most cookies.’ (Macedonian; M)

⁴For languages without an overt comparative element, or with an optional one, one might posit a covert comparative element. Our categorizations rely solely on the overt morphosyntax, so we use the code CMPR∅/STND to classify languages of these types.
2.3 What counts as a quantity superlative?

Every language surveyed used at least one of the strategies in (9) 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 Fintel & Matthewson, 2008), so we must be clear which aspects of meaning we take as definitional. We adopt the definitions in (18).

---

5 Gorshenin (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, 1993; Hewitt, 1995; Harris, 2004). Further elicitation confirmed that the *u...es* circumfix does not convey the uniqueness that characterizes true superlative meaning (N. Amiridze, p.c.).
a. **Superlative strategy**: A construction that conveys that a gradable property holds of an entity to a uniquely high extent among elements of an explicit or implicit comparison class.

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 (19) as well as probable adverbial superlatives as in Navajo (20).

The definitions in (18) also include languages whose quantity superlatives lack an overt **MANY**, provided its absence is consistent with the language’s broader quantity comparative-superlative paradigm. In French and Navajo, the same structures characterize quantity and quality superlatives: CMPR+DEF in French (19) and CMPR+ANY in Navajo (20). 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 ((19-c), (20-c)). Thus, quantity superlatives in both languages occupy the superlative cell in the comparative-superlative paradigm for **MANY**.

(19) a. Jean a lu le plus de livres.
   Jean has read DEF CMPR of book.PL
   ‘Kim 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 book.PL than 1SG
   ‘Kim has read more books than me.’

(20) a. Anna baáh likání ’a-láah-go yiyíyáá’.
   Anna cookie INDF.OBJ-beyond-ADV 3OBJ.3SUBJ.eat.PFV
   ‘Anna ate the most cookies.’

---

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.
b. Anna tsin ’a-láah-go ’áníñnééz-ígíí yaah
Anna tree INDF.OBJ-beyond-ADV 3SUBJ.tall-NMLZ 3OBJ.up
haas’na’. 3OBJ.3SUBJ.climb.PFV
‘Anna has climbed up the tallest tree.’

c. Anna bááh likání shi-láah-go yiyííyáá’.
Anna cookie 1SG.OBJ-beyond-ADV 3OBJ.3SUBJ.eat.PFV
‘Anna ate more cookies than me.’

The definitions in [18] exclude certain structures from the set of quantity superlatives. First, structures like (21) used to translate proportional prompts in French do not count as quantity superlatives because this construction does not involve only a superlative strategy. There is additional material, namely part.

(21) La plupart des cygnes sont blancs.
def majoriy of.DEF.PL swans 3PL.be white
Prompt: ‘Most swans are white.’

The VERY translation strategy was also excluded by the definitions in [18]. Kagulu illustrates. Both quality and quantity superlative prompts were translated with an intensifying ‘augmentative’ suffix -si (Petzell, 2008).

(22) 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 [18] because it does not convey that the gradable property holds to a uniquely high extent. The Kagulu consultant volunteered the following si-construction in a context where the speaker’s mango is just as large as the addressee’s. Each character can describe her respective mango as ikulu-si ‘big-INT’:

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

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

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

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

3 Results

Our typological study showed the proportional readings for quantity superlatives are rare. After demonstrating this result, we will examine the morphosyntactic details a bit more closely.

3.1 Relative readings universal; proportional readings rare

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

Figure 4 visually summarizes our findings for the representative sample of languages (one per genus) in Table 1. The colors represent superlative strategy and the shapes represent quantity superlative interpretation(s). The set of YES-YES languages (square) consisted of all Germanic languages along with Arabic (M), Basque (M), Hungarian (M), Romanian (CMPR+DEF), and Greek (CMPR+DEF). Greek illustrates:

(25) Éfaga ta perissoter a biskóta.
    ate.1SG DEF much.CMPR cookie.PL
    ‘I ate most of the cookies,’ ‘I ate the most cookies.’

Although the Greek sentence is ambiguous, quantity superlatives in some other YES-YES languages took a different shape depending on their interpretation; see §3.2 on this point.

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

(26) 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.’)

We use a green circle for languages that employ a CMPR strategy to translate superlative prompts with relative meanings only (Albanian, Armenian, Irish, Luo). These languages could be more accurately called ‘NO-◇’ languages.
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 4: Representative sample of languages investigated. One language per genus.

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:

(27) 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.’

Note that quality superlatives were always ambiguous between relative and absolute readings in these languages. In Persian, for example, the following sentences
were used with visual prompts that established the intended absolute (28) and relative (29) interpretations.

(28) Un aval say kard-ø 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...’

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

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

Finally, the set of ◇-◇ 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 têgg lu LOC child REL be 1POSS all school 1SG 1SG LOC play REL gën bëre ci sabar. surpass be.many LOC drum

b. Xale yu gën bëre ci sama ekkol bègg na ñu têgg child REL surpass be.many LOC 1POSS school like PFV 3PL play mizik. music

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

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

Crucially, two shapes are missing from Figure 4. First, no shape is needed to represent hypothetical YES-NO languages, in which the quantity superlative is used for proportional but not relative readings. Second, there is no need for a shape corresponding to NO-NO languages in which quantity superlatives exist but express only meanings other than proportional or relative.

Hence, the following universal was supported:

(31) Universal: Quantity superlatives have relative readings.

The following tendency was supported as well.
Tendency: Quantity superlatives do not have proportional readings.

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

3.2 Morphosyntactic generalizations

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

(33) **Number-marking generalization**
Quantity superlatives never disagree in number with the associated noun on proportional readings, but on relative readings, default agreement is attested.  
\[(\text{Coppock, 2019})\]

In languages with default agreement on relative readings of quantity superlatives, the same default agreement marking is characteristic of adverbial superlatives (Roelandt, 2016b; Coppock, 2019). The following generalization holds across all languages in our sample:

(34) **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.

(35) Jan heeft de meeste bergen beklimmen.  
Kim has the.PL many.SPRL mountain.PL climbed  
Kim 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:

(36) Jan heeft *het* meeste bergen bekloommen.
Kim has the.NEU.SG many.SPRPL mountain.PL climbed
‘Kim has climbed the most mountains.’

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

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

Coppock (2019) 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 (38), the superlative expression bears plural determiner -ak to agree with the substance noun *liburu* ‘books.’ This sentence only has a proportional reading.

(38) 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:

(39) 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:

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

Note however that the number-marking generalization in (33) allows the possibility that relative readings of quantity superlatives may show non-default agreement. Examples include Greek (25), 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 §4.8.
3.3 Distribution of proportional readings

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

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

We avoid putting stock into this latter observation, however, since geographical and structural factors are not clearly separable. Superlative strategies are unevenly distributed across the globe, as shown in Figure 1 (data combined from Gorshenin (2012) and Bobaljik (2012)). Our data therefore does not allow us to tease apart the potential impacts of geography and superlative strategy.\footnote{The dataset underlying this map is published at Harvard Dataverse (Coppock, 2016).}
Why, then, should the universal in (6) hold? In this section, we aim to derive it from the following assumptions:

- **Meaning of superlatives**
  We distinguish between INNER and OUTER COMPARISON CLASSES, which are distinct in the case of relative readings, and unified in the case of absolute readings. Superlatives characterize a member of the outer comparison class that is associated with a greater-valued member of the inner comparison class than any other member of the outer comparison class, according to a given MEASURE.

- **Surface predicate as measure**
  The gradable predicate to which a superlative marker attaches on the surface
denotes the measure according to which the members of the inner comparison class are compared.

- **Quantity words as gradable predicates of degrees**
  Quantity words denote gradable predicates of *degrees* (by default).

- **Compositionality of quantity superlatives**
  Quantity superlatives are the superlatives of quantity words.

- **Proportional as absolute**
  Proportional readings are absolute readings, in the sense that the inner and outer comparison classes are unified.

- **Proportional as plurality-comparing**
  Proportional readings involve comparison classes of individual pluralities, not degrees.

From these assumptions, it follows that proportional readings are not produced compositionally by quantity superlatives. We now flesh them out, and show how they explain our findings. A fully formalized analysis is given in §6, before we conclude.

### 4.1 Meaning of superlatives

As mentioned above, superlative meaning is typically characterized in terms of a **target** and a **comparison class**. But with relative readings, more subtlety is needed. Recall (4), repeated here:

(41) Kim put the tallest plant on the *bookcase*. (adapt. Heim 1999)

On a relative reading, with focus on *bookcase*, this sentence is true in the scenario depicted in Figure II, where the absolute tallest plant is not on the bookcase, but a taller plant is on the bookcase than anywhere else.

What is the comparison class in this case? This question is controversial, as it turns out. The comparison class is the furniture on theories of superlatives that invoke movement of *-est* (Heim 1985, 1999; Szabolcsi 1986; among others). However, the comparison class is comprised of plants if *-est* is thought to remain in situ (Farkas & É. Kiss 2000; Sharvit & Stateva 2002). To avoid taking a stand on this issue by our mere use of terminology, and to be completely clear, we distinguish between the OUTER COMPARISON CLASS and the INNER COMPARISON CLASS (corresponding to Coppock & Beaver’s 2014 ‘contrast set’ and ‘measured entities’, respectively). Figure II schematizes the situation for (4). The outer comparison class consists of focal alternatives to *bookcase*: the two locations where plants were
placed. The *inner* comparison class consists of plants whose heights are being compared. Members of the outer comparison class (OUTER COMPARANDS) are mapped onto members of the inner comparison class (INNER COMPARANDS) by the ASSOCIATION RELATION, here *Kim put y on x*. Inner comparands are in turn mapped onto DEGREES by the MEASURE RELATION, determined by the gradable predicate (*tall*).

**INNER COMP. CLASS:**

- plants

**OUTER COMP. CLASS:**

- locations

**ASSOCIATION RELATION:**

- *Kim put y on x*

**DEGREES:**

- height

Figure 6: Schematic representation: Kim put the tallest plant on the bookcase.

How is the outer comparison class distinguished grammatically? In English, the outer comparison class is usually determined by focus-marking. With our example, if focus intonation had been placed on *Kim* rather than *bookcase*, it would consist of Kim and his alternatives, on a relative reading.

But focus is just one of several potential ‘licensors’ for relative readings, or ways of identifying the outer comparison class. Others include *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]). We unfortunately do not offer a theory of why just these elements are appropriate licensors.

Superlatives contribute a predicate that holds of an outer comparand only if it is associated with a greater-valued inner comparand than any other member of the outer comparison class. The OUTER TARGET is what we call this lucky thing. We’ll use the term INNER TARGET for any associate of the outer target. In our current example, there is only one inner target (the plant on the bookcase). But as [Bumford (2017), 53] emphasizes, there may be many:

I would say that when Erwin Schneider climbed Jongsong Peak (7462 m) in 1939, besting the world record that he himself set at Nepal Peak
(7177 m) just 2 weeks prior, he did not thereby cease to be the alpinist who had scaled the greatest summit (Smythe 2013).

We consider both Jongsong Peak and Nepal Peak inner targets.

The outer and inner comparison classes are distinct only with relative readings. With absolute readings, the outer and inner comparison classes are unified as one COMPARISON CLASS. The association relation is then an identity relation on members of the comparison class. Consider the scenario in Figure 7 where the association relation is identity. No licensor is present or required. As the distinction between inner and outer target collapses, the term TARGET suffices for either (or both).

Figure 7: Kim put the tallest plant on the bookcase.

Figure 8: Schematic representation: Kim put the tallest plant on the bookcase.
4.2 Surface predicate as measure

We assume that the gradable predicate to which a superlative attaches on the surface plays the role of MEASURE RELATION in a superlative scenario, linking the members of the inner comparison class to degrees. (This claim is not incompatible with the possibility that *-est takes non-local scope, as under Heim’s (1999) analysis, since the gradable predicate is left in situ, where it may be applied to inner comparands.)

There is an important corollary: Since the domain of the gradable predicate includes the inner comparison class, the inner comparands must adhere to the semantic type requirements on the domain of the gradable predicate. We call this the TYPE-MATCHING PRINCIPLE. For example, if the domain of the measure consists of degrees, the inner comparands may not be individuals. As discussed below, the inner comparands are plural individuals under all existing compositional derivations of proportional readings, and we suggest that this is not an accident; rather, compositional derivations of proportional readings must have this property. Combined with the assumption that quantity words denote predicates of degrees, proportional readings will then be ruled out.

4.3 Quantity words as gradable predicates of degrees

Gradable predicates like *tall* are often thought to denote gradable properties of individuals (Cresswell 1977; von Stechow 1983; Heim 2000, i.a.), relating an individual with a degree, the individual’s height, for example. How analogous quantity words like *many* are to these is controversial. One possibility is that quantity words denote gradable properties of plural individuals, measuring, in the case of *many*, the number of individuals comprising the plurality (Milsark, 1974; Hoeksema, 1983a; Partee, 1989; Kamp & Reyle, 1993). Such an analysis forms the basis for proportional readings according to both Hoeksema (1983b) and Hackl (2003), as discussed below.

We instead take quantity words to denote gradable predicates of degrees, by default. Quantity words associate quantities with a degree representing their size. While this meaning for quantity words will be crucial to our explanation for the proposed universal, this is not our only motivation for the assumption. It has precedent and independent motivation in the work of Reit (2008) and Solt (2009, 2011, 2015). Solt argues that this kind of meaning can capture the full distribution of quantity words without appealing to polysemy, something which other approaches to quantity words cannot do. Adopting this assumption has the further advantage that it sheds light on additional typological generalizations regarding agreement and adverbial-relative connections (§3.2); we return to this point in §4.8.

---

9Solt (2015) places particular emphasis on quantity words as differentials, e.g. Sue is much taller than Kim.
What is the size of a quantity? Perhaps it is just the quantity itself. On this view, quantity words encode a certain identity relation. Indirect support for this view might be adduced from the fact that in many languages, comparative and superlative counterparts to MANY contain no overt trace of MANY (§2.3). Consider Italian, where MANY is *molto but MORE and MOST are più, not *più molto. It is not crucial for our argument that quantity words encode an identity relation, however; what is crucial is that quantity words relate quantities (degrees) with degrees.

Figure 9 gives a schematic representation for the quantity superlative on a relative reading in (42). The outer comparison class is determined by focus and consists of the bookcase and other locations where Kim put books. The inner comparison class consists of quantities of books. The association relation relates locations with these quantities.

(42) Kim put the most books on the bookcase.

Context: Kim placed five books on the bookcase, three books on the table, and two books on the chair.

Given the assumption that the gradable predicate is the measure, and its corollary, the type-matching principle, the assumption that quantity words denote predicates of degrees forces the inner comparison class to consist of degrees when the superlative of a quantity word is at play.

### 4.4 Compositionality of quantity superlatives

Another assumption that we must make explicit is that quantity superlatives are the superlatives of quantity words. Here we are not alone; the idea that words like
English *most* are compositionally derived as the superlatives of quantity words has been argued by many authors, beginning with Bresnan (1973).

There are several reasons to adopt a compositional view of quantity superlatives in general, as opposed to treating them as e.g. lexicalized determiners. First, while English *most* is morphologically rather coy about its superlative nature, there are plenty of languages in which quantity words have transparently superlative forms, and these are used under at least some of the circumstances where English *most* is used (Bresnan, 1973; von Stechow, 1984; Hackl, 2009; Krasikova, 2012; Bobaljik, 2012; Pancheva & Tomaszewicz, 2012; Szabolcsi, 2012; Roelandt, 2016a). This is confirmed by our own typological investigation. A particularly illustrative case is Scandinavian languages, which maintain a count/mass distinction throughout the positive-comparative-superlative paradigm, e.g. Norwegian *mange-fleire-flest* vs. *mye-mer-mest*.

Second, as Hackl (2009) emphasizes, the same sort of requirements on discourse context and interaction with focus are imposed by both quantity and quality superlatives on relative readings. Both of the following sentences are felicitous only in contexts where salient alternatives to Gloria have also read books.

\[(43)\]
\[
\begin{align*}
\text{a. } & \text{ Gloria has read the most books.} \\
\text{b. } & \text{ Gloria has read the longest books.}
\end{align*}
\]

A compositional treatment of MOST can capture these parallels.

As we have discussed, the question of whether proportional MOST can be compositionally derived as the superlative of a quantity word is much more controversial, and in some sense, this is what is at issue here: is proportional most, properly speaking, a quantity superlative? Regardless, the main point here is that a quantity superlative is by definition the superlative of a quantity word.

### 4.5 Proportional as absolute

Our treatment of superlatives allows for only two options:

1. The inner and outer comparison classes are distinct, and the outer comparison class is determined by a licensor (relative reading).
2. The inner and outer comparison classes are unified, and no licensor is required (absolute reading).

Proportional readings of quantity superlatives do not require a licensor. Hackl (2009) illustrates this fact using examples like the following (adapted from his (14a)):

\[(44)\]
\[
\text{There are people living on (*the) most continents.}
\]

In this sentence, there is no licensor for the relative reading, so English *the most*, which only has relative readings, is ruled out. But proportional *most* is acceptable
despite the lack of licensor. As proportional readings do not require a licensor, they must instantiate the latter of the two possibilities listed above. In this sense, proportional readings are absolute readings.

As an aside, note that Hackl (2009) makes a three-way distinction between proportional, absolute, and relative readings, but this distinction relies on a narrower conception of ‘absolute reading’. For Hackl, an ‘absolute reading’ of a quantity superlative would be something like ‘Sue visited the maximally high number of continents’ for the sentence Sue visited the most continents. As Hackl (2009) observes, absolute readings in this sense are missing for quantity superlatives. We mean ‘absolute’ in a broader sense.

4.6 Proportional as plurality-comparing

In this section, we argue that any compositional analysis of proportional readings must involve comparison among individual pluralities, rather than degrees. Of course, there may be non-compositional analyses of proportional readings that do not do this (Barwise & Cooper, 1981; Keenan, 1997; Ariel, 2004; Horn, 2005; Dobrovie-Sorin & Giurgea, 2015). Nothing prevents a language from having a morphologically simple proportional quantifier. Our claim here is that compositional derivation of proportional readings from a superlative source requires comparison among individual pluralities.

4.6.1 Existing compositional analyses

Let us first establish that in both of the extant compositional analyses of proportional readings that we are aware of — Hoeksema (1983) and Hackl (2009) — the comparison class consists of pluralities of individuals.

Hoeksema (1983). In Dutch, de meeste boeken, lit. ‘the most books’ is ambiguous between a relative and proportional readings (Hoeksema, 1983):

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

Hoeksema’s (1983) route to the proportional reading involves an absolute reading of the quantity superlative and a treatment of the quantity word as a gradable predicate of pluralities, measuring the number of atomic individuals they contain. The proportional reading arises when the comparison class consists of two particular pluralities, in this case the books Anton has read, and the books he hasn’t. The superlative contributes a predicate that holds of the larger of these two.\footnote{Hoeksema’s actual analysis is formulated in terms of a superlative predicate that takes a comparison relation such as taller than or more as an argument. This is in line with Bobaljik’s...}
Note that 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:

(46) 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 expressed with (historic or synchronic) comparative structures in Hindi (Bhatt & Takahashi 2011; Gorshenin, 2012) and many Slavic languages too.

Hackl (2009). The route to proportional readings that Hackl (2009) puts forth is similar to Hoeksema’s insofar as it involves an absolute reading for the superlative, combined with a gradable cardinality predicate of plural individuals. The main difference lies in Hackl’s semantics for the superlative, which allows for a different kind of comparison class.

Building on the ‘scope theory’ of the absolute/relative contrast (Heim 1985, 1999; Szabolcsi 1989; i.a), Hackl assumes that -est may occupy one of two different scope positions at Logical Form (LF), 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 strikeout notation; a null existential quantifier (3) takes its place.) The result is the following LF for (47):

(47) Gloria visited the most continents.

(48) Gloria [ -est λd visited [DP ∃ the [ d-many continents ] ] ]

In absolute and proportional readings, -est is interpreted DP-internally. The LF in (50) corresponds to (49):

(49) Gloria visited most continents.

(50) Gloria visited [DP ∃ [ -est λd [ d-many continents ] ] ]

As is standard, the superlative marker -est combines with a gradable predicate G and a comparison class C on Hackl’s view (Heim, 1999). What is unique to Hackl is that a superlative produces a predicate that holds of a given potential target x


11For alternative explanations for the non-definiteness of superlative-modified DPs, see Herdan & Sharvit (2006) and Sharvit (2015), Coppock & Beaver (2014), and Bumford (2017).
if $x$’s degree of $G$-ness exceeds the $G$-ness of any non-overlapping (as opposed to distinct) $y$ in $C$. Two plural individuals are non-overlapping if they have no common sub-individuals.

[Hackl (2009)] assumes further that $C$ can consist of a sum-lattice; for example, it could contain the plurality of all continents, along with all its sub-parts (e.g. Africa, Asia, Africa+Asia, ...). Under an in situ analysis as in [50] where many measures the numerosity of a plural individual, proportional truth conditions are derived: Gloria visited some continent-plurality $x$ more numerous than all other continent-pluralities $y$ in the comparison class $C$ which do not overlap with $x$. This holds for any $x$ that constitutes more than half of the continent-atoms, so the ‘more than half’ truth conditions—proportional truth conditions—are derived.

### 4.6.2 Comparison class of degrees?

We have established that proportional readings are a type of absolute reading, and we have shown that under both existing analyses of proportional readings, the gradable predicate measures pluralities of individuals, rather than degrees. Both of these analyses are inconsistent with the assumptions we have made, because the quantity word requires the inner comparison class to consist of degrees.

Is there any way for a proportional reading to be derived as an absolute reading in which it is degrees that are being compared instead? If so, [51] would have the schematic representation in Figure 10.

(51) Kim read most (of the) books.

![Diagram](https://example.com/diagram.png)

**Figure 10:** Schematic representation: Kim read most (of the) books.

Could the comparison class consists of two quantities, the number of books that Kim read, and the number of books that Kim didn’t read?

Let us first point out that kind of reading under consideration here would require us to sanction the possibility of comparison classes consisting of degrees, provided by the discourse context. Degrees are generally less salient than individuals. For
instance, if Chris enters the room, we might say to the person next to us, He is writing a paper with Nick, but not Nick is taller than that, if Chris’s height has not been mentioned or remarked upon explicitly.

An alternative possible explanation for why proportional readings do not arise when quantities are being compared, suggested by a reviewer, is that comparison classes consisting of degrees do not yield proportional readings because degrees constitute a set without an upper bound, and these constructions fail to delimit the set of degrees under consideration. It would not be possible for a superlative to pick out a degree which is greater than all others, of course, since there is no such degree. According to the reviewer’s suggestion, the reason that the set is not contextually restricted is that here, unlike with quality superlatives, the syntactic relation between the superlative and the following nominal is not an attributive one. Because of the lack of an attributive relationship, the inner comparison class is not restricted to be a subset of the denotation of the following nominal in the case of quantity superlatives. In order to turn this idea into a complete explanation, it would be necessary to give an account of why contextual restriction would be so dependent on the following noun; why couldn’t the listener accommodate a salient comparison class of degrees, without relying on an attributively modified nominal? We suggest that the answer lies in the inherently low salience of degrees, although the fact that the following noun does not delimit the inner comparison class in these constructions may be an important factor as well.

Second, observe that the truth conditions would entail ‘more than half’ only under two additional assumptions: there are only two quantities in the comparison class, and the sum of the quantities in the comparison class is (less than or) equal to the total number of objects satisfying the description of the following nominal. For example, for Kim read the most books, the comparison class would have to consist of two numbers, whose sum is less than or equal to the total number of books. We have no reason to assume that listeners would make these particular assumptions. Normally, comparison classes for superlatives involve at least three elements, and nothing about the sentence imposes any constraints about the sum of the quantities.

Finally, observe that as an empirical matter, constructions that make explicit a comparison among degrees of the kind envisioned here systematically lack proportional readings. A proportional reading is likewise unavailable for:

(52) Kim read the greatest number of books.

where quantities are explicitly being compared. This sentence implies a comparison between Kim and other book-readers—a relative reading. This pattern holds cross-linguistically. There are many languages in which quantity superlatives are translated using the literal equivalent of ‘greatest’ in combination with a noun. For relative readings, the following noun may be ‘number’, but not ‘part’. With proportional readings, the noun is never ‘number’, though it may be ‘part’. Take Irish,
for example; the relative reading can be expressed with *an méid is mó* ‘the amount that is more (most)’, and the proportional reading is expressed with *an chuid is mó* ‘the part that is more (most)*.

(53) Is mise an duine sa teaghlaigh a n-itheann *an món* is c.w.h eat *món* brioscá. COMP.WH.COP.PRES big.CMPR biscuit.PLGEN ‘I am the one who eats the most cookies’

(54) Is maith leis *an chuid is mó* de na páistí ar an scoil sagamsa ceol a sheinm. child.PLGEN at DEF school 1SG.IPOSS music COMP play ‘Most of the kids who go to my school like to play music.’

Consider also *il maggior parte* (lit. ‘the big part’) in Italian, which is used to express proportional meaning; *il maggior numero* (lit. ‘the big number’) in Italian does not have a proportional reading. This pattern is not uncommon.

It is thus a robust empirical generalization that proportional readings are absent when quantities rather than individual pluralities are compared. This kind of underlying structure does not yield a proportional interpretation.

Together with what we have established so far, this means that proportional readings are normally not available for the superlatives of quantity words. The quantity word is the measure by which the inner comparands are compared; quantity words denote gradable predicates of degrees; proportional readings are absolute readings, so the inner and outer comparison classes are unified; and proportional readings involve comparison among individuals.

### 4.7 How proportional readings can arise

What we have said so far rules out the possibility that proportional readings are derived compositionally from a combination of a quantity word with a superlative marker. How, then, do proportional readings come about compositionally in languages where we find them? We propose that proportional *most* can be derived compositionally when the assumption that quantity words are gradable predicates of degrees is lifted. Once the comparison class contains can contain entities rather than degrees, the compositional pathways to proportional meaning described by Hoeksema’s (1983b) or Hackl’s (2009). (These compositional pathways may become frozen, yielding a generalized quantifier type meaning à la those discussed by Barwise & Cooper (1981), Keenan (1997), Ariel (2004), Horn (2005), and Dobrovie-Sorin & Giurgea (2015).) Figure 11 schematizes the proportional reading under the
individual-predicate analysis of MANY.

\[
\text{COMPARISON CLASS: book pluralities} \quad \text{DEGREES}
\]

\[
\text{Measure relation: } \mu
\]

Figure 11: Schematic representation: Kim read most (of the) books.

4.8 Explaining the morphosyntactic generalizations

Our analysis also casts light on the morphosyntactic patterns discussed in §3.2:

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

- **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.

We can explain the first generalization if we assume that agreement patterns reflect the semantic type of the inner target and other members of the inner comparison class. According to Coppock’s (2019) Target-Domain Principle, the grammatical features exhibited by a superlative reflect the domain from which the ‘target’ argument is drawn. If we specify that the relevant target is the inner target, then the generalization is explained. On relative readings, the inner target is a degree, so default agreement is predicted. On proportional readings, where they exist, the inner target (which is identified with the outer target) is an individual, so ordinary agreement is predicted.

There are languages where quantity superlatives on relative readings can agree in number with the substance noun. Romanian, German, and Greek are three examples. In the Greek example (25), adnominal quantity superlatives with relative (and proportional) readings show number agreement between the noun and the definite article. Following Coppock (2013), we conjecture that syntactic factors can conflict with the (revised) Target-Domain principle, yielding full agreement with quantity superlatives even on relative readings.

The assumptions outlined above also shed light on the adverbial-relative connection. Consider an adverbial superlative like the following:
Here, the outer comparison class consists of individuals (Pam and friends) while the inner comparison class consists of running events. The association relation associates individuals with running events that they carry out. Thus both adverbial superlatives and quantity superlatives on relative readings have non-individual inner comparands. The (revised) Target-Domain principle thus predicts that both types of superlatives would evince default agreement.

Note that sentence (55) only allows an interpretation in which Pam is contrasted with other runners (i.e. a relative reading). Could there be an absolute reading of such 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, we have found. Thus it appears that adverbial superlatives cannot have absolute readings. But consider the fact that a given agent is necessarily the agent of the fastest running event that he or she carries out. In other words, the absolute reading is tautologous. Perhaps nothing beyond this needs to be said, although the inherently low salience of events may exacerbate the challenges faced by absolute readings.

5 Alternative proposals

Ours is not the first attempt to capture the markedness of proportional readings; there are several others. While these previous approaches contribute valuable insights, each faces difficulties. Pancheva (2015) already identified some of them; in this section, we summarize her observations and then discuss challenges for her own account.

5.1 DP layer?

Bošković (2008) proposed that the existence of a DP layer is a parameter setting that languages may or may not have. 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 most should have a proportional reading in any language with a DP layer. Using presence of a definite determiner as a proxy for ‘has a DP layer’, it is possible to operationalize this prediction. It is borne out for the languages studied by Živanović (2007a,b), but Pancheva (2015) observes that
it fails upon encounter with other languages including Bulgarian, French, Italian, and Spanish, with definite articles but no proportional reading.

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

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

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

Hebrew is also notable here. The regular superlative of many, haxi harbe, lacks a proportional interpretation, though Hebrew has a definite article. Proportional readings are expressed by rov ‘most’, which is not the superlative form of harbe (Hadas Kotek, p.c.).

5.2 Cardinal vs. proportional many?

Could the quantity words themselves be to blame? Partee (1989) claims that (58) is ambiguous between ‘cardinal’ and ‘proportional’ readings.12

(58) 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. Pancheva (2015) considers and rules out the possibility that a language’s inventory of quantity words determines the availability of the proportional reading. As she notes, given the broad availability of both uses of many in languages without proportional readings, this distinction cannot explain the distribution of proportional readings.

12See also Milsark 1977; Westerståhl 1985; Partee 1989; Büring 1996; Herburger 1997; Krasikova & Champollion 2011; Romero 2017, i.a.; and references therein.
5.3 Underlying pseudopartitive structure?

On Pancheva’s (2015) proposal, quantity superlatives derive from a pseudopartitive structure containing an abstract measure noun NUMBER; different interpretations emerge depending on whether \textit{individuating} or \textit{measure} pseudopartitives are involved:

(59)  
\begin{align*}
\text{a. } & \text{Kim broke two glasses of water. } \quad \text{[individuating]} \\
\text{b. } & \text{Kim added two glasses of water to the soup. } \quad \text{[measure]}
\end{align*}

In \textit{individuating} pseudopartitives like (59-a), the container or measure noun (\textit{glass}) is the head, whereas in \textit{measure} pseudopartitives like (59-b), the substance noun (\textit{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.

(60) il maggior numero di articoli  
DEF large.CMPR number of articles  
‘the most articles’

Pancheva proposes that in Slavic-type languages with proportional readings, the superlative of \textsc{many} spells out a combination of a special degree-oriented form of \textsc{large} (\textsc{large}d) and an abstract \textsc{number} noun specialized for \textit{individuating} pseudopartitives (\textsc{number}i) as in (60), along with -\textsc{est}. (This is the underlying structure only for the \textit{superlative} of \textsc{many}, as positive and comparative forms of \textsc{many} in Slavic are compatible with \textit{measure} pseudopartitives as well.) Pancheva posits a different abstract \textsc{number} noun (\textsc{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: Relative readings involve 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 \textsc{large} and the noun \textsc{number}, there is no trace of this underlying structure on the surface; quantity superlatives are not morphologically related to either \textsc{large} or \textsc{number}. Relatedly, Wilson (2016, 17) points out that if there is a silent \textsc{number} noun in combination with \textsc{largest}, then we might expect just \textsc{largest} to realize a structure excluding \textsc{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 \textsc{many} is the spell-out of ‘\textsc{large} \textsc{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 -\textsc{est} could not combine with \textsc{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* [60] while *di* is absent from quantity superlatives (de Boer, 1986), which unambiguously express relative readings. In Mandarin, the presence of the attributive modificational particle *de* in pseudopartitives forces a measure reading (Cheng & Sybesma, 1998; Rothstein, 2017, 156). Yet superlatives with *de* were accepted in relative-only contexts [12], suggesting that the relative reading need not reflect an individuating structure.

## 6 Formal analysis

### 6.1 Formal account of superlative meaning

**Syntactic assumptions.** Our compositional account reflects Bobaljik’s (2012) Containment Hypothesis, according to which “the representation of the superlative properly contains that of the comparative.”

(61) \[
\text{[ [ [ ADJECTIVE ] COMPARATIVE ] SUPERLATIVE ]}
\]

Bobaljik gives typological evidence that this structure is universally valid, drawing in part on languages where superlative forms transparently contain comparatives, e.g. Persian *boland-tar-in* (tall-CMPR-SPRL) ‘tallest’. As our proposal is meant to apply to any language with superlatives, we adopt this assumption in our compositional analysis as well (cf. Szabolcsi, 2012).

**Comparatives.** We analyze -*er* as follows. It takes two entities and the gradable predicate *G* that determines the measure relation.

(62) Lexical entry for phrasal comparative marker

\[
-er \sim \lambda G_{d,(\tau,t)} \lambda \beta \lambda \alpha \cdot \max(\lambda d \cdot G(d)(\alpha)) > \max(\lambda d' \cdot G(d')(\beta))
\]

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, it is not used in our superlative derivations. This makes it possible for the superlative to take as input the product of the phrasal comparative applied to a gradable predicate.

**Superlatives.** If absolute readings were all there were, we would not think twice about giving a lexical entry for superlative markers like this:

---

13For discussion of phrasal comparison in various languages, see Heim (1987); Kennedy (1997); Lechner (2003); Kennedy (2007); Bhatt & Takahashi (2011), and references therein.
\(\lambda C \lambda T \lambda x. \text{sup}(x, T, C)\)

where \(C\) is the comparison class, \(T\) is a relation like ‘taller’, and \(x\) is the target of the superlative. We would simply take \(\text{sup}(x, T, C)\) to be true if and only if \(x\) bears \(T\) to all elements of \(C\) other than itself.

In the case of relative readings, however, comparison is mediated by the association relation. One way to model this is to allow the (comparative and) superlative morpheme(s) to take scope over the non-focused material in the sentence (Szabolcsi, 1986; Heim, 1999; Bumford, 2017). Another option is to allow the superlative morpheme to accept an association relation as an additional argument (Farkas & É. Kiss, 2000; Coppock & Beaver, 2014). We opt for the latter approach here, because it allows us to specify the constraint that the inner comparands are in the domain of the measure quite straightforwardly.

Let us define a relation \(\text{sup}^\star(x, T, C, R)\) which holds of an inner target \(x\) only if there is an outer target \(x'\) such that:

- \(x'\) is in the outer comparison class \(C\)
- \(x'\) is associated with \(x\) via association relation \(R\)
- \(\text{sup}(x', T \star R, C)\)

where \(\star\) is defined as follows:

\[(64) \quad \text{For any } R \text{ and } T, R \star T \text{ holds of any } \alpha \text{ and } \alpha' \text{ iff there are } \beta \text{ and } \beta' \text{ such that } R(\alpha, \beta) \text{ and } R(\alpha', \beta') \text{ and } T(\beta, \beta').\]

With this in mind, we give the following lexical entry for a superlative marker (to be modified just slightly in order to account for the role of the modified noun in the meaning):

\[(65) \quad \text{Lexical entry for superlative marker (non-attributive version)}\]

\[-t \leadsto \lambda T \lambda (\tau, (\tau, \tau)) \lambda (\alpha, \beta, \gamma). \partial(\text{domain}(R) = C) \land \text{sup}^\star(\alpha, T, C, R)\]

where bold-faced variables are filled in by context. \(C\) is a contextually salient set of entities that are eligible for comparison, and \(R\) is an association relation, possibly identity. The clause:

\[\partial(\text{domain}(R) = C)\]

expresses a presupposition that the domain of the association relation is equal to the outer comparison class. This clause will be suppressed henceforth for readability.

\(\text{This is different from the relational composition of } R \text{ and } T, \text{ which would be a relation between elements of the domain of } R \text{ and elements of the range of } T. \text{ The } \star \text{ operator produces a relation whose domain and range are both identical to the domain of } R. \text{ This operation makes sense whenever } T \text{ is also a relation whose domain and range are the same.}\)}
Now, under the assumption that superlatives are inserted into a Bobaljik-style syntactic structure with a resolution of the type meta-variable $\tau$ that fits the domain of the gradable adjective, the target argument will be in the domain of the gradable predicate. Recall that the denotations for both comparative and superlative morphemes are underspecified with respect to the type of their first argument: $\text{cmpr}$ composes with a gradable predicate of type $\langle d, \langle e; t \rangle \rangle$, while $\text{sprl}$ composes with an expression of type $\langle \tau; \langle \tau; t \rangle \rangle$. $\tau$ is also the type of the inner target of the superlative ($\alpha_\tau$), and by extension the type of all inner comparands. For instance, if the gradable predicate at the root of the superlative is type $\langle d, \langle e; t \rangle \rangle$, all instances of type $\tau$ are set to $e$; this will be the type of the target argument and all other members of the inner comparison class. This is how the type-matching principle is implemented.

We should note that this analysis is open to the same objections that have been raised for similar accounts, in particular that of Coppock & Beaver (2014). As Bumford (2017) points out, it is not guaranteed that the inner target will be unique, so ‘Schneider climbed a highest mountain’ should be felicitous. A stopgap here would be to assume that the association relation is actually a function, so there is always only one inner target. Non-maximal associates of a given element in the outer comparison class could be pruned from the non-functional association relation in order to generate the functional one. We also lack an explanation for the fact that the association relation must be set by the content of the sentence, and cannot be set by context, as Farkas & E. Kiss (2000, 440) point out. For example, Kim photographed the highest mountain cannot mean that photographed a mountain higher than anyone else climbed, regardless of how salient climbing is in the context. Upstairs de dicto readings (Heim, 1999) are also a known problem for this type of analysis (though see Coppock & Beaver 2014 for discussion of this point). Bumford’s (2017) analysis, though technically quite challenging, overcomes these problems, and in future work, we hope to see the type-matching principle implemented in that more advanced framework.

We will, however, make one refinement to our theory of superlatives, before moving on. A question that arises under any account of superlatives is why, for example, the tallest mountain is necessarily tallest among some set of mountains, as opposed any other set of things. In Heim’s (1999) theory, short movement of $-\text{est}$ within the noun phrase is posited in order to account for this phenomenon. Here, we introduce an attributive variant of the superlative morpheme that takes the modified noun and requires that the inner comparison class (the range of the association relation) be a subset of its denotation, as follows:

\[(66) \quad \text{Lexical entry for superlative marker (attributive version)}
\]

\[-t \leadsto \lambda T_{\langle \tau; \langle \tau; t \rangle \rangle} \lambda P_{\langle \tau; t \rangle} \lambda \alpha_\tau . \partial (\text{range}(R) \subseteq P) \land \sup^* (\alpha, T, C, R)\]

If it could be enforced that this attributive variant is used whenever there is a
modified noun, then the observation would be accounted for. Perhaps the attributive variant in (66) is the only variant. This would explain the tendency for superlatives to behave attributively (Matushansky, 2008), although the tendency may be less universal than Matushansky claims (cf. e.g. Croitor & Giurgea, 2016). If so, then something must be said about non-attributive superlatives, including predicative and quantity superlatives. For such cases, we may assume that the argument is trivially saturated implicitly, yielding our original entry for -t. We will not show any such operation in our derivations, but we take it to be a reasonable assumption regarding the relation between the two variants.

The derivation in Figure 12 underlies both relative and absolute readings of *Kim put the tallest plant on the bookcase*. The two types of readings are distinguished by the value of association relation $R$.

We start with the relative reading of *Kim put the tallest plant on the bookcase*. Here, the outer comparison class $C$ consists of locations. The inner comparison class contains plants, one of which is the target argument of the superlative $\alpha/x$. The association relation $R$ maps locations to plants. The measure relation $G$ is the determined by the gradable predicate *tall*, which we assume expresses a relation

\begin{align*}
\lambda x_e \cdot \partial \langle \text{range}(R) \subseteq \text{plant} \rangle \land \sup^* (x, \text{taller}, C, R) \\
\langle (e, t), (e, t) \rangle \\
\lambda P_{(e, t)} \lambda x_e \cdot \partial \langle \text{range}(R) \subseteq P \rangle \land \sup^* (x, \text{taller}, C, R) \\
\langle (e, (e, t)), (e, (e, t)) \rangle \\
\lambda \tau_{(\tau, t)} \lambda P_{(\tau, t)} \lambda x_\tau \cdot \partial \langle \text{range}(R) \subseteq P \rangle \land \sup^* (\alpha, T, C, R) \\
\langle (\tau, (\tau, t)), (\tau, (\tau, t)) \rangle \\
\lambda y \lambda x . \text{height}(x) > \text{height}(y) \\
\langle d, (e, t) \rangle \\
\lambda d . \lambda x . \text{height}(x) \geq d \\
\lambda G_{(d, (\tau, t))} \lambda \beta_\tau \lambda \alpha_\tau . \max (\lambda d . G(d)(\alpha)) > \max (\lambda d' . G(d')(\beta))
\end{align*}

Figure 12: Derivation for the tallest plant.
between individuals and degrees to which they are high, which includes all degrees below their actual height (Heim, 1999). The gradable predicate is taken as argument by -er to yield the comparative relation $T$. The comparative relation $T$ is taken

as argument by the superlative marker. The truth conditions derived are just as expected: The plant Kim put on the bookcase is taller than the plants he placed elsewhere.

On an absolute reading of *Kim put the tallest plant on the bookcase*, the association relation $R$ is an identity relation on the comparison class. The distinction between the outer and inner comparison classes collapses, yielding a single comparison class of plants. As the domain and range of $R$ are the same, the constraint that the range consist of plants amounts to a constraint that $C$ consists of plants. The meaning derived can thus be expressed as follows:

$$\lambda x . \partial (C \subseteq \text{plant}) \land \text{sup}^\star (x, \text{taller}, C, =_C)$$

The expression in (67) denotes a property that holds of an individual $x$ if $x$ is tallest among some contextually given set of plants. (The fourth argument of $\text{sup}^\star$, $=_C$, stands for an identity relation on $C$.)

### 6.2 Quantity superlatives

#### 6.2.1 Relative readings

Like quality superlatives, quantity superlatives are built compositionally from a gradable expression, comparative marker, and superlative marker. We treat quantity words as denoting by default gradable properties of degrees:

$$\text{much} \sim \lambda d . \lambda d' . \mu(d') \geq d \quad \{d, \langle d, t \rangle \}$$

where $\mu$ is a salient extensive measure function

Given this meaning, some sort of compositional glue is needed when quantity expressions take a nominal complement. For this, 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 (Cresswell 1977; Krifka 1989; Kayne 2005; Schwarzscild 2006; Nakanishi 2007a,b; Cornilescu 2009; Solt 2009, 2015; Scontras 2013; and references therein). Here, we assume a separate head, which is similar to Rett’s (2014) M-Op except that it expects a predicate of degrees rather than a single degree. This change simplifies the derivations somewhat.\(^{15}\)

\(^{15}\)A reviewer asks whether M-Op is thought to be involved in the analysis of numeral constructions and pseudopartitives. This is possible. In a case like *two books*, the numeral *two* could saturate the $d$ argument, as Schwarzscild (2006) proposes, in the spirit of Krifka (1989); see also Scontras (2013) for a proposal in the same spirit in which a cardinality head synonymous with M-Op mediates between the numeral and 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).
Figure 13 shows the derivation for most books on a relative reading, represented schematically in Figure 4. As with quality superlatives, the type of the gradable predicate is filtered up through the comparative and superlative layers, and determines the type of the inner target and other members of the inner comparison class. Thus, the inner target argument here is a degree. We additionally assume that a predicative version of the \( \text{Fara, 2000; Coppock & Beaver, 2015} \), one that can apply to predicates of degrees, may insert itself. The meaning remains the same, as the definite article would serve only to enforce the trivially satisfied presupposition that there is at most one degree that is maximal in the way required by the superlative.\(^{16}\) By the reasoning laid out in §4, only a relative reading is available for this structure.

To see how we capture the adverbial-relative connection, consider an adverbial superlative:

(69) Pam ran the fastest.

Figure 14 shows the composition of run fastest. As with relative readings of quantity superlatives, the inner comparison class does not consist of individuals; here, it rather consists of events. As discussed in §4.8, this may be part of the explanation for why adverbial superlatives, like the superlatives of quantity words, have only relative readings. The fact that the inner comparands are events also suggests an explanation for why relative readings of quantity superlatives and adverbials are morphosyntactically similar: the agreement reflects the semantic type of inner target, and when the inner target is not an individual, default agreement arises.

6.2.2 Proportional readings

Proportional readings require a departure from one or more of the assumptions we have made. One possibility, suggested by an editor of Language, is that quantity pseudopartitives such as two ounces of gold, M-Op is plausibly realized as of \( \text{Schwarzschild, 2006, 106} \).\(^{16}\)

This treatment of the most means that it is an expression denoting a degree predicate. Possible independent support for this claim comes from the fact that it can also serve as a differential argument in degree achievement constructions (e.g. \( \text{Kennedy & Levin, 2015} \)):

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

However, we admit that we lack a ready explanation for the following contrast:

(ii) Kim\( F \) is \{ six inches/? the most \} taller than Bill.

What \( \text{ii} \) would mean with the most seems to be expressed more naturally with:

(iii) Kim\( F \) is taller than Bill by the most.

although this retains a degree of awkwardness as well. We hope that future work will shed light on why this restriction holds.
Figure 13: Derivation for *most books* (note: attributive -t not used here)
\lambda e \cdot \sup^* (e, \text{faster}, C, R) \land \text{run}(e)

Figure 14: Derivation for run fastest
superlatives are really superlatives of M-Op, taking scope over the following noun, rather than being superlatives of quantity words. This possibility is illustrated in Figure 15, where M-Op applies directly to M-Op+noun to produce a gradable property of individuals. With this structure, we expect proportional readings to be available, in the style of either Hackl or Hoeksema. Thus it is a crucial part of the explanation for the typological rarity of proportional readings that quantity superlatives contain quantity words, and that the quantity word determines the measure according to which members of the inner comparison class are evaluated.

A proportional reading could also be derived if the quantity word had the type of a gradable adjective, \( \langle d, \langle e, t \rangle \rangle \). Such a lexical entry figures in the derivation in Figure 16 for most books. The association relation is identity, and the comparison class consists of quantities of books. This tree can be used to derive Hoeksema’s analysis of proportional readings. A small tweak to the meaning of the superlative, so that it refers to non-overlapping rather than distinct pluralities, would produce a proportional reading in Hackl’s style.

The derivation in Figure 16 produces both relative readings as well. If \( R \) is non-trivial, and \( C \) corresponds to a set of focus alternatives, then a relative reading emerges. Thus one and the same lexical entry for the quantity word can form the basis of both proportional and relative readings in languages where quantity words denote gradable predicates of individuals.
Figure 16: Derivation for *most books* on a proportional reading.
Great diversity exists among the morphosyntactic strategies used to express superlative meanings cross-linguistically, and quantity superlatives add a layer of richness to this diversity. It is remarkable that in the midst of this, a linguistic universal could emerge. But so one has. 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 the following set of assumptions:

- Meaning of superlatives
- Surface predicate as measure
- Quantity words as gradable predicates of degrees
- Compositionality of quantity superlatives
- Proportional as absolute
- Proportional as plurality-comparing

Together, these assumptions force a relative interpretation for quantity superlatives under ordinary circumstances. Our assumptions also shed light on 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 may arise when quantity words denote predicates of individuals. This can be accomplished either by the reanalysis of the meaning of quantity words, or by omission of the quantity expression altogether, such that only the measurement operator remains. With the assumption that both options are uncommon, we can explain why relative readings are ubiquitous while proportional readings are rare.

One finding that our proposal does not account for is that proportional readings only occur in languages with morphological superlatives. Given how few languages use superlatives of MANY to express a proportional reading, however, this may turn out to be a statistical accident. If it holds more broadly, then perhaps proportional readings for MOST are facilitated by analogical pressure from other word-like quantifiers in the lexicon. The compositional route to a proportional reading might be complemented and strengthened by a direct route (cf. Hay’s (2003) dual-route model of morphology). We hope that future research will shed light on this question.

Now, 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 (1975)] 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 appears to arise through 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 point. At the same time, they support a refined view, as the compositional route to proportional readings is full of obstacles.

References


Bošković, Željko & Jon Gajewski. 2008. Semantic correlates of the NP/DP pa-


Dobrovie-Sorin, Carmen & Ion Giurgea. 2015. Quantity superlatives vs. proportional quantifiers: A comparative perspective. 25th Colloquium on Generative
Grammar, Bayonne.


Hackl, Martin. 2009. On the grammar and processing of proportional quantifiers: most vs. more than half. *Natural Language Semantics* 17. 63–98. [https://doi.org/10.1007/s11050-008-9039-x](https://doi.org/10.1007/s11050-008-9039-x).


Krifka, Manfred. 1989. Nominal reference, temporal constitution and quantifi-


