A unified semantics for distributive and non-distributive universal quantifiers across languages *†

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Abstract Universal quantifiers differ in whether they are restricted to distributive interpretations, like English *every*, or permit non-distributive interpretations, like English *all*. This interpretative difference correlates with a morpho-syntactic difference: cross-linguistically, distributive universal quantifiers take singular complements, while non-distributive quantifiers take plural complements. Based on the lexical contrast found in languages like English, the interpretational difference is traditionally captured by positing two unrelated lexical entries for distributive and non-distributive quantification, which leaves the correlation between distributivity and the morpho-syntactic number of the complement unexplained. In contrast, we propose a single lexical meaning for the universal quantifier that derives this correlation. Support comes from several unrelated languages that express distributive and non-distributive quantification using the same lexical item, with the interpretation determined by the number of the complement. For languages like English that have different expressions for non-distributive and distributive quantification, we propose that the distributive forms contain an additional morphosyntactic element that is semantically restricted to combine with a predicate of atomic individuals. This is motivated by the fact that in several languages, the form used in distributive quantification is structurally more complex than the non-distributive form and sometimes even contains it transparently.

keywords: universal quantification, distributivity, non-distributivity, morpho-syntactic number, morphosemantics

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†Glossing abbreviations: ABS = absolutive, ACC = accusative, AFF = affirmative (polarity marker), AUX = auxiliary, DAT = dative, DEF = definite, DET = determiner, ERG = ergative, FEM = feminine gender, FIN = 'head of FinP' (in examples taken from Tamba et al. 2012), GEN = genitive, INDEF = indefinite, INTR = intransitive, MASC = masculine gender, NCL = noun class marker, NEUT = neuter gender, NOM = nominative, PFV = perfective, PL = plural, PROG = progressive, PROX = proximal, REDUP = reduplication, REFL = reflexive marker, SG = singular, UQ = universal quantifier, VM = verb particle, 3 = 3rd person

1 Introduction and outline

Cross-linguistically, many languages have two (or more) expressions for DP-internal universal quantifiers (UQs) which seem to differ semantically in a uniform way (Gil 1995, Keenan & Paperno 2012, 2017 a.o.). In English, for example, the UQ *every* is restricted to a distributive interpretation, (1-a): When *every boy* combines with a predicate like *ate 20 sausages (in total)*, the sentence can only express that this property holds of each boy separately; furthermore, such DPs are incompatible with collective predicates like *met in the yard*. In contrast, the English UQ *all* also permits a non-distributive interpretation, (1-b): Combining *all the boys* with *ate 20 sausages (in total)* allows for a cumulative reading (where the number of sausages eaten by the boys add up to 20) and moreover is compatible with collective predicates.

(1) a. ***Every boy*** *ate 20 sausages in total / *met in the yard.*
✓DISTRIBUTIVE, *CUMULATIVE, *COLLECTIVE

b. ***All the boys*** *ate 20 sausages in total / met in the yard.*
✓DISTRIBUTIVE, ✓CUMULATIVE, ✓COLLECTIVE [1]

In languages with overt number marking on the NP/DP complements of quantifiers (henceforth 'number languages')[2], this difference in interpretation seems to correlate with the morpho-syntactic number on the complement: while UQs limited to distributive interpretations tend to occur with singular complements, e.g. *boy* in (1-a), UQs permitting non-distributive interpretations usually occur with plural complements, e.g. *boys* in (1-b).

Based on this observation, Gil (1995) proposes the generalization that if two UQs in the same language differ regarding the permitted readings and in terms of the number of the complements they select, then distributivity correlates with singular complements and non-distributivity with plural complements. Gil ties this generalization to a proposal concerning the meanings of UQ: Singular and plural UQs are taken to have different denotations. English *all* is lexically underspecified between distributive and non-distributive quantification, whereas English *every* is a distributive quantifier. This meaning difference in turn is tied to a 'markedness'-asymmetry in the sense that *every*-type UQs are 'more marked' than *all*-type UQs in two respects: For Gil, the distributive meaning of *every* is more specific than that of *all*; moreover, he assumes that *every* consists of two semantic components, the universal force – the '*all*-part' – and an additional distributive component. Gil does not provide a compositional analysis; it is thus unclear to us whether the assumed asymmetry in semantic complexity should be translated to an asymmetry in morphosyntactic complexity.

In this paper we present an extended set of cross-linguistic data on number and UQs, partly novel and partly taken from the diverse sample of languages in Keenan & Paperno (2012), Paperno & Keenan (2017). Based on this dataset, we propose an account for UQs that extends and deviates from Gil's proposal in several respects. In particular, it captures the following three observations:

Observation 1: Within number languages, the combination of UQ and singular complement is always *restricted* to a distributive interpretation. In contrast, the combination of UQ and plural complements is almost never restricted to a distributive interpretation. (Or rather, 'never': We will encounter some *prima facie* counterexamples to this part of the generalization, but Section 7 will show that they can arguably be made compatible with a strict correlation between the interpretation of the UQ and the number of the complement.) This suggests that Gil's 1995 generalization is too weak.

Observation 2: Several unrelated languages have strategies where both non-distributive and distributive

[1] Note that there is some speaker variation regarding the availability of non-distributive interpretations with *all*.

[2] Our claims in this paper are limited to such 'number languages'. We leave open whether our proposal extends to languages in which the complements of quantifiers are systematically number-neutral.

quantification are expressed by a single lexical item: the quantifier receives a distributive interpretation if its complement is singular, and a non-distributive one if its complement is plural. This suggests that we need a single underlying meaning for universal quantifiers, instead of two distinct meanings (as proposed by Gil 1995).

Observation 3: Cross-linguistically, UQs that are limited to a distributive interpretation tend to be morphosyntactically more complex than those that permit non-distributive construals. This supports the idea of a structural asymmetry between the two forms: UQs limited to distributive interpretations involve more structure.

Taking these observations at face value, our proposal is as follows: there is a single underlying meaning for universal quantifiers, $\mathbf{Q}_\forall$, cross-linguistically. $\mathbf{Q}_\forall$ applies its nuclear-scope predicate to every maximal element of the noun denotation. In the case of singular complements, this means that the predicate is applied to all the atoms in the noun extension; in the case of a plural complement, the predicate is applied to the maximal plurality in the noun extension. Thus, the difference in interpretation is a result of the combination of $\mathbf{Q}_\forall$ with the respective complement meaning.

In languages with different forms for distributive and non-distributive quantification, the distributive form corresponds to a more complex underlying syntactic structure. This structure consists of $\mathbf{Q}_\forall$ and an additional syntactic element which we dub ONE due to its semantic similarity with the numeral *one* and which only combines with singular complements. Support for this comes from languages where morphemes formally identical to the numeral *one* appear in forms expressing distributive universal quantification. Non-distributive forms like English *all* have less complex structures. While some of these non-distributive forms seem to permit both interpretations, we will argue that they do not themselves introduce distributivity in those cases where the sentence has a distributive reading. Rather, the distributive reading results from a VP-level distributivity operator (Link 1987 a.o.) that must be realized overtly in some languages.

Unlike Gil (1995), we capture the cross-linguistic morpho-syntactic complexity asymmetries between distributive and non-distributive forms without having to assume that one of them is semantically underspecified or has a 'less marked' meaning relative to the other. We follow Gil's intuition that distributive UQs should be decomposed into two components, but interpret it more literally: On our account, the lexical entry for the quantifier itself is exactly the same in distributive and non-distributive UQs, and distributive quantification arises compositionally when this quantifier co-occurs with the additional syntactic head ONE. As a consequence, strategies where one and the same form is used to express both types of quantification are expected and in fact the default case. Further, our proposal goes beyond Gil's description of the correlation between distributivity and number in providing a compositionally interpreted syntax for UQs that rules out the unattested number-interpretation combinations.

The paper is structured as follows: Section 2 presents the empirical situation motivating our distributivity-number generalization (DNG): the interpretation of a universal quantifier is determined by the number of its restrictor complement. Section 3 shows that standard assumptions about the semantics of morphological number on nouns, combined with a standard semantics for *every*-type and *all*-type quantifiers, fail to derive the DNG. Section 4 provides some background on plural semantics and presents our proposal: there is a single lexical meaning for universal quantifiers cross-linguistically that derives the correlation between complement number and distributivity. Section 5 extends the proposal to strategies making use of distinct distributive and non-distributive UQ forms. In Section 6 we refine the semantics suggested in section 4 in order to exclude unattested meanings of quantifiers combining with numeral-modified NPs and account for certain issues arising in the context of definite DPs. Section 7 discusses putative counterexamples to the DNG and whether they can be analyzed in a way that is underlyingly compatible with the generalization. Section 8 concludes the paper and points to some open issues.

2 Empirical situation: a novel generalization

We first provide an overview of the empirical situation regarding attested combinations of quantifier interpretation and complement number. We then introduce new data from Dagara (Mabia) and conclude with a novel empirical generalization that yields stronger predictions than an existing generalization suggested by Gil (1995).

2.1 Two forms for universals

We start with the observation that the pattern presented in (1) is no idiosyncratic property of English: in several languages with two formally different DP-internal UQs, the latter differ both syntactically, i.e. with respect to the number of the complements they permit, and semantically, i.e. concerning the availability of distributive and non-distributive readings (henceforth '2-forms languages').[3]

We will focus on UQs in subject position, as schematized in (2) (XP stands for the constituent introducing the UQ's restriction).[4] A UQ will be said to permit a distributive interpretation if the sentence is true in scenarios where the property expressed by the VP holds of each atomic XP-individual separately. And a UQ will be said to permit a non-distributive interpretation if (i) the UQ can combine with collective predicates, or ii) cumulative construals are possible, which, intuitively speaking, means that we 'add up' properties of the parts of the plurality of all XPs, so that the property expressed by the VP holds of that plurality as a whole and not of each atomic part separately.

(2) [[$_{DP}$ UQ XP] [$_{VP}$ .....]]

Example (3) shows that the two German UQs *jed-* and *alle* differ regarding their compatibility with collective predicates: while *all* can combine with such predicates, (3-b), *jed-* cannot, (3-a).

(3) a. *#Jeder Bub hat sich im Hof getroffen.*
UQ boy.SG has REFL in.the yard met
'Every boy met in the yard.'
b. *Alle Buben haben sich im Hof getroffen.*
UQ boy.PL have REFL in.the yard met
'All the boys met in the yard.'

Moreover, *alle* allows for a cumulative construal, but *jed-* does not: While (4-b) is true in the cumulative scenario (5-a), (4-a) is false in this scenario. Finally, both *all* and *jed-* permit a distributive construal – both (4-a) and (4-b) are true in the distributive scenario (5-b).[5] From now on, we refer to UQs such as German *all* which are compatible with non-distributive construals as [−dist], and to those that are obligatorily distributive such as German *jed-* as [+dist]. ([+dist] / [−dist] are non-symmetric values: [−dist] indicates compatibility with non-distributive readings (collective predicates and/or cumulativity) but does not indicate whether the element in question also permits a distributive reading.)

[3] Note: Several languages have more than one expression of a given type, e.g. English has both *every* and *each* as UQs that are limited to distributive interpretations. This paper does not discuss potential distinctions between elements of the same semantic class (e.g., between *every* and *each*.)

[4] See Schein 1997, Kratzer 2000, Ferreira 2005, Champollion 2010, Haslinger & Schmitt 2018, Chatain 2021 a.o. on complications regarding UQs in object position.

[5] We will argue below that the distributive interpretations available with *all*-type quantifiers are not tied to the quantifier, but due to distributivity operators within the predicate it combines with.

(4) a. *Jeder Bub hat (insgesamt) 10 Bücher gelesen.*
UQ boy.SG has in-total 10 book.PL read
'Every boy read 10 books (in total).' *CUMULATIVE, ✓DISTRIBUTIVE

b. *Alle Buben haben (insgesamt) 10 Bücher gelesen.*
UQ boy.PL have in-total 10 book.PL read
'All boys read 10 books (in total).' ✓CUMULATIVE, ✓DISTRIBUTIVE

(5) a. CUMULATIVE SCENARIO: Boys: A, B, C. A read 3 books, B read 4 books, C read 3 books.

b. DISTRIBUTIVE SCENARIO: Boys: A, B, C. A read 10 books, B read 10 books, C read 10 books.

Across number languages, these semantic differences correlate with a syntactic difference: the elements restricted to a distributive construal ([+dist] elements) tend to take singular NP complements, e.g., German *jed-*, (6), while the elements permitting a non-distributive reading ([−dist] elements) tend to take plural NP complements, e.g., German *alle*, (7).[6]

(6) a. *jed-es Buch*
UQ-NOM.SG.NEUT book(SG)
'every book'

b. **jed-e Büch-er*
UQ-NOM.PL book-PL

c. **jed-es die Büch-er*
UQ-NOM.SG.NEUT the.NOM.PL book-PL

(7) a. **all-e(s) Buch*
UQ-NOM.SG.NEUT book(SG)

b. *all-e Büch-er*
UQ-NOM.PL book-PL
'all books'

c. *all die Büch-er*
UQ the.NOM.PL book-PL
'all these books'

As noted above, Gil (1995) already observes this correlation between the interpretation of a quantifier and the number of its potential complements. He suggests the following implicational universal:

(8) If distributive and non-distributive UQs of a certain language differ with respect to the number of the complement they permit, then the distributive UQ requires a singular complement and the non-distributive UQ a plural complement.

[6] In German partitive structures, *jed-* combines with a genitive DP complement, (i-a), or a PP containing a dative DP, (i-b). As will be discussed in section 5.5, we assume that in partitive constructions the DP is not the direct argument of the quantifier. Rather, the more complex phrase that combines with the quantifier may be semantically singular. If the partitive is only marked by case inflection as in (i-a), this can lead to the appearance that partitives violate the distributivity-number generalization introduced in (17) below. For now, we ignore partitive complements in all the languages discussed.

(i) a. *jed-es der Büch-er*
UQ-NOM.SG.NEUT the.GEN.PL book-PL
'each of the books'

b. *jed-es von den Büch-er-n*
UQ-NOM.SG.NEUT of the.DAT.PL book-PL-DAT
'each of the books'.

(8) does not exclude languages in which distributive and non-distributive UQs both take plural complements, or both take singular complements. It therefore does not consistently rule out the combination of a singular complement with non-distributivity, or of a plural complement with distributivity. Thus, it raises the empirical question of whether we actually find such combinations, or whether this implicational universal should be strengthened.

To answer this question, we considered a broader typological sample, involving both existing data from the literature (Keenan & Paperno 2012, Paperno & Keenan 2017) and novel data we elicited.

Our first crucial observation is that we find the same pattern observed for German and English in several other Indo-European and non-Indo-European languages. Table 1 give some examples.

	distributivity	SG complement?	PL complement?
English *every*	[+dist]	✓	×
German *jeder*	[+dist]	✓	×
Imbabura Quichua *kada* (Barchas-Lichtenstein et al. 2017)	[+dist]	✓	×
Turkish *her* (Özyildiz 2017)	[+dist]	✓	×
Basque *bakoitz* (Etxeberria 2012)	[+dist]	✓	×
Telugu *prăti:* (Ponamgi 2012)	[+dist]	✓	×
English *all*	[−dist]	×	✓
German *all*	[−dist]	×	✓
Imbabura Quichua *tukuy(-lla)* (Barchas-Lichtenstein et al. 2017)	[−dist]	×	✓
Turkish *bütün, hepsi* (Özyildiz 2017)	[−dist]	×	✓
Basque *guzti, den, oro* (Etxeberria 2012)	[−dist]	×	✓
Telugu *ăndărŭ, ăn:ĭ, ănta:* (Ponamgi 2012)	[−dist]	×	✓

Table 1: Some of the languages with [+dist]-singular and [−dist]-plural universal quantifier

More generally, and excluding languages that do not mark number on complements of quantifiers at all (so that these complements could be viewed as semantically number-neutral rather than singular), only two of the four logically possible number-distributivity combinations are widely attested: [+dist] UQs (i.e. UQs that are obligatorily distributive) with singular complements, and [−dist] UQs (i.e. UQs that can receive a non-distributive interpretation) with plural complements.

[−dist] UQs with a singular complement are not attested in our sample. The sample does contain a few languages in which a [+dist] quantifier seems to take a plural complement. However, Section 7 will show that these cases are all susceptible to plausible alternative analyses compatible with the generalization that [+dist] quantifiers with a plural complement are ruled out.

2.2 One form for the universal

Our second crucial observation is that some languages – like Dagara, Moore, and Gourmantchema (Mabia), Wolof (Atlantic) or Syrian Arabic – have a single lexical item that can express both distributive and non-distributive quantification depending solely on the number of the complement it combines with ('1-form languages')[7]: in these languages, there is a single UQ form that is used both in construc-

[7]We use the label "1-form languages" for languages that have *some* UQ strategy of this kind, regardless of whether it is the only strategy. So a 1-form language may have additional UQ forms specified as [+dist] or [−dist]. Since our account

tions expressing distributive quantification and in constructions expressing non-distributive quantification. Crucially, we find the same correlation between number and interpretation in 1-form as in 2-form languages: if the complement is singular, the result is [+dist] universal quantification; if itt is plural, we obtain [−dist] universal quantification. Thus in 1-form languages the interpretation is exclusively determined by the number of the restrictor complement.

Take Dagara[8]: the UQ form *'hà* yields [+dist] universal quantification when combined with a singular NP complement (*'hà*+$\mathrm{NP}_{\mathrm{sg}}$): (9-a) is true in a distributive scenario like (10-b), but false in a cumulative scenario such as (10-a). In contrast, combining *'hà* with a plural DP complement (*'hà*+$\mathrm{DP}_{\mathrm{pl}}$) yields a [−dist] universal quantification: (9-b) can be true in a cumulative scenario such as (10-a), but fails to be true in a distributive scenario such as (10-b):

(9) Dagara

a. *Bí-é 'hà dìn mágò-rɔ átá.*
child-SG UQ ate mango-PL three
'Each child ate three mangoes.' *CUMULATIVE, ✓DISTRIBUTIVE

b. *A bìbììr 'hà dìn mágò-rɔ átá.*
the child.PL UQ ate mango-PL three
'All the children ate three mangoes (between them).' ✓CUMULATIVE, *DISTRIBUTIVE

(10) a. CUMULATIVE SCENARIO: Three children A, B and C. A ate 1 mango, B ate 1 mango, C ate 1 mango.

b. DISTRIBUTIVE SCENARIO: Three children A, B and C. A ate 3 mangoes, B ate 3 mangoes, C ate 3 mangoes.

While it is possible to construct sentences with the *'hà*+$\mathrm{DP}_{\mathrm{pl}}$-strategy that have a distributive interpretation, this requires distributivity marking on the predicate, i.e. an extra PL-marker on the lower numeral DP. This is exemplified in (11), which is true in a distributive scenario like (10-b), but false in a cumulative scenario like (10-a). Without distributivity marking on the predicate, e.g., in (9-b), a distributive construal is unavailable, so the *'hà*+$\mathrm{DP}_{\mathrm{pl}}$ strategy cannot be said to be underspecified between distributive and non-distributive interpretations.

(11) Dagara

a. *A bìbììr 'hà dìn mágò-rɔ átá -ri.*
the child.PL all ate mango-PL three-PL
'All the children / each child ate three mangoes each.' *CUMULATIVE, ✓DISTRIBUTIVE

The same pattern is observable in other Mabia languages[9]: in Moore and Gourmantchema, for example, the single lexical items *fãa* and *kuli*, respectively, yield [+dist] universal quantification in the context of singular NP complements ((12-a) and (13-a) are true in a distributive scenario like (10-b), but false in a cumulative scenario like (10-a)), and [−dist] universal quantification in the context of plural DP complements ((12-b) and and (13-b) can be true in a cumulative scenario such as (10-a), but fails to be true in a distributive scenario such as (10-b)). To receive a distributive interpretation with the *fãa/kuli*+$\mathrm{DP}_{\mathrm{pl}}$-strategies, extra distributivity marking within the lower numeral DP is necessary, (12-c) and (13-c).

of the distinction between 1-form and 2-form strategies will involve variation in the selectional properties and postsyntactic realization of particular functional heads, rather than language-level parameters, it is compatible with the co-existence of both strategies within a language. However, we will have little to say about the reasons why a language would lexicalize multiple UQs compatible with a [+dist] interpretation, or multiple UQs compatible with a [−dist] interpretation. We suspect there might be subtle semantic differences between these forms that are orthogonal to the issue of distributivity.

[8] All the Dagara data come from one of the authors, who is a native speaker.

[9] These data were elicited with native speaker consultants.

(12) Moore

a. *Biig fãa ri mangi atãbo.*
child.SG UQ ate mango.PL three
'Each child ate three mangoes.' *CUMULATIVE, ✓DISTRIBUTIVE

b. *Kamba fãa ri mangi atãbo.*
child.PL UQ ate mango.PL three
'All the children ate three mangoes (between them).' ✓CUMULATIVE, *DISTRIBUTIVE

c. *Kamba fãa ri mangi atãbo nekamfãa.*
child.PL UQ ate mango.PL three each.one
'All the children / each child ate three mangoes each.' *CUMULATIVE, ✓DISTRIBUTIVE

(13) Gourmantchema

a. *Biyeng kuli mua manga taa.*
child.SG UQ ate mango.PL three
'Each child ate three mangoes.' *CUMULATIVE, ✓DISTRIBUTIVE

b. *A bila kuli mua manga taa.*
DEF child.PL UQ ate mango.PL three
'All the children ate three mangoes (between them).' ✓CUMULATIVE, *DISTRIBUTIVE

c. *A bila kuli mua manga taa biyeng kuli.*
DEF child.PL UQ ate mango.PL three each child.SG
'All the children / each child ate three mangoes each.' *CUMULATIVE, ✓DISTRIBUTIVE

According to Tamba et al. (2012), the Wolof universal *-epp* exhibits the same pattern. It is [+dist] when combining with a singular noun (14-a), but [−dist] when combining with a plural noun or plural DP (14-b):[10] *-epp* with a plural noun/DP is compatible with collective predicates (15-b), but *-epp* with a singular noun is not, (14-a):

(14) Wolof

a. *b-epp xale (*b-i)*
CL-UQ child CL-DEF.PROX
'every child' (Tamba et al. 2012:917, (72b))

b. *xale y-epp*
child CL.PL-UQ
'all of the children' (Tamba et al. 2012:917, (72a))

(15) Wolof

a. **B-epp xale daje-na*
CL-UQ child gather-FIN
Intended: 'All the children gathered.' *COLLECTIVE (Tamba et al. 2012:923, (89c))

b. *Xale y-epp daje-na-ñu*
child CL.PL-UQ gather-FIN-3PL
'All the children gathered.' ✓COLLECTIVE (Tamba et al. 2012:923, (89a))

Furthermore, the same pattern is found with Syrian Arabic *kul*[11]: *kul*+NP_{sg} is a [+dist] universal; i.e. (16-a) can be true in a scenario such as (10-b), but not in a scenario such as (10-a). *kul*+DP_{pl} on the other hand, is a [−dist] universal; i.e. (16-b) can be true in (10-a), and also – even if dispreferred – in (10-b):

[10] Tamba et al. (2012) report that some, but not all speakers accept *-epp* with a DP argument in addition to the NP strategy illustrated in (14-b).

[11] These data were elicited with a native speaker consultant.

(16) Syrian Arabic

a. *Kul tefi akl tlet tufahat*
UQ child.SG ate.PL three apple.PL
'Every child ate three apples.' *CUMULATIVE, ✓DISTRIBUTIVE

b. *Kul al atfal akalu tlet tufahat*
UQ DEF child.PL ate.PL apple.PL
'All the children ate three apples.' ✓CUMULATIVE, ✓/?DISTRIBUTIVE

The table below sums up the pattern in 1-form languages:[12]

	non-distributive?	distributive?
Dagara *'hà*+NP_{sg}	×	✓
Dagara *'hà*+DP_{pl}	✓	×
Moore *fãa*+NP_{sg}	×	✓
Moore *fãa*+DP_{pl}	✓	×
Gourmantchema *kuli*+NP_{sg}	×	✓
Gourmantchema *kuli*+DP_{pl}	✓	×
Wolof *-epp*+NP_{sg}; Tamba et al. (2012)	×	✓
Wolof *-epp*+NP_{pl}/DP_{pl}; Tamba et al. (2012)	✓	unknown
Arabic (Damascus) *kul*+NP_{sg}	×	✓
Arabic (Damascus) *kul*+DP_{pl}	✓	✓/?

Table 2: One element: [+DIST] SG and [−DIST] PL UQ

2.3 The distributivity-number generalization

Given this overall cross-linguistic pattern, we propose the following generalization for number languages:

(17) **Distributivity-number generalization** (DNG)

a. If the complement of a universal is SINGULAR, it is [+dist]
b. If the complement of a universal is PLURAL, it is [−dist]

The DNG excludes certain types of UQ strategies in the set of languages it is defined for (in both 1-form and 2-form strategies): i) UQs expressing [−dist] universal quantification when they combine with a singular complement, and ii) UQs expressing [+dist] universal quantification when they combine with a plural complement. The DNG is thus stronger than Gil's 1995 implicational universal, which does not exclude such strategies. Evidence that this strengthening is empirically justified comes from the survey in Keenan & Paperno (2012), Paperno & Keenan (2017): Excluding languages in which complements of quantifiers do not exhibit evidence of morpho-syntactic number, their diverse cross-linguistic sample contains no counterexamples to (17-a). In section 7 we will discuss counterexamples to (17-b) and argue that these constructions can be analyzed in such a way that they are compatible with the DNG.

Supported by languages like Dagara, Moore or Gourmantchema where extra marking on the predicate is needed to get a distributive interpretation with a [−dist] UQ ((11-a), (12-c), (13-c)) we furthermore suggest that the distributive interpretations of [−dist] UQs result from the presence of distributivity operators in the VP (see e.g. Link 1987). In contrast to the Mabia languages, this additional material

[12]The 'distributive?' row is backgrounded since the availability of the distributive interpretation of plural DPs varies depending of the interpretation of the predicate (see below).

can be covert in languages like English and German (see Flor et al. 2017 for additional evidence for the cross-linguistic availability of a VP-level distributivity operator). Thus, the source of distributive interpretations of [−dist] UQs is independent of the semantic contribution of the UQ, and [−dist] UQs as such are specified for non-distributive interpretations. This goes against Gil's 1995 claim that [−dist] quantification is semantically less marked – i.e. underspecified wrt. distributivity – compared to [+dist] quantification. Rather, neither combination of UQ and complement number is underspecified regarding its interpretation.

All of this points to a direct correlation between singular complements and distributive meanings, and between plural complements and non-distributive meanings. If sentences with UQs with plural complements permit distributive interpretations in addition to the non-distributive ones, the reason for this is the predicate rather than any underspecification of the quantifier.

3 The semantic puzzle raised by the DNG

Before presenting a novel, unified semantics for UQs that captures the DNG, we motivate the need for such a new account, showing that the observed correlation between the interpretation of quantifiers and the morphological number of potential complements is unexpected in light of standard assumptions: given existing semantic analyses of morphological number on nouns and a standard semantics for *every*-type and *all*-type quantifiers, there is no obvious explanation for the complementary distribution of UQ-forms based on number as suggested by the data in Table 1 and Table 2.

3.1 Background: Plural individuals and parthood

As a background for our discussion, we first introduce some basic notions of plural semantics.

We assume that the domain D_e contains not only what we would pre-theoretically think of as individuals, but also **sums** or **pluralities** of individuals (we use these two terms interchangeably). We use the symbol $\bigplus$ for the operation that maps any nonempty subset of D_e to its sum – for instance, $\bigplus(\{x : \textbf{student}(x)\})$ is the sum of all the students, and $\bigplus(\{\text{Ann}, \text{Bert}\})$ is the plurality consisting of Ann and Bert. To avoid clutter, we also use the notation $a + b$ for $\bigplus(\{a, b\})$.

We call an individual **atomic** if it is not a sum of two or more distinct parts; $AT \subset D_e$ is the set of atomic individuals. While we do not technically identify sum individuals with nonempty subsets of AT (see e.g. Link 1983, Schwarzschild 1996 for discussion of this issue), we assume that there is a one-to-one correspondence between them, i.e. the structures $(D_e, \bigplus)$ and $(\mathcal{P}(AT)\backslash\{\emptyset\}, \bigcup)$ are isomorphic. For instance, the sum $a + b$ corresponds to the set $\{a, b\}$. Due to this correspondence, we can think of D_e as having the structure of a complete atomic Boolean algebra with the bottom element removed. This is illustrated in Figure 1.

We use the symbol $\sqsubseteq$ for the mereological part-of relation on D_e, which can be defined as in (18). (For an overview of the use of mereology in semantics, see Champollion & Krifka (2016).)

(18) $\forall x, y \in D_e.x \sqsubseteq y$ iff $x + y = y$.

Finally, our formulas will occasionally make use of a pluralizing '**star operator**' * that attaches to unary predicates (Link 1983). Intuitively, a pluralized predicate $^*P$ is true of an individual iff that individual can be expressed as a sum of individuals that satisfy P:

(19) Given a predicate P: $^*P(x)$ iff $\exists S \subseteq D_e.x = \bigplus(S) \wedge \forall y[y \in S \rightarrow P(y)]$

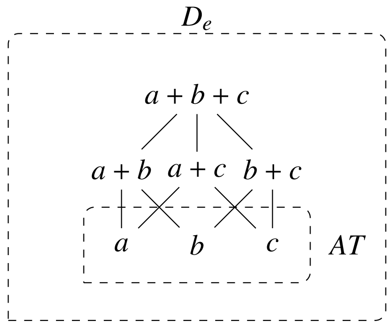


Figure 1: Atomic individuals and pluralities in D_e

3.2 Why the DNG is unexpected under standard assumptions

Usually, singular nouns are taken to denote sets of atomic individuals (20-a), whereas plural nouns denote sets of atomic as well as plural individuals (20-b) (see e.g. the underlying number semantics assumed in Sauerland 2003).[13]

(20) a. $[[\textit{student}]] = \lambda x.\mathbf{student}(x)$
atomic individuals – e.g. $\{a, b, c\}$
b. $[[\textit{student}\text{-}\textsc{pl}]] = \lambda x.{}^{*}\mathbf{student}(x)$
atomic and plural individuals – e.g. $\{a, b, c, a+b, a+c, b+c, a+b+c\}$

The classical semantics for *every*-type and *all*-type quantifiers assumes unrelated lexical entries (e.g. (Link 1983)). While the former require the nuclear scope predicate to hold separately of each individual in the restrictor set (21-a), the latter require it to apply to the sum of all individuals of that set (21-b):

(21) a. $[[\textit{every}]] = \lambda P_{\langle e,t\rangle}.\lambda Q_{\langle e,t\rangle}.\forall x[P(x) \rightarrow Q(x)]$ Q must hold of every P-individual
b. $[[\textit{all}]] = \lambda P_{\langle e,t\rangle}.\lambda Q_{\langle e,t\rangle}.Q(+(\{y : P(y)\}))$ Q must hold of the sum of all P-individuals

Combining the meaning for *every* with the singular noun denotation thus gives us a distributive quantifier, (22-a), while combining the meaning for *all* with the plural noun denotation gives us a non-distributive quantifier, (22-b).

(22) a. $[[\textit{every student}]] = \lambda Q_{\langle e,t\rangle}.\forall x[\mathbf{student}(x) \rightarrow Q(x)]$
Q must hold of every atomic student
b. $[[\textit{all student}\text{-}\textsc{pl}]] = \lambda Q_{\langle e,t\rangle}.Q(+(\{y :{}^{*}\,\mathbf{student}(y)\}))$
Q must hold of the sum of all atomic and plural student-individuals $\equiv$ Q must hold of the sum of all students

So far, so good. However, note that under these standard assumptions, there is no semantic reason to expect a complementary distribution based on number, as the two cross-linguistically unattested combinations – [+dist] + $\mathrm{NP_{pl}}$ and [−dist] + $\mathrm{NP_{sg}}$ – are also interpretable.

First consider the unattested case [−dist] + $\mathrm{NP_{sg}}$: (23) shows that there is no reason to expect this pattern to be absent, as the result of combining $[[\textit{all}]]$ from (21-b) with a singular noun denotation should yield exactly the same meaning as combing it with a plural noun denotation.

[13] Competing proposals assume that the denotations of plural nouns contain no atomic individuals (see e.g. Farkas & de Swart 2010, Bale & Khanjian 2014). The choice between the two types of theories is irrelevant for our point here.

(23) $[[all\ student\text{-SG}]] = \lambda Q_{\langle e,t\rangle}.Q(\bigoplus(\{y : \textbf{student}(y)\}))$
Q must hold of the sum of all students

For the combination [+dist] + NP_{pl}, the combination of the standard assumptions for number on nouns and those for universal quantifiers (i.e. (21-a)) yields the meaning in (24). Again, there is no reason why this meaning should be blocked.[14]

(24) $[[every\ student\text{-PL}]] = \lambda Q_{\langle e,t\rangle}.\forall x[{}^{*}\textbf{student}(x) \rightarrow Q(x)]$
Q must hold of every atomic student and every plurality of students

One option to account for the observed correlation between interpretation and the morpho-syntactic number of the complement, while maintaining the gist of the standard assumptions, would be to slightly change the lexical meanings of *all* and *every* so that they semantically select a complement with a certain semantic number. However, this is not only stipulative, but also requires the assumption that in 1-form languages we are dealing with lexical ambiguity. Accordingly, we propose a novel syntax and semantics for universal quantifiers that derives the correlation between number and interpretation. Our approach treats 1-form languages like Dagara, Moore, Gourmantchema, Wolof and Syrian Arabic as the default case, rather than requiring special assumptions for such languages.

4 Proposal (preliminary version)

We suggest that the existence of 1-form languages, i.e. languages with a single universal quantifier that receives a [+dist] interpretation if the complement is singular and a [−dist] interpretation if the complement is plural, motivates a single underlying meaning for universal quantification whose interpretation is determined by the semantics of the complement:

(25) **Single Quantifier Meaning Hypothesis**
There is only one meaning for universal quantification ($\mathbf{Q}_{\forall}$).
When $\mathbf{Q}_{\forall}$ combines with a semantically singular (≈ quantized) predicate, the result is distributive quantification. [+DIST]
When $\mathbf{Q}_{\forall}$ combines with a semantically plural (≈ cumulative) predicate, the result is non-distributive quantification/plural predication. [-DIST]

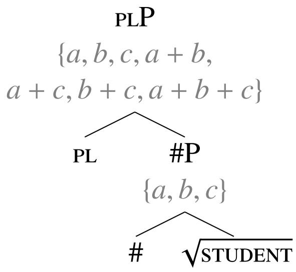
As a first step towards specifying $\mathbf{Q}_{\forall}$, let us consider the syntactic and semantic differences between singular and plural nouns. On the syntactic side, we take the singular to be less marked, in the sense of requiring less structure. For concreteness, we assume that all count nouns come with a projection of a feature # (26), and plural count nouns contain an additional head PL on top of # (27). We take the extension of the #P to always consists of atomic individuals only, but remain neutral on how exactly this comes about (e.g. whether # has substantial semantic content that could be related to the semantics of classifiers). Note that our general proposal does not hinge on this assumption that there is a syntactic containment relation between singular and plural; i.e. it is also compatible with analyzing languages where such a containment is not visible (such as Dagara) as suggested by the surface structure.

(26) *student*

#P
$\{a, b, c\}$
\# $\sqrt{\text{STUDENT}}$

[14] To our knowledge, this meaning is unattested in natural languages. It is unclear why, since it would in principle give rise to non-trivial truth conditions. See Link (1987) for related discussion.

(27) *students*



However, the extensions of singular and plural nouns differ in their algebraic structure. Consider the definition of maximality in (28), according to which an element x is maximal in a set S only if S does not include an element of which x is a proper part. Given this definition, singular noun denotations consist exclusively of maximal elements, while plural noun denotations have a single maximal element:

(28) For any set S, x is maximal in S iff $x \in S \wedge \neg\exists y \in S[x \sqsubset y]$

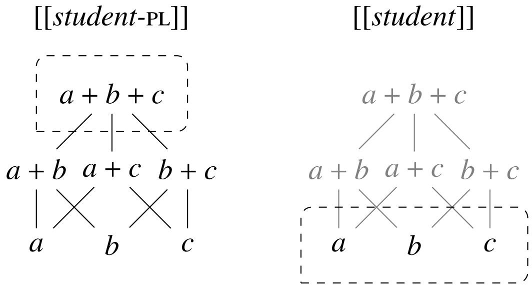


Figure 2: Maximal elements of plural and singular noun extensions

Exploiting this structural difference between singular and plural noun denotations, we assume that the morpheme $Q_\forall$ – the object language correlate of $\mathbf{Q}_\forall$ in (25) – has the denotation in (29)[15]: $[[Q_\forall]]$ (i.e., $\mathbf{Q}_\forall$) applies its scope argument to every maximal element of the noun denotation. ((29) will be revised slightly below, but the basic intuition will be preserved.)

(29) (to be revised)
$[[Q_\forall]] = \mathbf{Q}_\forall = \lambda P_{\langle a,t\rangle}.\lambda Q_{\langle a,t\rangle}.\forall x[[P(x) \wedge \neg\exists y[P(y) \wedge x \sqsubset y]] \rightarrow Q(x)]$

Combining $\mathbf{Q}_\forall$ with singular and plural noun denotations immediately derives the DNG: When $\mathbf{Q}_\forall$ combines with a plural noun denotation as in (30-a), its requirement that the scope property must hold of every maximal element in the restriction will yield non-distributivity – the only maximal element in [[*student*-PL]] is the plurality of all students and the scope property will thus have to hold of this plurality. This gives us the attested pattern [−dist] + $\mathrm{NP_{pl}}$. When $\mathbf{Q}_\forall$ combines with a singular noun denotation as in (30-a), the same requirement will yield distributivity – all the atomic individuals in [[*student*]] are maximal, hence the scope property will have to hold of each of them separately. This, in turn, yields the attested pattern [+dist] + $\mathrm{NP_{sg}}$. Crucially, the two unattested patterns [−dist] + $\mathrm{NP_{sg}}$ and [+dist] + $\mathrm{NP_{pl}}$ are not derivable within the current proposal.

(30) a. $[[Q_\forall\ \textit{student}\text{-PL}]] = \lambda Q_{\langle e,t\rangle}.Q(a + b + c)$
b. $[[Q_\forall\ \textit{student}]] = \lambda Q_{\langle e,t\rangle}.Q(a) \wedge Q(b) \wedge Q(c)$

[15]This is to say that $\mathbf{Q}_\forall$ can be spelled out as in (29).

5 Mapping the semantic proposal to morphology

The proposal directly accounts for the uniform realization of [+dist] and [−dist] UQs in 1-form languages such as Dagara. But given the uniform meaning $\mathbf{Q}_\forall$, how do we derive 2-form languages like German or English?

Intuitively, it seems plausible to correlate the formal variation in the UQs with a difference in the morpho-syntactic number of the complement. But matters will turn out to be more complicated, involving an asymmetry in terms of the morpho-syntactic complexity of the UQs in question. In order to capture these facts, we will formulate our morphosyntactic proposal within a realizational framework where vocabulary items can spell out a 'span' of several heads in a functional sequence (see e.g. Blix 2021 for the notion of a span, Caha 2020, 2018 for the concept of complex spell-out more generally).

We will introduce the proposal in two steps. We first explore the idea that the UQ forms in 2-form languages are portmanteaus of $Q_\forall$ and morphosyntactic number. While this works for English, it fails to predict several cross-linguistically common properties of [+dist] and [−dist] UQs, most notably the tendency for [+dist] UQs to be internally complex and contain parts formally identical to the numeral 'one'. We then address these problems by positing an additional syntactic head ONE in [+dist] UQs, which is independently restricted to co-occurring with singular NP complements. We suggest that the spell-out of $Q_\forall$ is sensitive to the presence or absence of ONE and thus depends only indirectly on number.

5.1 Step 1: Realization determined by number agreement

Some UQs in 2-form languages show number agreement with the complement NP or DP. In line with the DNG, this agreement is singular in [+dist] UQs and plural for [−dist] UQs, as illustrated for German, (31), and Hindi, (32).[16]

(31) German

a. *jed-**es*** *Buch*
UQ-NOM.SG.NEUT book(SG)
'every book'

b. *all-**e*** *Büch-er*
UQ-NOM.PL book-PL
'all the books'

(32) Hindi (Mahajan 2017:398)

a. *praty-ek akhbaar*
UQ-one newspaper
'each newspaper'

b. *saar-**ii*** *akhbaar-ē*
UQ-FEM.PL newspaper-PL
'all newspapers'

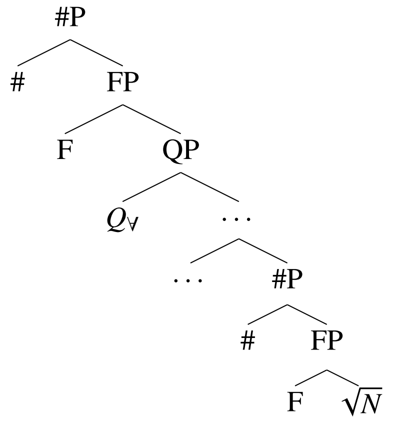
Following the idea that a universal underlying syntactic structure should be the null hypothesis (Matthewson 2001), we now make a first attempt at deriving the surface patterns of 1-form and 2-form languages from a uniform underlying syntax. We will then see that the idea of directly exploiting number agreement for this purpose encounters several problems, which will lead us to posit a more complex underly-

[16] Hindi has other UQ strategies besides the two mentioned in (32). We do not attempt to account for all of them here, since it is unclear from the description in Mahajan (2017) whether there are differences in meaning between the various [+dist] strategies, or between the various [−dist] strategies.

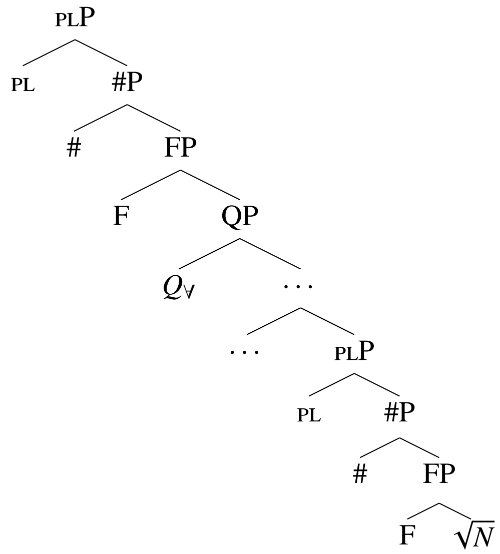
ing structure for [+dist] UQs.

We employ a morphosyntactic framework in which the morphology ‘interprets’ the output of syntactic derivations rather than feeding them, and a single phonological form can serve as the realization of a complex substructure containing more than one syntactic head. Within theories of this kind, it is usually assumed that every syntactic feature corresponds to a separate head, hence it is no longer obvious how to implement the notion of feature agreement. We sidestep this issue by assuming the trees in (33), where the functional subsequence corresponding to the ϕ-features of the complement NP/DP is repeated at the level of the quantifier. We leave the question of how this structure is derived is left open and also remain neutral on whether the higher ϕ-feature layer is semantically interpreted.[17] We assume that any relevant ϕ-features other than number are encoded as functional heads appearing below #. Since the exact representation of these features does not matter for our proposal, we will represent them as a single head F.

(33) [+dist] structure (to be revised)



(34) [−dist] structure (to be revised)



The idea behind our first analysis attempt (to be revised substantially in Section 5.3) is the following: In 1-form languages, a single underspecified lexical entry jointly spells out $Q_\forall$ and number and can be inserted in both (33) and (34). But in 2-form languages, the [+dist] form is the realization of a complex span consisting of $Q_\forall$ and #, while the [−dist] form must be selected to realize a complex span that additionally contains PL.

Within the realizational morphology literature, vocabulary items spelling out complex chunks of structure are standardly used in Nanosyntax (Starke 2009) and related frameworks (see e.g. Caha 2020, 2018, Blix 2021 for introductory treatments, Baunaz et al. 2018 for technical issues relating to phrasal spell-out), although the idea has also been explored within Distributed Morphology (see especially Radkevich 2010, Bobaljik 2012). Here we will adopt some ideas from the Nanosyntax literature without committing to all the standard assumptions of that framework. Specifically, we do not commit to the assumption that the spell-out algorithm triggers movement, or last-resort insertion of additional features (cf. Caha et al. 2019) in order to create constituents exactly matching the complex syntactic objects stored in the lexicon. We therefore adopt the proposal by Blix (2021) that permits vocabulary items spelling out non-constituents in a highly restricted set of cases. The basic assumption in Blix (2021) is that a vocabulary item must realize a **span** of syntactic heads:

(35) A **span** is a finite sequence of syntactic heads $\langle X_n, \ldots, X_1 \rangle$ such that, for $1 \leq i < n$, the maximal

[17] For discussion, see Sauerland (2003). However, it is crucial for us that unlike in Sauerland’s system, number on the complement of the quantifier has its standard semantic contribution rather than being a mere reflex of agreement.

projection headed by X_i is the complement of X_{i+1}. (adapted from Blix 2021)

Following Blix, we write $[X_n\ [X_{n-1} \cdots\ [X_1]]]$ for the span $\langle X_n, \ldots, X_1\rangle$, without assuming that this span must form a constituent (i.e. X_1 could potentially select another functional projection whose head does not belong to the span).

Unlike in Distributed Morphology, where a vocabulary item must have a subset of the features of the head at which it is inserted, Nanosyntax assumes that vocabulary insertion is governed by a **Superset Principle**: A vocabulary item must have all the features of the chunk of structure it spells out. This permits the insertion of vocabulary items that have superfluous features, but not insertion of a vocabulary item that lacks a feature present in the syntactic span it is supposed to realize. For concreteness, consider the following condition on matching between a vocabulary item and a syntactic span:

(36) A vocabulary item that lexicalizes a span $\langle X_n, \ldots X_1\rangle$ matches a syntactic span S iff there is a $m \leq n$ such that $S = \langle X_m, \ldots X_1\rangle$. (adapted from Blix 2021)

The choice between multiple matching vocabulary items is assumed to be regulated by a version of the Elsewhere Condition that favors vocabulary items with fewer unnecessary features.

With this background, we return to the contrast between languages like English and languages like Dagara. For now, we assume the following vocabulary items for English:

(37) English (to be revised)
   a. $[\#[F[Q_\forall]]] \leftrightarrow$ *every*
   b. $[\textsc{pl}[\#[F[Q_\forall]]]] \leftrightarrow$ *all*

Consider first the tree in (33), under the assumption that the complement of $Q_\forall$ has already been spelled out. The two vocabulary items in (37) both match the span from $Q_\forall$ to #, but due to the Elsewhere Condition, we must insert (37-a), which lacks the unnecessary PL feature of (37-b). Therefore, $Q_\forall$ and its ϕ-feature agreement are jointly realized as *every*. In contrast, in (34), only (36-b) is a possible match that realizes all the features from $Q_\forall$ upwards, so we must insert *all*.

For 1-form languages like Dagara, we could assume a single vocabulary item spelling out the entire sequence, as in (38). This will match both the singular structure in (33) and the plural structure in (34). Unlike in English, there is no better competitor in the singular case, so the quantifier is realized as *'hà* in both structures.

(38) Dagara
   $[\textsc{pl}[\#[F[Q_\forall]]]] \leftrightarrow$ *'hà*

This simple proposal illustrates that it is possible to account for the difference between 1-form and 2-form languages purely in terms of post-syntactic spell-out. However, the proposal in its current form makes several wrong predictions, which we turn to now in order to motivate a more fine-grained underlying syntax for UQs.

5.2 Some problems

In (37), we assumed that the English UQ forms are a joint realization of $Q_\forall$ and number agreement. Three observations make this proposal look questionable.

Problem 1: [+dist] UQs derived from [−dist] UQs The current proposal fails to account for the fact that UQ forms in 2-form languages may be internally complex. This is already illustrated by the number agreement found in German (31) and Hindi (32); however, there is another form of internally complex UQ, illustrated in Table 3.

	[−dist]	[+dist]
Q'anjobal	*masanil*	*ju-jun*
	UQ1	one-one
Hindi	*saar-ii/saar-e*	*praty-ek*
	UQ1-PL	UQ2-one
Western Armenian	*amen*	*amen meg*
	UQ	UQ-one
Georgian	*q'vela*	*q'ovelma*
	UQ1	UQ2

Table 3: [+dist] morpho-syntactically more complex

What stands out in Table 3 is that [+dist] forms often seem to involve the numeral 'one'. Crucially, some languages like Persian and Western Armenian even exhibit a transparent morphosyntactic containment relation in which the [+dist] UQ form consists of the [−dist] form plus a morpheme formally equivalent to the numeral 'one'. This is illustrated for Western Armenian in (39) and (40).[18]

(39) Western Armenian (Khanjian 2012)

a. *amen aʃagerd-ner-ə*
UQ student-PL-DEF
'all students' [−dist]

b. *amen meg aʃagerd*
UQ one student
'every student' [+dist]

(40) Western Armenian

a. *Amen aʃagerd-ner-ə dun katsin*
UQ student-PL-DEF home go.PAST.3PL
'All (of the) students went home.' (Khanjian 2012:864, (111))

b. *Amen meg aʃagerd kənutjan vra darper hartsum mə badasχan-ets*
UQ one student exam.GEN on different question INDEF answer-PAST.3SG
'Each student answered a different question on the exam.' (Khanjian 2012:867, (124))

Such data suggest that the underlying syntactic structure of [+dist] UQs should involve an element related to the numeral 'one' that is absent in [−dist] UQs. Introducing an extra element in in [+dist] structures would also fit well with less transparent cases like Georgian: Gil (1995) suggests that the Georgian [+dist] form *q'ovelma* is derived from the [−dist] form *q'vela*, although not via a synchronically productive process.

On our current proposal, the features of [+dist] UQ forms are a proper subset of those present in [−dist] UQs, so that there is no way for a [+dist] marker to be transparently derived from a [−dist] marker.

Problem 2: Overt number agreement We accounted for the *every/all* distinction in English by as-

[18] According to Khanjian (2012), Western Armenian also permits *amen* without the numeral *meg* as a [+dist] UQ. We will not analyze these uses here since it is not clear from the description whether adding *meg* makes a semantic difference.

suming that the quantifiers are portmanteau realizations of $Q_\forall$ and number. But this cannot work for languages like German (41) and Hindi, where the [+dist] and [−dist] UQ exponents co-occur with overt number agreement. The problem is that, if we assigned separate lexical entries to the agreement markers as in (42), our current account of the *jed-/all-* allomorphy would disappear: The vocabulary item for $Q_\forall$ would no longer contain any of the number features, resulting in an unattested pattern that resembles 1-form languages except for an extra agreement marker, as illustrated in (43). At the same time, it would be implausible to lump together $Q_\forall$ and number agreement in a single vocabulary item: The agreement markers in the German examples (41) and (42) are also found in the inflectional paradigms of non-quantificational adjectives. An analysis with a single vocabulary item for $Q_\forall$ and number agreement would treat this as a coincidence.

(41) German

a. *jed-**es*** *Buch*
UQ-NOM.SG.NEUT book(SG)
'every book'

b. *all-**e*** *Büch-er*
UQ-NOM.PL book-PL
'all the books'

(42) a. [# [F]] ↔ *-es*

b. [PL [# [F]]] ↔ *-e*

(43) a. In case we introduce [$Q_\forall$] ↔ *jed-*:
jed-es Buch, **jed-e Bücher*

b. In case we introduce [$Q_\forall$] ↔ *all-*:
**all-es Buch*, *all-e Bücher*

It is worth noting that the two kinds of internal structure in UQs can co-occur within a language. For instance, Hindi has both [−dist] quantifiers with plural agreement and [+dist] quantifiers containing the numeral 'one' (Mahajan 2017).

Problem 3: 'whole' meanings with singular complements Our current analysis also faces an empirical problem that is independent of the internal morphosyntax of UQs. Some languages have structures in which a [−dist] UQ form co-occurs with a singular complement, but which do not have a standard UQ semantics. These structures seem to refer to a single atomic individual, with the UQ form contributing a maximality effect that can be paraphrased by adding 'whole'. This is exemplified for Wolof in (44) (when used prenominally, exactly the same UQ form would yield a standard distributive universal quantifier interpretation). Similarly, in Hindi, the [−dist] UQ form *saar-* seems to contribute the meaning of 'whole' when it combines with a singular complement and takes singular agreement (45).

(44) Wolof

a. *jàng-na-a* *téére b-épp*
read-FIN-1SG book CL.SG-UQ
'I read the whole book' (Wolof, Tamba et al. 2012:917, (73))

(45) Wolof

a. *saar-aa* *šahar*
UQ-SG.MASC town
'the entire town' (Hindi, Mahajan 2017:399, (85))

On our general approach, the difference between these structures and standard [+dist] UQs with a singular complement must be syntactic rather than lexical. Two observations provide a clue to the relevant syntactic distinction: First, in several languages, the UQs permitting a 'whole' reading obligatorily select for a DP rather than NP complement, as illustrated for Modern Greek in (46). Second, in our sample, $Q_\forall$ elements combining with a singular DP complement always yield a 'whole' reading, never a distributive-quantifier reading.

(46) Modern Greek (Giannakidou 2012:307f.)

a. *óli* *#(tin)* *túrta*
UQ.ACC.FEM the.FEM.ACC cake
'the whole cake'

b. *óli* *#(i)* *fitités*
UQ.PL the.PL students
'all the students'

We therefore speculate that these 'whole' structures result from combining $Q_\forall$ with a singular DP rather than a singular NP, so the relevant functional sequence looks as in (47). (We abstract away from the possibility of D agreeing in number with the noun, which would give rise to a third ϕ-feature layer.) As the Hindi and Wolof examples above show, the D element in such structures does not have to be realized overtly.[19]

(47) [# [F [$Q_\forall$ [D [# [F $\sqrt{N}$]]]]]

One advantage of this hypothesis is that it helps us make sense of the semantics of the construction: If the singular DP picks out the unique atomic individual in the NP domain, the semantic contribution of $Q_\forall$ could be to ensure that all parts of this individual must be taken into account when evaluating the predicate. In Section 6.2 below, we will show that our semantics for $Q_\forall$ straightforwardly extends to derive this result, and also accounts for the lack of distributivity in such constructions.

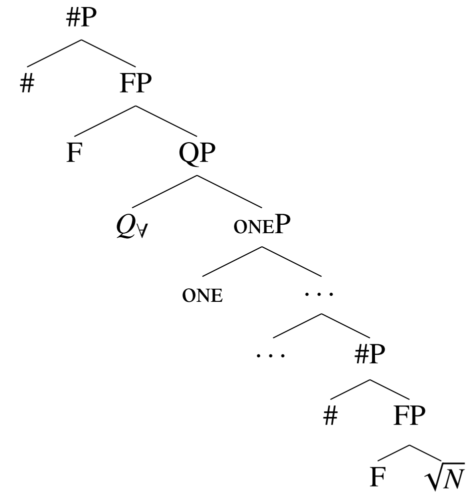
We omit more detailed empirical investigation of the syntax of this construction. For now, the important point is that the co-occurrence of [−dist] forms with singular complements in this construction poses a problem for any direct interpretation of the DNG in terms of number agreement. While the [+dist] forms are obligatory if the complement is a singular NP, they should not be thought of as a direct consequence of singular number, since DPs with the same number features are systematically treated differently.

5.3 Step 2: distributive quantification structurally complex

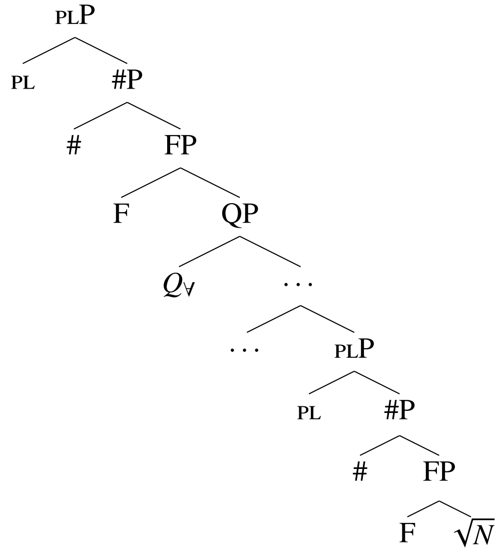
We suggest that the key to addressing these problems is to take the occurrence of the numeral 'one' in [+dist] UQs as indicative of an additional structural element. As a first stab at an implementation, we posit a functional element ONE right below $Q_\forall$, which has a semantics closely related to the numeral 'one' and which is not present in the structure corresponding to [−dist] UQs. This assumption is illustrated in (48) (the structure for [−dist] UQs in (49) is the same as before).

(48) [+dist] structure (to be revised)

[19] However, it is suggestive that the postnominal position of the quantifier in Wolof is the same as with plural DP complements.



(49) [−dist] structure (to be revised)



To be able to derive the DNG from these structures, we need two restrictions on the syntactic distribution of ONE: (i) ONE must occur whenever $Q_\forall$ combines with a singular NP, and (ii) ONE is blocked from co-occurring with plural complements and singular DP complements.

We speculate that restriction (i) is an instance of a broader pattern where heads impose a restriction on the minimum size of the functional sequence of their complement: at least in 2-form languages (but possibly universally), $Q_\forall$ is restricted from merging with a complement as small as a #P. This restriction can be circumvented by making the complement plural as in (56) or making the complement a DP, but given our semantics, neither option results in a [+dist] UQ interpretation: A plural complement yields a [−dist] UQ and a DP complement yields a 'whole' meaning. Inserting ONE, we claim, is the only way of meeting the restriction that gives rise to a [+dist] semantics.

While this amounts to a purely syntactic stipulation, restriction (ii) can be accounted for in the semantics. We assume that the semantic contribution of ONE is to presuppose that the extension of its complement only contains atomic individuals. While (50) is not identical to the standard, intersective lexical entry for the numeral *one* in that atomicity is presupposed rather than asserted, it seems close enough for there to be an obvious grammaticalization path from the intersective to the presuppositional meaning.[20]

(50) $[\![\text{ONE}]\!] = \lambda P_{\langle e,t\rangle} : \forall x \in P[x \in AT].P$

To see why it is impossible to combine ONE with a plural complement, consider the trees in (51) and (52). In (51), the complement of ONE is a #P, which we assumed must denote a set of atomic individuals, so that its presupposition is met. But as shown in (52), the PL head below ONE guarantees the presence of plural individuals in the extension, so that the presupposition of ONE is violated whenever PL is present.[21]

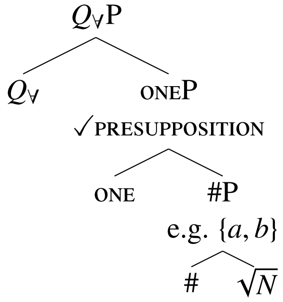
[20]The standard intersective entry for the numeral *one* is given in (i):

(i) $[\![one]\!] = \lambda P_{\langle e,t\rangle}.\lambda x.x \in AT \wedge P(x)$

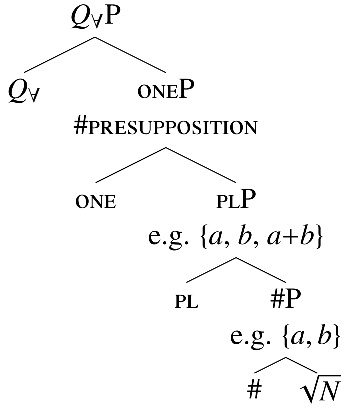
The difference is that ONE presupposes the atomicity constraint, rather than removing the non-atomic individuals from the extension. One might try to unify ONE and the numeral *one* by claiming that *one* is semantically unlike other numerals, but the proposal in the main text, on which there is no synchronic derivational relation between the two, strikes us as less problematic.

[21]Strictly speaking, the extension of the #P could be a singleton set, in which case nothing would go wrong with the presupposition of ONE. Yet, quantifiers generally give rise to the inference that their domain is not a singleton, so we suspect that this situation is blocked by an independent aspect of the meaning of $Q_\forall$ not modeled in our semantic analysis.

(51) *every student*



(52) **every students*



The co-occurrence of ONE with a plural DP can be blocked along the same lines: In Section 6 we will discuss a semantics for definite singular and plural DPs that will allow them to combine with $Q_\forall$. This semantics will have the property that a definite plural DP denotes a set of individuals that always contains some non-atomic individuals, and therefore predicts that any structure in which ONE merges with a plural DP gives rise to a presupposition failure.

But why do we not find [+dist] forms with a singular DP complement? We suggest that, since ONE is not syntactically required in this configuration, the structure with ONE competes with a simpler alternative without ONE. Further, given that a definite singular DP never contributes a plural individual, the structures with and without ONE are guaranteed to be semantically equivalent, since the presupposition of ONE is guaranteed to be met in both cases. In such cases of competition between two semantically equivalent structures, the use of the 'unnecessarily complex' structure is arguably pragmatically blocked (see e.g. Meyer 2014, Katzir & Singh 2015, Solt 2018 for pragmatic constraints on 'needless complexity').

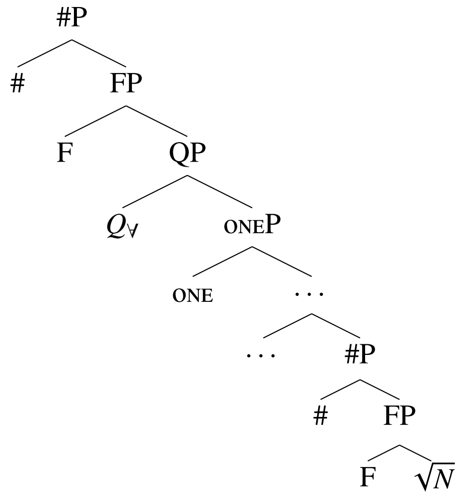
In sum, we have stipulated that ONE must be present if the complement would otherwise be a mere #P (i.e. a singular NP), and derived its absence in all other configurations from its semantics. This provides a new account of the different realizations of $Q_\forall$ in 2-form languages: The [+dist] forms realize both $Q_\forall$ and ONE, while the [−dist] forms are the realizations of $Q_\forall$ selected in the absence of ONE. This idea avoids the three problems set out in the previous section: 1) the observation that [+dist] forms are often morphologically complex and tend to contain the numeral ONE is naturally accounted for; 2) the co-occurrence of the 2-form pattern with number agreement is no longer problematic since our account of the allomorphy of $Q_\forall$ now relies on ONE rather than number agreement; and 3) the co-occurrence of $Q_\forall$ with the singular in structures with a 'whole' interpretation follows from the pragmatically motivated absence of ONE in this configuration.

We now turn to the consequences of our new structural proposal for the postsyntactic vocabularies of different 1-form and 2-form languages.

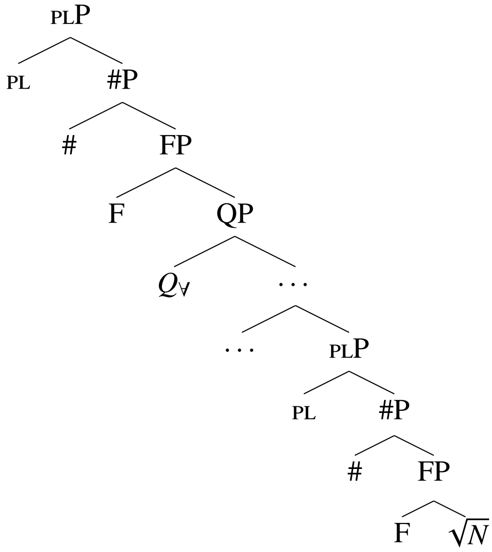
5.4 Deriving the surface patterns

The underlying syntactic structures we assume for [+dist] and [−dist] UQs are repeated in (53):

(53) [+dist] structure

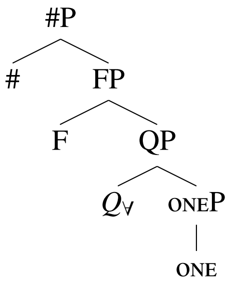


(54) [−dist] structure

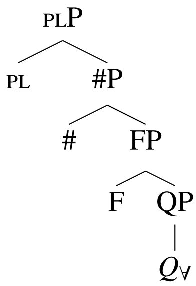


We assume that the complement of ONEP in the singular case, and $Q_\forall P$ in the plural case, is opaque to the spell-out mechanism—either because it has already received its final realization or because it has undergone movement to create a PF constituent corresponding to the UQ. We remain neutral about the choice between these options and assume merely that the spell-out mechanism is faced with the following two structures:

(55) [+dist] structure after spell-out of the complement



(56) [−dist] structure after spell-out of the complement



We start with 1-form languages like Dagara, where there is no morphological evidence for the presence of the head ONE. In principle, we could assume that the syntactic restriction that requires the insertion of ONE is absent in such languages. But we could also take ONE to have a null realization, which would permit keeping the uniform structure in (56) for both 1-form and 2-form languages. The relevant part of the lexicon of Dagara would then be as in (57-b,c). Recall that due to the Superset Principle (57-b) is able to match the span from $Q_\forall$ upwards in (55) although there is no PL-feature in this tree.

(57) Dagara

a. [−dist]: *'hà*, [+dist]: *'hà*

b. [PL[#[F[$Q_\forall$]]]] $\leftrightarrow$ *'hà*

c. ONE $\leftrightarrow$ $\emptyset$

Given (57), we might expect to find languages that have the same pattern except that the phonological realization of ONE is overt. This case is represented by Western Armenian, where a [+dist] UQ can be formed by combining the [−dist] form with the numeral *one*:

(58) Western Armenian

a. [−dist]: *amen*, [+dist]: *amen meg* 'UQ one'

b. [PL[#[F[$Q_\forall$]]]] ↔ *amen*

c. ONE ↔ *meg*

Returning to the English pattern, where neither of the two UQ forms is (synchronically) internally complex, we can still account for the contrast in terms of the vocabulary items in (59). Note, however, that the choice between the two UQ forms in the singular case is no longer driven by the Elsewhere Principle: Since (59-c) does not contain the feature ONE, (59-b) is now the only vocabulary item that matches the structure in (55) once the complement of ONEP has been spelled out.

(59) English

a. [−dist]: *all*, [+dist]: *every*

b. [#[F[$Q_\forall$[ONE]]]] ↔ *every*

c. [PL[#[F[$Q_\forall$]]]] ↔ *all*

Next, we turn to a case that was problematic for our previous proposal: systems in which the UQ allomorphs are distinct, but also co-occur with overt ϕ-agreement, as in German. In such languages, we can take the relevant part of the functional sequence to be divided into two spans: First, the UQ element itself, which comes out as *jed-* if ONE is present and *all-* otherwise (60-b-c), and second, the agreement marker (60-d-e). In the singular case, the agreement marker in (60-e) must be selected due to the Superset Principle; in the plural case, both vocabulary items match, but (60-d) must be selected due to the Elsewhere Principle. The vocabulary items for the agreement markers do not contain any features specific to UQs, which fits well with the observation that the same markers occur in the paradigms of non-quantificational adjectives.

(60) German

a. [−dist]: *all-e* 'UQ$_1$-PL', [+dist]: *jed-er* 'UQ$_2$-SG'

b. [$Q_\forall$[ONE]] ↔ *jed-*

c. [$Q_\forall$] ↔ *all-*

d. [PL[#[F]]] ↔ *-e*

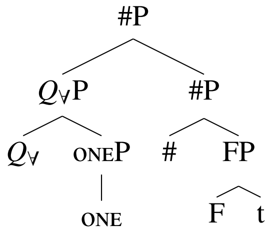
e. [#[F]] ↔ *-er*

At this point, we must say something about the fact that the agreement markers in German are suffixed to the UQ element rather than preceding it. In most of the Nanosyntax literature, this kind of word-order fact is derived via movement driven by the spell-out algorithm, which requires any span spelled out by a single vocabulary item to form a syntactic constituent. Here we merely assume that PF-movement takes place on a language-specific basis, without taking a stand on how it is triggered.[22]

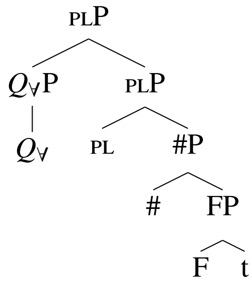
In German, this movement targets $Q_\forall$P, stranding the projections corresponding to the agreement marker, as in (61). Since the Nanosyntax literature typically assumes that traces are ignored by the spell-out algorithm, we can directly apply the lexicon in (60) to (61) and (62).

[22]See Caha et al. (2019) for an interesting way of structurally distinguishing prefixes and suffixes in terms of the syntactic operations they trigger prior to spell-out. We leave open how such proposals can be reconciled with our analysis of UQs.

(61) German [+dist] structure after movement

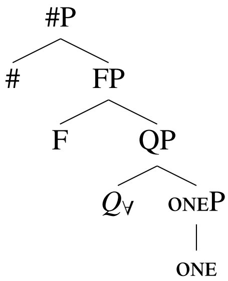


(62) German [−dist] structure after movement

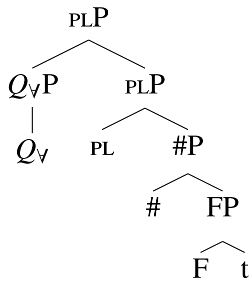


Finally, we turn to Hindi, which has both a transparent realization of ONE in some of its [+dist] UQs and and suffixal number agreement in some of its [−dist] UQs. While we now have the necessary tools to spell out both the ONE-morpheme and the agreement marker, this pattern is puzzling: The lack of number agreement in the [+dist] form suggests there is no movement of the $Q_\forall P$ in the presence of ONE, so that the structures are as in (63) and (64). This rather stipulative restriction on movement suggests that the functional sequence in (55) is probably still not all there is to the underlying morphosyntactic structure of [+dist] UQs. In this context, it seems relevant that many languages have several different [+dist] UQ forms (e.g. English *every* vs. *each*; Hindi *har ek* vs. *praty-ek*). We suspect that by further exploring this variation, one could motivate further syntactic features in the structure of [+dist] UQ phrases, which could be exploited to derive distinct linear-order patterns in [+dist] and [−dist] UQs.

(63) Hindi [+dist] structure without movement



(64) Hindi [−dist] structure after movement



(65) Hindi
  a. [−dist]: *saar-ii* 'UQ$_1$-PL', [+dist]: *praty-ek* 'UQ$_2$-one'
  b. [$Q_\forall$] ↔ *saar-*
  c. [PL[#[F]]] ↔ *ii*
  d. [ONE] ↔ *-ek*
  e. [#[F[$Q_\forall$]]] ↔ *praty-*

In summary, although there are some open issues (notably the role of movement in the derivation of constituents corresponding to the UQs), we now have a way of deriving a wide range of attested UQ paradigms from a uniform underlying syntactic structure. The proposal captures several non-trivial generalizations about the morphosyntax of UQs, including the connection between [+dist] UQs and 'one', the observation that non-quantificational uses of UQ forms with a singular complement always involve the [−dist] form and the occurrence of number agreement on UQs.

5.5 Partitives

Since we assumed that the realization of UQs in 2-form-languages is conditioned by syntactic features of their complement, the question arises why both forms are possible in partitive constructions, as exemplified for German in (66):[23]

(66) German

a. ***Jedes von den Büchern*** *hat insgesamt mehr als 300 Seiten.*
UQ of the books AUX.SG in.total more than 300 pages
'In total, each of the books has more than 300 pages.' [+dist]

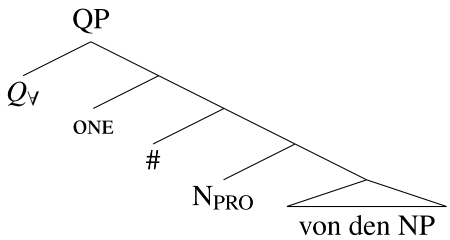
b. ***Alle von den Büchern*** *haben insgesamt mehr als 300 Seiten*
UQ of the books AUX.PL in.total more than 300 pages
'In total, all of the books have more than 300 pages.' [−dist]

These facts could be accounted for within the current proposal in two ways. First, one could assume that partitive constructions contain a silent pro-N, as independently suggested by Jackendoff (1977), Sauerland & Yatsushiro (2004). Sauerland & Yatsushiro (2004) propose that this pro-N, semantically, can either be an exact copy of $\sqrt{N}$ embedded in the partitive phrase (i.e. $\sqrt{book}$ in (66)) or a semantically bleached predicate like that expressed by *thing*. As there is no evidence to the contrary for the cases discussed here, we assume the former variant for the sake of simplicity.

Assuming such a silent pro-N, the (non-)distributivity and the spell-out of $Q_\forall$ are both predicted to be determined by its number features, and should therefore still correlate.

Building on this idea, a possible structure for a singular partitive is (67): The functional layers above $\sqrt{N}$ are as above. The presence of the # head in the covert structure licenses both the occurrence of ONE in the syntax and restricts the extension of the node dominating N_{PRO} and the partitive phrase to atomic individuals, so that ONE is semantically licensed (for expository purposes, we omit the functional structure above QP):

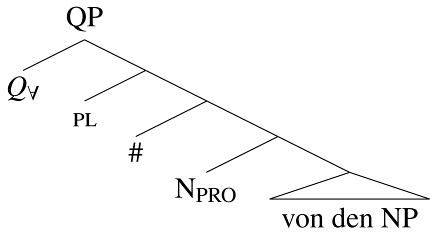
(67) *jeder von den Buben* [+dist]



In (68) on the other hand, $Q_\forall$ combines with a PLP that denotes a set of both atomic and plural individuals, and therefore ends up applying the nuclear-scope predicate to the maximal element of that set:

(68) *alle von den Buben*

[23] This problem is independent of the particular underlying syntax we assume for [+dist] UQs: the assumption that the spell-out of $Q_\forall$ is conditioned by morphosyntactic number would give rise to the same problem.



[−dist]

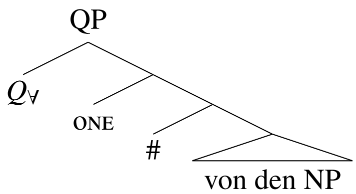
For the moment, we assume the standard semantics in (70) for the partitive marker: it takes a complement of type *e* (e.g., the definite DP *den Buben* in (68) and (67)), and returns a function that maps all and only the parts of this individual to true.[24] The result is a predicate true of both atomic and plural individuals. (However, we will revise our account of the semantics of partitives in the next section, once we have adapted the semantics of DPs to allow them to combine directly with $Q_\forall$).

(69) $[[\text{PART}]] = \lambda x_e.\lambda y_e.y \leq x$ to be revised

The predicate in (69) can then be intersected with the silent N_{PRO}. If the latter is semantically identical to $\sqrt{N}$ within the partitive phrase (i.e., $\sqrt{boy}$) in (67) and (68)) the intersection will leave the initial set provided by the partitive phrase intact (assuming that $\sqrt{N}$ is not specified for number) . Adding # on top of the resulting structure will then yield us a set of atomic individuals (atomic boy-individuals in (67) and (68)). This licenses insertion of ONE in (67); adding $Q_\forall$ gives us the sub-structure that will be spelled-out as *jed-* and a [+dist] interpretation. However, if we add PL instead of ONE, we derive the spell-out of *alle* and a [−dist] interpretation.

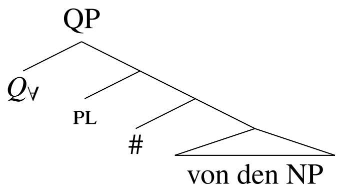
While this derives the correct results, a simpler solution is also feasible: As, to our knowledge, no data from German force us to assume a pro-N in this language[25], we could also assume that no pro-NP is present in the first place. Rather, the functional structure that we assumed on top of $\sqrt{N}$ above (for our present purposes, # and either ONE or PL are the relevant parts of this structure) is built directly on top of the partitive phrase, as in (70) and (71), respectively. The effect of # on the denotation of the partitive (a set of atomic and plural individuals) will be that we obtain a set of atomic boys. Insertion of ONE is thus both syntactically and semantically licensed in (70), yielding the form *jed* and a [+dist] interpretation. If, on the other hand, we insert PL as in (71), we obtain a set containing both atomic and plural individuals, which gives us a [−dist] interpretation and, due to the absence of ONE in the structure, the form *alle*.

(70) *jeder von den Buben*



[+dist]

(71) *alle von den Buben*



[−dist]

[24] Since PART denotes a function that takes only individuals as its complement, it directly encodes the partitive constraint (see Jackendoff 1977, Barwise & Cooper 1981 a.o.).

[25] Evidence for pro-NP – and thus the necessity to assume such an element in partitive constructions – is subject to language variation. See e.g. Sauerland & Yatsushiro (2004) for convincing evidence *for* such an element in Japanese.

6 Refining the semantics

We now address two issues that force us to refine the preliminary semantics for $Q_\forall$ proposed in section 4. The first issue is that our current version predicts an unattested meaning for $Q_\forall$ in combination with numeral-modified indefinites. The second issue concerns $Q_\forall$ in the context of plural DPs where we are a) confronted with a type-mismatch, and b) must make certain assumptions about the semantics of plural DPs to account for the maximality effects triggered by $Q_\forall$. Finally, we will briefly sketch how the account can be extended to the 'whole' reading $Q_\forall$ contributes when it combines with a singular DP.

6.1 Numeral-modified indefinites

Our current semantics for $Q_\forall$ predicts that when the complement of a UQ is modified by a numeral ≥ 2, the UQ can distribute down to the minimal pluralities meeting the size requirement of the numeral. Hence, when $Q_\forall$ combines with the denotation of *two students*, a set containing pluralities consisting of two atomic elements, the scope predicate is applied to each of these pluralities:

(72) a. $[[\textit{two students}]] = \{a + b, b + c, a + c\}$
b. $[[Q_\forall]]([[\textit{two students}]]) = \lambda Q_{\langle e,t \rangle}.Q(a + b) \wedge Q(b + c) \wedge Q(a + c)$

[[*two student*-PL]]

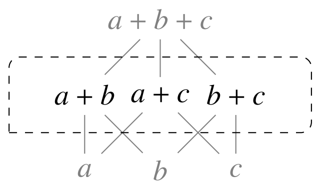


Figure 3: Maximal elements of numeral-modified plural NP extensions

In the 2-form-languages English and German, only the [−dist] form *alle/all* is grammatical when combined with numeral modified indefinites. This is expected if the structure for [+dist] form *jed-/every* obligatorily involves the element ONE, which presupposes atomicity of all the elements in the complement denotation (see (50)).[26] However, the meaning we obtain when using the [−dist] form is not the one predicted by (72-b)[27]: while (73) is grammatical, it is only acceptable if there are only two salient boys in total, i.e. (73) cannot receive the meaning in (72-b) under which the predicate is required to hold of every pair of two boys in the set. [28]

[26] However, we would expect NPs modified by the numeral *one* to occur as complements of $Q_\forall$ with a distributive interpretation, which is borne out e.g. in English:

(i) *Each / every one of the boys read a book.*

[27] We do not discuss configurations like German *Alle zwei Meter steht ein Baum* or its English correlate *Every two meters, there is a tree.*

[28] However, we do not want to claim that this generalization holds universally. In particular, Hebrew $Q_\forall$ *kol* can combine with numeral modified indefinites with a result seemingly analogous to (72-b). But it is unclear to us at whether, in such cases, the set of pluralities it quantifies over must be restricted to avoid overlap. We are therefore unsure how exactly to capture the cross-linguistic variation. (Francez & Goldring (2012) suggest Hebrew might be a 1-form language, but see Bar-Lev & Margulis (2014) for data that complicate the picture and suggest that the different uses of *kol* are better captured in terms of distinct lexical items.)

(73) German

a. *Alle zwei Buben haben sich getroffen.*
UQ two boys AUX REFL met
'Both boys met.'
#'Every plurality consisting of two boys met.'

The same holds for Dagara, (74), and Wolof, (75-a), where $Q_\forall$ with a numeral modified plural complement yields the same interpretation:

(74) Dagara

a. *A bìbììr 'hà ayi nyɛ́-n taa*
the child.PL UQ two saw-AFF each.other
'Both children met.'
#'Every plurality consisting of two children met.'

(75) Wolof

a. *ñaar i xale y-ëpp dem-na-ñu*
two PL.AGR child NCL.PL-all go-FIN-3PL
'Both children went' (Tamba et al. 2012)
#'Every plurality consisting of two children went.'

Intutively, this suggests that $\mathbf{Q}_\forall$ should not quantify over all maximal elements of the restriction: If there are several maximal elements that overlap, these overlapping elements should be excluded from the domain of $\mathbf{Q}_\forall$. We implement this requirement by revising our semantics for $Q_\forall$ as in (76). The intuition in (76) is that the predicate applies only to those elements x of its restrictor set such that x does not overlap with any other elements of the restrictor set except for those that are part of x.

(76) $[[Q_\forall]] = \mathbf{Q}_\forall = \lambda P_{\langle a,t\rangle}.\lambda Q_{\langle a,t\rangle}.\forall x[[P(x) \wedge \neg\exists y[P(y) \wedge \exists z[z \sqsubseteq x \wedge z \sqsubseteq y] \wedge y \not\sqsubseteq x]] \rightarrow Q(x)]$

Combining this updated quantifier denotation with the denotation of numeral-modified indefinites like *two students* correctly rules out the unattested meaning in (72-b): Since every maximal element in the denotation (72-a) overlaps with another maximal element, $Q_\forall$ now ends up quantifying vacuously over the empty set. For $Q_\forall$ to be able to combine with *two students* at all, the extension of *two students* must be a singleton set containing a single plurality of two students, which means there must be exactly two salient students.[29]

Having fixed the first issue by revising the semantics for $Q_\forall$, we turn to the second issue concerning $Q_\forall$ in the context of plural DPs.

6.2 Plural DPs

So far, we only discussed the behavior of $Q_\forall$ in the context of singular/plural NP complements. But $Q_\forall$ can also combine with plural DPs in many languages, yielding a [−dist] interpretation just as with plural

[29] Note that there are non-singleton sets of pluralities like (i) that meet the non-overlap condition imposed by $Q_\forall$. But crucially, these sets are not possible denotations for standard singular or plural NPs modified by a numeral (unless we add collective modifiers or assume that the domain of pluralities can be restricted arbitrarily by a contextually provided cover/partition before the quantifier is merged).

(i) $\{a + b, c + d\}$

NPs. This is for example the case in Dagara (9) or in English (77):

(77) *All the students read three books (between them).*

The pre-theoretical intuition developed in this paper correctly leads us to expect a [−dist] semantics here, since definite plural DPs are taken to pick out the unique maximal plurality in the NP-extension.

(78) a. $[\![\textit{student}]\!] = \{a, b, c\}$
b. $[\![\textsc{def}\ \textit{student}\text{-}\textsc{pl}]\!] = a + b + c$

However, when directly applying our analysis to definites, two complications arise – one is purely technical, but the other is an empirical issue.

The technical complication is that (78-b) is of the wrong type to combine with $\mathbf{Q}_\forall$, $\mathbf{Q}_\forall$ requires a type $\langle e,t\rangle$ argument. This could be fixed by assuming that plural definites are in fact of type $\langle e,t\rangle$, e.g., by letting a plural definite denote a singleton set containing the maximal plurality, (79):

(79) a. $[\![\textsc{def}\ \textit{student}\text{-}\textsc{pl}]\!] = \{a + b + c\}$
b. $[\![Q_\forall\ \textsc{def}\ \textit{student}\text{-}\textsc{pl}]\!] = \lambda P_{\langle e,t\rangle}.P(a + b + c)$

However, this raises the question of how the definite composes with the predicate in sentences without quantifiers like (80). If the definite and the predicate are both of type $\langle e,t\rangle$, this will not work.

(80) *The children are awake.*

To resolve this type issue, we take inspiration from recent work arguing that plural predicates themselves perform existential quantification over a set of pluralities contributed by the argument DP (see Chatain 2021 and Križ & Spector 2021). As Chatain (2021) shows, the idea that plural predicates have existential quantificational force is motivated independently by the exceptional narrow scope behavior of definite plurals and bare plural indefinites.

While there are different implementations of this idea, the exact choice is irrelevant for our purposes. For simplicity, we assume that the argument contributes the pluralities to be quantified over (unlike much of the literature, which takes them to be contributed by an operator attaching to the predicate; see Chatain 2021 and Križ & Spector 2021 for discussion). So in (80), *awake* quantifies existentially over a set of pluralities contributed by *the children*. Accordingly, definite DPs denote objects of type $\langle e,t\rangle$ and (plural) predicates are raised to type $\langle\langle e,t\rangle,t\rangle$.[30] Each plural predicate performs existential quantification over the set of pluralities contributed by its argument, as in (81):[31]

(81) $[\![\textit{awake}]\!]_{\langle\langle e,t\rangle,t\rangle} = \lambda Q_{\langle e,t\rangle}.\exists x_e \in Q.{}^*\mathbf{awake}(x)$
where ${}^*P$ is a predicate true of a plurality x iff there is a set of individuals that all satisfy P and whose sum is x (cf. Link 1983)

This permits definites to compose with the predicate in the absence of a quantifier, (82).[32]

[30] This hypothesis will also introduce an asymmetry between verbal predicates (projections of V) and nominal predicates (projections of N), with only the former being of type $\langle\langle e,t\rangle,t\rangle$ and requiring existential quantification. More precisely, any phrase traditionally assigned type $\langle e,t\rangle$ that takes the denotations of definite DPs as its argument, is now assigned type $\langle\langle e,t\rangle,t\rangle$.

[31] Such a high type for plural definites and plural predicates is also assumed by Bennett 1974, Van der Does 1992, Winter 2001, but their motivation for assuming that is different from ours.

[32] The proposal has the additional advantage of deriving an existential semantics for bare plurals without having to posit a

(82) $[\![\textit{child}]\!] = \{a, b, c\}$
$[\![\textit{The children are awake}]\!] = [\lambda Q_{\langle e,t\rangle}.\exists x_e \in Q.{}^*\mathbf{awake}(x)](\{a + b + c\})$
$= 1$ iff ${}^*\mathbf{awake}(a + b + c)$

Since verbal plural predicates like *awake* are now of type $\langle\langle e, t\rangle, t\rangle$, we must adjust the type of the second argument of $\mathbf{Q}_\forall$. For each x among the non-overlapping maximal individuals picked out by $\mathbf{Q}_\forall$, $\mathbf{Q}_\forall$ requires the nuclear scope predicate to apply to the singleton set $\{x\}$, so that its existential force is trivialized:

(83) $[\![Q_\forall]\!] = \lambda P_{\langle a,t\rangle}.\lambda Q_{\langle\langle a,t\rangle,t\rangle}.\forall x[[P(x) \wedge \neg\exists y[P(y) \wedge \exists z[z \sqsubseteq x \wedge z \sqsubseteq y] \wedge y \not\sqsubseteq x]] \rightarrow Q(\{x\})]$

This predicts the same truth conditions as before for *All the children are awake*:

(84) a. $[\![\textit{the children}]\!] = \{a + b + c\}$
b. $[\![\textit{all the children}]\!]$
$= [\lambda P_{\langle a,t\rangle}.\lambda Q_{\langle\langle a,t\rangle,t\rangle}.\forall x[[P(x) \wedge \neg\exists y[P(y) \wedge \exists z[z \sqsubseteq x \wedge z \sqsubseteq y] \wedge y \not\sqsubseteq x]] \rightarrow Q(\{x\})]](\{a+b+c\})$
$= \lambda Q_{\langle\langle a,t\rangle,t\rangle}.Q(\{a + b + c\})$
c. $[\![\textit{all the children are awake}]\!] = {}^*\mathbf{awake}(a + b + c)$

While these adjustments solve the problem of letting $Q_\forall$ combine with both NPs and definite DPs without a type mismatch, an empirical problem remains: The account predicts *The children are awake* and *All the children are awake* to be equivalent and therefore fails to capture the **non-maximal construals** available for definites in some languages (Brisson (1998), Malamud (2012), Križ (2015) a.m.o.).

Non-maximality is the property of plural definites by virtue of which they do not always require the predicate to hold of the maximal plurality contributed by the DP. This is the case if it is irrelevant for the discourse goals whether the predicate is satisfied by the maximal plurality or a smaller one. For instance, in scenario (85), what matters for the QUD is whether *any* of the children are still awake. Here (85-a) gets an existential interpretation, while this is no longer possible if we add $Q_\forall$:

(85) CONTEXT: A and B are trying to get their four children to sleep. Unfortunately, after an hour two of them are still awake.
a. ✓A: *The children are still awake.*
b. #A: *All the children are still awake.*

Thus, we must explain the fact that definite plurals permit non-maximal construals and $Q_\forall$ blocks them. We follow Križ & Spector (2021) in assuming that non-maximal construals involve existential quantification over a contextually provided upward-closed subset of the plural NP extension. 'Upward-closed' here means that if some plurality x in the NP-extension is in the subset, so are all the bigger pluralities that contain x. Unlike Križ & Spector (2021) and most other work in this vein, we assume that definite plurals directly denote such upward-closed sets. The exact choice of the set is determined by a contextual parameter $\preceq$, a 'similarity relation' between individuals that has to satisfy the following constraints (cf. Burnett 2017 for the intuition that context-dependent notions of similarity can be modeled by convex relations):

---

covert existential determiner, (i) (where $[\![\textit{child}]\!] = \{a, b, c\}$):

(i) $[\![\textit{children are awake}]\!] = [\lambda Q_{\langle e,t\rangle}.\exists x_e \in Q.{}^*\mathbf{awake}(x)](\{a, b, c, a + b, a + c, b + c, a + b + c\})$
$= 1$ iff $\exists x_e \in \{a, b, c, a + b, a + c, b + c, a + b + c\}.{}^*\mathbf{awake}(x)$

(86) a. $\preceq$ is reflexive: $\forall x.x \preceq x$
b. $\preceq$ is constrained by parthood: $\forall x, y.x \preceq y \rightarrow x \sqsubseteq y$
c. convexity constraint: $\forall x, y, z.x \preceq z \wedge x \sqsubseteq y \sqsubseteq z \rightarrow y \preceq z$

[[*the student*-PL]]$^{\preceq}$

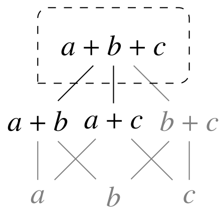


Figure 4: Maximal elements of numeral-modified plural NP extensions

An example of a definite DP denotation relative to this parameter is given in (87-b). Note that if $\preceq$ is the identity relation, the set in (87-a) will only contain the maximal individual in P, resulting in a maximal reading.

(87) a. $[[\text{DEF}]]^{\preceq} = \lambda P_{\langle e,t\rangle}.\{x \mid x \preceq \iota y[P(y) \wedge \forall z[P(z) \rightarrow z \sqsubseteq y]]\}$
b. $[[\text{DEF PL } \textit{child}]]^{\preceq} = \{a + b + c, a + b, a + c\}$

Given the definite plural denotation in (87-b), the truth conditions of *The children are awake* are now weaker: they merely require at least one of the pluralities in (87-b) to satisfy the predicate ***awake**.

(88) $[[\textit{The children are awake}]]^{\preceq} = [\lambda Q_{\langle e,t\rangle}.\exists x_e \in Q.^*\mathbf{awake}(x)](\{a + b + c, a + b, a + c\})$
$= 1$ iff $^*\mathbf{awake}(a + b + c) \vee {}^*\mathbf{awake}(a + b) \vee {}^*\mathbf{awake}(a + c)$

Importantly, this weaker semantics for definite plurals will not affect our predictions about constructions in which $Q_\forall$ combines with a DP. This is because, if we assume following Križ & Spector (2021) that a definite plural always has to denote an upward-closed subset of the NP extension, this subset must contain the maximal plurality. $\mathbf{Q}_\forall$ then ensures that its nuclear scope predicate is applied to the singleton set containing this maximal plurality, giving rise to a maximal reading. Thus, even given the denotation in (87-b) for the definite, the *all*-QP will have the semantic contribution in (89):

(89) $[[\textit{all the children}]]^{\preceq} = [[Q_\forall \text{ DEF PL } \textit{child}]]^{\preceq} = \lambda P_{\langle e,t\rangle}.P(\{a + b + c\})$

So our proposal correctly predicts that $Q_\forall$ blocks non-maximality.

Having raised the type of definite plurals, we also must adjust the type of the partitive operator PART, which combines with a definite plural as well. The phrase headed by the definite determiner DEF in a structure like (90) now has type $\langle e, t\rangle$, so PART must be permitted to take a type $\langle e, t\rangle$ argument.

(90) *all of the boys*
$[Q_\forall$ [PL [# [PART [DEF [PL [# [N_{PRO} $\sqrt{\text{BOY}}$]]]]]]]]

We thus assume the revised lexical entry in (91) for the partitive. Its presupposition, which requires the type $\langle e, t\rangle$ argument to be a singleton set, encodes the partitive constraint. Note that, when [[PART]] combines with a definite plural, the presupposition will be met only if the definite plural receives a maximal interpretation.

(91) $[\![\textsc{part}]\!] = \lambda P_{\langle e,t \rangle} : |P| = 1.\lambda x.\exists y[y \in P \& x \sqsubseteq y]$ revised

The semantics in (91) correctly predicts that partitives cannot combine with bare (singular or plural) NPs: While the latter will also denote sets of type $\langle e, t \rangle$, they will always have more than one element (except in cases where there is only a single individual that has the property in question).[33]

6.3 'Whole' interpretations with singular DP complements

Since we now have a way of combining $Q_\forall$ with a DP without a type mismatch, let us briefly return to constructions in which $Q_\forall$ combines with a singular complement and gives rise to a maximality inference that can be paraphrased using 'whole'.

As discussed in Section 5.2, in languages in which $Q_\forall$ is permitted to take a singular DP complement, the result is always the 'whole' interpretation rather than distributive quantification. Based on this observation, we hypothesized that more generally, the 'whole' reading is the result of $Q_\forall$ combining with a singular DP complement, in which the determiner may receive a null realization on a language-specific basis. Here we briefly show how our proposal needs to be adapted to derive the correct semantics for this construction under this assumption.

The structure we need to interpret is of the following type:

(92) $[Q_\forall\ [\textsc{def}\ [\#\ \sqrt{\textsc{book}}]]]$
'the whole book'

By assumption, the #P denotes a predicate that is true only of atomic individuals:

(93) $[\![\#P]\!] = \lambda x_e.x \in AT \wedge \textbf{book}(x)$

We now need to compose this predicate with our definite determiner meaning, which is repeated in (94).

(94) $[\![\textsc{def}]\!]^{\preceq} = \lambda P_{\langle e,t \rangle}.\{x \mid x \preceq \iota y[P(y) \wedge \forall z[P(z) \rightarrow z \sqsubseteq y]]\}$

Due to the use of the ι-operator in (94), the definite determiner introduces the presupposition that the extension of the predicate it combines with has a single maximal element. The following variant of the lexical entry makes this presupposition explicit:

(95) $[\![\textsc{def}]\!]^{\preceq} = \lambda P_{\langle e,t \rangle} : \exists! y[P(y) \wedge \forall z[P(z) \rightarrow z \sqsubseteq y]].\{x \mid x \preceq \iota y[P(y) \wedge \forall z[P(z) \rightarrow z \sqsubseteq y]]\}$

Combining this with the singular predicate extension in (93), we end up with the following denotation for the DP:

(96) $[\![\textsc{def}\ \#\ \sqrt{\textsc{book}}]\!]^{\preceq} = \{x \mid x \preceq \iota y[y \in AT \wedge \textbf{book}(y)]\}$
defined only if $\exists! y[y \in AT \wedge \textbf{book}(y)]$

This DP meaning introduces the presupposition that there is a unique book (for the connection between this presupposition and maximality in the semantics of plural DPs, see Sharvy 1980). However, unlike

[33] Note, however, that the system we propose no longer provides a semantic explanation for why a bare singular NP cannot be the argument of a verbal predicate in languages like English and German.

the standard analysis on which singular definite DPs are referential, this analysis assigns a denotation of type $\langle e,t\rangle$ to the DP, i.e. a set of individuals. This set depends on the contextually provided similarity relation $\preceq$ and consists of those parts of the unique book that count as 'similar enough' to the whole book for the contextually relevant purposes. This is a good prediction, since sentences with singular definites, like (97) and (98), in fact permit some degree of non-maximality: (97-a) may be true if the cover of the book is mostly blue but has some negligible white parts, and (97-b) may still be considered true if the book contains some lengthy quotes in English.[34] These effects fall out from the truth conditions our approach generates, which are schematized in (97-c).

(97) a. *The book is blue.*
b. *The book is written in Dutch.*
c. $[\![\textit{the book } P]\!]^{\preceq} = 1$ iff $\exists x[x \preceq \iota y[y \in AT \wedge \mathbf{book}(y)] \wedge \mathbf{P}(x)]$

Being of type $\langle e,t\rangle$, the denotation of a singular DP can now combine with $\mathbf{Q}_\forall$. However, a small change to $\mathbf{Q}_\forall$ is necessary to make the correct predictions here. Technically, (98) quantifies over elements of the argument set that are maximal wrt. the relation $\sqsubseteq$, which was defined as holding between pluralities and their (plural or atomic) part. So, material parts of a non-plural individual x—such as the top half of a book—do not stand in the $\sqsubseteq$ relation to x. This means that every element of the set $[\![\textit{the book}]\!]$ counts as maximal wrt. $\sqsubseteq$ and $Q_\forall$ ends up quantifying distributively over the non-maximal parts of the book provided by $\preceq$.

(98) $[\![Q_\forall]\!] = \lambda P_{\langle a,t\rangle}.\lambda Q_{\langle\langle a,t\rangle,t\rangle}.\forall x[[P(x) \wedge \neg\exists y[P(y) \wedge \exists z[z \sqsubseteq x \wedge z \sqsubseteq y] \wedge y \not\sqsubseteq x]] \rightarrow Q(\{x\})]$

To fix the problem, it is sufficient to replace $\sqsubseteq$ with a more general part-whole relation that also covers material parthood (see Wagiel 2018 for discussion of a generalized parthood relation and the properties of material parthood). For instance, writing $x \trianglelefteq y$ for "$x \sqsubseteq y$ or x is a material part of y", we can generalize the semantics of $Q_\forall$ so that it is sensitive to both kinds of maximality and overlap, as in (99).

(99) $[\![Q_\forall]\!] = \mathbf{Q}_\forall = \lambda P_{\langle a,t\rangle}.\lambda Q_{\langle\langle a,t\rangle,t\rangle}.\forall x[[P(x) \wedge \neg\exists y[P(y) \wedge \exists z[z \trianglelefteq x \wedge z \trianglelefteq y] \wedge \neg[y \trianglelefteq x]]] \rightarrow Q(\{x\})]$

Using the lexical entry in (99), the QP as a whole ends up applying the predicate to the maximal element of the DP denotation, which is the entire book (as opposed to a non-maximal part of the book that counts as 'similar enough' for contextual purposes).

(100) $[\![Q_\forall \text{ DEF } \# \sqrt{\text{BOOK}}]\!]^{\preceq} = \lambda Q_{\langle\langle a,t\rangle,t\rangle}.Q(\{\iota x.x \in AT \wedge \mathbf{book}(x)\})$
defined only if $\exists! y[y \in AT \wedge \mathbf{book}(y)]$

In sum, with a small change to the denotation of $Q_\forall$ that does not seem to cause any problems for the plural uses of $Q_\forall$, it is possible to unify the singular DP uses of $Q_\forall$ with the plural DP uses, without giving up on the distributive effect of $Q_\forall$ with a singular NP complement.

[34] This cannot be the whole story about non-maximality in non-plural predication: unlike in the plural case, non-maximal readings are not restricted to definites. For instance, (i) can be true if the covers of the books in question have some white parts, although numerals remove non-maximality in the plural case. We leave a deeper investigation of this issue to future work; our aim here is simply to show that the unusually weak interpretation we generate for singular definites is independently useful rather than problematic.

(i) *Two books are blue.*

6.4 Interim summary

Our approach to the semantics of $Q_\forall$, when combined with a semantics for definite plurals that accounts for non-maximality, immediately derives the observation that $Q_\forall$ blocks non-maximality when it combines with a definite. Implementing this at the technical level requires some nonstandard assumptions about the types of plural predicates and nominal projections, because singular NPs, plural NPs and plural DPs must have the same type for $Q_\forall$ to be able to combine with all of them. Once these assumptions are in place, they also help us make sense of the 'whole' reading that $Q_\forall$ forms in some languages receive when they combine with singular complements.

7 Putative counterexamples to the DNH

Let us take stock of the overall contribution of this paper. We have developed a unified cross-linguistic semantics for distributive and non-distributive universal quantification. Under our account, the interpretation of a structure of the form '$Q_\forall$ + complement' depends on the semantic number of the complement. In order to account for formal differences between [+ dist] and [− dist] UQs in languages like English or Western Armenian, we suggested that forms restricted to [+ dist] universal quantification involve an additional element that is semantically restricted to combine with a predicate of atomic individuals. This is supported by the fact that we find overt realizations of such an element in several languages. Thus, our account captures the empirical generalization motivated in section 2, repeated below:

(101) **Distributivity-number hypothesis** (DNH)
  a. If the complement of a universal is SINGULAR, it is [+dist]
  b. If the complement of a universal is PLURAL, it is [−dist]

Before concluding the paper, we will discuss some *prima facie* counterexamples to the DNH and point out some potential ways of making these data compatible with our account.

It is noteworthy that all of the counterexamples to the DNH we came across concern (101-b) rather than (101-a). Thus, all exceptions are such the interpretation of a UQ is [+dist], while the complement is plural. Within our sample, such forms seem to be present in St'át'imcets (Matthewson 1999), Gitksan (Bicevskis et al. 2017), Q'anjob'al (O'Flynn 2017), as well as in Hungarian, in the context of definite DPs with numerals (Csirmaz & Szabolcsi 2012).

In St'át'imcets for example, the UQ *zí7zeg'* appears with plural DP complements, but is purely distributive relative to its nuclear scope (see Matthewson 1999, Davis 2010 for the interaction of this element with scope): it is limited to a distributive interpretation in examples like (102) and is incompatible with collective interpretations, (103-a).

(102) St'át'imcets
  a. *Zí7zeg' i wa7 píx-em' kwámem ku míxalh*
  UQ PL.DET PROG hunt-INTR take(REDUP) DET bear
  'Each of the hunters caught a bear.' (they caught one each) (Matthewson 1996:342, (2-a))

(103) St'át'imcets
  a. *Zí7zeg' i sqáycw-a gew'p*
  each PL.DET man-DET meet
  *'UQ of the men met.' (Matthewson 1999:101, (42-b))

Another puzzling configuration arises in Hungarian. The standard uses of UQs in Hungarian do not fall within the scope of our generalization, because the NP complement of the quantifier needs to be number neutral (Csirmaz & Szabolcsi 2012:402). However, the Hungarian UQ *mind* can sometimes combine with a definite DP containing a numeral or *az összes* ('the all'), (104). In such cases, the complement of the quantifier must be semantically plural independently of our assumptions about number-neutral NPs. Unexpectedly, according to Csirmaz & Szabolcsi (2012), such expressions have a purely distributive interpretation, as illustrated in (105-a).

(104) Hungarian

a. *Mind { az ősszes / a harminc } diák*
UQ the all / the thirty student
'all the students / all the thirty students' (Csirmaz & Szabolcsi 2012:408, (31-b))

(105) Hungarian

a. *Mind a két fiú fel emelte a zongorát*
UQ the two boy.NOM up lifted the piano.ACC
'Both boys lifted the piano.' ***collective** (Csirmaz & Szabolcsi 2012:409, (34-a))

On the surface, these data are clear counterexamples to the DNH. But could there be a reason for the exceptional surface pattern in these languages that is still compatible with our generalization? We briefly want to explore two possible answers:

(106) a. Option 1: These structures in fact involve a partitive structure, but PART is not obligatorily marked ('Zero partitive')
b. Option 2: Distributivity is not contributed by material within the quantifier phrase, but by an independent element

At first sight, option 1 seems compatible with claims about Q'anjob'al and St'át'imcets from the literature. For Q'anjob'al, O'Flynn (2017) claims that there generally does not seem to be a morphological distinction between partitives and non-partitives. If so, we could analyze the exceptional UQ structures as involving a null PART element. Concerning St'át'imcets, even though Matthewson (1996) discusses proportional quantifiers and so-called 'proportional' readings of indefinites in detail, these do not appear to come with overt partitive marking. Matthewson (1996:365ff.) also suggests for independent reasons that universal quantifiers in St'át'imcets, more generally, have something in common with partitives, despite lacking their familiarity requirement.
For Gitksan, we are not aware of any general discussion about partitives. However, Bicevskis et al. (2017) provide examples involving plural expressions that are translated as partitives, but do not seem to involve overt partitive marking. This could point to the option of zero-partitive in Gitksan, i.e. the zero-partitive hypothesis is at least not ruled out for this language.

But the zero-partitive hypothesis is not straightforwardly compatible with Hungarian, as there is no evidence for unmarked partitives in the language whatsoever. So, what about option 2? Do we find any motivation for the hypothesis that distributivity is contributed independently of the quantifier in the exceptional cases in Hungarian? We tentatively suggest a positive answer to this question: The discussion of the syntax of Hungarian quantifiers in (Csirmaz & Szabolcsi 2012) (henceforth 'C&S') suggests that the distributivity requirement of *mind*-phrases with plural complements might be due to their syntactic position. According to C&S there are three regions of the left periphery in which preverbal quantifiers can appear. Further, C&S claim i) that *mind*-phrases are in general restricted to region 2 (p. 452) and ii) that all quantifiers in region 2 – independently of whether they are universal or existential – receive an obligatorily distributive interpretation (p. 402).

‘Counting expressions’, on the other hand, are typically associated with region 3, according to C&S, and *az összes*-DPs typically must appear in region 1. If *mind* forces these phrases to appear in region 2, the distributive interpretation might be due to a distributivity operator syntactically separate from the quantifier in region 2.

While the exact positional requirements of *mind*+DP-phrases cannot be determined from the data in C&S, this hypothesis makes another testable prediction: Non-distributive uses of the *mind*+DP construction should be possible if the quantifier does not appear in the left periphery. This seems to be borne out: in (107), the *mind*+DP construction occurs postverbally, and the sentence has a non-distributive interpretation, i.e., it can convey that the number of poems read by the thirty students adds up to thirty.

(107) Hungarian.

a. *A harminc verset el olvasta mind a harminc diák.*
the thirty poem.ACC VM.away read UQ the thirty student
‘The thirty poems, all the thirty students read.’ (Flóra Lili Donáti, p.c.)

Summing up, there seem to be potential independent explanations for languages with [+dist] UQ strategies that superficially contradict the DNG. In Hungarian, the distributive effect in the examples of interest might not actually be due the quantifier. For the other exceptional languages, there is independent reason to suspect that they might permit zero-marked partitives. We take this to suggest that our cross-linguistic semantic proposal based on the DNG can be maintained, although more research is of course needed to further test these hypotheses.

8 Conclusion

Based on existing as well as new data, we strengthened a correlation previously noted in the literature between the interpretation of universal quantifiers (UQs) and the morphological number of their restrictor complement: distributive UQs have singular complements and non-distributive UQs – or rather, UQs that permit non-distributive interpretations – have plural complements.

Supported by the observation that languages like Dagara use one and the same form for both types of quantification the interpretation of which depends exclusively on the number of the complement, we proposed a single element $Q_\forall$ as underlying both distributive and non-distributive universal quantification cross-linguistically, contrary to standard assumptions. Appealing to the different semantic properties of singular and plural nouns, we argued that the correlation between number of the complement and distributivity can be derived from the combination of $Q_\forall$ with a singular or plural noun, respectively: $\mathbf{Q}_\forall$ requires the scope property to hold of every maximal element of its complement’s denotation. If the latter contains pluralities, the effect will be non-distributive quantification, but if it only contains only atoms, this will result in distributive quantification. We argued that this approach also gives us the correct predictions for complements containing numeral-modified indefinites if the maximal elements are required to be non-overlapping, and correctly predicts blocking of non-maximality with definite complements.

Since strategies involving a single UQ form for both types of quantification are the default case under our approach, the formally different distributive and non-distributive UQs in languages like English required further explanation: based on i) cross-linguistic structural complexity asymmetries between forms associated with distributive and non-distributive quantification, respectively, and ii) the frequent occurrence of morphemes formally identical to the numeral ‘one’ in [+dist] forms, we suggested that distributive quantification involves extra structure: we posited an additional head ONE that applies right below $Q_\forall$ in such languages and presupposes atomicity. In some languages, this head can be spelled out together $Q_\forall$, resulting in two different forms for [+dist] and [−dist] UQs.

The last step of our discussion was to point to a number of putative counterexamples to our distributivity-number correlation where UQs limited to distributive interpretations occur with plural complements. We argued that all these cases have independent explanations that render them still compatible with our account.

There are still a number of unresolved issues. Apart from the ones already mentioned, the following two seem to us to be particularly interesting for future work.

The first issue concerns 2-form languages where floated $Q_\forall$ takes a plural complement irrespective of its spellout. In particular, certain languages permit floated UQs (Sportiche 1988, Bobaljik 2003 a.o.). Crucially, in these configurations, the morphological number of the antecedent is plural independently of the spellout of $Q_\forall$, as illustrated for German in (108).

(108) German

a. *Die Buben haben jeder/alle ein Buch gelesen.*
the boy.PL AUX.PL UQ/UQ a book read
'The boys have each/all read a book.'

b. **Der Bub hat jeder ein Buch gelesen.*
the boy.PL AUX.SG UQ a book read

One potential explanation might be that the spell-out as well as the interpretation in these constructions depend on a (singular or plural) pro-NP in a silent partitive structure in the floated position. But this hypothesis does not seem to be on the right track: In German, floating with a DP antecedent is possible only for UQs, as shown by the contrast between (108-a) and (109-a), but the antecedent is a full partitive structure, this restriction no longer applies and non-universals can be floated, (110). If (108-a) involved a covert partitive structure, the set of quantifiers that can appear in the floated position should be the same as with overt partitive antecendents. Accordingly, the exceptional behaviour of $Q_\forall$ in floated constructions remains an open issue for now

(109) German

a. **Die Buben haben manche/drei ein Buch gelesen.*
the boy.PL AUX.PL some/three a book read
'The boys have some/three read a book.'

b. *Von den Buben haben manche/drei ein Buch gelesen.*
from the boy.PL AUX.PL some/three a book read
'As of the boys, some/three have read a book.'

The second issue concerns the morpho-syntactic relation between [+dist] and [−dist] forms in 2-form languages. We claimed that the [−dist] forms in such languages can either be decomposed into an exponent of $Q_\forall$ (possibly together with the number features) and an exponent of ONE, or they are essentially suppletive forms that spell out $Q_\forall$ together with ONE. This would predict that, cross-linguistically, transparent morpho-syntactic containment should be quite common. However, while Gil (1995) points out that it is often the case that the [+dist] form is clearly based on the [−dist] form morphologically, he also notes that the former does not seem to be derived from the latter via a productive process. For example, Gil notes that in Georgian, which has the [−dist] form *q'vela*, (110-a), as well as the [+dist] form *q'ovelma*, (110-b), intercolation of *-o-* is not a productive morphological process.

(110) *Georgian*

a. *Q'vela kacebma sami čanta c'ayes.*
UQ man.ERG.PL three.ABS suitcase.ABS PFV.carry.3PL
All the men carried three suitcases.' ✓DISTRIBUTIVE, ✓CUMULATIVE

b. *Q'ovelma kacma sami čanta c'ayo.*
UQ man-ERG three.ABS suitcase.ABS PFV.carry.3-SG
'Each man carried three suitcases.' ✓DISTRIBUTIVE, *CUMULATIVE (Gil 1995:p. 323)

If Gil is right that such unproductive derivations are a cross-linguistically common source of [+dist] forms, our proposal has nothing to say about why this is the case and why the transparent containment pattern found e.g. in Western Armenian is not more common.

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