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# Pluractionality and distributive numerals

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## Abstract

Cross-linguistically, morphological marking on verbs and nouns can indicate that a plurality of events or individuals is distributed with respect to another plurality. In these verbal domain, these have been called *pluractionals*; in the nominal domain, they have been called *distributive numerals* or *dependent indefinites*. This paper discusses recent semantic approaches to the cross-domain parallels between the two phenomena. After establishing some formal and typological background, we introduce a number of recent compositional challenges that have been introduced by these patterns.

**Keywords:** pluractionality, distributive numerals, dependent indefinites, distributivity, plurality, event semantics, *same/different*

## 1 Introduction

In natural language, there are many ways to introduce pluralities. Perhaps the simplest way is through morphological marking—for example, changing singular *zebra* to plural *zebras*. In other constructions, however, a plurality may be generated through more complex means, through an interaction with another plural. In (1), for example, ‘*one book*’ is morphologically singular, and yet we infer that there are a plurality of books, one per girl. As it turns out, a wide range of languages have a way of morphologically indicating this kind of dependent plurality. In languages as diverse as Hungarian, Telugu, and Kaqchikel Mayan, it is possible to communicate this dependency by reduplicating a numeral: *one-one*, *two-two*, *three-three*, and so on. The Kaqchikel sentence in (2) means that there are three tortillas per person. In the literature, these inflected numerals have been variously called distributive numerals or dependent indefinites (Gil 1982; Farkas 1997).

(1) The girls each read one book.

(2) Xeqatij ox-ox wäy  
we-eat three-three tortilla  
‘We ate three tortillas each.’

(Kaqchikel, Henderson 2014)

28 Many languages of the world also provide a grammatical way to encode *pluractionality*, that is,  
29 a plurality of events. This might be one thing happening again and again, or many things happening  
30 at the same time. For example, in Upriver Halkomelem, the verb *yáleq*’ is the pluractional form  
31 of the verb meaning ‘to fall’. The sentence in (3) can be used to describe a situation where many  
32 trees fell down at the same time, or where the same tree fell down multiple times, but not one in  
33 which one tree fell down one time.

34 (3) *yáleq*’ -et -es te theqát  
fall.pl -tr. -3S det. tree  
35 ‘He/they felled the tree(s).’ (Upriver Halkomelem, Thompson 2009)

36 Distributive numerals and pluractional verbs pertain to different syntactic categories and dif-  
37 ferent semantic domains: distributive numerals modify noun phrases to indicate a plurality of in-  
38 dividuals; pluractional morphemes modify verb phrases to indicate a plurality of events. However,  
39 despite these differences of domain, the two phenomena share a number of formal and typological  
40 semantic properties. In both cases, a hallmark property is the fact that the plurality in question is  
41 defined *relative to another plurality* in the sentence or context. Just as the plurality of tortillas in  
42 (2) is defined relative to the plural subject, the plurality of falling events in (3) is defined relative  
43 to a plural set—either a plurality of trees that fell or a plurality of times at which a tree fell. The  
44 relation between these two pluralities is described in §2.

45 Distributive numerals and pluractional verbs also share important compositional properties. Of  
46 note, these properties turn out to be different from those of generalized quantifiers like *every child*  
47 or floated adverbial *each*, as in (1). In any of these cases, the final sentential meaning is one that  
48 involves distribution, but the compositional way in which this meaning is derived is rather different,  
49 leading to different empirical patterns. In short, generalized quantifiers and adverbial *each* are  
50 pluralizing operators, that sum atomic objects into plural objects. In contrast, distributive numerals  
51 and pluractional verbs check that there is a plurality, but don’t create one. These compositional  
52 differences, and the patterns they lead to, are described in §3. Up until this point, the formal  
53 generalizations sketched will reflect converging analyses from a range of theoretical traditions.

54 In §4, we turn to a recent debate in the literature, regarding a pattern that could be called  
55 ‘distributive concord,’ in which a distributive numeral or pluractional verb appears to be redundant  
56 with a distributive operator like *each student*. We discuss one important division in the analyses  
57 of these cases, which either puts the explanatory burden on the syntax or on the semantics. After  
58 giving some recent arguments in favor of a semantic analysis, we lay out some further choice-  
59 points within the set of semantic analyses.

60 In §5, we outline some new avenues of research, including connections to phenomena else-  
61 where. First, we show that the behavior of pluractional verbs and distributive numerals is parallel  
62 to that of the adjectives *same* and *different*, another rich domain of semantic research. Second,  
63 we turn to cases of ‘event-internal’ pluractionals, which show distinct semantic behavior from  
64 canonical cases of pluractionality.

## 2 Dimensions of distribution

Both pluractionals and distributive numerals relate to pluralities that are defined based on their distributive relationship with a second plurality. Terminologically, we call this second plurality the *key*, while the plurality introduced by the pluractional or the distributive numeral is the *share*. For example, (4) provides a Turkish sentence with the distributive numeral *üçer*, ‘three each’; the sentence is compatible with a scenario in which six suitcases are distributed across two men. On this reading, the share—i.e., what is distributed—are the suitcases, and the key—i.e., what the suitcases are distributed across—are the men.

- (4) İki adam üçer bavul taşıdı  
two man three-DIST suitcase carried  
Two men carried three suitcases (each). (Turkish, Gil 1982)

In the case of distributive numerals, the distributive share is the plurality of individuals associated the noun phrase. In the case of pluractional verbs, the distributive share is the plurality of events associated with the verb. In both cases, however, there may be a choice regarding the distributive *key*. For example, in the example in (3), the plurality of events may be distributed across participants (i.e. different trees falling down), or across times (i.e. one tree falling down repeatedly). Distribution across participants is called the participant key reading, and distribution across times is called the temporal key reading. In some cases, distribution is also allowed over regions of space, or contextually salient groupings.

### 2.1 Typological variation

One of the strong generalizations emerging from typological work on pluractionals is that a particular morpheme in a given language may specify what is allowed as the distributive key (Cusic 1981; Lasersohn 1995). While the Halkomelem example in (3) is underspecified, allowing distribution across participants or time, in the related language Squamish, the pluractional made by reduplicating verb *xwet*, ‘jump,’ specifies distribution across time; the sentence cannot be used to describe a single occasion on which each individual jumped.

- (5) chet xwet-xwit-im  
1S.PL RED-jump-INTR  
‘We are jumping.’ (Squamish, Bar-El 2002)

A single language may have pluractional morphemes that specify different distributive keys. For example, in French Sign Language, *-rep* (exact repetition) requires distribution across time, and *-alt* (alternating hands) requires distribution across participants (Kuhn and Aristodemo 2017). Sentence (7), for example, becomes ungrammatical with singular object ‘ONE WORD.’

- (6) ONE PERSON FORGET-rep ONE WORD.  
‘One person forgot one word repeatedly.’  
(7) ONE PERSON FORGET-alt SEVERAL WORDS.  
‘One person forgot several words.’ (LSF, Kuhn and Aristodemo 2017)

100 In fact, the range of meanings that are generated by pluractional inflection goes beyond the  
 101 strictly distributive; in some languages, the same set of suffixes that mark distribution can also be  
 102 used to mark a variety of related interpretations, like increased effort or excessive action, such as  
 103 Dyrbal *balbalgan* ‘hit too much’, compared to *balgan* ‘hit’ (Dixon 1972). See Cusic (1981) for  
 104 an exhaustive typology of pluractional meanings.

105 For distributive numerals, a similar situations holds. For distributive numerals in Telugu (Balusu  
 106 2005), Tlingit (Cable 2014), and Kaqchikel (Henderson 2014), the distributive key may be partic-  
 107 ipants or space-time segments. In Hungarian, the dependent existential *egy-egy*, ‘one-one’ allows  
 108 the same choices, but dependent numerals greater than one like *két-két*, ‘two-two,’ only allow the  
 109 participant key reading (Farkas 2015).

110 (8) Minden gyerek hozott {egy-egy/két-két} könyvet.  
 Every child brought {one-one/two-two} book.  
 111 ‘Each child brought {one book/two books}.’

112 (9) A politikus mindig megtapsolt egy-egy ellenzéki hozzászólást.  
 The politician always applauded one-one opposition comment.  
 113 ‘Always, the politician applauded an opposition comment.’

114 (10) \*A politikus mindig megtapsolt két-két ellenzéki hozzászólást.  
 The politician always applauded two-two opposition comment.

115 (Hungarian, Farkas 2015)

116 A related point of variation is whether or not this distributive key may be implicitly inferred  
 117 (Henderson 2014). In Kaqchikel and Hungarian, distributive numerals require their distributive  
 118 key to appear overtly in the sentence; in Telugu and Tlingit, the distributive key may be inferred  
 119 from context, provided that this results in a ‘cognitively natural’ partition (Cable 2014). Thus, the  
 120 Telugu sentence in (11) allows an implicitly-inferred temporal-key reading, while the Kaqchikel  
 121 sentence in (12), without an overt licenser, is ungrammatical.

122 (11) Raamu renDu-renDu kootuluni cuuseeDu  
 Ram two-two monkeys saw  
 123 ‘Ram saw two monkeys at each time/location.’

(Telugu, Balusu 2005)

124 (12) \*Xe’inchäp ox-ox wäy.  
 I-handle three-three tortilla  
 125 ‘I took three tortillas each.’

(Kaqchikel, Henderson 2014)

126 Although similar patterns hold for both pluractionals and distributive numerals, it is interesting  
 127 to note a few differences in these typologies. First, pluractionals sometimes allow a broader range  
 128 of meanings, including intensification or culmination, mentioned above. Second, there is variation  
 129 with respect to the ‘default’ distributive key. For distributive numerals, a temporal key reading may  
 130 or may not be available, but it seems that a participant key reading always is. For pluractional verbs,  
 131 a participant key reading may or may not exist, but if it does, it is very likely that a temporal key  
 132 reading does, too. The one counterexample to this tendency of which I am aware is the pluractional  
 133 marker *-alt* in French Sign Language, which only has a participant key reading. (And here, it is  
 134 notable that other iconic properties are introduced with the use of two hands; see Lepic et al. 2016.)

## 135 2.2 Underspecification or ambiguity?

136 The way that we have characterized pluractionality and distributive numerals above makes refer-  
137 ence to a second plurality (the distributive key). However, as emphasized by Cable (2014), the  
138 link between these two pluralities may be rather indirect. As an example, consider the plural of  
139 the English event-denoting noun *party*, as in (13). This sentence may be true if the same group  
140 of students threw multiple parties throughout the year, and also if multiple subgroups of students  
141 threw simultaneous parties on a single evening. These contexts seem to correspond to what we  
142 have called the ‘temporal-key’ and ‘participant-key’ readings, but no standard analysis of the plu-  
143 ral suffix /-s/ makes reference to a distributive key. Rather, the distribution across participants,  
144 space, or time is just a necessary condition for what it means to be two distinct events.

145 (13) The students threw many parties.

146 Motivated by this observation, Cable (2014) argues that a similar situation holds for distributive  
147 numerals: for him, all readings of distributive numerals are ‘event-key’ readings, and the variety  
148 of compatible contexts arises from the different spatio-temporal ways in which these events might  
149 be distinguished. Cable (2014) shows that this kind of analysis is particularly adapted to Tlingit,  
150 in which distributive numerals never lexically specify a participant or temporal key reading.

151 On the other hand, we have just seen that some languages *do* identify a particular dimension  
152 of distribution. How do we account for these patterns? One option is to have further specification  
153 of the plural event. Just as the English noun phrase ‘*repeated parties*’ restricts the set of events  
154 to those temporally distributed in time, a pluractional verb or distributive numeral can specify  
155 this information in its lexical entry. Lasersohn (1995) spells out such an analysis for pluractional  
156 verbs, which may specify that the subparts of a plural event are distributed across time, space, or  
157 participants.

158 For some languages, it has also been argued that distributive numerals contain a null pronoun  
159 that is anaphoric to their distributive key (see, e.g. Zimmermann 2002 for English binominal  
160 *each*, Brasoveanu and Farkas 2011 for distributive numerals more generally). Kuhn (2017) argues  
161 that this co-indexation is made morphologically overt in American Sign Language, in which a  
162 distributive numeral, like ONE-arc, is required to be spatially co-indexed with its plural licenser. In  
163 (14), lowercase ‘a’ indicates spatial colocation.

164 (14) BOYS THEY-arc-a READ ONE-arc-a BOOK.

165 ‘The boys read one book each.’

(ASL, Kuhn 2017)

166 These points of view are not necessarily in conflict. It may be the case that distributive numerals  
167 in one language incorporate a null pronoun, and that a similar construction in another language  
168 does not. In any case, all these morphemes share the common property of event plurality, and the  
169 potential for distributive association with another plural in the sentence.

## 170 3 Plurality filters

171 The English and Hungarian sentences in (15) receive near-identical truth conditions, associating  
172 each child with a book. Likewise, the English and LSF sentences in (16) receive near-identical truth

173 conditions, associating each of my friends with an arriving event. However, the compositional way  
 174 in which these meanings are derived turns out to be quite different in the two cases.

- 175 (15) a. The children each brought one book.  
 176 b. A gyerekek hoztak egy-egy könyvet.  
 177 The children brought one-one book (Hungarian, Farkas 1997)
- 178 (16) a. My friends each arrived.  
 179 b. MY FRIENDS ARRIVE-alt. (LSF, Kuhn and Aristodemo 2017)

180 The analytical difference boils down to a difference between pluralizing *operators* and plurality  
 181 *filters*. Pluralizing operators sum objects together to make new pluralities. In contrast, plurality  
 182 filters restrict a set to only the plural objects, but they do not add any new elements to the set.  
 183 Examples of these two kinds of operations are shown in (17). Here,  $x \oplus y$  (the sum of  $x$  and  $y$ ) is  
 184 defined as the smallest object that both  $x$  and  $y$  are part of.

- 185 (17) a. *Pluralizing operators* sum together the objects in a set  
 186  $\{a, b, c\} \rightarrow \{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$   
 187 b. *Plural filters* restrict a set to only its plural objects  
 188  $\{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\} \rightarrow \{a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$

189 Note: because pluractionality deals with event pluralities, it will be convenient to me to use  
 190 event semantics (Davidson 1967; Parsons 1990) and an algebraic semantics for plurals (Link 1983;  
 191 Krifka 1998). However, the operator/filter distinction can be formulated in other frameworks. In  
 192 standard truth-conditional semantics, e.g., distributive *operators* quantify universally over their  
 193 scope. Plurality *filters* impose an intersective restriction on a set, removing non-plural individuals.

194 English adverbial *each*, like German *jeweils* and similar items in other languages, is typically  
 195 taken to be a distributive/pluralizing operator (Zimmermann 2002, *i.a.*). On an event-semantic  
 196 analysis, the denotation of ‘*brought one book*,’ only contains events that involve a single atomic  
 197 book, as in (18). But, since *each* sums events in the denotation of its complement—including ones  
 198 with different themes—the sentence in (15a) admits events in which multiple books were brought  
 199 (see, e.g. Champollion 2015, building on Link 1987).

200 (18)  $\llbracket \text{brought one book} \rrbracket = \lambda e. *bring(e) \wedge *book(\text{theme}(e)) \wedge |\text{theme}(e)| = 1$

201 In contrast, pluractional verbs and distributive numerals act as plurality *filters*. The definition in  
 202 (19) sketches a very simple definition for pluractional morphemes; here,  $|e|$  returns the number of  
 203 atomic parts of  $e$ ; additional conjuncts can specify the meaning further, such as adding restrictions  
 204 on how the subevents are distributed. On an event-semantic analysis, the denotation of *arrive*  
 205 contains all singular and plural arriving events. The sentence in (16b) filters out only those plural  
 206 events in which multiple people arrived. Since the semantic contribution of the pluractional is  
 207 included as a separate conjunct, no events are returned that were not included in the original set.

208 (19)  $\llbracket \text{-PLURACT} \rrbracket = \lambda V e. V(e) \wedge |e| > 1 \wedge \dots$   
 209 ‘Given a predicate  $V$ , return the set of non-atomic  $V$ -ing events.’  
 210 (cf. Lasersohn 1995; Kuhn and Aristodemo 2017)

211 Empirically, the fact that pluractionals are plurality filters can be observed in two related prop-  
 212 erties. First, pluractionals cannot induce variation in a plain indefinite. Second, pluractionals and  
 213 distributive numerals can appear redundantly in a sentence without multiplying the distributive  
 214 effect. These properties, and their contrast with adverbial *each*, are shown in Sections 3.1 and 3.2.

### 215 3.1 No variation of plain indefinites

216 When a plain indefinite (e.g., *someone, a student, two apples*), appears under a distributive oper-  
 217 ator, the interpretation of the indefinite can co-vary with the distributive operator. On the surface-  
 218 scope reading of (20), each professor is associated with a potentially different student.

219 (20) Every professor invited a student.

220 Across a variety of languages, a number of authors have observed that pluractional morphemes  
 221 do *not* have this property (see Yu 2003 for Chechen, van Geenhoven 2004 for West Greenlandic,  
 222 Laca 2006 for Spanish, Henderson 2014 for Kaqchikel, Kuhn and Aristodemo 2017 for French  
 223 Sign Language). The French Sign Language pair in (21) illustrates the contrast between distributive  
 224 operators and pluractional markers in this respect. In (21a), the distributive operator EVERY-DAY  
 225 can scope over the indefinite ‘ONE WORD’ allowing the words to vary day by day. In contrast,  
 226 although the pluractional morpheme *-rep* may also indicate an event recurring over time, these  
 227 events must involve the same word on each occasion. This contrast is particularly notable with  
 228 what Cabredo Hofherr and Laca (2012) call ‘once-only’ predicates—denoting events that can only  
 229 happen a single time to an individual. In Chechen, for example, *lilxira* is the pluractional form of  
 230 the verb ‘explode’; the sentence in (22) can only be used to describe the unlikely scenario in which  
 231 the same bomb exploded multiple times.

- 232 (21) a. EVERY-DAY JEAN ONE WORD FORGET. ✓many words ✓one word  
 233 ‘Every day, Jean forgot one word.’  
 234 b. JEAN ONE WORD FORGET-*rep*. \*many words ✓one word  
 235 ‘Jean forgot one word repeatedly.’ (LSF, Kuhn and Aristodemo 2017)
- 236 (22) Bomba lilxira  
 237 bomb.SG explode.PLR  
 ‘A/the bomb exploded repeatedly.’ (Chechen, Wood 2007)

238 Analytically, this can be understood on an analysis of pluractional markers as plurality filters.  
 239 In (21), the constituent ‘ONE WORD FORGET’ denotes the set of singular or plural events involving  
 240 a single word; the pluractional marker *-rep* filters out only those plural events distributed over time.  
 241 Notably, this returns a subset of the original set, so these events, too, involve only a single word.

### 242 3.2 Innocent redundancy

243 When distributive operators are nested one inside another, this gives rise to ‘doubly-distributive’  
 244 meanings. For example, if I have three children, then (23a) entails that at the end of a week, there  
 245 have been 21 hugs (= 3 children × 7 mornings). In (23b), if there are *n* professors and *m* classes,



246 then there are  $n \times m$  nominations. The expressions *every X*, adverbial *each*, and *per X* are all  
 247 distributive operators that introduce their own level of distribution.

- 248 (23) a. I hug each of my children every morning.  
 249 b. The professors each nominated one student per class.

250 In contrast, pluractionals and distributive numerals may appear redundantly in a sentence with-  
 251 out multiplying distributivity (Gil, 1982; Oh, 2006). Sentence (24) provides an example from  
 252 Kaqchikel; here, the sentence includes both the pluractional marker *-ala'* and a distributive nu-  
 253 meral *ju-jun*, ‘one-one.’ The two pluractionality markers reside peaceably in the same sentence;  
 254 both the events and books vary with respect to a single distributive key—times or locations.

- 255 (24) Xinkan-ala' ju-jun wuj.  
 I-search-LA' one-one book  
 256 ‘I looked for a book on each occasion.’ (Kaqchikel, Henderson 2014)

257 Similarly, multiple distributive numerals may occur together without compounding distributive  
 258 force. The Korean sentence in (25), where *ssik* marks two distributive numerals, allows a reading  
 259 in which men and boxes are both distributed with respect to the same event-based distributive key.

- 260 (25) Namca twu-myeng-ssik-i sangca sey-kay-ssik-ul wunpanhayssta  
 man two-Cl-Dist-Nom box three-Cl-Dist-Acc carried  
 261 ‘Two men carried three boxes on each occasion.’ (Korean, Oh 2006)

262 Again, the difference in behavior can be explained by the operator-filter distinction. Plural-  
 263 izing operators sum events together, so nesting multiple operators will compound the effect, by  
 264 summing together events that have already been pluralized. (Or, in truth-conditional semantics,  
 265 by having nested universal quantifiers.) On the other hand, plurality filters contribute intersective  
 266 meanings, so they may further refine the attributes of a plural event, but the repeated specification  
 267 of pluractionality is innocently redundant. In (24), the pluractional verb and the distributive nu-  
 268 meral both check that there is a plurality of events. Each item may specify additional properties of  
 269 the event—for example, the distributive numeral specifies the number of books involved in each  
 270 sub-event; however, checking for plurality twice does not ‘multiply’ distributivity. This can be  
 271 seen schematically in (26), where syntactically nested pluractionality operators can be simplified  
 272 to a single conjunct checking for event plurality. (Formally, simplification is possible since logical  
 273 conjunction is associative, commutative, and idempotent).

$$\begin{aligned}
 274 \quad (26) \quad \text{PLURACT}[\dots \text{PLURACT}(V)\dots] &= \lambda e.[V(e) \wedge |e| > 1 \wedge \dots] \wedge |e| > 1 \wedge \dots \\
 &= \lambda e.V(e) \wedge |e| > 1 \wedge \dots
 \end{aligned}$$

### 275 3.3 Diverse frameworks

276 The properties described above are shared across analyses from a wide range of theoretical frame-  
 277 works, including standard truth-conditional semantics, event semantics, and dynamic semantics.

278 The ‘operator’ view of adverbial *each* and related constructions, for example, can be seen in Zim-  
 279 mermann (2002), Champollion (2015), and van den Berg (1996), each of which comes from a  
 280 different theoretical tradition. The ‘filter’ view of pluractionals and distributive numerals appears  
 281 in Lasersohn (1995), Cable (2014), and Kuhn and Aristodemo (2017), which use event semantics,  
 282 as well as Henderson (2014) and Kuhn (2017), which use dynamic semantics. One notable shared  
 283 property of event semantics and dynamic semantics is that they represent sub-sentential semantic  
 284 structure as the conjunction of propositional terms, which is convenient for analyzing the formal  
 285 properties of pluractionality described above.

## 286 4 Licensing by distributive operators

287 As seen in §2, pluractionals and distributive numerals introduce a plurality of objects that is in  
 288 a distributive relationship with a second plurality. We saw that participant key readings entail  
 289 distribution across event participants. One consequence of this is that participant key readings must  
 290 be licensed by the presence of a plural elsewhere in the sentence. Example (27) provides a minimal  
 291 contrast (repeated from (2) and (12)); when all other arguments in the sentence are singular, the  
 292 distributive numeral makes the sentence ungrammatical, similarly to the English translation.

- 293 (27) a. Xeqatij ox-ox wäy  
 294 we-eat three-three tortilla  
 294 ‘We ate three tortillas each.’  
 295 b. \*Xe’inchäp ox-ox wäy.  
 295 I-handle three-three tortilla  
 296 ‘I took three tortillas each.’ (Kaqchikel, Henderson 2014)

297 With respect to licensing, pluractionals and distributive numerals turn out to show a surprising  
 298 interaction with distributive operators like English *each* (or Kaqchikel *chikijujunal*), that distribute  
 299 down to atoms. In general, quantifiers like *each* yield the inference that the predicate holds of  
 300 each atomic individual, schematized in (28). This inference pattern is exhibited in the ungram-  
 301 maticity of distributive operators with collective predicates, as in (29). It is ungrammatical to  
 302 say ‘Sam gathered in the market,’ ‘Gabe gathered in the market,’ and so on, and so it is equally  
 303 ungrammatical to say that ‘Each of them gathered in the market’ (or the Kaqchikel equivalent).

304 (28) ‘Each individual Xed’ → ‘Sam Xed’ and ‘Gabe Xed’ and ‘Oliver Xed’ ...

- 305 (29) \*Chikijujunal xkimol ki’ pa k’ayb’al.  
 305 each gathered REFL in market  
 306 ‘Each of them gathered in the market.’ (Kaqchikel, Henderson 2014)

307 Surprisingly, however, pluractionals and distributive numerals *are* licensed by distributive op-  
 308 erators, as seen in (30). As has been observed by a number of authors (notably Henderson 2014;  
 309 Kuhn 2017), this poses a compositional puzzle, since the ‘unpacked’ version of (30), ‘X hugged  
 310 one-one dog, Y hugged one-one dog, and so on,’ would be ungrammatical, just like (27b).

311 (30) Chikijujunal ri tijoxela' xkiq'etej ju-jun tz'i'.  
 each the students hugged one-one dog  
 312 'Each of the students hugged a dog.' (Kaqchikel, Henderson 2014)

313 For distributive numerals, this licensing puzzle has been well-documented, including for Hun-  
 314 garian (Farkas 1997), Telugu (Balusu 2005), Korean (Oh 2006), Tlingit (Cable 2014), Kaqchikel  
 315 (Henderson 2014), and American Sign Language (Kuhn 2017). For pluractional marking on verbs,  
 316 the property has been less well documented, but has been reported for both participant key and  
 317 temporal key distribution in French Sign Language (Kuhn and Aristodemo 2017).

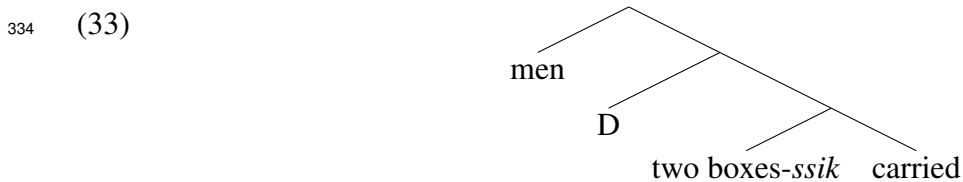
318 (31) a. BOY EACH FORGET-alt BRING CAMERA.  
 319 'Each boy forgot to bring a camera.'  
 320 b. EVERY-DAY ONE BOOK JEAN GIVE-1-rep.  
 321 'Every day, Jean gave me one book.' (LSF, Kuhn and Aristodemo 2017)

#### 322 4.1 Two points of view

323 The puzzle above opens two attractive but opposing avenues for analysis, both of which are repre-  
 324 sented in the literature: an analysis based on syntactic agreement, and an analysis based on scope.

325 On an agreement-based analysis, the pattern exemplified in (30) and (31) is viewed as a kind  
 326 of 'distributive concord.' Similar to standard analyses of negative concord (Zeijlstra, 2004), what  
 327 appears as pluractional marking on the numeral or verb is the expression of a semantically un-  
 328 interpreted feature, with a syntactic constraint that requires it to appear in the scope of a higher  
 329 (interpreted) distributivity operator. Thus, the sentence in (32) would be assigned the LF in (33), in  
 330 which the distributive numeral is syntactically licensed by a silent D-operator. This point of view  
 331 has been most clearly articulated by Oh (2006) and Kimmelman (2015).

332 (32) Namca-tul-i sangca twu-kay-ssik-ul wunpanhayssta.  
 Man-Pl-Nom box two-Cl-Dist-Acc carried  
 333 'Men carried two boxes each.' (Korean, Oh 2006)

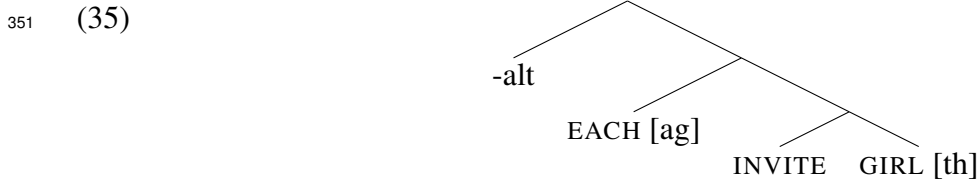


335 On such an analysis, examples like (30) are unsurprising, since the only difference is that the  
 336 distributive operator is overt. Two critical properties should be observed about this line of analysis.  
 337 First, even when there is no overt distributivity operator like *each*, as in (32), distributive numerals  
 338 and pluractional verbs signal the presence of a silent distributivity operator in the sentence. Second,  
 339 distributive numerals and pluractional verbs appear structurally *below* this distributive operator.

340 On a scope-based analysis, there is no reliance on a covert distributive operator: the plurac-  
 341 tional verb or distributive numeral itself contributes the plurality inference. In order to account for  
 342 licensing by distributive operators, as in (30), a mechanism of scope-taking allows the pluractional

343 morpheme to be interpreted at a higher structural position than the distributive operator. The effect  
 344 is one of innocent redundancy, like what is described in §3.2. First, the distributive operator plu-  
 345 ralizates a predicate, resulting in a set of plural events. Then, the pluractional morpheme applies as  
 346 a filter on this set; notably, the plurality check is satisfied by the output of the distributive operator.  
 347 The sentence in (34) would thus be assigned the LF in (35). This point of view has been advocated  
 348 for by Henderson (2014), Kuhn and Aristodemo (2017), and Kuhn (2017).

349 (34) EACH INVITE-alt GIRL.  
 350 ‘Each of them invited a girl.’ (LSF, Kuhn and Aristodemo 2017)



352 On this analysis, if a distributive operator appears in the sentence, the pluractional morpheme or  
 353 distributive numeral necessarily takes scope *above* it.

## 354 4.2 Against silent D-operators: the behavior of plain indefinites

355 One of the critical components of the agreement-based analysis is the obligatory presence of a  
 356 silent distributive operator in some environments. Several recent analyses argue against the pres-  
 357 ence of such an operator by looking at the behavior of plain indefinites in these environments.

358 Henderson (2014) develops such an argument by looking at the interaction of pluractionals  
 359 and distributive numerals in Kaqchikel. In Kaqchikel, distributive numerals are not licensed when  
 360 all other elements in a sentence are singular, as shown in (36), repeated from (12). On the other  
 361 hand, they *are* allowed in sentences when the verb shows pluractional marking, as shown in (37),  
 362 repeated from (24).

363 (36) \*Xe'inchäp ox-ox wäy.  
 I-handle three-three tortilla  
 364 'I took three tortillas each.'

365 (37) Xinkan-ala' ju-jun wuj.  
 I-search-LA' one-one book  
 366 'I looked for a (different) book on each occasion.' (Kaqchikel, Henderson 2014)

367 Pluractional verbs are thus sufficient to license distributive numerals in Kaqchikel. Under an  
 368 agreement-based analysis, this means that there must be a distributivity operator in the environment  
 369 embedding the distributive numeral in (37). If this is indeed the case, then it should be possible  
 370 for a *plain indefinite* in the same environment to vary with respect to this distributivity operator.  
 371 This turns out not to be the case. Similarly to pluractionals in other languages, pluractional verbs  
 372 in Kaqchikel cannot induce variation in a plain indefinite (cf. §3.1). The sentence in (38) can only  
 373 describe a scenario in which a single book was looked for several times.

374 (38) Xinkan-ala' jun wuj.  
 I-search-LA' one book  
 375 'I looked for a (particular) book on each occasion.' (Kaqchikel, Henderson 2014)

376 Kuhn (2017) develops a similar argument using sentences in which a distributive numeral ap-  
 377 pears alongside a plain indefinite. The Hungarian sentence in (39) contains a distributive numeral,  
 378 which—under an agreement-based analysis—indicates the presence of a silent distributive opera-  
 379 tor. In (39), however, the distributive numeral is conjoined to a plain indefinite. The agreement-  
 380 based analysis thus predicts that the plain indefinite, too, must be trapped under the distributive  
 381 operator, entailing two appetizers per student. As it turns out, though, the sentence easily allows a  
 382 reading in which only two appetizers were ordered in total.

383 (39) A diákok két előételt és egy-egy főételt rendeltek.  
 The students two appetizers and one-one main-dish ordered  
 384 'The students ordered two appetizers one main dish.' (Hungarian, Kuhn 2017)

385 In both cases, the absence of variation in plain indefinites provides evidence that the distributive  
 386 numerals in (37) and (39) are appearing *without* the presence of a higher distributive operator.

### 387 4.3 Iconicity and scope in LSF

388 In LSF, Kuhn and Aristodemo (2017) show that pluractional markers display iconicity: the rate  
 389 at which a verb is reduplicated indicates the relative rate at which the event happened. Formally,  
 390 this can easily be incorporated into the definition. An iconic predicate describes a set of events by  
 391 reference to the phonetic form  $\Phi$ ; as an event predicate, it is thus of the correct type to be added as  
 392 a modifier to the pluractional morpheme, as in (40).

393 (40)  $\llbracket \text{-alt/-rep} \rrbracket = \lambda V \lambda e. \underbrace{V(e) \wedge |e| > 1 \wedge \dots}_{\text{Logical component}} \wedge \underbrace{\mathbf{Icon}^{\Phi}(e)}_{\text{Iconic component}}$   
 394 '/-alt/ and /-rep/ give the set of non-atomic *V*-ing events (with other specified logical prop-  
 395 erties), which are distributed temporally in the manner shown'

396 Iconicity provides another way to resolve the theoretical question regarding the hierarchical  
 397 position of the pluractional morpheme. Kuhn and Aristodemo (2017) show that the iconic meaning  
 398 of the pluractional marker in ASL and LSF can be interpreted with narrow scope or wide scope:  
 399 for example, accelerating reduplication of a verb can indicate the rate at which each individual  
 400 performed an event, or it can indicate the overall rate at which events were performed by members  
 401 of a plural licenser. Critically, they show that the level at which the iconic component is evaluated  
 402 is exactly the structural position at which the logical component is evaluated. In particular, in the  
 403 case of distributive operators, a slow movement of /-alt/ under EACH must denote an event which  
 404 happens slowly *from a global perspective*, indicating that the pluractional morpheme is evaluated  
 405 at a high structural position.

406 (41) BOY EACH BOOK GIVE-1-alt-slow DOWN. (LSF, Kuhn and Aristodemo 2017)

- 407 a. ✓ ‘Each boy gave me books, which happened slowly from a global perspective.’  
 408 b. \* ‘Each boy gave me books at a slow rate. (Because there are so many boys, I received  
 409 books quickly.)’

410 The interpretation of iconic information in sign language thus provides evidence for a structure  
 411 in which the pluractional morpheme scopes above the distributive operator, as in the LF in (35), as  
 412 opposed to one in which it takes scope below the distributive operator, as in the LF in (33).

#### 413 4.4 How to take scope

414 If pluractional morphemes and distributive numerals are evaluated as though at a higher structural  
 415 position, by what semantic process does this scope-taking occur? At least three proposals have  
 416 been made in the literature: implicature, standard scope-taking, and dynamic postsuppositions.

417 Balusu (2005) suggests that the plurality inference of distributive numerals may be an implica-  
 418 ture, analogous to an implicature-based account of plural nouns (Zweig, 2005). As an implicature,  
 419 the meaning is evaluated at the level of the sentence. Henderson (2014) argues that an analysis in  
 420 terms of *conversational* implicature falls short on a number of fronts, including the behavior of dis-  
 421 tributive numerals in embedded contexts and the fact the plurality inference can never be canceled.  
 422 Nevertheless, an analysis in terms of *conventional* implicature may still be a viable option.

423 Kuhn (2017) proposes that, at least for distributive numerals, the process is exactly the same as  
 424 standard quantifier scope (i.e. quantifier raising or equivalent). In particular, quantifiers are known  
 425 to be sensitive to scope-islands out of which they cannot take scope. Cross-linguistically, distribu-  
 426 tive numerals have been shown to be sensitive to a similar locality constraint: distributive numerals  
 427 need to appear in the same clause as their plural licenser (Choe, 1987; Oh, 2006; Zimmermann,  
 428 2002; Cable, 2014; Kuhn, 2017). Sentence (43) provides an example from Hungarian, in which an  
 429 *if*-clause blocks the licensing of a distributive numeral. Whatever mechanism allows the plurality  
 430 inference to be interpreted high, it is thus sensitive to at least some of the locality constraints that  
 431 delimit quantifier scope.

432 (42) Minden professzor két-két diákról mondta, hogy meglepné ha ⟨diplomát szereznének⟩.  
 every professor two-two students-of said that surprised if diploma receive  
 433 ‘Every professor said of two students that he would be surprised if they graduated.’

434 (43) \* Minden professzor azt mondta, hogy meglepné, ha ⟨két-két diák diplomát szerezne⟩.  
 every professor DEM said that surprised if two-two student diploma receive  
 435 ‘Every professor said that he would be surprised if two students graduated.’

436 (Hungarian, Kuhn 2017)

437 Finally, Henderson (2014) proposes an analysis of distributive numerals in terms of ‘postsup-  
 438 positions,’ defined in a dynamic semantic system. If *presuppositions* check that a property holds of  
 439 a context *before* a proposition is evaluated, a *postsupposition* is required to hold of a context *after*  
 440 a proposition is evaluated. In the case at hand, the plurality inference of distributive numerals is  
 441 evaluated after the distributive operator has been applied. See Charlow (to appear) for a discussion  
 442 of the relationship between postsuppositions and standard quantifier scope.

443 For the case of pluractional verbs, the analytical situation is less clear; note, for example, that  
444 quantifier raising is not an operation generally assumed for verbal affixes. In the verbal domain,  
445 there has also been sparser documentation of licensing by distributive operators, making the em-  
446 pirical landscape less sure. On the other hand, similar phenomena have been discussed for the case  
447 of verbal aspect. Deo (2009) and Ferreira (2016) discuss the interaction between imperfect aspect  
448 and temporal quantifiers. They argue that, in order to get the correct meaning for sentences like  
449 (44), the imperfect aspect must be interpreted at a higher position than the temporal quantifier *sem-*  
450 *pre*, ‘always.’ No explicit scope-taking mechanism is proposed, but the fact that aspect-marking  
451 is an inflectional morpheme opens the possibility that it is base-generated at this higher structural  
452 position. (Pluractional marking, in contrast, is generally considered a derivational morpheme.)

453 (44) Quando Pedro escrevia um artigo, ele sempre o submetia a um periódico.  
454 When Pedro wrote-IMP an article, he always it submitted-IMP to a periodical  
455 ‘When Pedro wrote an article, he always submitted it to a periodical.’  
(Portuguese, Ferreira 2016)

456 For both distributive numerals and pluractional verbs, more precise generalizations about this  
457 scope-taking mechanism will likely emerge with further fieldwork on spoken and sign languages.

## 458 5 Further directions

459 This section briefly describes some further directions to the study of pluractionality and distributive  
460 numerals, including formal parallels with the adjectives *same* and *different*, and cases of ‘event-  
461 internal’ pluractionality.

### 462 5.1 Parallels with *same* and *different*

463 The adjective *same* is known to be ambiguous between an ‘external’ and an ‘internal’ reading. On  
464 the external reading, sentence (45) compares the dogs to another individual in context (‘My pet  
465 rabbit licked a cat....’); on the internal reading, it compares the dogs to each other. Critically, the  
466 internal reading of (45a) is only licensed by the presence of a plural elsewhere in the sentence. Out  
467 of the blue, the sentence in (45b) is ungrammatical; we are left asking, ‘As who?’

468 (45) a. All the dogs licked the same cat.  
469 b. \* Fido licked the same cat.

470 The adjective *same* shows striking parallels with pluractionals and distributive numerals. First,  
471 Hardt et al. (2012) and Hardt and Mikkelsen (2015) observe that sentences with *same* necessarily  
472 involve multiple events—that is, they are pluractional. The sentence in (46) cannot be used to  
473 describe a single event in which Mary sold John a book.

474 (46) John bought and Mary sold the same book. (Barker 2007)

475 On its internal reading, *same* also shows licensing patterns similar to the ones above. The  
476 contrast in (45) shows that the internal reading must be licensed by a plural licenser, but, just as  
477 for distributive numerals and pluractionals, this licenser may be an operator that distributes down  
478 to atomic individuals, as in (47).

479 (47) Each student recited the same poem.

480 Finally, Kuhn (2017) shows that in American Sign Language, the adjectives *same* and *different*  
481 are morphologically unified with distributive numerals. In each case, distributivity is marked by  
482 reduplication or movement across an area of space. Spatial co-indexation with another plural is  
483 used to specify the distributive key. Thus, in (48), the arc-movement of ONE or SAME over location  
484 ‘a’ (where the boys were indexed) yields a distributive reading for (48a), and an obligatory internal  
485 reading of (48b).

486 (48) a. ALL-a BOY READ ONE-arc-a BOOK.  
487 ‘All the boys read one book.’  
488 b. ALL-a BOY READ SAME-arc-a BOOK.  
489 ‘All the boys read the same book.’ (ASL, Kuhn 2017)

490 Like pluractionals and dependent indefinites, the patterns exemplified by *same* and *different*  
491 have posed compositional challenges, motivating enrichments to the semantic system (Keenan  
492 1992; Barker 2007). Empirical parallels between these phenomena suggests that insights in one  
493 area can and should inform analyses in the other.

## 494 5.2 Event-internal pluractionality

495 Cusic (1981) and Wood (2007) highlight another parameter of variation: event-*external* or event-*internal*  
496 pluractionality. All forms discussed so far have been cases of event-external pluraction-  
497 ality: roughly speaking, we have a plurality of events of the same kind. Intuitively, event-internal  
498 pluractionals are atomic events that are nevertheless comprised of smaller parts. The English words  
499 *nibble*, *flutter*, *juggle*, *applaud* seem to have this property: a single juggling event is divided in time  
500 into many moments at which a throwing event happened.

501 Many languages of the world have morphemes that indicate this kind of event-internal plurac-  
502 tionality. The derivations in (49) provide examples from Syrian Arabic that illustrate.

503 (49) a. safa? ‘to clap, slap’ → saffa? ‘to applaud/clap in rhythm’  
504 b. kasar ‘to break in two’ → kassar ‘to break to pieces’  
(Syrian Arabic, Cowell 1964)

505 Wood (2007) describes a range of properties that distinguishes event-internal pluractionality  
506 from event-external pluractionality. First, there are *aktionsart* restrictions that apply only to event-  
507 internal predicates: they appear on semelfactives and possibly achievements (as in (49a) and (49b),  
508 respectively), but do not appear on accomplishments. Second, event-internal pluractionals gener-  
509 ally carry the requirements of multiplicity and density. Whereas event-external pluractionals seem



510 to be felicitous with at least two repetitions of the event, event-internal pluractionals generally en-  
 511 tail numerous sub-parts in quick succession. Third, a subclass of event-internal pluractionals carry  
 512 the entailment that the series of repetitions share a common goal or result. Again, this can be seen  
 513 in the examples above: in (49a), keeping rhythm is a goal that can be accomplished through a  
 514 plurality of claps; in (49b), repetitive breaking yields a single result-state.

515 Event-internal pluractionals also differ from event-external pluractionals with respect to com-  
 516 positional properties. In particular, we saw above that event-external pluractionals may allow (or  
 517 require) distribution across the members of a plural licenser—a different subevent associated with  
 518 each participant. This is never possible with event-internal pluractionals. The pluractional in (49b),  
 519 for example, must describe the breaking up of a single object, not multiple objects being broken a  
 520 single time. Similarly, in (50), the Kaqchikel suffix glossed *Ca'* marks event-internal pluractional-  
 521 ity. The sentence must mean that each individual glanced at the speaker several times; it cannot be  
 522 used to describe a situation in which each person glanced at the speaker once.

523 (50) Xikitz'et-etz'a' ri winaqi'  
 look.at-Ca' the people  
 524 'The people kept glancing at me.' (Kaqchikel, Henderson 2017)

525 These observations suggest an analysis in which event-internal pluractionals are in fact *atomic*,  
 526 but have a temporal/spatial trace that can be divided into small parts (Henderson 2017). The  
 527 expression in (51) sketches the meaning of an event-internal pluractional marker. We let  $\tau$  be a  
 528 function that gives the temporal or spatial trace of an event—i.e., when and where it occurred. The  
 529 function 'fine-partition' returns a set of overlapping intervals that cover this area of space-time.  
 530 Event-internal pluractionals entail that a given event occurred at each of these subintervals.

531 (51)  $\lambda V \lambda e. |e| = 1 \wedge \exists P[\text{fine-partition}(P, \tau(e)) \wedge \forall t \in P[\exists e'[t = \tau(e') \wedge V(e')]]]$   
 532 'Given a predicate  $V$ , return the set of atomic events whose temporal (or spatial) trace can  
 533 be divided into small parts, each of which contains a  $V$ -ing event.'  
 534 (cf. Henderson 2017)

535 Notably, this definition differs from the one for event-external pluractionality in (19) in a critical  
 536 way: the output of (19) is a set of plural events ( $|e| > 1$ ); the output of (51) is a set of atomic events  
 537 ( $|e| = 1$ ). This has compositional consequences. Notably, when a plural individual is an argument  
 538 of a plural event, a cumulative reading is allowed in which each atomic individual associates with  
 539 a different subevent. For event-external pluractionals, this allows the participant-key reading. For  
 540 event-internal pluractionals, all arguments of the plural individual must be associated with the  
 541 same, atomic event.

## 542 6 Conclusion

543 Despite pertaining to different domains of objects—events or individuals—pluractional verbs and  
 544 distributive numerals share a core collection of parallel semantic properties. In both cases, they  
 545 mark an object as a distributive share, and may put restrictions on what can serve as a distributive

546 key. Compositionally, both constructions act as a plurality filter; this means that they cannot in-  
547 duce variation in plain indefinites, and that multiple markers can appear redundantly in the same  
548 sentence. Pluractional constructions also raise a number of compositional questions. Of note, they  
549 may be licensed by operators that distribute down to atomic individuals. We provided evidence in  
550 favor of an analysis in which distributive numerals and pluractional verbs take scope above these  
551 distributive licensors, and discussed several possible implementations. Finally, we outlined par-  
552 allels with the adjectives *same* and *different*, and discussed cases of event-internal pluractionality,  
553 where internal structure may nevertheless be predicated of atomic events.

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