# On Distributivity in Karitiana *

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## 1. Introduction

Karitiana is the sole surviving language of the Arikém family (Tupi stock), and is currently spoken by approximately 330 people living on a demarcated Indian reservation 95 kilometres from Porto Velho, capital of the state of Rondônia in the Northwest of Brazil (see Storto & van der Velden 2005).

There are many languages from a wide range of distinct language families that express distribution by the use of distributive numerals. Some examples are: Maricopa (Hokan, spoken in Arizona), Gã (Niger-Congo, spoken in Ghana), Bura (Afro-Asiatic, spoken in Nigeria), Nubian (Nilo-Saharan, spoken in Egypt), Rumanian (Indo-European), Turkish (Altaic), Tagalog (Austronesian, spoken in the Philippines), Japanese, and Georgian (South Caucasian) (see Gil 1995).

Cross-linguistically, distributive numerals are frequently formed by the use of reduplication (see Gil 1982, 1995). This is also the case for Karitiana. In Karitiana, distributive numerals are reduplicated numerals, as illustrated in examples (1) and (2) below. [1] This paper focuses on the expression of distributivity in Karitiana. It compares distributivity generated by lexical cumulativity, with distributivity generated by distributive numerals. More specifically, this paper studies the syntax and the semantics of reduplicated numerals in Karitiana.

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[1]The data is presented as follows: 1st line: orthographic transcription of the Karitiana sentence; 2nd line: morphological segmentation; 3rd line: morpheme by morpheme gloss; 4th line: translation. The abbreviations used are as follows: NFT = non future, AUX = auxiliary, RDPL = reduplication, DECL = declarative, IRR = irrealis, IMP = imperative, 1s = 1st person singular agreement, 2s = 2nd person singular agreement, 3 = 3rd person agreement, OBL = oblique, CAUS = causative, VERB = verbalizer, ASST=assertive, OFC = object focus, POS = postposition, SUB = subordinator, TV = thematic vowel. In some cases, we chose to separate the translation from the context. In the context we present the situation which was given to the informant.

(1) Myhint myhint nakam'at gooj õwã[2]
myhim-t myhim-t Ø-naka-m-'a-t gooj õwã
one-OBL one-OBL 3-DECL-CAUS-build-NFT canoe child
'Children built canoes distributively'
('Each child built one canoe'/ 'On each occasion, children built one canoe')'[3]

(2) Sypomp sypomp nakam'at gooj õwã
sypom-t sypom-t Ø-naka-m-'a-t gooj õwã
two-OBL two-OBL 3-DECL-CAUS-build-NFT canoe child
'Children built canoes distributively'
('Each child built two canoes'/ 'On each occasion, children built two canoes')'[4]

Depending on the context, sentence (1) can be understood as distributing over the subject ('each child built one canoe'), or over occasions ('on every occasion, children built two canoes'). Similarly, sentence (2) may be understood as 'every child built two canoes', or as 'on every occasion, there was an event of children building two canoes'. As far as we can tell, there is no distribution over the object with distributive numerals in Karitiana.[5]

We maintain that distributive numerals are not ambiguous between a Determiner Quantifier and an Adverbial Quantifier, and that distributivity over the subject and distributivity over occasions are both generated by the same semantics.[6] Our thesis is that distributive numerals are always adverbial pluractional operators - they pluralize the events in the denotation of a relation between events and entities and impose a cardinality restriction on its entities. This means that sentence (1) could be paraphrased as (3). The fact that the sentence may be understood as distributing over children or over occasions is attributed to the vagueness that involves event individuation.[7]

(3) 'There was a plural canoe building event by children and this event was made up of sub-events of children building one canoe'.

The data presented and discussed in this paper was obtained by means of controlled elicitation, unless otherwise indicated. In addition, the research carried out for this paper involved the analysis and discussion of data obtained by other researchers through both spontaneous speech and controlled elicitation. This particular investigation, which is an

[2] Karitiana has two tenses, future and non-future. We translated all sentences into the past in order to simplify our explanation. Both tenses may have a generic/habitual interpretation which is not considered in the translations. These decisions do not interfere with the issues under discussion.

[3] We will consistently translate Karitiana bare nouns into English bare plurals. Nevertheless, it is important to remember that they are number-neutral and can refer to both singular and plural individuals. They are also unmarked for the definite-indefinite distinction.

[4] We will consistently translate Karitiana bare nouns into English bare plurals. Nevertheless, it is important to remember that they are number-neutral and can refer to both singular and plural individuals. They are also unmarked for the definite-indefinite distinction.

[5] We will not discuss here the non-availability of distribution over the object with distributive numerals in Karitiana.

[6] Determiner Quantifiers are quantifiers that belong to the nominal projection, whereas adverbial quantifiers are VP or sentential quantifiers (see Bach et al. 1995).

[7] The basis for event individuation in Karitiana is also a subject for further research. We know that they may be individuated on the basis of occasions or of entities, but there may very well be other ways in which this can be done.

analysis of the syntax and semantics of plurality and distributivity in Karitiana, requires detailed structural paradigms which correspond to controlled discourse contexts, whose adequacy or truthfulness the speaker has to judge. We therefore proceeded as follows: the native consultant was provided with a context and was asked how he would convey a specific Portuguese meaning in his own language. Once the sentence had been produced in the target language, we double-checked its adequacy in other contexts and with other consultants.[8]

The paper is organized as follows. Section 2 below presents the theoretical background on which our analysis is based. Section 3 presents the relevant facts concerning the grammar of Karitiana. In Section 4 we discuss how cumulative, collective and distributive readings are generated by lexical cumulative denotations of verbs and nouns. In Section 5 we discuss the expression of distributivity in Karitiana, which can be generated both by lexical cumulativity and by distributive numerals. In Section 6 we present our analysis of distributive numerals as plural operators over the event argument of the sentence. In Section 7 we provide evidence in support of our analysis of distributive numerals as adverbials. Finally, Section 8 concludes with a summary of our findings and their consequences.

## 2. Theoretical Framework

In this section we present the theoretical premises of the current analysis. Our investigation takes event semantics as a starting point, i.e. it assumes that verbs take an event argument (see Davidson 1967, Parsons 1990, Schein 1993, Lasersohn 1995, *inter alia*). More specifically, we adopt Kratzer's (2003) proposal that verbs can only take one argument besides the event argument, i.e. the internal argument. The subject is not considered to be a real argument of the verb. It is introduced by means of a functional projection headed by the functional category of voice. Thus any semantic operation on verbal denotations will only affect the event argument and the internal argument (if there is one).

In this model, a sentence such as (4) corresponds to the logical form in (5), whose meaning can be paraphrased as, "There is an event *e* such that Inácio is the agent of *e* and *e* is an event of lifting Nádia". We will assume, following Kratzer, that denotations of verb phrases (VPs) are minimal. This means that verb phrases denote events, in which nothing other than that which is expressed by the lexical meaning of verb and object (if there is one) occurs. For example, the verb phrase *lift Nádia* in (4) denotes an event in which nothing other than the lifting of Nádia occurs. Thus no other child can participate, no table can be lifted, nor can any other entity or event take part in this event. Crucially, however, minimal events can be plural events.

(4) Inácio lifted Nádia.
(5) ∃e [**agent** (Inácio)(e) & **lift** (Nádia)(e)]

Another premise put forward by Kratzer 2003, 2005 is the Cumulativity Universal, which postulates that, in natural languages, simple predicate denotations are always cumulative (see Krifka 1992, Landmann 1996). A predicate is cumulative if whenever it

[8] See Matthewson 2004 for a detailed proposal of a methodology for fieldwork.

applies to two individuals it also applies to their sum. A classic example is the nominal plural. If Maria and João are students and Carlos and Andrea are students, then Maria and João and Carlos and Andrea are students. That is, any sum of students belongs to the denotation of *students*. The same pattern can be used to illustrate verbal cumulativity: if is *e* an event of *lifting Nádia* and *e'* is another event of *lifting Nádia*, then *e*+*e'* is also an event of *lifting Nádia*.

The definition of cumulativity for one place nominal predicates is presented below in (6) and illustrated in (7) by the nominal root √*student*. The definition of cumulativity for one-place verbal predicates is presented in (8) and illustrated in (9) by the intransitive verbal root √*sleep* (see Kratzer 2003). Just as with nouns, (8) states that a verbal predicate is cumulative if, and only if, for any two events to which it can be applied, it can also be applied to the two events considered as a plurality.

(6) Cumulativity (of 1-place nouns):
A nominal predicate P is cumulative if, and only if, for every individual *x* and every individual *y*, if P(x) is true and P(y) is true, then P(x+y) is also true[9].

(7) [[√student]] = {Maria, João,…, Maria+João,…, Maria+João+Carlos, ... Maria+João+Carlos+Andrea,... }

(8) Cumulativity (of intransitive verbs):
A verbal predicate P is cumulative if, and only if, for every event *e* and every event *e'*, if P is true of *e* and P is true of *e'*, then P is true of *e*+*e'*. [10]

(9) $[[\surd sleep]] = \{e_1, e_2, \ldots e_n \ldots e_1 + e_2, \ldots, e_1 + e_2 + \ldots + e_n\}$

As a consequence of Kratzer's proposal that external arguments are introduced by the functional category of voice, intransitive verbal roots denote only events. When verbal roots are transitive or ergative they denote relations between events and individuals.

Having presented the theoretical background, we now move on to briefly introduce the facts of Karitiana grammar that are relevant to our discussion.

## 3. About Karitiana

In this section, we present some facts about the grammar of Karitiana that will give the reader enough background to interpret our data. Karitiana displays an ergative-absolutive agreement pattern, absence of tense in subordinate clauses, and a general complement-head order, all of which are characteristic of Tupi stock languages (see Storto 1999).

Although Noun Phrases (NPs) are not marked for case, Karitiana displays an ergative-absolutive pattern with respect to verbal agreement: intransitive verbs agree with their subjects, whereas transitive verbs agree with their direct objects (see Storto 1999). This pattern is illustrated by the contrast between subject agreement in

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[9] Formal definition: $\lambda P_{\langle et \rangle} \forall x \forall y$ [[P(x) & P(y)] $\rightarrow$ P(x+y)], where: P: variable over predicates, x, y: variables over entities (Kratzer 2003).

[10] Formal definition: $\lambda P_{\langle st \rangle} \forall e \forall e'$ [[P(e) & P(e')] $\rightarrow$ P(e+e') ], where: P: variable over predicates, e, e': variables over events ( Kratzer 2003).

intransitive sentences such as (10) and (11), and object agreement in transitive sentences such as (12) and (13).

(10) Atara! Storto 1999
A-tar-a
2s-go- IMP
‘(you) Go away! ’

(11) João i’ot.
João i-‘ot-∅
João 3-fall-NFT
‘João fell down’

(12) Yn naka'yt sypomp pikom.
yn Ø-naka-'y-t sypom-t pikom
1s 3-DECL-eat-NFT two-OBL monkey
‘I ate two monkeys’/ ‘I ate monkeys twice’

(13) An ytaokyt yn Storto 1999
an y-ta-oky-t yn
2s 1s- DECL-hurt- NFT I
‘You hurt me’

Karitiana has a general complement-head order: complements precede postpositions in Postpositional Phrases (PPs), as illustrated by the PPs *Sete de Setembro tyym* (‘along Sete de Setembro (avenue)’) and *hotel pip* (‘to the hotel’) in (14); possessors precede possessed within the NP, as illustrated in (15) and (16), and subordinate clauses precede main clauses, as illustrated in (17).

(14) Sete de Setembro tyym atakatari hotel pip Storto 1999
Sete de Setembro tyym a-taka-tar-i hotel pi-p
Sete de Setembro POS 2s-DECL-go-IRR hotel place- POS
‘You will get to the hotel along Sete de Setembro (avenue)’

(15) ysypy’et Storto 1999
y-sypy’et
1s-uncle
‘my uncle’

(16) Inacio carro
Inacio car
‘Inácio’s car’

(17) [Yn opiso] atakakãrãt an Storto 1999
[yn opiso] a-taka-kãrã-t an
I listen 2s-DECL-think-NFT you
'You thought that I was listening'

According to Storto (1999), Karitiana is a verb-final language, which features obligatory movement of the main verb to second position in matrix clauses. There is a

complementary distribution between matrix clauses and subordinate clauses with respect to the position of the verb. In most cases, declarative matrix clauses have the verb in second position (SVO, OVS), as in sentences (12), (13) and (17) above and (18) and (19) below. Embedded clauses, however, are always verb-final, as in the embedded clauses of sentences (17) above and (19) below.

(18) Taso naka'yt boroja
taso Ø-naka-'y-t boroja
man 3-DECL-eat- NFT snake
'Men ate snakes'

(19) [Taso õwã mangataty] ytapyting yn
[taso õwã mangat-a-ty] y-ta-pyting-∅ yn
man child lift-TV-OBL 1s-DECL- want-NFT I
'I want men to lift children'

According to Storto, verb movement in matrix clauses seems to be associated with the presence of agreement and tense, which are always absent from dependent clauses, as illustrated by presence vs. absence of tense morphemes in the subordinate vs. matrix clauses of sentences (14), (17), (18) and (19) above. The V-final analysis is consistent with head-final word-order.

There is no morpho-syntactic marker for number in the nominal system of Karitiana. In sentence (20) below, the NP *myhint pikom* ('one monkey') is semantically singular, while in sentence (21) the NP *sypomp pikom* ('two monkeys') is semantically plural. However, the NPs of both sentences remain uninflected for number in both contexts. Sentences (20) and (21) also demonstrate that Karitiana does not require numeral classifiers in phrases related to counting, since the numerals are linked directly to the common noun, without the need for classifiers. On the other hand, sentence (22) (in which the NPs occur in their bare form) conveys the meaning that the speaker ate an undefined number of monkeys (one or more), which is expressed by the uninflected noun *pikom*.

(20) Yn naka'yt myhint pikom
yn Ø-naka-'y-t myhin-t pikom
1s 3-DECL-eat-NFT one-OBL monkey
'I ate one monkey'/ 'I ate monkeys once'

(21) Yn naka'yt sypomp pikom
yn Ø-naka-'y-t sypom-t pikom
1s 3-DECL-eat-NFT two-OBL monkey
'I ate two monkeys'/'I ate monkeys twice'

(22) Yn naka'yt pikom
yn Ø-naka-'y-t pikom
1s 3-DECL-eat-NFT monkey
'I ate (the/a/some) monkey(s)'

In Karitiana, there is no marker for definiteness/indefiniteness and/or definite/indefinite determiners. In sentence (18), repeated below as (23), for example, both *taso* (man) and

*boroja* (snake) can be translated either as definite or indefinite and either as singular or plural, depending on the context in which the sentences are uttered. Sentence (23) also demonstrates that the denotation of common nouns in Karitiana is number-neutral, since the sentence conveys the meaning that one or more snakes were eaten by one or more men.

(23) Taso naka'yt boroja
taso Ø-naka-'y-t boroja
man 3-DECL-eat-NFT snake
'Men ate snakes'
('A/the/some man/men ate a/the/some snake(s)')

The numerals could constitute a potential counter-example to the claim that the nominal system in Karitiana is divested of functional morphemes, since they appear to be in a functional position, as we saw in sentences (20) and (21), repeated below as (24) and (25).

(24) Yn naka'yt myhint pikom
yn Ø-naka-'y-t myhin-t pikom
1s 3-DECL-eat-NFUT one-OBL monkey
'I ate one monkey'/ 'I ate monkeys once'.

(25) Yn naka'yt sypomp pikom
yn Ø-naka-'y-t sypom-t pikom
1s 3-DECL-eat-NFUT two-OBL monkey
'I ate two monkeys'/ 'I ate monkeys twice'

Karitiana has a numerical system with units from 1 to 5. Larger numerals are composed of these basic units. However, when in adjunct position, they occur with the oblique suffix *–t*. Table 1 illustrates the morphological structures of numerals in Karitiana.

Table 1: Numerals in Karitiana

| Numerals | Morphological Composition | Word |
|---|---|---|
| 1 | myhin+t<br>one-OBL | Myhint |
| 2 | sypom+t<br>two-OBL | Sypomp |

Numerals are best analyzed as NP or VP adjuncts in the language. Firstly, they are PPs (as we have already pointed out). Secondly, one has to bear in mind that Karitiana is a head-final language. Thus the pre-NP position of the numerals in sentences (24), (25) and (26) is an adjunct position. Thirdly, the numerals also function as adverbials, as illustrated by their potential translation in sentences (24) and (25) as frequency adverbs. Finally, further evidence for their adverbial behavior is the fact that their interpretation as modifying over the NP or over the VP does not depend on their structural position. Sentence (26) illustrates this fact.

(26) Sypomp nakaponpon João sojxaty kyn
sypom-t Ø-naka-pon-pon-Ø João sojxaty kyn
two-OBL 3-DECL-shot-REDUPL-NFT João boar POS

'João shot twice at the/a/some boar(s)'/'João shot at two boars'

The denotation of verbs and of VPs that have not undergone further number operations is also number-neutral in Karitiana. This is demonstrated by the possibility of iterative interpretations for sentences like (27). The adequacy of sentence (27) in a large number of contexts illustrates the possibilities offered by the combination of number-neutral denotations of NPs and the number-neutral denotation of the VP.

(27) Contexts: A/The man ate a snake once.
A/The man ate snakes several times.
(The) Men ate a snake once.
(The) Men ate snakes once.
(The) Men ate snakes many times.
Etc.

| | | |
|---|---|---|
| Taso | naka'yt | boroja. |
| Taso | ∅-naka-'y-t | boroja |
| Man | 3-DECL-eat-NFUT | snake |

'Men ate snakes'
Literally: 'A non-specific number of men ate a non-specific number of snakes a non-specific number of times'.

Unlike its NPs, Karitiana verbs may be marked for number by affix reduplication as attested in the contrast between examples (28a) and (28b). The non-reduplicated sentence is unmarked for number and may describe both singular and plural events. In sentence (28a), the two eggs may have been broken at the same time, i.e. there was only one egg-breaking event, or they may have been broken one at a time, i.e. there were two egg-breaking events. Reduplicated sentences are plural in the sense that they may only describe plural events. For sentence (28b) to be felicitous, there has to more than one egg-breaking event.

(28) a. Contexts: A child broke two eggs at once (one event only).
A child broke one of two eggs at a time (two or more events).

| | | | |
|---|---|---|---|
| Õwã | nakakot | sypomp | opokakosypi. |
| õwã | ∅-naka-kot-∅ | sypom-t | opokakosypi |
| child | 3-DECL-break-NFUT | two-OBL | egg |

'Children broke two eggs'

b. Contexts: *A child broke two eggs at once (one event only).
A child broke one of two eggs at a time (two or more events).

| | | | |
|---|---|---|---|
| Õwã | nakokonat | sypomp | opokakosypi.[11] |
| õwã | ∅-na-kot-kot-a-t | sypom-t | opokakosypi |
| child | 3-DECL-break-RDPL-VERB-NFUT | two-OBL | egg |

'Children broke two eggs'

[11] The phonological rules of affix reduplication in Karitiana have not yet been described.

Having presented the relevant characteristics of Karitiana grammar, we now proceed to the discussion of the collective, cumulative and distributive interpretations of utterances in the language.

## 4. Cumulative, Collective and Distributive Readings in Karitiana

This section discusses cumulative, collective and distributive interpretations of sentences such as (29) in Karitiana. All these interpretations are claimed to be generated by the lexical cumulativity of its verbs and nouns.

(29) Õwã nakam'at gooj
õwã Ø-naka-m-'a-t gooj
child 3-DECL-CAUS-build-NFT canoe
'Children built canoes'

Literally: An undefined number of children built an undefined number of canoes.

We assume that the Cumulative Universal is true for both nouns and verbs in Karitiana. Given that nouns and verbs are cumulative when they are part of syntactic structures, we can predict that Karitiana sentences that have not undergone number operations (such as the use of numerals or distributive operators) will have a range of possible interpretations regarding the number of individuals or events that a particular sentence can describe. This range of interpretations was illustrated above by sentences (27) and (29).

Sentence (29) is neutral as to the number of events and entities involved in the situation it describes. The sentence *Õwã nakam'at gooj* holds true for any number of events in which any number of children built any number of canoes. This interpretation is formally represented in (30).[12] The sentence and its logical representation hold true for situations which may be referred to as (i) cumulative: children building canoes in various possible combinations; (ii) collective: a group of children building a group of canoes together; and (iii) distributive: each child building one canoe, or each child building two canoes, etc..

(30) ∃E∃X∃Y [**build** (Y) (E) & **agent**(X)(E) & **child**(X) & **canoe**(Y)],
Where: E is a variable over singular and plural events, and X and Y are variables over singular and plural entities.

Assuming that **child** and **canoe** are cumulative predicates, and **build** and **agent** are cumulative relations, the logical representation in (30) accounts for the fact that sentence (29) holds true in a range of situations such as: (i) one child building a single canoe; (ii) a group of children building a single canoe; (iii) one child building some canoes; (iv) each child building a canoe *et alia*.

In order to illustrate our conclusion, we will create three situations: a cumulative situation, a collective situation and a distributive situation. We will then proceed to show that the fact that sentence (29) holds true in all of the three situations is the result of lexical cumulativity. Table 2 illustrates a possible cumulative situation in which three girls (Ana, Bia and Cris) build canoes. Ana and Bia build one canoe each, and the three girls together build one other canoe.

[12] The logical representation in (30) leaves out the interpretation of the functional morphemes NFT, CAUS, DECL, as they are not relevant to the conclusion being drawn.

Table 2: situation 1 - cumulative

| **Agent** | **Theme** | **Event** |
|---|---|---|
| **Ana** | $canoe_1$ | $e_1$ |
| **Bia** | $canoe_2$ | $e_2$ |
| **Ana+Bia+Cris** | $canoe_3$ | $e_3$ |

The logical representation in (30), attributed to the sentence *Õwã nakam'at gooj*, holds true for situation 1. This interpretation can be derived from the cumulative denotations of the predicates involved (see (31)). Capital letters represent the names of the girls, $e_n$ stands for events, c stands for canoes, and n is a variable over the natural numbers. Situation 1 is described by the attribution of the values in (32) to the variables X, Y and E in (30).[13]

(31) [[**child**]] = {A, B, C, A+B, A+C, B+C, **A+B+C**}
[[**canoe**]] = {$c_1$, $c_2$, $c_3$, $c_1$+$c_2$, $c_2$+$c_3$, $c_1$+$c_3$, **$c_1$+$c_2$+$c_3$**}
[[**agent**]]= {<A,$e_1$>,<B,$e_2$>,<A+B+C,$e_3$>,<A+B,$e_1$+$e_2$>,<A+C,$e_1$+$e_3$>, <B+C, $e_2$+$e_3$>,**<A+B+C, $e_1$+$e_2$+$e_3$>, ...**}
[[**build**]]= {<$c_1$,$e_1$>,<$c_2$,$e_2$>,<$c_3$,$e_3$>,<$c_1$+$c_2$,$e_1$+$e_2$>,<$c_1$+$c_3$,$e_1$+$e_3$>, <$c_2$+$c_3$,$e_2$+$e_3$>, **<$c_1$+$c_2$+$c_3$,$e_1$+$e_2$+$e_3$>**, ...}

(32) X → A + B + C
Y → $c_1$+$c_2$+$c_3$
E → $e_1$+$e_2$+$e_3$

Table 3 illustrates a possible collective situation, in which the three girls build each of the three canoes together. Again, *Õwã nakam'at gooj* holds true. And the reasons for this are the same as for Situation 1: there is a plural event which is the sum of all three building-canoe events, and which has the sum of all three girls as its agent. This is so because, although the denotations of **agent** and **build** have changed in situation 2 (see (33)), they are still cumulative, which means that the same attribution of values as in (32) is still possible.

Table 3: situation 2 - collective

| **Agent** | **Theme** | **Event** |
|---|---|---|
| **Ana+Bia+Cris** | $canoe_1$ | $e_1$ |
| **Ana+Bia+Cris** | $canoe_2$ | $e_2$ |
| **Ana+Bia+Cris** | $canoe_3$ | $e_3$ |

(33) [[**agent**]] = {<A+B+C,$e_1$>,<A+B+C,$e_2$>,<A+B+C,$e_3$>,<A+B+C,$e_2$+$e_3$>, **<A+B+C, $e_1$+$e_2$+$e_3$>**, ...}
[[**build**]] = {<**$c_1$**,**$e_1$**>, <**$c_2$**,**$e_2$**>, <**$c_3$**,**$e_3$**>, <$c_1$+$c_2$,$e_1$+$e_2$>, <$c_2$+$c_2$,$e_2$+$e_2$>, <$c_1$+$c_3$,$e_1$+$e_3$>, **< $c_1$+$c_2$+$c_3$, $e_1$+$e_2$+$e_3$>**, ...}

Table 4 illustrates a possible distributive situation in which the three girls (Ana, Bia and Cris) each build one canoe. Again, although the denotations of **build** and **agent** are not

[13] Our model has only three children and three canoes for simplicity, but other objects may be being built, and there may be other agents within the denotations of **build** and **agent**, which are represented by ' …'.

the same as in situations 1 and 2 (see (34) below), *Õwã nakam'at gooj* also holds true in Situation 3. The reasons are the same ones that make the sentence true in the two previous situations: there is a plural event which is the sum of all three building-canoe events, and which has the sum of the three children as its agent.

Table 4: situation 3 - distributive

| **Agent** | **Theme** | **Event** |
|---|---|---|
| **Ana** | canoe$_1$ | e$_1$ |
| **Bia** | canoe$_2$ | e$_2$ |
| **Cris** | canoe$_3$ | e$_3$ |

(34) [[**agent**]]= {<A,$e_1$>, <B,$e_2$>, <C,$e_3$>, <A+B,$e_1$+$e_2$>, <A+C,$e_1$+$e_3$>,<B+C,$e_2$+$e_3$>, **<A+B+C, $e_1$+$e_2$+$e_3$>**, ...}

[[**build**]] = {<$c_1$,$e_1$>, <$c_2$,$e_2$>, <$c_3$,$e_3$>, <$c_1$+$c_2$,$e_1$+$e_2$>, <$c_1$+$c_3$,$e_1$+$e_3$>, <$c_2$+$c_3$,$e_2$+$e_3$>, **< $c_1$+$c_2$+$c_3$, $e_1$+$e_2$+$e_3$>**, ...}

As mentioned in section 3, a relevant aspect of Karitiana grammar is that verbs may be marked for number by affix reduplication. This phenomenon has been called pluractionality in the literature (see Cusic 1981, Newman 1990, and Lasersohn 1995). Pluractionality refers to event plurality. Sentence (35b) is the pluractional version of sentence (29) repeated below as (35)a.

(35) a. Õwã nakam'at gooj
õwã Ø-naka-m-'a-t gooj
child 3-DECL-CAUS-build-NFT canoe
'Children built canoes' (both singular and plural events)

b. Õwã nakam'ab'adn gooj
õwã Ø-naka-m-'a-m-'a-t gooj
child 3-DECL-CAUS-build-CAUS-RDPL-NFT canoe
'Children built canoes' (only plural events)

Müller & Sanchez-Mendes (2008) defend the hypothesis that pluractional affixes act as plural operators on the cumulative denotations of the verbs in the language. In their view, what reduplicated affixes do in Karitiana is subtract singular events from the cumulative denotations of verbs.

According to this assertion, the interpretation attributed to sentence (35b) is exactly the same as that attributed to sentence (35a), except for the fact that its denotation lacks atomic events. The pluractional sentence holds true only for plural events. Atomic events such as *one child building one canoe,* or *a group of children collectively building one canoe,* do not belong to its denotation. Sentences (28a-b), repeated below as (36a-b) illustrate this fact. Sentence (36a) is appropriate for both singular- and plural-event contexts, whereas sentence (36b) is only appropriate for plural-event contexts.

(36) a. Õwã nakakot sypomp opokakosypi.
õwã ∅-naka-kot-∅ sypom-t opok-ako-sypi
child 3-DECL-break-NFT two-OBL egg
'Children broke two eggs'

| | | | | |
|---|---|---|---|---|
| b. | Õwã | nakakokonat | sypomp | opokakosypi. |
| | õwã | ∅-naka-kot-kot-a-t | sypom-t | opok-ako-sypi |
| | boy | 3-DECL-break-RDPL-TV-NFT | two-OBL | egg |

'Children broke two eggs'/ 'Children broke eggs twice'

It is important to note that, in line with this analysis of pluractional affixes in Karitiana, reduplication influences the lexical denotation of verbs, i.e. pluractional affixes are not plural or distributive operators over the whole VP or over the whole sentence. They only affect the verb itself. The formulas in (37) and (38) set out the definitions of the pluractional operator for both intransitive (37) and transitive verbs (38).

(37) $PL = \lambda P_{<s,t>} \lambda E\ [P(E)\ \&\ \text{non-atomic}\ (E)]$

(38) $PL = \lambda P_{<e<s,t>>} \lambda X\ \lambda E\ [P(X)(E)\ \&\ \text{non-atomic}\ (E)]$

Where: X: variable over singular and plural entities,
E: variable over singular and plural events,
P: variable over predicates,
e: semantic type of entities,
s: semantic type of events.
t: semantic type of sentences

Thus sentence (35b), which is the pluractional version of sentence (35a), is predicted to also hold true for the three situations referred to above, since even if one strips out the atomic events from the verbal denotation, there is still a plural event for which the pluractional sentence holds true. According to Müller & Sanchez-Mendes 2008, this prediction is actually borne out in the language itself.

As mentioned in the introduction, Karitiana has distributive numerals, as in sentence (1), repeated below as (39). Sentence (39) is only true for distributive situations, such as the one in Situation 3 in which each girl built one canoe; or, as in situation 2 (with an iterative interpretation) where, on each occasion, the three girls built one canoe. Note that Situation 2 may be a collective situation in terms of the agent of each event because the girls always act as a group, but it is a distributive situation in that there is one canoe-building event per occasion (day, week, etc).

| | | | | | |
|---|---|---|---|---|---|
| (39) | Myhint | myhint | nakam'at | gooj | õwã |
| | myhim-t | myhim-t | Ø-naka-m-'a-t | gooj | õwã |
| | one-OBL | one-OBL | 3-DECL-CAUS-build-NFT | canoe | child |

'Children built canoes distributively'
('Each child built one canoe'/ 'On each occasion, children built one canoe')

We have shown that that both *Õwã nakam'at gooj* and *Myhint myhint õwã nakam'at gooj* have distributive interpretations. This means that both lexical cumulativity and *myhint myhint* generate distributive readings. The question then arises of whether these distributive readings have the same semantics. We will address this question in the next two sections.

## 5. Distributivity in Karitiana

In this section, we will show that the distributive interpretations generated by lexical cumulativity differ from the distributive interpretations generated by distributive numerals. In the first case we will show that they are just a subset of the range of possible interpretations permitted by lexical cumulativity. The distributivy generated by distributive numerals, on the other hand, is a result of the pluralization of the events denoted by the sentence.

By event pluralization we understand an operation that generates the set of all the sums under union of the members of the original set denoted by the relation over which the distributive numeral has scope. This kind of plural operation differs from the kind of pluralization we claimed was the case for verbal reduplication. In this case, pluralizing of the denotation of a verb by reduplication involved stripping out the atoms of a cumulative lexical denotation.

In the previous section, we went through the interpretations generated by lexical cumulativity. Sentence (29), repeated below as (40), was shown to hold true for any number of canoe-building events, in which any number of children and any number of canoes were involved.

(40) Õwã Ø-naka-m-'a-t gooj
child 3-DECL-CAUS-build-NFT canoe
'Children built canoes'

However, when the cardinality of the object NP is fixed, the distributive interpretations of sentence (40) disappear. Sentence (41) below has only one interpretation in which, no matter how many children participated in the event, only one canoe was built. Crucially, sentence (41) does not hold true for a situation such as Situation 3, in which each child built one canoe, or for a situation such as Situation 2 in which, on each occasion, children built only one canoe.

(41) Õwã nakam'at myhint gooj
õwã Ø-naka-m-'a-t myhin-t gooj
õwã 3-DECL-CAUS-build-NFT one-OBL canoe
'Children built one canoe'

Distributive numerals, on the other hand, only allow for distributive interpretations. For example, sentence (42), with the distributive numeral *myhint myhint* ('one one'), only holds true for distributive situations, such as situations in which each of the children built one canoe or in which, on each occasion, children collectively built only one canoe. Cumulative and collective interpretations such as those illustrated by sentence (40) are simply not possible.

(42)
Myhint myhint õwã nakam'at gooj
Myhim-t myhim-t õwã Ø-naka-m-'a-t gooj
one-OBL one-OBL child 3-DECL-CAUS-build-NFT canoe
'Children built canoes distributively'
('Each child built one canoe'/'On each occasion, children built one canoe')

The contrast between the meanings of sentences (41) and (42) is reminiscent of Kratzer's (2003) argument in favor of the existence of both lexical cumulativity and VP plurality. She points out that lexical cumulativity is not sufficient to explain the contrast between the difference among the number of possible interpretations for sentences (43a) and (43b). Sentence (43a) means that the subject always guards the same parking lot, whereas sentence (43b), in addition to this interpretation, has a distributive meaning in which each individual in the denotation of the subject guards a different parking lot.

(43) a. She guards a parking lot.
b. They guard a parking lot.

Since the events are assumed to be minimal, the event of guarding one parking lot can never contain more than one parking lot, even if it is a plural event, otherwise one would have an event of guarding more than one parking lot. This explains why (43a) always relates to the same parking lot no matter how many times the event is iterated. It also shows that lexical cumulativity alone is not sufficient to explain how one identifies more than one parking lot in the distributive interpretation of (43b). Kratzer concludes from this that the VP in (43b) must have been pluralized.

As we have already pointed out, the same contrast in the availability of distributive readings holds true between sentences (40) and (42). We take this as demonstrating a case of phrasal plurality which was generated by the insertion of *mynhint myhint.*

We therefore conclude that lexical cumulativity differs from phrasal plurality or from phrasal distributivity as predicted by Kratzer (2003, 2005), and that distributive numerals are phrasal plural operators. Having resolved this issue, we can now turn to an analysis of distributive numerals as plural operators over events.

## 6. 'Myhint Myhint' – The Analysis

In this section, we focus on the semantics of distributive numerals in Karitiana. We claim that distributive numerals are adverbial operators that pluralize the event argument of a relation between entities and events and impose a restriction on the cardinality of the entities. By pluralization of the event argument, we mean that the event denoted by the sentence or by the VP must be plural.

The analysis for *myhint myhint* ('one one') is given a logical representation in (44). The logical representation states that an event that makes a sentence with *myhint myhint* true is about a plural event, whose subevents are events of children building one canoe. We leave the criteria for individualizing the sub-events open. The translations show that they may be individualized on the basis of the agent or on the basis of ties. However, this matter deserves further research. Contrary to usual distributive quantifiers such as *each* that quantify over entities, *myhint myhint* quantifies over events, not over entities. In the case of other distributive numerals like, for example, *sypomp sypomp* ('two two') or *myjim myjym* ('five five'), the cardinality of the entities in the denotation of the relation varies according to the cardinality of the reduplicated numeral. The denotation in (44) is similar to the denotation Matthewson (2000) proposes for the St'at'imcets distributive element *pelpala7*.

(44) [[**myhint myhint**]] = $\lambda X\, \lambda R_{<e,<s,t>>}\, \lambda E\, [\exists e_1\, \exists e_n\, [*E = e_1 + \cdots . + e_n\, \&$
$n \geq 2\, \&\, \forall e_n\, \exists x\, [*x < *X\, \&\, |x| = 1\, \&\, R(x)(e_n)]]$
where: X, x: variables over singular and plural entities;
E: variable over singular and plural events;
R: variable over relations between events and entities;
$e_n$: variable over subevents;
n: variable over the natural numbers.

Sentence (39), repeated below as (45), which is the distributive numeral version of sentence (39), is taken to have a meaning that can be paraphrased as 'There was plural event of children building canoes and for every subevent of this plural event, there is a canoe that is built in it'. In other words, it describes a situation that is the sum of multiple events of children building one canoe. Its logical representation is laid out in (46).

(45)

| | | | | |
|---|---|---|---|---|
| Myhint | myhint | õwã | nakam'at | gooj |
| Myhim-t | myhim-t | õwã | Ø-naka-m-'a-t | gooj |
| one-OBL | one-OBL | child | 3-DECL-CAUS-build-NFT | canoe |

Children built canoes distributively
('Each child built canoes'/'On each occasion, children built one canoe')

(46) $\exists E \exists X \exists Y$ [**agent**(X)(E) & **child** (X) & $\exists e_1 \ldots \exists e_n$ $[E = e_1 + \cdots . + e_n\, \&$
$n \geq 2\, \&\, \forall e_n\, \exists x\, [*y < *Y\, \&\, \textbf{canoe}(Y)\, \&\, |y| = 1\, \&\, \textbf{build}(y)(e_n)]]$,
where: Y,y are variables over singular and plural entities, and the other variables are as in (44).

In this section, we have claimed that distributive numerals in Karitiana are plural operators over events. In the next section, we provide evidence that lends support to the analysis of distributive numerals are adverbial quantifiers, not determiner quantifiers.

## 7. Distributive Numerals as Adverbial Quantifiers

The main purpose of this section is to provide syntactic and semantic evidence in support of the analysis of distributive numerals as adverbial distributive operators and as unambiguous between a Determiner-Quantifier and an Adverbial Quantifier.

Firstly, reduplicated numerals such as *myhint myhint*, obligatorily distribute semantically. Furthermore, the interpretation: *children built canoes distributively* ('Each child built one canoe'/ 'On each occasion, children built one canoe'), associated with the sentences in (47) does not depend on the position of the adverbial operator. No matter what position *myhint myhint* occurs in (of all the possible positions), it is always the case that the same interpretations are available.

(47)

| | | | | | |
|---|---|---|---|---|---|
| a. | **Myhint** | **myhint** | nakam'at | gooj | õwã |
| | myhim-t | myhim-t | Ø-naka-m-'a-t | gooj | õwã |
| | one-OBL | one-OBL | 3-DECL-CAUS-build-NFT | canoe | child |

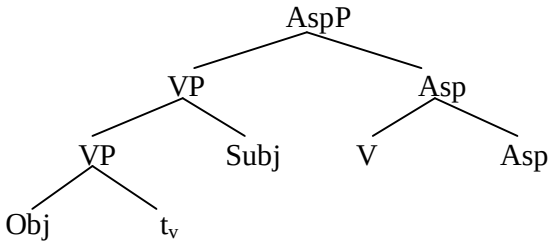
'Children built canoes distributively'
('Each child built one canoe'/ 'On each occasion, children built one canoe')

b. Õwã Ø-nakam'at **myhin-t** **myhin-t** gooj
child 3-DECL-CAUS-build-NFT one-OBL one-OBL canoe
'Children built canoes distributively'
('Each child built one canoe'/ 'On each occasion, children built one canoe')

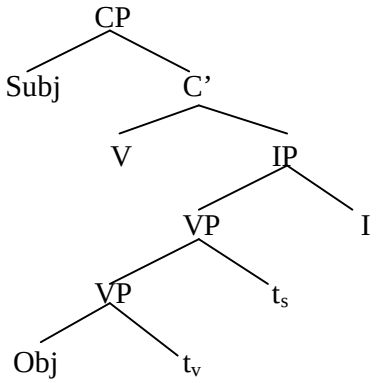
c. Õwã Ø-nakam'at gooj **myhin-t** **myhin-t**
child 3-DECL-CAUS-build-NFT canoe one-OBL one-OBL
'Children built canoes distributively'
('Each child built one canoe'/ 'On each occasion, children built one canoe')

In order to reinforce the syntactic argumentation in favor of the adverbial nature of reduplicated numerals, we will rely mainly on Storto's (1999) proposal for the clausal structure of Karitiana. The author proposes the following syntactic structures presented in (48) for embedded clauses and (49) for matrix clauses, in order to account for some of the properties of Karitiana already set out in section 2: (i) complementary distribution between matrix clauses and subordinate clauses with respect to the position of the verb, verb-second in matrix clauses, verb-final in embedded clauses; (ii) complementary distribution between matrix and embedded sentences with regard to the presence or absence of the inflectional markers of tense; (iii) movement of the verb to the complementizer phrase of matrix clauses, the locus for nominative case checking.

(48) $[_{AspP}\ [_{VP}\ [_{VP}\ Obj\ t_v\ ]\ Subj\ ]\ [_{Asp}\ V\ Asp\ ]\ ]$




(49) $[_{CP}\ Subj\ [_{C'}\ V\ [_{IP}\ [_{VP}\ [_{VP}\ Obj\ t_v\ ]\ t_s\ ]\ I\ ]\ ]\ ]$




In Storto's analysis of embedded clauses (50), the verb moves from its base position to the head final position of the only embedded clause functional projection, an Aspectual Phrase (AspP), given that embedded clauses are not inflected for tense. Her analysis of

matrix transitive clauses is given in structure (49). In matrix clauses, the verb moves up as far as $C^o$. When the verb is in $C^o$, the subject usually moves up to the Specifier of the CP position (Spec CP), where it checks nominative case, and the object is permitted *in situ*.

The position of the adverbs in the sentence is used by Storto (1999) to give support to the clause structure analyses proposed above. In Karitiana, adverbs left-adjoin to maximal projections, except for those above the CP, which may also right-adjoin to the CP. The paradigm in (50) shows the distribution of the adverb *mynda* ('slowly') in subordinate clauses. There is only one position available for adverbs in embedded clauses, insofar as they adjoin to the only functional projection, AspP. This explains the grammaticality of (50a) as opposed to the ungrammaticality of (50b,c,d).

(50) a. [**mynda** ysypy'et him okej] *Adv S O V*
mynda y-sypy'et him okej Storto (1999)
slowly 1s-uncle meat cut
'My uncle cut the meat slowly'

b. *[y-sypy-'et **mynda** him okej] * *S Adv O V*
1s-uncle slowly meat cut Storto (1999)

c. *[y-sypy'et him **mynda** okej] * *S O Adv V*
1s-uncle meat slowly cut Storto (1999)

d. *[y-sypy'et him okej **mynda**] **S O V Adv*
1s-uncle meat cut slowly Storto (1999)

The paradigm in (51) shows the distribution of adverbs in matrix clauses. The data in (51) shows that the adverb *mynda* may be left-adjoined to CP as in (51a), right-adjoined to CP as in (51d) or left-adjoined to VP as in (51c). The ungrammaticality of sentence (51b) is evidence for moving the analysis of the verb up to $C^o$, followed by moving the subject up to Spec CP (no constituent can come between the subject and the verb in a Spec-head configuration).

(51) a. **Mynda** taso nampotporaj ese *Adv S V O*
mynda taso Ø-na-m-potpora-j ese Storto (1999)
slowly man 3-DECL-CAUS-boil-FUT water
'Men boiled water slowly'

b. *Taso **mynda** Ø-na-m-potpora-j ese **S Adv V O*
man slowly 3-DECL-CAUS-boil-FUT water Storto (1999)

c. Taso Ø-na-m-potpora-j **mynda** ese *S V Adv O*
man 3-DECL-CAUS-boil-FUT slowly water Storto (1999)

d. Taso Ø-na-m-potpora-j ese **mynda** *S V O Adv*
man 3-DECL-CAUS-boil-FUT water slowly Storto (1999)

The first syntactic argument in favor of our analysis of reduplicated numerals as adverbial distributive operators has to do with the fact that *myhint myhint* has the same

distribution as other adverbs such as *mynda*, both in matrix and embedded clauses. As for all adverbs in embedded clauses, the only possibility is for *myhint myhint* to be adjoined to VP (see paradigm (52)).

(52) a. [**Myhint myhint** jonso õwã mangataty] ytapyting yn
[myhim-t myhim-t jonso õwã mangat<a>-ty] y-ta-pyting-∅ yn
one-OBL one-OBL woman child lift-OBL 1s-DECL-want-NFT I
'I want women to lift children distributively (in ones)'

b. *[jonso **myhint myhint** õwã mangataty] ytapyting yn
woman one-OBL one-OBL child lift-OBL 1s-DECL- want-NFT I

c. *[jonso õwã **myhint myhint** mangataty] ytapyting yn
woman child one-OBL one-OBL lift-OBL 1s-DECL- want-NFT I

d. *[jonso õwã mangataty **myhint myhint**] ytapyting yn
woman child lift-OBL one-OBL one-OBL 1s-DECL- want-NFT I

Returning to paradigm (47), we observed that, in matrix clauses, *myhint myhint* may be left-adjoined to CP as in (47a), right-adjoined to CP as in (47c), or left-adjoined to VP as in (47b). Like other adverbials in Karitiana, *myhint myhint* cannot come between the subject and the verb in CP, as shown by the ungrammaticality of (53), which also serves as evidence for a second syntactic argument. This shows that *myhint myhint* does not form a constituent with the subject NP. If reduplicated numerals were DP quantifiers (part of the DP constituent headed by the noun *õwã*) they would not interrupt the adjacency between the verb and the subject when moving of the subject up to CP has taken place.

(53) *Õwã **myhin-t myhin-t** Ø-nakam'at gooj
child one-OBL one-OBL 3-DECL-CAUS-build-NFT canoe

A third syntactic argument that supports the adverbial status of *myhint myhint* is the fact that it occupies the same position as other adverbial quantifiers such as *kandat* 'a lot'/'many times', as demonstrated by the sentences in (54).

(54) a. **Kandat** jonso nakaot ese *Adv S V O*
kandat jonso Ø-naka-ot-Ø ese
kandat woman 3-DECL-get-NFT water
'Women brought water many times'

b. *jonso **kandat** Ø-naka-ot-Ø ese *S Adv V O*
woman kandat 3-DECL-get-NFT water

c. jonso Ø-naka-ot-Ø **kandat** ese *S V Adv O*
kandat 3-DECL-get-NFUT kandat water

d. jonso Ø-naka-ot-Ø esse **kandat** *S V O Adv*
woman 3-DECL-get-NFT water kandat

Our final argument against an analysis of distributive numerals as D-quantifiers is based on the structure of NPs in Karitiana, which have no non-empty functional projections. As mentioned in Section 3, there are no morphosyntactic markers for number, classifiers or (in)definiteness within the nominal system in Karitiana. [14]

However, the universal quantification marker could be a potential counter-example to our conclusions. In line with the paradigm in (55), one could hypothesize that *akatyym***,** the universal quantification marker, is a determiner-quantifier that forms a constituent with the head noun, inasmuch as it appears right-adjacent to the noun on which it operates [the subject in (55a) and the object in (55b)], a position that is occupied by nominal determiners in head final languages. The paradigm in (55a-d) shows the contrast between the distribution of *akatyym* in matrix clauses with the distribution of distributive quantifier *myhint myhint* (see (47)). We should remember that, in matrix clauses, adverbials and adverbial quantifiers cannot interrupt the adjacency between the subject and the verb.

(55) a. Taso **akatyym** nasoko'it eremby Coutinho-Silva 2009
taso aka-tyym Ø-na-soko'i-t eremby
man be-SUB 3-DECL-tie-NFT hammock
'All men tied hammocks'

b. Taso nasoko'it eremby **akatyym** Coutinho-Silva 2009
taso Ø-na-soko'i-t eremby aka-tyym
man 3-DECL-tie-NFT hammock be-SUB
'Men tied all hammocks'

c. ***Akatyym** taso nasoko'it eremby Coutinho-Silva 2009
aka-tyym taso Ø-na-soko'i-t eremby
be-SUB man 3-DECL-tie-NFT hammock
'All men tied hammocks'

d. *Taso nasoko'it **akatyym** eremby Coutinho-Silva (2009)
taso Ø-na-soko'i-t aka-tyym eremby
man 3-DECL-tie-NFT be-SUB hammock
'Men tied all hammocks'

Nevertheless, as hinted at in the glosses, *akatyym* has internal structure. Müller et al. (2006) and Coutinho-Silva (2009) maintain that *akatyym* has the structure of a relative clause. Relative clauses in Karitiana are verb final, just like other subordinate clauses, as illustrated in (56).

(56) Ypyso'ooton yn eremby João tisokõit Storto 1999
y-py-so'oot-on yn eremby João ti-sokõi-t
1s-ASSERT-see-NFUT I hammock João OFC-tie.up-OBL
'I saw hammocks João tied up'

Therefore, if we look carefully at data that suggest that Karitiana has something close to nominal quantifiers, we realize that that is not the case. The evidence given in this

[14] We are digressing from the DP/NP distinction, since a discussion of whether nominal phrases in Karitiana are DPs our NPs is outside the scope of this paper.

section strongly supports our assertion that distributive numerals are adverbial operators.

## 8. Conclusions

We have argued that there are (at least) two kinds of distributivity in Karitiana: distributivity generated by lexical cumulativity, and distributivity generated by a distributive numeral. Distributive numerals were considered to be adverbial operators over a relation between entities and events denoted by VPs or sentences - they pluralize the events and impose a cardinality restriction on the entities. The two different interpretations of a sentence with distributive numerals were claimed to stem from the different criteria that can be used to individualize events. This claim was supported by syntactic evidence that distributive numerals in Karatiana always behave as adverbials and never as determiner-quantifiers.

The semantics of nouns and verbs in Karatiana provides support for the Cumulativity Universal as proposed by Krifka (1992), Landmann (1996) and Kratzer (2003, 2005). It also provides evidence for the existence of (at least) two sources of plurality and distributivity: lexical cumulativity and VP cumulativity, as outlined by Kratzer (2003, 2005).

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