Reduplicated Numerals as Pluractionals: Distributivity as a Window to the Individuation of Events[*]

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Abstract

The focus of this paper are Reduplicated Numerals in Mandarin Chinese (Sino-Tibetan) and in Karitiana (Arikém, Tupi). Our goal is to elucidate their semantics and thus to contribute to the understanding of the relation between distributivity and individuation in the event domain. It is well known that reduplicated numerals have distributive effects across languages (Gil 1988, Balusu 2006). In this paper, we look at reduplicated numerals in two typologically unrelated languages that lack morphological Number marking on the NP/DP. We analyze the distributive effects of reduplicated numerals as generated by a pluractional operation (see also Cable 2014). By considering the semantic contribution of the numeral phrase within the pluractional operator, we wish to open a window on the delicate issue of event individuation.

1. Introduction

The notion of pluractionality has been introduced by Newman (1988) in order to describe the morphological marking of plurality on the verb in some African languages. Pluractional markers have been endowed with semantic content as verb-bound morphemes, cf. Lasersohn (1995): "*pluractionals markers attach to the verb to indicate a multiplicity of actions, whether involving multiple participants, times or locations*". Most recent analysis, however, use the notion of pluractionality in a broader sense, where this term is no more restricted to the description of morphological marking and covers more generally the definition of plurality of events. This is the way we will use it in this paper.[1]

Event plurality is described in the literature as subject to different distributive requirements. Plural events may be obtained by distributing over spatial and temporal coordinates or over the participants to the event. Some pluractional markers are specified for one or the other dimension (Collins 2001, Yu 2003), others allow more than one choice in context and can thus be interpreted as having different distributional or individuating options.

In this paper, we discuss a pluractional construction of the latter type. Reduplicated Numerals (RedNums) in Mandarin (1) and Karitiana (2) can be used to describe at least three possible situations, corresponding to the readings (a-c) below.[2] The three readings in (a)–(c) may be described roughly as cases of distribution over participants, time or space. Note that while both Mandarin and Karitiana allow for distribution over internal arguments and temporal-spatial coordinates, only Mandarin has also the option of distributing over the external participant to the event (1c).

(1) Haizi **liang-ge.liang-ge-**de   chi-wan- le   huashendou
    child two-NCL.two-NCL-DE_2 eat-finish-ASP   peanut[3]
    ≈ 'The children ate the peanuts two by two.'

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[1] For an overview, see Cabredo-Hofherr & Laca (2010) and references therein.

[2] Throughout the paper we use the following abbreviations in the Mandarin and Karitiana glosses: 3 – third person; ABS – absolutive agreement; ADJ – adjunct marker; ANAPH – anaphora; ASP – aspectual marker; DE_2 – adverbial modification marker; DECL – declarative mood; FT-future tense; NCl – Nominal Classifier; NFT – non-future tense; OBL – oblique case; PART – participle; STR – structural morpheme (e.g. object-preposing marker BA); VCL – verbal classifier; <TV> – thematic vowel.

[3] We use the subscript 2 to distinguish the adverbial modification marker DE_2 from the sometimes homophonous adnominal modification marker DE_1. The two functional morphemes are written using two different characters, namely 地 and 的。

For each child, there is an event of his eating two peanuts.
For each occasion/location, there is an event of children eating two peanuts.
For each occasion/location, there is an event of two children eating peanuts.

(2) **Sypom-t.sypom-t**   ombaky Ø-naka-'y-t   pikom.
    two-ADJ.two-ADJ   jaguar   3-DECL-eat- NFT   monkey
    ≈ 'Jaguars ate monkeys two by two.'

For each jaguar, there is an event of his eating two monkeys.
For each occasion/location, there is an event of jaguars eating two monkeys.
#For each occasion/location, there is an event of two jaguars eating monkeys.

  We focus on the semantics of RedNums in the two languages and relate it to the issue of event individuation. As for Red-Nums we will defend the following claims. Firstly, we claim that Reduplicated Numerals are pluractional operators. Specifically, we argue that the pluralization of events through Reduplicated Numerals comes from pluralizing the relation between events and their arguments, as events are individuated through them. We will argue that the time – and space-related interpretations of RedNum-sentences arise from the vagueness pertaining to event individuation (see also Müller & Negrão 2010, Cable 2013), and hence the availability of the readings (a)-(c) depends on the way in which the participants individuating the event are paired with time intervals or with distinct locations in context.

  Secondly, we claim that the reduplicated phrase is invariably an adverbial constituent taking scope over the verbal phrase (vP/VP), and that the different readings in the two languages (and in particular the infelicity of the reading paraphrased by (c) in Karitiana) are due to distinct scope options for the RedNum with respect to the verb phrase. Hence the different array of readings in (a)-(c) are not due to the scopal ambiguity of a distributive operator (DP vs. VP scope).

  We also wish to address a more general issue: What are the conditions under which events are identified as individual entities? The two languages that we are discussing here may give us a specific insight on this issue. Mandarin and Karitiana both allow bare nouns to be arguments of the verb (see (1) and (2)). We assume that these bare arguments have number-neutral, cumulative denotations (Kratzer 2008, Müller 2004). Therefore, in these languages cumulative denotations are not only a property of verbs (which is assumed to be true for all languages, according to Kratzer's 2008 cumulativity universal), but also of vPs/VPs with bare arguments. In Mandarin an explicit functional morpheme, a (nominal) classifier, is used for sorting, counting and referring to the entities denoted by bare NPs. Karitiana, conversely, makes no use of nominal classifiers. Setting apart distributive and cumulative readings of sentences in the two languages thus requires an

operation of sorting out and deciding on the kind of entities in the denotation of the bare noun argument that are to be taken as the basis of individuation.

We will show that the criterion for individuation required by the pluractional operator has to be encoded in the RedNum itself since bare NPs do not mark which constituents are to be distributed and on what basis. We will also show that, in both languages, the numeral in the adverbial phrase specifies the cardinality of the entities that form a group participant to the event.

Although the vP/VP to which the pluractional operator – the RedNum – applies denotes a relation between a set of events and a set of objects, only the entities in the denotation of the latter have a criterion of identity specified by the reduplicated numeral – the (explicit or implicit) classifier. This identity criterion is then carried over to the events denoted by the verb, providing a way to individuate events and thus to obtain the plurality of events, which is needed for distributivity.

In the remainder of this section, we will present the aspects of the Karitiana and Mandarin grammar which will be needed in order to follow the argument and understand the data presented in the paper (section 1.1.). The structure of the paper then is the following. In section 2, we present an overview of the typological work on distributive numerals. In section 3, we show that Reduplicated Numerals in Mandarin and in Karitiana behave as typologically expected of distributive markers. In this section, we also show that RedNums are adverbials in the two languages. In section 4, we present the different analyses of distributive numerals provided in the literature, and opt for a pluractional analysis. Then, in section 5, we present our analysis of the semantics of RedNums in Mandarin and in Karitiana. Section 6 shows that RedNum-readings in the two languages are as predicted by a pluractional analysis. Finally, section 7 draws some conclusions concerning the contribution of this analysis to the theoretical issue of event individuation.

1.1. Mandarin and Karitiana

1.1.1. Mandarin Chinese

Mandarin Chinese (Sino-Tibetan) is an isolating language, which has no morphological number and no tense marking, either in the nominal phrase (NP/DP) or the verbal phrase (VP). Assuming a structural analogy between the nominal and verbal domains (Bach, 1986), nouns and verbs can refer, in their bare forms, to singularities and pluralities of objects and events, i.e. they are number neutral and cumulative.[4] By having these two properties, DP/NPs

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[4] By number-neutral, we mean that NPs or VPs are not marked for number, that is, that they do not encode the singular vs. plural distinction. Number-neutrality of predicates entails cumulativity. A cumulative predicate is such that if it applies to

in Mandarin may refer to both atomic and plural entities. The meaning of the DP/NP *shu* ('book') in sentence (3) illustrates our point.

(3) Zhangsan   xiang   mai   shu.
    Zhangsan   want   buy   book
    'Zhangsan wants to buy one book/books.'

Mandarin is typologically described as a classifier language, that is, a language where a functional morpheme is dedicated to sorting entities. In the nominal domain, a N(ominal) Cl(assifier) obligatorily intervenes between numerals and NPs, irrespective of the fact that NPs may be semantically count or mass (Cheng and Sybesma 1999, 2005; Cheng et al. 2008; see also section 4). Classifiers have the function of sorting the individual entities in the denotation of the NP, thus allowing counting and referentiality as illustrated by the DP *yi ben shu* ('one book') in sentence (4) vs. the BN in (3).

(4) Zhangsan   xiang   mai **yi**   **ben**   **shu.**
    Zhangsan   want   buy one   NCL   book
    'Zhangsan wants to buy one book/ a (specific) book.'

Several authors, both in standard grammars (Chao 1968; Abbiati 1998) and in the linguistic literature (Paris 1981, 2011; Shao 1996; Sybesma 1999; Donazzan 2012, a.o.), also recognize a category of classifiers in the verbal domain (verbal classifiers, VCl), which, like adverbial *time*-phrases in English, specify the number of times the type of event in the denotation of the VP has occurred. Contrary to nominal classifiers such as *ben* in (4), VCl are adverbial expressions that count events. The expression *yi bian* ('once') in (5) is an example of a Num+VCl construction.

(5) Zhangsan   du-le   na   ben   shu   **yi**   **bian**.
    Zhangsan   read-ASP   that   NCL   book   one   VCL
    'Zhangsan read that book one time.'

1.1.2. Karitiana

Karitiana (Arikém family, Tupi stock) is a native Brazilian language, spoken by a community of approximatively 400 people, in western Amazonia (Storto & van der Velden 2005). In Karitiana, the DP/NP presents itself devoid of any functional operators such as number inflection, definite/indefinite determiners, or determiner quantifiers. In sentence (6a) below, *myhint pikom* 'one monkey' is semantically singular, whilst in sentence (6b) the phrase

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any two individuals in its denotation it also applies to their sum (see Krifka 1992; Landman 1996; Kratzer 2003, 2005).

sypomp pikom 'two monke ys' is semantically plural. However, the NPs of both sentences remain uninflected for number in both contexts. On the other hand, sentence (7) with the NP *pikom* conveys the meaning that the speaker ate an undefined number of monkeys (one or more). Sentences (6a-b) also show that Karitiana is not a classifier language, that is, a language that demands numeral classifiers in numeral phrases. We see that numerals are linked directly to the common noun, without the need for classifiers.

(6) a.   yn   Ø-naka-'y-t   **myhin-t**   **pikom**
          I   3-DECL-eat-NFT   one-ADJ   monkey
          'I ate one monkey.'

    b.   Yn   Ø-naka-'y-t   **sypom-t**   **pikom**
          I   3-DECL-eat-NFT   two-ADJ   monkey
          'I ate two monkeys'

(7)   Yn   Ø-naka-'y-t   pikom
          I   3-DECL-eat-NFT   monkey
          'I ate (the/a/some) monkeys'

Following the universal cumulativity hypothesis (Krifka 1992, Landmann 1996, Kratzer 2003), Müller & Sanchez Mendes (2008) and Müller and Negrão (2012) claim that both noun and verbs have number-neutral, cumulative denotations in Karitiana. Like in Mandarin, these number-neutral denotations are maintained throughout the syntactic derivation unless these constituents are modified for boundedness. Sentence (7) for example is totally underdetermined as for the number of monkeys and events involved. It is true both in 'singular' situations that involve only one monkey and one event; and in 'plural' situations that involve more than one monkey and/or more than one event.

In the next section we present the current typological work on RedNums.

2. Distributive numerals across languages

In this section we give a brief overview on the typology of distributive numerals across languages, which is summarized by two of Gil's (1988) universals. Reduplication is associated to distributive effects in various unrelated languages (Moravcsik 1978). Distributive numerals are also a widespread phenomenon. In his typological survey, Gil (2013) mentions almost 200 languages, as diverse as Gã (Níger-Congo, Ghana), Burushaski (isolated language in India & Pakistan), Comanche (Uto-Aztec, USA), Georgian (Caucasic, Georgia). In most cases, as in Georgian (8b), distributive

numerals are obtained by the reduplication of the numeral or of the numeral phrase (Gil 1988).

(8) a.   Orma   k'acma   **sami**   čanta   c'airo
        two$_{erg}$ men$_{erg}$ three$_{abs}$ suitcase$_{abs}$ bring$_{ps\text{-}3sg}$[5]
        'Two men brought three suitcases.'

   b.   Orma   k'acma   **sam-sami**   čanta   c'airo
        two$_{erg}$ men$_{erg}$ three-three$_{abs}$ suitcase$_{abs}$ bring$_{ps\text{-}3sg}$
        'Two men brought suitcases three by three.'

According to Gil (1988), sentence (8b), where the numeral *sami* 'three' is reduplicated, can have two interpretations. Under one reading, it means that two men brought three suitcases each. Under this reading, the sentence is true in scenarios where each of the two men brought three suitcases any number of times. In any of such scenarios, the number of suitcases must equal 6 x the number of carrying events (that is: 6, 12, 24, … suitcases). According to a second reading, (8b) means that the two men brought the suitcases in threes, i.e. three suitcases each time. Differently from the latter reading, (8b) can only be true in scenarios where there are 3 suitcases per carrying event. In these scenarios, the number of suitcases must equal 3times the number of carrying events that is: 6, 9, 12, 15,… suitcases. In such reading, the sentence is true of an array of situations, such as e.g. the two men bringing three suitcases collectively each time, or the first man bringing two suitcases and the second man only one each time, etc., as long as three suitcases are brought by two men each time. In other words, in this case as well there must be more than one event of bringing three suitcases, but the plurality does not come from the distribution of suitcases over the participants, but over occasions or times.

Gil (1982, 1988) was probably the first to describe the ambiguity of (8b) as a scopal ambiguity. After surveying the behavior of distributive numerals cross-linguistically, he proposes the generalization in (9), presented as a typological universal for reduplication.
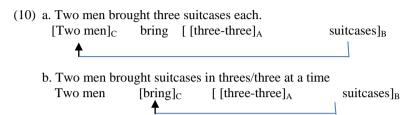
(9) GEN 1 – syntax-semantics of reduplication:
     Reduplication of an expression A forces an expression B containing A to distribute over a constituent C disjoint from B (Gil 1988:1046).

The author uses a very schematic way to represent scope effects, where an arrow links two constituents of the sentence: the constituent to be distributed (B) is linked to the constituent over which the distribution takes place (C), as

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[5] Erg – ergative; abs – absolutive; pst-3sg – 3rd person singular past tense.

schematized in (10a) and (10b) below. In (10a) reduplication of the Numeral (A) imposes distribution of the entities in the denotation of the Determiner Phrase – DP – (B) that contains (A), over the entities denoted by the subject DP, the disjoint constituent (C). In (10b) reduplication of the Numeral (A) impose distribution of the entities in the denotation of the DP (B) that contains (A), over the events denoted by the verb, the disjoint constituent (C).

(10) a. Two men brought three suitcases each.
   [Two men]$_C$ bring   [[three-three]$_A$ suitcases]$_B$

   b. Two men brought suitcases in threes/three at a time
   Two men   [bring]$_C$ [[three-three]$_A$ suitcases]$_B$

In a more standard framework, (10a) and (10b) above can be described along the lines of (11), where the scopal ambiguity is captured by the different material in the restrictor of the distributive operator (Lasersohn 1995). Within this framework, the two readings of sentence (8b) could be depicted as in (12a-b). An analysis in these terms might apply also to distributive numerals in Chinese and Karitiana such as the ones that we presented in (1) and (2) above. However, in this paper, we will defend a different hypothesis, and assume that reduplicated numerals are in fact markers of pluractionality. This view will be developed in sections 4 and 5.

(11) [[DIST]] =   [plural individuals or events]$_{restrictor}$ [entities in the VP]$_{scope}$

(12) a. [[sam-sami]] =   [two men]$_{restrictor}$ [three suitcases]$_{scope}$
     b. [[sam-sami]] =   [times]$_{restrictor}$ [three suitcases]$_{scope}$

Gil's second generalization about distributive numerals – Universal 10 – presented as GEN2 in (15), is about the role of the morphological markings on distributive numerals. According to it distributive numerals may belong to different categories (α) across languages. These categories (α) mentioned are to be understood as the categories of the constituents to which the RedNum belongs.

(13) GEN2 – Distributive numerals of a category α are formed through:
     A (non empty) marker of distributivity
     A (potentially null) marker of the category α

As an illustration, let's look at Georgian *sam-sami* in (8). Gil (1982) analyzes the reduplication as the marker of distributivity (a), and the absolutive case as the categorial marking of the NP (b). Thus in the case of

Georgian, the RedNum belongs to the category noun phrase (NP), and, in accordance with GEN1, forces the NP to distribute over *orma k'acma* ('two men').

In the next section, the two descriptive universals presented as GEN1 (9) and GEN2 (13) will help us identify whether we are dealing with the same kind of syntactic and semantic phenomenon.

3. Distributive numerals in Mandarin and Karitiana.

Before arguing for a semantic analysis of the constructions in (1) and (2) above in terms of pluractionality, we will show that the morphological marking that we are considering in the two languages under discussion is interpretable as a marker of distributivity. Let's take as guidelines Gil's two typological universals presented in (9) and (13). The question of whether RedNums can be interpreted as markers of distributivity can then be addressed in the following terms: do RedNums in Mandarin and Karitiana follow GEN1 and GEN2?

We start answering these question by showing that both in Mandarin Chinese and in Karitiana reduplication is a productive morphological process that yields an array of distributive effects. In section 3.1, we present a very brief overview of the occurrence of reduplication in the two languages. The goal here is to illustrate the fact that reduplication is a very productive morphological process in that it always yields distributive effects. In section 3.2, we will show that reduplicated numerals are adverbial operators in the two languages. We thereby establish their categorical status (that is, their α-category, in Gil's terms). Finally, in section 3.3, we conclude by showing that RedNums in Mandarin and in Karitiana behave in accordance to Gil's proposed universals for Distributive Numerals (DistNums) and must therefore be dealt as such.

3.1 Distributive effects of reduplication in Mandarin and Karitiana

Both in Mandarin and Karitiana reduplication is a productive grammatical operation. In Mandarin, reduplication of nouns, classifiers and verbs has been associated to distributive interpretations. Sentences (14a) and (14b) below present cases of noun and nominal classifier (NCl) reduplication respectively. Both sentences are interpreted as cases of universal quantification on contextually restricted sets (Yuan 2011).[6]

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[6] For a more detailed analysis of the different patterns of reduplication of Ns and Vs in Chinese, the reader is referred to Paris (2007). For Karitiana, see Müller & Sanchez-Mendes (2008) and Storto (2012).

(14) a. Xianzai **jia-jia**   zhuan   wanglu NP reduplication
        now   house-house install internet
        'Nowadays, all households have internet connection.'

    b. Dian-li **zhi-zhi** mao   dou   hui   miaomiaojiao *NCl red*
        shop-in NCL-NCL cat   all   can   miawl
        'In the shop, all cats can miawl.'

Reduplication of dynamic (15a) or stative verbs (15b), on the other hand, is associated to aspectual modification (Paris 2011). Reduplication of a predicate yields a 'diminutive' (15a) or an 'intensive' (15b) interpretation. In the typological literature, diminutive readings have also been described as a special case of pluractional readings (Dressler 1968).

(15) a. Zhangsan xiang qu   **san-san**   bu
        Zhangsan want go   walk-walk   step
        'Zhangsan wants to have a walk/ walk a bit.'

    b. Zhangsan   **gao-gao** de.
        Zhangsan   tall-tall STR
        'Zhangsan is quite tall.'

In Karitiana, reduplication of the verbal stem is a case of plural marking on the verb (Müller & Sanchez-Mendes 2008, Storto 2012). This is precisely the type of morphological marking originally described in the literature as pluractional (Newman 1990). Verbal plurality yields an iterative reading, i.e. a distribution over time as illustrated by the reduplication of the verb *mangat* ('lift') in sentence (16). Interestingly, reduplicated predicative adjectives, as all pluractional predicates in Karitiana, are only interpreted as iteration or distribution in time, and do not have the durative interpretations or the diminutive/intensive readings found in Mandarin (15), as illustrated by the possible translations for sentence (19) (Müller & Sanchez-Mendes 2008).

(16) Inacio   Ø-na-**mangat-mangat**-Ø Nadia ka'it   *V reduplication*
    Inacio   3-DECL-lift-lift-NFT   Nadia today
    'Inacio lifted Nadia today (more than once).'

(17) Inacio   Ø-na-aka-t   i-**osedn-osedn**-Ø.
    Inacio   3 – DECL-cop-NFT PART-happy-happy-ABS
    'Inácio was happy repeatedly'
    *'Inácio was happy for a long time'
    *'Inácio was very happy'

We see then that reduplication is a productive operation in both languages and yields various kinds of distributive readings. Within this picture, the reduplication of numeral phrases is also expected to yield distributive effects.

3.2. Reduplicated numerals as adverbial operators

In this section, we show that reduplicated numerals are adverbials both in Mandarin and Karitiana, and therefore have scope over the events denoted by the predicate within their scope. Following the parametric difference between the two languages with respect to the use of classifiers (cf. 1.1.1 above), we note that an important difference is found in the reduplicated construction: Mandarin reduplicates the numeral alongside with the nominal classifier (1), while Karitiana only reduplicates the bare numeral (2).

3.2.1. Mandarin Chinese

In Mandarin Chinese, non-reduplicated numerals plus NCl are part of the nominal phrase and must occur in adnominal position (18a). Mandarin does not allow Numeral+NCl constructions to float to pre-verbal positions (18b); numerals and NCls can appear without their head nouns only in cases that can be interpreted as nominal ellipsis, and are thus constrained to argumental positions, like full NPs.

(18) a. Zhangsan   xiang   mai **yi ben shu**. Wo xiang mai
       Zhangsan   want   buy one NCL book I   want buy
       liang   ben   Ø
       two   NCL   Ø
       'Zhangsan wants to buy one book, I want to buy two.'

     b. *Zhangsan   **yi ben** xiang   mai   (**shu**)
         Zhangsan   one NCL want   buy   (book)

When reduplicated, however, the numeral phrase has access to the pre-verbal position. Its adverbial status is then marked (optionally) by the morpheme DE_2 (19) [7], which also attaches to manner adverbials (20).

(19) Haizi **liang ge.liang ge-**(de)   chi-wan-le   dianxin
     child   two-NCL.two-NCL-(DE_2)   eat-finish-ASP pastry
     'Children ate the pastries two by two.'

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[7] Reduplicated numerals can also be adnominal modifiers in Mandarin. In this case, they are marked by the adnominal modifier DE_1 (cf. ftn. 1) at the left of the modified NP. We will not discuss adnominal reduplicated numerals here, but see Yuan (2011) for a descriptive overview.

(20) Haizi   **hen.kuai**-(de)   jiu   chi-wan -le   dianxin
    child   very.fast-DE_2 then   eat-finish-ASP pastry
    'Children quickly ate the pastries.'

As we have already shown in the introduction (cf. (1a-b))), adverbial reduplicated numerals in Mandarin can take both the internal and the external arguments in their scope. The availability of two distinct readings becomes more evident when the numeral in the construction is followed by a classifier that may refer specifically only to the entities denoted by one of the two NPs. Thus, while the general classifier *ge* in (1) is compatible both with children and peanuts, the classifier *ke* in (21) below can refer only to small objects like peanuts, and the reading in (1c) is no more available.

(21) Haizi   **liang ke.liang ke**-(de)   chi-wan-le   huashengdou
    child   two-NCL.two-NCL-(DE_2)   eat-finish-ASP   peanuts
    'Children ate the peanuts two by two.'

    For each child, there is an event of his eating two peanuts.
    For each occasion/location, there is an event of children eating two peanuts.
    #For each occasion/location, there is an event of two children eating peanuts.

One may wonder, at this point, if there is any evidence for assuming two distinct adjunction sites for the adverbial operator that may explain the two interpretations as a scopal ambiguity. To answer this question, we must first take a closer look at the distribution of manner adverbials in Mandarin. Manner adverbials in Mandarin are restricted to pre-verbal position; contrary to English adverbials, which must scope below auxiliaries and light verbs (22)[8], Mandarin manner adverbials can however adjoin higher in the sentence, below modal auxiliaries but to a position to the left of light verbs (Ernst 2010). As an example, we will discuss here the light-v BA, which is used for marking the preposing of the object to a pre-verbal position.[9] As shown in (23), the manner adverbial phrase *hen kuai de* « (very) quickly » can adjoin to the left or to the right of BA.

(22) John (*rapidly) has (rapidly) finished the book (rapidly).

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[8] Assuming that English auxiliaries raise to T, the second occurrence of *rapidly* in (22) would scope above the base position of *have*.

[9] For an analysis of BA as a light v, and its difference with respect to modals in Chinese, see Huang et al. (2009).

(23) Zhang   (**hen kuai-**de)   ba   shu   (**hen kuai-**de)
Zhang   quick-DE$_2$ BA   book   quick-DE$_2$

kan-wan-le   (*__hen kuai-__de)
read-finish-ASP   quick-DE$_2$
'Zhangsan quickly finished the book.'

There are thus two preverbal positions for manner adverbials in Mandarin, above and below the light-v BA. While Ernst (2010) does not discuss possible interpretational differences for the manner adverbials in (23), the two adjunction sites seem to be endowed with distinct scope options for the pluractional operator. Let's consider the two sentences in (24). The NCls within the reduplicated numeral phrase in (24a) and (24b) are chosen to be compatible with the NPs realizing the external and internal arguments, respectively: *zhi* is a classifier currently used for small animals, and *di* 'drop', is used in this case to partition the mass NP *shui* 'water' into countable units.[10]

(24) a.   Xiaoniao   **yi-zhi.yi-zhi-**de   he-wan-le   shui.
Small-bird   one-NCL$_{sbj}$.one-NCL$_{sbj}$-DE   drink-finish-ASP   water
'The small birds drank the water one by one.'

b.   Xiaoniao   **yi di.yi di-**de   he-wan-le   shui.
small-bird   one-NCL$_{obj}$.one-NCL$_{obj}$-DE   drink-finish-ASP   water
'The small birds drank the water drop by drop.'

However, while both interpretations for Red-Num are available in standard pre-verbal position (24), when the light-v BA is overtly present only the Red-Num referring to the object NP can attach to the innermost position below the light-v, cf. (25) vs. (26).

(25) Xiaoniao   (**yi zhi.yi zhi-**de)   ba   shui
small-bird   one-NCL$_{sbj}$.one-NCL$_{sbj}$-DE   BA   water

(*__yi zhi.yi zhi-__de)   he-wan-le
one-NCL$_{sbj}$.one-NCL$_{sbj}$-DE   drink-finish-ASP

(26) Xiaoniao   (**yi di.yi di-**de)   ba   shui
small-bird   one-NCL$_{sbj}$.one-NCL$_{sbj}$-DE   BA   water

(**yi di.yi di-**de)   he-wan-le.
one-NCL$_{sbj}$.one-NCL$_{sbj}$-DE$_2$ drink-finish-ASP

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[10]   Classifiers of this kind are called *massifiers* by Cheng & Sybesma (1999).

How can we relate these distributional differences to the syntactic position of the light-v BA? We will follow Ernst (2002) and assume that the light-v BA is the head of a functional vP, which in turn marks the left edge of the "lower range" for adverbial modification (27). Adverbs that scope below BA have a narrower scope over the VP, while adverbs adjoining above BA can take a functional vP in their scope.

(27) $[DP_i [_{BaP} BA [_{vP} t_i [_{v'} v VP]]]]$

If this is in the right track, it means that Red-Nums in a position below vP cannot take the subject under their scope. This "subject-oriented" interpretation is to be associated with the constraint that the adverbial take the external argument under its scope. The two scopal possibilities of RedNums in Mandarin are thus consistent with their analysis as adverbial phrases, that adjoin to distinct positions within the complex vP.

3.2.2. Karitiana

In Karitiana, as shown by Müller (2012), RedNums are adverbial phrases. Firstly, note that reduplicated numerals have the same distribution of adverbs and adverbial phrases. The distribution of adverbials and of RedNums is sketched in (28a) and illustrated in (28b). Sentences (31a-d), show that the reduplicated numeral *myhint-myhint* 'one-one' and the adverb *kandat* 'many times' have the same distribution. Both adverbials and Red Nums can occur in sentence initial and sentence final positions, as well as between the verb and its internal argument (29a,c,d); but are ungrammatical between the subject and the verb in matrix clauses (29b).

(28) a. adv SUBJECT *adv VERB adv OBJECT adv

   b. *Myhint   owã   *myhint   nakapon   myhint   boroja   myhint*
      one   child   *one   shot   one   snake   one
      1   2   3   4

(29) a. **Kanda-t/myhim-t.mynhim-t** jonso   Ø-naka-ot-Ø   ese   1
      Many-times-ADV/one.one-ADV woman 3p-DECL-get-NFT   water
      'Women brought water many times/ bucket by bucket'

   b. *jonso **kanda-t/myhim-t.mynhim-t**   Ø-naka-ot-Ø   ese   2

   c. jonso   Ø-naka-ot-Ø **kanda-t/myhim-t.mynhim-t**   ese   3

   d. jonso   Ø-naka-ot-Ø ese **kanda-t/myhim-t.mynhim-t**   4

Unlike Mandarin, the interpretation of sentences with RedNums or with any other adverbials does not depend on the syntactic position of the operator. As in (29), no matter what position the distributive numeral occupies (among the ones that are possible for it), the possible readings are always the same. This is on a par with the fact that it always has the same scope.

Additional evidence for the adverbial status of RedNums in Karitiana is the presence of the suffix *–t* that attaches to them and shows up in most adverbial phrases (Sanchez-Mendes 2014). This suffix is present in the adverbial *kandat* 'many times' in (29). Another example is the adverb *soasot* 'fast' in (30) below. Adjectives and their modifiers, on the other hand, bear no functional morphology, as illustrated by the NP *õwã ty pita 'very tall child' in* sentence (31). The contrast between the presence vs the absence of functional morphology in nominal adjuncts and adverbials is very clearly illustrated by the absence of *–t* in the modifier *pita* 'very' in (31) and its presence in *pita-t* ('a lot') in (32).

(30) Joao   Ø-naka-taga-t   gooj   **soaso-t**.
      Joao   3-DECL-drive-NFT vehicle fast-ADJ
      'John drives the car fastly'   (Sanchez-Mendes 2014, ex. 229)

(31) **Owa**   **ty**   **pita**   i-otam-Ø.
      Child   big   very   PART-arrive-ABS
      'The very tall boy arrived'   (Sanchez-Mendes 2014, Table 40)

(32) Joao   i-pytim'and-<a>-t   **pita-t**.
      Joao   PART-arrive-<VT>-ABS a.lot-ADJ
      'Joao worked a lot'   (Sanchez-Mendes 2014, ex. 227)

Our last argument for the adverbial status of RedNums in Karitiana comes from the structure of noun phrases in Karitiana, which have no non-empty functional projections. As mentioned in section 1, there are no morphosyntactic markers for number, sorting (classifiers) or (in)definiteness within the NP (see Müller et al 2006). The language has no determiner quantifiers similar to *every* or *some* or articles. Hence, it would go against this behavior to posit that RedNums belong to the nominal system.

3.3. Summing up

After showing that RedNums are adverbials in both Chinese and Karitiana, we return to the typological generalizations. According to GEN 1 (9) the constituent to which the RedNum belongs is to be distributed over some other disjoint constituent. This holds for RedNums in Mandarin and in Karitiana. We have seen that they are adverbials and belong to the vP/VP constituent,

which is distributed over some external key – external arguments, times or locations. GEN2 (13), on the other hand, claims that distributive numerals are formed by: (a) a marker of distributivity; and (b) a marker of the category to which they belong (adverbials in our case). For Mandarin and Karitiana, we claim that morphological reduplication of the numeral is to be seen as the non-empty marker of distributivity (a), and that RedNums in these languages bear a specific category marker: the adverbial marker DE_2 in Chinese and the adverbial suffix *–t* in Karitiana (b). Hence the claim that RedNums in the two languages are distributive markers is more than justified since they follow both generalizations.

Having determined that Reduplicated Numerals phrases are adverbial modifiers that act as distributive markers in the two languages under scrutiny, we will focus on the semantics of the construction. In section 4, we present the current analyses for DistNums.

4. Distributive numerals as dependent indefinite operators vs. distributive numerals as pluractionals

In this section, we discuss two lines of analyses that have been put forward for distributive numerals in recent literature – distributive numerals as operators on dependent indefinites and distributive numerals as pluractionals; and opt for the latter.

The first line analyzes distributive numerals as distributive operators on dependent indefinites (Farkas 1997, Henderson 2011, a.o.). This analysis is provided for adnominal distributive numerals, and the general observation in this case is that distributive effects are subject to licensing conditions, e.g. in most cases, the distributive operator must be licensed by a plural DP or be in the scope of a quantifier. To give an example of distributive dependency, Yanovich (2005) analyzes dependent indefinites (also called *nibud'*-indefinites) in Russian, and shows that co-variation is licensed only when an overt quantifier is present in the sentence. Thus, (33) is ungrammatical, since the indefinite expression *kogo-nibud* cannot co-vary with respect to the external argument of the sentence, which denotes a single individual. In (34) and (35), on the other hand, distribution is licensed by the adnominal quantifier *každyj* (≈ 'every') and the event quantifier *često* 'often', respectively.

(33) *Petja   vstretil   **kogo-nibud'**   iz svoix odnoklassnic.
     Petja   meet-PST   who-nibud   of his   classmates[11]
     'Petja met one of his girl classmates.'   (Yanovich 2005, (17))

---

[11]   PST – past tense.

(34) **Každyj** malčik-vstretil **kogo-nibud'** iz svoix odnoklassnic.
every boy meet-PST who-nibud' of his classmates
'Every boy met one of his girl classmates (e.g. a different classmate for
each boy).' (Yanovich 2005, (18a))

(35) Petja **často** vstrečal **kogo-nibud'** iz svoix odnoklassnic.
Petja often meet-IMP-PST who-nibud' of his classmates[12]
'Petja frequently met a (different) girl.' (Yanovich 2005, (18b))

Adnominal distributive numerals in the Kaqchikel language (Mayan)
follow this pattern and are thus analyzed as dependent indefinites by
Henderson (2011). The contrast between sentences (36a, b) and (37)
illustrates the need of a 'weak' or 'strong' licensor (the plural NP *rije'* 'they'
in (36a) or a quantifier pluralizing the relevant set of times *jantape'* 'always'
in (36b)) in order for the distributive numeral (the reduplicated numeral *ox-ox*
'in threes') to distribute over subject participants or times. If the NP in
subject position denotes a singular individual, and no explicit quantificational
expression over times is present, the use of a distributive numeral is
infelicitous (37).

(36) a. **Rije'** x-0-ki-chäpel **ox-ox** kab'
they CP-A3s-E1p-handle-DIR three-three candy[13]
'They took three candies (each).' (Henderson 2011, (15))

b. **Jantape'** e' k'o **ox-ox**
always A3p exist three-three

ix-tan'i chu-u-wäch r-ochoch.ajaw
girl-PL P-E-3s-face E3s-house.lord

'There are always three (different) girls out front of the church.' \
(Henderson 2011, (14))

(37) *X-e'in-tz' ët **ox-ox** b'atz'
CP-A3p-E 1s-see three-three monkey
[I saw three-three monkey] (Henderson 2011, (21))

---

[12] IMP – imperfective aspect.

[13] CP – completive aspect; A – absolutive; 1, 3 – 1st, 3rd person; s – singular; E –
ergative; p – plural person; DIR – directional.

a. # I saw three monkeys each time
b. # I saw three monkeys in different places

A second line of analysis has been proposed for reduplicated numerals in adverbial position, and starts from the intuition that they correspond, at least for their interpretation, to distributive adverbials like English *one by one, one after the other,* which have been analyzed as pluractional operators (Beck & Stechow 2007, Brasoveanu & Henderson 2009). In this case, distributivity is not subject to licensing conditions.

In this paper, we will adopt this line of analysis, which has also been defended recently for distributive numerals in Tinglit by Cable (2013). RedNums in Mandarin and Karitiana will be analized as operators that induce the pluralization of the relation between the verb and one of its arguments. We will take Beck and Stechow's (2007) cumulation operator ** as our starting point. The **-operator pluralizes predicates of type $\langle d, \langle \varepsilon, t \rangle\rangle$, that is, it pluralizes relations between entities and events.[14] When applied to a predicate, ** results in a relation that "is true of all the things that the original relation was true of, plus all the part-whole structures that can be built from them (Beck & Stechow 2007:2)". Its definition is presented in (38) below.

(38) Cummulation operator **:
       "Let R be a relation of type $\langle d, \langle \varepsilon, t \rangle\rangle$. Then **[** (R)]** is the smallest relation R' such that the conditions in (a) and (b) are satisfied.
  a. $R \subseteq R'$
  b.   for all $\langle x, e \rangle$ and $\langle y, e' \rangle$:
       If $\langle x, e \rangle \in R'$ and $\langle y, e' \rangle \in R'$, then $\langle x+y, e+e' \rangle \in R'$ "
                                                           (Beck & Stechow 2007: 2, (9))

For descriptive purposes, we will depict the distributive effects yielded by RedNums as in (39), where external participants, times or locations act as possible distributive keys, whereas the set of sub-events denoted by the verbal predicate acts as the distributive share.[15] The distributive key corresponds to the restriction of Lasersohn's distributive operator (see section 2 (11)); and the distributive share corresponds to its scope. Note however that our use of (39) is merely descriptive since we will not analyze reduplicated numerals as distributive operators in the sense of Lasersohn, but as pluractionals.

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[14] d – type of entities; ε – type of events; t – type of sentences.

[15] The terms in (39) are due to Choe (1987) and became standard in the literature on distributivity. The formula in (39) mimics Lasersohn's (1995) analysis of distributivity presented in (11) of section 2.

(39) DIST ($_{share}$ sub-events) ($_{key}$ external argument/time/space)

Sentence (2) of Karitiana repeated below as (40) will thus be represented as in (41).

(40) **Sypom-t.sypom**-t   ombaky Ø-naka-'y-t   pikom.
       two- ADJ.two-ADJ   jaguar   3-DECL-eat-NFT   monkey
       ≈ 'Jaguars ate monkey two by two.'

(41) SYPOMP-SYPOMP ($_{share}$ sub-events of eating two monkeys)
                                                    ($_{key}$ jaguars/times/locations)

An important difference between adverbial distributive markers with respect to adnominal distributive markers and universal quantifiers in general is that the distributive key need not exhaust all individuals of a contextually determined set of times, locations or participants. The proposition expressed by (40) above, for example, may be true in a scenario where not all the jaguars in the contextually relevant set ate two monkeys each, just like the English sentence (42) does not entail that all the waiting men are bringing two bamboo baskets to shore. What the two sentences seem to entail is rather that the set of contextually relevant baskets (42) or monkeys (40) are paired with some relevant key. This fact can be captured by a pluractional analysis, but would not be predicted by an analysis where distributive readings depend on a quantificational relation between the distributive key and the distributive share.

(42) Waiting co-workers rush the boats to hoist bursting, fish-laden bamboo baskets two by two to shore suspended on ropes along traditional bamboo shoulder poles.
       (Vivienne Kruger, Balinese Food: The Traditional Cuisine & Food Culture of Bali)

An additional argument in favor of a pluractional analysis has to do with theoretical soundness. As noted by Cable (2013), distributive numerals constitute a specific challenge for an analysis in terms of scopal ambiguity, because, although their morphology – the numeral (+NCL) reduplication – seems to mark distributivity, it does not directly tell which distributive share, and which distributive key to pick out. Rather, reduplication marks a numeral phrase that relates to strict sub-parts of the distributive share, namely only to the participants to the sub-events denoted by the share. This theoretical conundrum can be solved by an analysis of reduplicated numerals as pluractional operators. All the pluractional operation needs to know is which constituent to pluralize; and this information is revealed by its adverbial status.

In the following section, we present our analysis of RedNums as pluractional operators.

5. RedNums as pluractionals – Mandarin & Karitiana

In this section, we discuss in detail the semantics of RedNums. Distributive numerals seem to enforce a distributive relation between the events in the extension of the distributive share and some external key of distribution provided by participants, temporal intervals and spatial locations. Nevertheless, in the previous section, we have seen that an analysis of RedNums as distributive operators faces problems. Firstly, differently from distributive operators over dependent indefinites, the distributive relation in the case of adverbial RedNums does not seem to depend on the existence of a licenser. Secondly, contrary to standard quantifiers, its potential restriction need not encompass all the entities in the domain. Finally, RedNums in Mandarin and in Karitiana mark neither their keys nor the shares.

Taking the alternative path, we will claim that what distributive numerals actually do is pluractionalize the vP (or VP) and that distributivity occurs as a byproduct of this operation. More specifically, we claim that the sub-events in the share of a RedNum-sentence are generated via the pluractionalization of the predicate. We will argue that, within the reduplicated numeral: (i) reduplication marks pluractionality, that is, it marks the generation of plural events; (ii) the classifier is responsible for sorting out the participants in the share; and finally (iii) the numeral (+classifier) is responsible for the criterion of individuation for the events in the share, by providing groups of a certain cardinality

By sorting and grouping the participants to the event to be distributed, the Numeral+Classifier construction provides a criterion of identity for the sub-events. Each plural participant in the share is the witness for the identity of a sub-event, in the sense that the identity criterion for the sub-event is derived *via* its individual participants (as grouped by the numeral). Thus reduplicated numerals are apparently involved in at least four distinct semantic operations.

i.   **Individuating**: The attribution of a sortal category to (one of) the participants of the sub-events in the share.
ii. **Grouping**: The partitioning of one of the arguments in the share in groups of a certain cardinality.
iii**. Pluractionalizing**: The partitioning of the <event, participant> pair into a sum of <sub-event, participant> pairs.
iv. **Distributing**: The distribution of the <sub-event,participant> pairs per occasions, locations or participants.

In the remainder of this section, we will look at the semantics of the pluractional operator considering these four semantic components in a stepwise fashion. We will argue that: (i) the (covert or overt) classifier is responsible for individuating the entities to be distributed; (ii) the numeral+classifier is responsible for grouping the individuated entities in pluralities of a cardinality set by the numeral; and (iii) reduplication is responsible for pluractionality; (iv) distributivity is a epiphenomenon of pluractionality.

5.1.Individuating and grouping – the role of Numeral + NCL

The classifier contributes to the definition of the RedNum denotation the information on how to sort the participants in the share. The role of the functional classifier of sorting out the entities in the share is particularly clear in the case of Mandarin, where the reduplicated phrase displays an overt nominal classifier. The participants are then grouped by the numeral, and are witnesses to the identity of the sub-events in the distributive share. One must remember that the use of a NCl, in a language like Mandarin Chinese, does not depend on the mass-count distinction. Nominal classifiers in Chinese are required irrespectively of the conceptual representation that we may assign to the denotation of Ns and NPs. Thus, for instance, both the NP *xuesheng* 'student' in (43), which arguably denotes a set of intrinsically countable entities, and *shui* 'water' in (44), which is intrinsically mass, require a classifier in reduplicated numeral constructions.

(43) Xuesheng   **liang ge.liang ge**-de   jinlai
     student   two NCL.two NCL-DE$_2$ enter-come
     'The students come in two by two.'

(44) Xiaoniao   ba   shui   **yi di.yi di**-de   he-wan-le
     little-bird   STR   water   one NCL.one.NCL DE$_2$ drink-finish-ASP
     'The little bird drank the water drop by drop.'

Karitiana, on the other hand, has no functional category corresponding to that of nominal classifiers, but in Karitiana as well entities are contextually sorted as individuals for counting purposes.[16] This becomes more transparent in the case of potential mass nouns such as *'ejepo* 'stone'. In (45) below, the entities denoted by this NP are divided into units according to some contextually relevant criteria.

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[16] See Doron & Müller (2013) for a more detailed defense of this claim.

(45) 'ejepo Ø-na-aka-t   i-'ot-'ot- Ø   myhin-t.myhin-t
    stone 3-DECL-cop-NFT   PART-fall-fall-NFT   one-ADJ.one–ADJ
    'Rocks fell one by one.'

We will adopt the definition of NCl as a functional operator that is (overtly or covertly) present in both languages to specify which one of the possible sortings of an NP denotation is to be picked out in a given context. We also assume that the classifier bears the additional information that every sortal cell counts as a distinct individual. The notion of individual is crucial for computing pluralities. Following Geach (1962), we assume that plurality is a property of 'substantival' predicates, that is, predicates that satisfy two independent sets of criteria (Geach 1962, Barker 1999), cf. (46) below. The presence of the NCl in the construction is thus conceptually required, since only predicates that satisfy, besides the criterion of application, also the criterion of identity can supply individual entities that count as distinct participants to plural events.[17]

(46) a. *Criterion of application:* necessary and sufficient conditions required for membership in the extension of a property.
    b. *Criterion of identity:* necessary and sufficient conditions required for determining whether two entities in the extension of a property are the same or are distinct.

Finally, the part played by the numeral in the RedNum construction is that of establishing the cardinality of the parts of the plurality to be distributed. Thus, in sentence (44), after being individuated by the classifier *di* 'drop', the plurality denoted by the bare noun *shui* 'water' is partitioned into groups of two drops each.

5.2. Pluractionalizing

Given a criterion for individuating and grouping the entities to be distributed, the sub-events in the distributive share of a sentence with a RedNum are generated via the pluractionalization of the relation between events and entities denoted by the predicate. For example, in sentence (1), repeated below as (47), the potential relations to be pluractionalized are represented in (47a-b). (47a) expresses a relation between children in twos with events of eating peanuts; whereas (47b) expresses a relation between peanuts in twos with events of children eating them.

---

[17]   We follow Borer (2005) in assuming that nouns come out of the lexicon unsorted.

(47) Haizi   **liang ge.liang ge-**de   chi-wan- le   huashendou
     child   two NCL.two NCL-DE$_2$ eat-finish-ASP peanut
     ≈ 'Children ate peanuts in twos/two by two.'

  $\lambda x \lambda e$ [children (x) & x ate peanuts in e & |x| = 2].
  $\lambda y \lambda e$ [peanuts (y) & children ate y in e & |y| = 2]

The formal definition of the RedNum operator is presented in (48) and follows Cable (2013). According to this account, the relation <e,x> (or <e,y>) denoted by the predicate is pluractionalized by the operation marked by the reduplicated morphology. By pluractionalization, in this case, we mean that the relation <e,x> is partitioned into pairs <e',x'>, where e' is a sub-event of e and x' is a proper part of the entity x. Remember that the cardinality of x' is set by the numeral and that x is individuated by the classifier. It is important to note that the RED$_{Cl}$-operator makes the relation <e, x> equal to the supremum of all <e', x' >, that is <e, x> = $\sigma_{<e',x'>}$. This guarantees that all sub-events e' and all entities x' are part of the larger event e and of the 'larger' entity x which have both been partitioned.[18]

(48) [[RED$_{Cl}$-]] = λn [$\lambda P_{<d,<\varepsilon, t>>}$ [λx_d [λe_ε: P(x)(e) & <e, x> = $\sigma_{<e',x'>}$: x'<x
    & *Individual*$_{CL}$ (x) & |x|=n & e'< e]]][19]

where: n: variable over the natural numbers; x: variable over entities; e: variable over events; d: type of entities; ε: type of events; t: type of sentences.

We illustrate the proposed semantics of RedNums by applying it to the predicate *'y pikom* 'eat-monkey' of sentence (40), repeated below as (49). Its denotation is presented in (50). Finally, in (51) the derivation of the logical form of *sypomp.sypomp 'y pikom* 'eat monkeys two by two' is presented.

(49) **Sypom-t.sypom-t**   ombaky Ø-naka-'y-t   pikom.
     two-ADJ.two-ADJ   jaguar 3-DECL-eat-NFT   monkey
     ≈ 'Jaguars ate monkeys in twos/ two by two.'

(50) [[eat.monkey]] = $\lambda x \lambda e$.[*eat (x)(e) & *monkey(x)]

---

[18] The supremum of a set or lattice is the maximal sum made out of all entities in the set or lattice.

[19] We are assuming, with Kratzer (2003) that, whereas the subject is not an argument of the verb, the object is.

(51) [[2.2 (eat.monkey)]]= RED$_{Cl}$-2 [[(eat.monkey)]] =   λxλe   [*eat
   (x)(e) & *monkey (x) & <e,x> = σ$_{<e',x'>}$: x'<x & |x'|=2 & e'<e and
   individual$_{cl}$(x')]

   The logical form in (51) states that 'eating monkeys two by two' is an
event of eating monkeys which is divided into sub-events of eating two
monkeys each. Let's now look at the derivation of a sentence where the
classifier within the RedNum phrase sorts out entities denoted by the NP in
the external argument of the predicate, as in the Mandarin sentence (52).

(52) Xiaoniao   **yi.zhi yi.zhi**-de   he   wan   le   shui.
   Small-bird   one.NCL one.NCL-DE$_2$ drink finish ASP   water
   'The small birds drank up the water drop by drop.'

   In section 3.2.1 we have shown that, based on the distribution of
RedNums whose classifier refers to the external argument, it is plausible to
assume that these adverbial operators adjoin to a higher projection in the
sentence, above the site where the external argument relation has been
introduced, repeated above as (52). In such a case, the relation over which the
pluractional operator scopes is the relation between the event and its external
argument. The logical form of such a sentence is presented in (53).

(53) [[Red-Num (bird (drink.water))]] = λxλeλy [*drink (x)(e) & *water (x)
   & *AG(e) = y & *bird(y) & <e,y> = σ$_{<e',y'>}$: y'< y and *individual*$_{cl}$ (y')
   & |y'|=2 & e'< e)]

5.3. Distributing

   In this section we show that distributivity is an epiphenomenon of the
individuation of the pluractional sub-events by RedNums. Sentence (54) is
devoid of distributive numerals and is therefore allowed a whole array of
cumulative readings. The sentence is completely neutral as to the number of
jaguars, monkeys and eating events. Its logical form in (55) states that there
is a (potentially) plural event of eating, whose agent is an indeterminate
number of jaguars that eat an indeterminate number of monkeys.

(54) ombaky   Ø-naka-'y-t   pikom
   jaguar   3-DECL-eat-NFT   monkey
   ≈ 'Jaguars ate monkeys.'

(55) $\exists e \exists y \exists x$ [*eat(y) (e) & *AG(e)=x & *monkey(y) & *jaguar(x)]^{20}

As we have claimed in section 4.3.2, the RedNum in (56) below, then, pluralizes the relation <e,y> denoted by the VP into the sum of pairs <e',y'>. Given this, where does distributivity come from? What the logical form in (57) states is that there is a plurality of jaguars that ate monkeys, and that the monkeys are to be divided into pairs, each of which belongs to a sub-event of eating-monkeys.

(56) **Sypom-t.sypom-t**   ombaky Ø-naka-'y-t   pikom.
    two-ADJ.two-ADJ   jaguar 3-DECL-eat- NFT monkey
    ≈ 'Jaguars ate monkeys in twos/ two by two.'

(57) $\exists e \exists x \exists y$ [*eat(y)(e) & *AG(e)=x & *jaguar(x) & *monkey(y)
    & <e,y> = σ<e',y'>. eat(y')(e') & *individual*$_{CL}$ (y') & |y'|=2 & y'<y & e'<e]

Let's suppose, for ease of explanation, that we have four jaguars at the zoo, and that they are fed with monkeys. Sentence (56) can be used to describe various distinct scenarios, each of which has the sole constraint of involving two monkeys for each sub-event. One could choose to utter this sentence to convey the perspective of distributing monkeys over jaguars (each jaguar eating two monkeys) or rather to convey the perspective of distributing monkeys over times (for each occasion, there is an event of jaguars eating two monkeys). The first option is represented by the scenario in (58), while the second option would be true, among other possibilities, in the scenario presented in (59).

(58)

eat	Agent	Theme
e_1	j_1	m_1+m_2
e_2	j_2	m_3+m_4
e_3	j_3	m_5+m_6
e_4	j_4	m_7+m_8

(59)

eat	time	Agent	Theme
e_1	t_1	$j_{1+}j_2+j_3+j_4$	m_1+m_2
e_2	t_2	$j_1+j_2+j_3+j_4$	m_3+m_4

---

[20] The starred predicates are to be understood as cumulative predicates, whose denotations encompass both atomic entities and their sums.

In both cases, the pluralized *eat-monkey* event satisfies the truth conditions of (57). In the scenario (58), the plural event corresponds to $*e= e_1+e_2+e_3+e_4$, that is, the sum of all the sub-events $\langle e', x' \rangle$ whose agent belongs to the denotation of the plural predicate $*jaguar$ ($j_1+ j_2+ j_3+ j_4$) and whose theme is an individual pair of monkeys. This scenario corresponds to the reading "for each monkey, there is an event of his eating two jaguars". In the scenario (59), the plural event is the sum of e_1+e_2, whose agent is again in the denotation of the plural predicate $*jaguar$ ($j_1+ j_2+ j_3+ j_4$) and whose internal argument are monkeys. The scenario in (59) corresponds to the interpretation "for each occasion, there is an event of jaguars eating two monkeys".

The underspecified representation in (57) thus correctly shows that sentences like (56) can be true in a number of distinct scenarios, each involving a different number of participants or events, provided that the relation between entities and events established *via* the pluractional operation (in this case, the presence of two monkeys for each sub-event) is respected. In the next section, we show that the readings available for the RedNum sentences in Mandarin and Karitiana support the pluractional analysis.

6. Readings of RedNums in Chinese and Karitiana

Since according to our analysis the distributive share is provided by the predicate and one of its arguments and the distributive key is provided by external arguments, times or locations, the range of possible interpretations is predicted to depend on the – arity of the verb. Our analysis also predicts that the readings of RedNum sentences should not depend on the presence of licensors, such as plural NPs or quantifiers.

In the following, we will first look at RedNum-sentences with different types of verbal predicates and at their possible interpretations.

6.1. Transitive verbs

We start by presenting the readings of sentences with distributive numerals and transitive verbs both with plural and with singular subjects. In all cases the distributive share is made out of sub-events; whereas the distributive key may be provided by participants, times or locations.

6.1.1. Plural subjects

Sentences (60) and (61) present cases of transitive sentences with reduplicated numerals both in Mandarin and in Karitiana. Note that the potential readings are the same, with the exception that Mandarin, as shown

in the introduction, also allows for a subject-oriented interpretation of the RedNum share when it scopes over the subject.[21]

(60) Haizi   **liang ge-liang ge**-de   chi-wan- le   huashendou
     child   two NCL-two NCL-DE$_2$ eat-finish-ASP peanut
     ≈ 'Children ate peanuts in twos/two by two.'

For each child, there is an event of his eating two peanuts.
For each occasion/location, there is an event of children eating two peanuts
For each occasion/location, there is an event of two children eating peanuts.

(61) **Sypom-t.sypom-t**   ombaky Ø-naka-'y-t   pikom.
     two-ADJ.two-ADJ   jaguar 3-DECL-eat-NFT   monkey
     ≈ 'Jaguars ate monkeys in twos/ two by two.'

For each jaguar, there is an event of his eating two monkeys.
For each occasion/location, there is an event of jaguars eating two monkeys.
#For each occasion/location, there is an event of two jaguars eating monkeys.

6.1.2. Singular subjects

Sentences (62) and (63) present cases of transitive sentences with reduplicated numerals where the external argument cannot guarantee a means for co-variation, because it denotes a singleton set. In these cases, the subject is no more available as a distributive key. As expected, in the two languages temporal (a) or spatial keys (b) of distribution are still available, which is not the case for RedNums that are dependent indefinites.

(62) Mali   ba   yifu   **yi jian-yi jian–de**   tang-hao
     Mary   BA   dress   one NCL-one NCL–DE$_2$ iron-well
     'Mary ironed the dresses one by one.'   (Yuan 2011: 290)

#For each Mary, there is an event of her ironing one dress.[22]
For each occasion/location, there is an event of Mary ironing one dress.

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[21] Karitiana has other means to distribute over the subject. One example is the reduplicated adverbial quantifier *tamyryt.tamyryt* in (i) below. Contrary to reduplicated numerals, *tamyryt.tamyryt* always yields distribution over the subject participant, that is, it only takes the subject as its distributive key.
    (i) Ta-myry-t. ta-myry-t   Ø-naka-m'a-t   õwa   gooj
         3ANAPH-alone.3ANAPH-alone   3-DECL-build-NFT   child   canoe
         'Each child built a canoe'.

[22] We thank one of the referees for pointing out that this would be the precise rendering of the interpretation that is missing for singular subjects.

(63) Inácio   Ø-na-manga-t   õwã   **sypom-t. sypom-t.**
     Inacio   3 – DECL-lift-NFT   child   two-ADJ.two- ADJ
     'Inácio lifted children two by two.'

#For each Inácio, there is an event of his lifting one child.
For each occasion/location, there is an event of Inacio lifting two children.

   A similar case is discussed by Balusu (2006) with respect to Telugu
(Dravidian), cf. (64) (Balusu's example (9)).

(64) Raamu   **ren.Du-ren.Du**   kootu-lu-ni   cuus-ee-ru[23]
     Ram   two-two   monkey-PL-ACC   see- PST-3Psg
     'Ram saw monkeys in twos.'

a.   #For each Ram, there was an event of his seeing two monkeys.
b.   For each occasion/location, there was an event of Ram seeing two
     monkeys.'

Therefore, this is not a case in which the dependent indefinite is subject to
quantificational restrictions. Compare sentences (62)-(64) above to the
Kaqchikel example (36) above, discussed by Henderson (2011). In the latter
case, the sole use of a distributive numeral does not suffice to generate
distributivity. This behavior strengthens the claim that RedNums in Mandarin
and Karitiana are not dependent indefinites in need of licensors. Indeed,
distribution over spatial locations and times is sometimes preferred. Yuan
(2011) argues that the reduplicated numeral is infelicitous in sentence (65)
(her example (923)) because the adverb *tongshi* 'at the same time' contrasts
with the interpretation of the reduplicated numeral as distributing over time.

(65) #Qiuyuan-men ba   qiu   **yi ke.yi ke-**de   **tongshi**
     Player-PL   STR ball   one NCL.one NCL-DE$_2$ simultaneously

     fang-jin-le   xiangzi-li
     put-enter-ASP box-in
     (Intended: 'The players put the balls one by one in the box at the same
     time.')

   In fact, according to our informants, the use of *tongshi* with the
reduplicated numeral is felicitous in a more specific context. When presented
with the scenario below, the informants judged sentence (65), repeated as
(66), acceptable.

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[23]   ACC=accusative; Pl=plural; PST=past; 3Psg=3rd person singular.

Context: there is a group of basketball players training before the match in a big Olympic stadium. They are spread among different playgrounds, warming up and trying to score in different baskets. In this context, would you accept to describe the situation by saying:

(66) Qiuyuanmen ba   qiu **yi.ke-yi.ke**-de   **tongshi**
     player-PL   STR ball one.NCL-one.NCL-DE$_2$ simultaneously

     tou-jin-le   lan   li
     throw-enter- ASP   basket   in

     'The basketball players threw the balls one by one in the baskets, all at the same time.'

6.2. Intransitive verbs

We now move to the interpretations of RedNum sentences with intransitive verbs. According to Rocha (2011) and Storto & Rocha (*in press*), all intransitive verbs in Karitiana are syntactically unaccusative. Hence their only argument is an internal argument of the verb and thus patterns like the object of a transitive verb. The fact that subjects of intransitive verbs fall under the scope of the RedNum is therefore expected in Karitiana. Sentence (67) shows that this is so.

(67) **Sypom-t.sypom-t**   Ø-na-otãm-Ø   taso
     two- ADJ.one- ADJ   3- DECL-arrive-NFT   man
     'Men arrived two by two/in twos'

   a. #??For each man, there is an event of him arriving in two by two.
   b. For each occasion/location, there is an event of two men arriving.

In Mandarin, intransitive verbs are an interesting case for distributive readings. In fact, in Mandarin nearly all semantically intransitive verbs are actually syntactically transitive, in the sense that the verb must be followed by a bare NP, which behaves as a dummy object (Cheng & Sybesma 1998).[24] While syntactically active, the dummy object is nevertheless semantically bleached and non-referential. Such non-referential bare nouns cannot be sorted or counted. The impossibility of using the non-referential object as a distributive key or share in (68a, c) is thus not unexpected. Hence the only option left for intransitive verbs in Mandarin is that of having the external argument as the share (68b), and to distribute over time or space.

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[24] Cheng & Sybesma (1998) mention only two intransitive verbs which do not consist of a VO combination, namely *xiao* 'smile, laugh' and *ku* 'cry'.

(68) Chang-shang xuesheng **liang.ge-liang.ge-**de   tiao   wu
     stage-on   student   two.NCL-two.NCL-DE$_2$ dance dance
     'On the stage, students danced two by two'

   a. # ??For each student, there is an event of him dancing two by two.
   b. For each occasion/location, there is an event of two students dancing.
   c. #For each occasion/location, there is an event of students dancing two dances.

7. Conclusions

In this paper, we have proposed an analysis of adverbial reduplicated numerals in Mandarin and Karitiana as pluractional operators. We have shown that the distributive effects over time, space or external participants associated to this construction in the two languages can be captured by assuming that reduplicated numerals pluralize the relation denoted by the the vP/VP, and that the choice of different distributive keys is contextual.

Our analysis rests on two major assumptions. First, we have claimed that the reduplicated numeral is a pluractional operator that pluralizes the verbal phrase. We therefore interpret the notion of pluractionality as plurality of events, thus encompassing the definition of pluractionality as verbal plurality (Lasersohn 1995), that is, as a local distributive operation on the denotation of the verb. We have shown that RedNums are adverbial operators in Mandarin and Karitiana and that they have scope over the vP or the VP. We therefore predict this kind of pluractional operation to be available in all languages that have distributive operators in adverbial position.

A second assumption bears more specifically on the ontological properties of events and on their possible criteria of identity. We have claimed that the plurality of events generated by RedNums is built necessarily upon the pluralization of the external or internal participants. These participants have their identities specified in terms of cardinality and individuality. We have captured the individuation of the sub-events *via* their participants by stating that they act as the witnesses for the individuation of the events. The distributive effect associated to the pluractional operation, on the other hand, is claimed to be a byproduct of the pairing of the sub-events along three possible dimensions: temporal intervals, spatial locations or participants. Therefore, the choice of these dimensions is only context-dependent. As shown by Cable (2013), however, these three dimensions are in fact the only dimensions available for distribution, thus restraining the set of possible interpretations to the dimensions to which events are parasitic as abstract entities.

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