Reduplication across Categories in Cantonese

Charles Lam

Linguistics Program, Purdue University
Beering Hall, Room 1289
West Lafayette, IN 47907
`charleslam@purdue.edu`

Abstract

This paper investigates the formal semantics of reduplication in Cantonese, i.e. how the meaning of reduplicated forms are encoded and computed with the given meaning from the base forms. In particular, this paper argues that reduplication denotes a summation function that adds up arguments (be they object-, event- or degree-arguments) and return a collection of the elements. The surface difference across categories is accounted for in terms of cumulativity and quantization (Krifka, 1998; Krifka, 2001; Rothstein, 2004). The present approach makes use of scalar structure and summation as formal tools to model the cross-categorial behaviour of reduplication. It provides the advantage of a unified theory for lexical composition across categories nouns, verbs and adjectives.

Keywords: *reduplication, formal semantics, cumulativity, cross-categorial behaviour*

1 Introduction

Reduplication is found across syntactic categories noun, verb and adjective in Cantonese. They all share a similar surface order, but the interpretation can be quite differently. Nominal reduplication denotes an exhaustive list such as 'everybody, every apple'. Verbal reduplication displays either durative or iterative reading, depending on the telicity of the verbal predicate. Adjectival reduplication shows a hedging and diminutive reading, as in 'a little fat' or 'reddish'

The goal of this paper is to establish a unified account for the cross-categorial reduplication that can interpret the various meanings. We argue that the common thread behind these interpretations is *summation*. Building on the notions of cumulativity and quantization, the interpretations of reduplication are predictable.

In what follows, section 2 lists out the distribution and characteristics of reduplication in Cantonese. Section 3 reviews previous studies and points out that they cannot account for the behaviour of reduplication across categories. Section 4 discusses the formal property of *cumulativity* (Krifka, 1998; Rothstein, 2004), which provides a basis to account for the surface differences across categories. To test the hypothesis, section 5 provides the details of the proposal and shows how various interpretations can be handled by the present cumulativity analysis. Section 6 discusses the advantage of this approach and also the theoretical implications.

2 Data

This section makes a few observations on reduplication in Cantonese. We will first focus on adjectives, then include nouns and verbs, which share a similar surface pattern. Consider the sentence (1), which provides a reduplicated adjectives denote a sense of hedging or diminution.

(1) *keoi5 gou1 gou1 dei2*
3sg tall tall Prt
'S/he is fairly tall.'

Uttering (1) means that the person is considered tall, but probably not the tallest person or not even 'very tall'. This can be seen in (2), which is infelicitous unless it is otherwise specified that all other members of the group are simply short.

(2) *keoi5 gou1 gou1 dei2, so2ji5 keoi5*
3sg tall tall Prt, therefore 3sg
zeoi3 gou1
SUPERLATIVE tall
'#S/he is fairly tall, so s/he is the tallest.'

The reduplicated adjective form with the particle *gou1 gou1 dei2* is in complementary distribution with (3), where an overt marker shows the magnitude of tallness. This requirement of degree marker in (3) is well-documented, see Grano (2011) for a recent discussion of its syntax and semantics.

(3) *keoi5 *(hou2 / gei2) gou1*
     3sg   very / fairly   tall
     'S/he is very / fairly tall.'

Third, adjective reduplication shows an interesting parallelism on the surface with nominal (4) and verbal (5) reduplication in Cantonese.

(4) *go2 go2 sai3lo6 *(dou1) hou2 lek1*
     CL CL child   DISTR   very smart
     'Every child is very smart.' [1]

(5) *ngo5 tai2 tai2 ha5 syu1 fan3 zo2*
     1sg   read read Dur book sleep Perf
     'I fell asleep while reading.'

The data above show that reduplication can apply to lexical categories (i.e. nouns, verbs and adjectives). This parallelism is not unique to Cantonese: Chakraborty and Bandyopadhyay (2009) also report that reduplication in Bengali can denote repetition (e.g. 'every year'), plurality (e.g. 'the houses'), emphasis (e.g. 'deep red rose') and imperfective verbs (e.g. '*Talking about something*, suddenly he stopped.'), together with a few other meanings. It is therefore plausible that reduplication denotes some function that is more generic and applicable to different elements. This paper does not attempt to account for cross-linguistic data, but instead focuses on Cantonese. The working hypothesis is that reduplicated forms have a common semantic thread between them, and that that common thread is *summation*. What the summation function does is 'add up' atomic elements into a collection. Reduplicated nouns denote an exhaustive group. For example, (4) refers to a group of children, which is equivalent to 'every single child' in English. Reduplicated verbs denote a durative event, as in *tai2 tai2 ha5 syu1* 'reading (books)' in (5). An interesting feature is that the predicates denoted by reduplicated verbs must be an atelic event, which in turn suggests that

reduplicated verbs denote a collection of homogeneous subevents, following the assumption that atelic events have 'subevental properties' (Bennett and Partee, 1972; Krifka, 2001). This paper applies the existing analysis of cumulativity to reduplication in the nominal and verbal domain and further extends the analysis to adjectival reduplication. We thus hypothesize the following:

(6) Reduplication in Cantonese denotes a summation function.

The hypothesis in (6) predicts that the result of the function is always a sum of the input. If the result of the reduplication does not denote a sum or total of the given input, one may claim that hypothesis (6) is falsified.

3 Previous studies

3.1 The complex nature of adjectives

In general, the denotation of adjectives or properties can be decomposed into semantic functions of dimension, scale and degree. A dimension is a choice of measurement, such as height or weight. Scale is an linear ordered set within the same dimension, such as *tall* or *short* for the same dimension of height and *heavy* or *light* for weight. A degree specifies a point along the scale. The degree can bear specific value, as in *full* or *empty* in English. For example, whenever a speaker perceives the water level in a cup to reach the maximum value (i.e. 100%), then it would be felicitous to say *The cup is full*. However, a degree can also bear a fuzzy value, which may vary depending on the context. For instance, one would have very different standard of 'being tall' for *John is tall* and *The Willis tower is tall*. This decomposed adjective phrase analysis is also known as the DegP-shell analysis. Based on this analysis (Xiang, 2005; Grano and Kennedy, 2012), this paper assumes that adjective phrases are internally complex. In terms of syntax, there are multiple heads within the traditional AdjP.

3.2 Cross-categorial reduplication in various languages

There is little discussion specifically on adjectival reduplication in the literature. Although adjectival reduplication is attested in many other languages, e.g. Basque (De Rijk and De Coene, 2008), Bengali (Chakraborty and Bandyopadhyay, 2009) and a handful of others (Rubino, 2011), little attention

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[1] Abbreviations: CL- classifier, DISTR- distributive marker, Dur- durative aspect, Perf- perfect aspect, 3sg- third person singular pronoun, Prt- particle

is put on its formal semantic properties. Regier (1994) does provide a good summary of what reduplication can mean in various languages, but does not include Cantonese.

A recent study on adjective reduplication in Mandarin (Liu, 2012) provides an informal pragmatic account of some restrictions on adjectives that can undergo reduplication. Liu's account, like other works cited in this section, adopts an informal cognitive grammar approach to the issue. Also, Liu did not attempt to handle reduplication in nouns and verbs, thus the present analysis differs from Liu's analysis both in terms of the formal approach and scope of study.

Based on crosslinguistic data, Abraham (2005) suggests 'divisibility' as a criterion for base forms that undergo reduplication. He generalizes that reduplicated forms always denote predicates that are divisible, so these divisible predicates must always be a collection of some elements. Abraham (2005) also notes that this generalization would contradict the empirical data that some reduplication forms actually denote diminutive adjectives.

Kouwenberg and LaCharité (2005) address the apparent contradiction of diminutive or 'approximative' interpretation of reduplication and suggest that the diminutive reading is an extension from a dispersive interpretation. That means a diminutive reading of 'yellowish' would come from a dispersive 'yellow-spotted'. 'Dispersive' means that multiple instances of *yellow-ness*, such as spots or stains, are spread over or dispersed. This reading can therefore be construed as multiple instances of 'yellow'. For Kouwenberg and LaCharité (2005), this is a connecting context where reduplication first bears plurality. This reading can be extended to diminution, in the sense that yellowness is spread over the entity in a diluted way, instead of being individual spots or patches. However, such an account does not constrain when a language or an expression can perform semantic extension from dispersive to diminutive. It does work well for reduplication of colour adjectives in Cantonese, but not with adjectives of size and shape. For example, reduplication of predicates such as 'big' or 'tall' can never bear any dispersive reading, because the property of 'big' or 'tall' always predicates over the whole entity, not part of it. Kouwenberg and LaCharité (2005)'s theory of extension relies on the dispersive reading extending to diminution. Therefore, it cannot account

for size and shape adjectives bearing diminutive reading, because the dispersive reading is impossible for size and shape adjectives. This paper takes the intuition that reduplication denotes a sense of multiplicity of elements, but does not assert that diminution comes from dispersion. Instead, this paper suggests that both diminutive and dispersive readings are the result of summation, as will be further discussed in section 5.3.

The theory in Abraham (2005) and Kouwenberg and LaCharité (2005) treats iconicity as a central property in reduplication. This paper takes the multiplication as an intuition that there is a summation process. In sections 4 and 5, we show that the formal properties of cumulativity and quantization can resolve the apparent contradiction that the same predicate can denote the sum of a collection and a subpart of the same collection.

4 Cumulativity and Quantization

The central claim of this paper is that summation is the underlying common thread in reduplication. Before we move on to the implementation, it is crucial to understand that cumulativity and quantization have a direct impact on the result of the elements undergoing summation. This section sets up the background of cumulativity in the literature on nouns and verbs.

Krifka (2001) defines cumulativity as the following:

(7) A predicate P is cumulative iff
 (i) $\forall x, y[P(x) \land P(y) \rightarrow P(x \oplus y)]$
 (ii) $\exists x, y[P(x) \land P(y) \land \neg x = y]]$

Condition (i) means when two entities x and y are added together, they can still be described with the same denotation. Condition (ii) ensures x and y are distinct elements. For example, in a situation when Mary said she saw that John left, and Jane also said she saw that John left, we cannot infer that John left twice or conclude that 'leaving' is cumulative. The reason is that 'John' in the two utterances is the same person.

Cumulative predicates include 'wine' or 'apples'[2]. If an object x called 'wine' is added to another object, which is distinct from x, let's call it y, which is also wine, we have a new object containing x and y. Since we can reasonably describe this

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[2]Here the term predicate is used in a logical sense, not a linguistic sense. It bears no specification of category such as noun or verb, nor is it restricted to events or properties.

new object as 'wine' (as opposed to 'two wines', which is possible in a different context), we can conclude that 'wine' denotes a cumulative predicate. Typically, but not necessarily, cumulative predicates include mass nouns and count plural nouns. As noted in Rothstein (2004), there are several 'exceptions' like *line*, *sequence* or *fence* in English, which we will not discuss in detail here.

The same characteristic can be applied to verbal predicates. Atelic predicates are typically cumulative. Take *run* in English as an example. Two distinct instances of *run*, when put together, can also be described as 'run'. Likewise, putting *John built houses last year* and *John builds houses this year* together, one can still describe the whole event as 'building houses'.

In contrast, count nouns with number marking are characterized by the property of *quantization*. Krifka (2001) defines quantized predicates as:

(8) A predicate P is quantized iff
$\forall x, y[P(x) \land P(y) \to \neg y < x]]$

Using the example in Krifka (1998), if an element x can be called '3 apples', then it is impossible for any proper subset of x to be described as '3 apples'. This captures our intuition that part of '3 apples' can be an apple, or two apples, but not three apples. Similarly, a proper part of quantized events cannot be identical to its superset. If we say 'John made **four cakes**.', the part of the event, for example John making one cake, cannot be described as 'John made **four cakes**.' It shows that the verbal predicate 'make four cakes' is quantized.

The notions of cumulativity and quantization capture the human understanding of collective entities. There are two important messages. Firstly, summation of two elements (more precisely, two predicates) can often result in an element with same denotation, as seen in cumulative predicates 'apples' or 'run'. Note that the count-mass distinction is linguistic, which means that the encoding of whether a noun is count or mass is independent from ontology. For example, nouns like 'furniture' or 'footwear' are considered mass because they do not co-occur with numerals or the singular indefinite article, as in '*four furniture' or '*a footwear'. Second, the count-mass distinction is language-specific, meaning that an entity denoted by a mass noun in one language can be count in another language.

5   Summation as a common thread

The previous section shows that the behaviour or the interpretation of the sum (i.e. the returned value as a result of summation) can be used to indicate cumulativity and quantization. The denotation of 'SUM' in (9) is essentially 'every' in English (Heim and Kratzer, 1998).

(9) $\llbracket \text{SUM} \rrbracket = \lambda f \in D . \forall x \in D \to f(x) = 1$

This ensures all the individuals x are included in the sum D. From this formalization, we can see that whenever the sum shares the same denotation as its atomic elements, then we can see that the atomic elements must be cumulative. (e.g. 'some water' can be a collection of 'some water'). On the contrary, if a collection does not share the same denotation as its atoms (e.g. 'a chair' cannot have 'a chair' as its proper subset), the elements are quantized.

This section shows the implementation of summation in reduplication across the categories noun, verb and adjective in Cantonese.

5.1   Nouns

Cantonese nominals in general require classifiers on top of the noun. Nominal reduplication always applies to the classifier, as in (10). In (10) and (11), both the classifier and noun are present. The crucial difference between (10) and (11) is that the former reduplicates its classifier, which is acceptable, and the latter reduplicates its noun, which is unacceptable. Sentence (12) shows reduplication of the noun without a classifier, which is also unacceptable.

(10) *go2 go2 sai3lo6 dou1 hou2 lek1*
CL   CL child DISTR very smart
'Every child is very smart.'

(11) **go2 sai3lo6 sai3lo6 dou1 hou2*
CL   child   child   DISTR very
lek1
smart
Intended: 'Every child is very smart.'

(12) **sai3(lo6) sai3lo6 dou1 hou2 lek1*
child   child   DISTR very smart
Intended: 'Every child is very smart.'

The data show that Cantonese reduplication applies only to classifiers, but not nouns [3] . Both

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[3] For detailed discussion syntax of classifier and noun in Cantonese, see Cheng, 2012), which points out two puzzles

the classifier and the noun must be present and whenever there is reduplication, it must apply to the classifier[4].

There are a few apparent exceptions to the generalization that reduplication always applies to the classifier, such as *jat6 jat6* 'day-day – every day', *jan4 jan4* 'person-person – everybody', *dou6 dou6* 'place-place – everywhere', where there is no classifier present. However, one can also observe that these nouns behave differently from other common nouns in other contexts. For example, these nouns can cooccur with numerals without any classifiers, as shown in (13). Also, exceptions like *jat6* 'day' or *nin4* 'year' are measurement units of time, which can never occur with classifiers (**saam1 go3 jat6* 'three-classifier-day' would be unacceptable for '3 days'). We can therefore treat these nouns as if they already carry the functional feature that classifiers add to common nouns. This observation conforms with (Zhang, 2013)'s view that individuation is not exclusively expressed by classifiers and bare nouns in classifier-languages can denote countable objects.

(13) *keoi5 heoi5 zo2 hon4gwok3 sap6*
3sg   go   Perf Korea   ten
(*go3) jat1
CL   day
'S/he went to Korea for ten days.'

Now with well-formed reduplication like (10), we can see that each single member 'child' in the group 'every child' is quantized, but not cumulative, because a proper subpart of a child would not qualify as a child, i.e. one cannot reasonably call a subpart, say the shoulder of a child, 'a child'. Formally:

(14) $[\![\text{SUM}]\!](\text{child}) = \lambda f \in D \,.\, \forall x \in D \rightarrow f(x){=}1$
$= \forall x \in D \rightarrow \mathbf{child}(x){=}1$

The phrase 'every child' is true (truth value=1), iff each of the members in the domain D is a child. The Cantonese phrase *go3 sai6lo6* 'a child' (before reduplication) works the same way as its English counterpart. Since the phrase *go3 sai6lo6* 'a

child' is quantized, we predict that a summation of such elements would result in a quantized entity. This prediction is borne out in the data. To see this, let us focus on the individual member first. Since the utterance (10) denotes an exhaustive group of 'every child', it means that the predicate 'very smart' would apply to each of the individual members. The interpretation is also supported by the self-contradiction in the utterance in (15). Since (15) is not acceptable, we can infer that the reduplicated noun must denote every single member of 'the children'.

(15) *#go2 go2 sai3lo6 dou1   hou2 lek1,*
CL   CL   child   DISTR very smart
dan6hai6 jau1 jat1 go3 m4   lek1
but   EXIST one CL   Neg smart
'#Every child is very smart, but one of them is not.'

As predicted for the reduplicated form denoting 'every child', we can also observe the predicted result of a quantized entity. A proper subset of 'every child' cannot be also described as 'every child', for the reason that if a set y is the proper subset of a larger set x, y is necessarily smaller and thus does not include at least one of the members in x. Thus it is impossible to describe set y with the same denotation of x and we can conclude that the reduplicated noun phrase denotes a quantized predicate as well.

5.2 Verbs

Verbal reduplication in Cantonese shows a different pattern than nominals. Example (5) is repeated below as (16). The reading event must be interpreted as a prolonged, durative event, as its English translation suggests.

(16) *ngo5 tai2 tai2 ha5 syu1 fan3 zo2*
1sg   read read Dur book sleep Perf
'I fell asleep while reading.'

As first suggested by Bennett and Partee (1972), all the subparts within an atelic event are homogeneous. It provides a basis to compare an atom of a durative event to a singular member in plural count nouns. That means, the durative reading event in (16) can be seen as a collection of atomic reading subevents. Since these subevents are homogeneous, the whole reading event is considered atelic.

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[4]For independent reason, presumably phonological, Cantonese reduplication often takes one syllable. The unacceptability of (12) shows that a partial reduplication (i.e. reduplicating only the first syllable) would not make the utterance acceptable.

about Cantonese classifier reduplication. While both Cantonese and Mandarin use classifiers in their nominals, only Cantonese allows classifier reduplication.

Atelic events can be independently tested with duration modification, which is equivalent to the *for / in a period of time* test in English. If a predicate can be modified by 'for an hour' (or any other context-appropriate time interval), then the predicate is atelic. For example, *John read for an hour* is acceptable, whereas **John read in an hour* is not. It shows that 'read' is atelic. Cantonese does not use a prepositional phrase to show duration, but uses the verb copying construction like (17) instead[5]. Example (18) is equivalent to *in 3 minutes* in English. Since only (17) but not (18) is compatible with *tai2 syu1* 'read', we can conclude that *tai2 syu1* is atelic.

(17) *ngo5 tai2 syu1 tai2 zo2*
     1sg   read book read Perf
     saam1-fen1-zong1
     3-minute
     'I read for 3 minutes.'

(18) **ngo5 hai2 saam1-fen1-zong1 zi1noi6*
     1sg   in   3-minute   within
     tai2 syu1
     read   book
     '*I read (with)in 3 minutes.'

Because *tai2 syu1* 'read' is atelic, we can say that each instance of reading is identical to other instances within the same event.

What makes verbal reduplication such as (17) different from nominal reduplication is that the members of the reading events are non-quantized and cumulative. Conceptually, an instance of reading counts as reading, no matter how long it lasts. Also, adding up two instances of reading would also be interpreted reading. In other words, atelic predicates such as *tai2 syu1* 'read book' in Cantonese are cumulative. Let x and y be distinct atomic events, and *tai2 syu1* ⟦read⟧ be predicate over each of them. The interpretations above are formalized in (19) below:

(19) ⟦read⟧$(x) \wedge$ ⟦read⟧$(y) = 1$
     ⟦read⟧$(x \oplus y) = 1$

What the durative interpretation of verbal reduplication tells us is that it must denote a sum of multiple subevents as members, otherwise one should be able to find verbal reduplication examples that are punctual (i.e. not durative). However, since

the reduplicated verb still denotes one prolonged event, we must account for this difference from nominal reduplication (which denotes a collection of distinct, individuated members) in terms of cumulativity.

However, it is also possible for verb reduplication to contain non-cumulative and quantized subevents. Semelfactive verbs, such as *jump* and *knock* in English are always punctual, i.e. they cannot be durative. This is shown by the observation that *John jumps for an hour* would only give the iterative reading that there are more than one jumps in that hour, rather than the reading that one single jump lasts for an hour. The verb *tiu3* 'jump' in Cantonese works the same way as its English counterpart. Only (20), but not (21), is acceptable[6].

(20) *ngo5 tiu3 zo2 saam1-fen1-zong1*
     1sg   jump Perf 3-minute
     'I jumped for 3 minutes.' (*iterative only*)

(21) **ngo5 hai2 saam1-fen1-zong1 zi1noi6*
     1sg   in   3-minute   within
     tiu3 (zo2)
     jump   Perf
     '*I jumped (with)in 3 minutes.'

When the verb *tiu3* 'jump' is reduplicated, as in (22), the only reading allowed is that jumping is iterative, i.e. there must be more than one instance of repeated jumping.

(22) *ngo5 tiu3 tiu3 ha5 gok3dak1*
     1sg   jump jump Dur feel
     tou5ngo6
     hungry
     'I (begin to) feel hungry while jumping.'
     (*iterative reading only*)

The fact that (22) cannot be durative can naturally be explained by the cumulativity and quantization contrast.

(23) ⟦jump⟧$(x) \wedge$ ⟦jump⟧$(y) = 1$

(24) ⟦jump⟧$(y) \rightarrow \neg y < x = 1$

If (23) is true, then (24) is necessarily true, i.e. the atomic event y must not be a proper subpart of the atomic event x (cf. definition (8)). Since

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[5]Note that the two occurrences in (17) are not contiguous, thus it is distinct from verb reduplication.

[6]Similar to English, one would judge (21) as acceptable if there was an implicit object that gives some other meaning. (21) intends only the literal meaning of 'jump'.

tiu3 'jump' is punctual and quantized, the sum of multiple instances of it must be a proper superset of each individual instance, therefore the reduplication is interpreted as an iterative event, but not a durative one.

This section has shown that the summation formulation naturally handles the two kinds of verb reduplication without stipulating summation itself. The choice between durative reading of one instance of the same event and the iterative reading that represents multiple instances can be predicted solely by the nature of the event denoted by the base verb. If the base form is cumulative, the summation function returns a durative event; if the base form is quantized, summation returns an iterative reading.

5.3 Adjectives

There are two independent issues in the interpretation of adjectives. The first one concerns the status of reduplication as a semantic function and a syntactic head in the domain of adjectives. The second issue is the apparent contradiction between summation and the hedging and diminutive reading. This section will show that reduplication is indeed one of the variants that denotes degree, alongside *hou2* 'very' and other degree markers, such as *gei2* 'fairly'. It will also be shown that the diminutive reading does not contradict summation or plurality in general, echoing previous studies on diminutive reduplication (Abraham, 2005; Kouwenberg and LaCharité, 2005).

Regarding the first issue, the distribution of reduplication shows that the reduplication morpheme should be a functional head asserting some sort of degree. By comparing (25) and (26) against the ungrammatical (27), we can see that adjectival predicates must either have *hou2* 'very' or reduplication to be acceptable.

(25) *go2 zek3 maau1 hou2 fei4*
　　 that CL　cat　　very　fat
　　 'That cat is very fat.'

(26) *go2 zek3 maau1 fei4 fei4 dei2*
　　 that CL　cat　　fat　fat　Prt
　　 'That cat is fairly fat.'

(27) **go2 zek3 maau1 fei4*
　　 that CL　cat　　fat
　　 '*Intended*: That cat is fat.'

Since reduplication and degree markers like *hou2* 'very' cannot cooccur and one of them must appear in the utterance, they are in complementary distribution and must denote similar function.

Section 3 showed that adjective predicates are internally complex, based on previous studies on scale and degrees. Following Grano (2011) and Grano and Kennedy (2012)'s analysis of Mandarin, elements like 'very' in Chinese denote a morpheme that turns a bare adjective into a degree-marked element[7]. More specifically, the assertion of the degree-marked adjective would involve a morpheme $[\![pos]\!]$, which provides the contextual standard to determine whether the object in question meets the standard for the given property. Since reduplication also denotes the assertion that an entity meets a certain standard, one can say that reduplication shares the same position as $[\![pos]\!]$, by the distribution shown above.

The second issue is the diminutive interpretation as a counterexample of to the present summation theory. Abraham (2005) investigates how reduplication can provide diminutive interpretation, assuming reduplication was a iconic manifestation of multiplicity. The data for diminitive reduplication cited in Abraham (2005) and Kouwenberg and LaCharité (2005) include verbs and adjectives, but the adjective examples are colour terms and other adjectives that can describe part of an entity, as in (28) and (29).

(28)　a. Base form: *red* 'red'
　　　 b. *redi-redi* 'reddish, red-spotted'
　　　 Caribbean Creoles (Abraham, 2005, p.552)

(29)　a. Base form: *brok* 'to break'
　　　 b. *brokii-brokii* 'as if broken all over'
　　　 Caribbean Creoles (Kouwenberg and LaCharité, 2005, p.538)

The explanation given in Kouwenberg and LaCharité (2005) is that there is an intermediate meaning of 'red-spotted' or 'as if broken all over' which denotes multiple instances of redness (or for (29), breaks). The dispersive reading ('red-spotted' or 'as if broken all over') is then extended to diminutive reading ('reddish' or 'fairly/

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[7]Cantonese is similar to Mandarin in all the related aspects here. Grano (2011) also notes that (27) can provide implicit comparative reading in a contrastive context, but this is outside the focus of this paper.

slightly broken'). In such a theory, both Kouwenberg and LaCharité (2005) and Abraham (2005) claim that reduplication in form does denote a sense of multiplicity, only that the multiplicity is distributed to the same entity. (Kouwenberg and LaCharité, 2005) claim that '(t)he real-world effect of such scattered distribution of colour is to tone down rather than intensify the colour'. Therefore the multiple spots of the colour would result in a diminutive reading, through the dispersive reading.

However, the iconicity theory cannot explain the Cantonese examples like (26), where there cannot be a dispersive reading. Since the predicate *fei4* 'fat' applies to the whole entity 'cat', but not part of it, it is impossible to interpret *fei4 fei4 dei2* as 'being fat everywhere / all over' in (26). The cumulative analysis pursued in this paper avoids the problem with dispersive reading. Based on the discussion of distribution above, we can see that bare adjectives (27) are not allowed in the language. If we further assume that adjectival predicates should include the positive morpheme $[\![pos]\!]$ for any assertion, the Cantonese data would mean that bare adjectives do not denote the positive degree, since they cannot assert the positive degree.

The cumulativity analysis, on the other hand, explains the correct diminutive interpretation and why no intensification arises. Given the formulation of cumulativity in (7), a predicate is considered cumulative if the sum of the predicate has the same denotation of its atomic elements. Let x and y be two property-denoting variables, each predicated by $[\![fat]\!]$ as in (30a):

(30) a. **fat**(x) $\wedge$ **fat**(y) = 1
      b. $\forall$x,y [**fat**(x$\oplus$y)] = 1
      c. $\forall$x,y [**fat**(x) $\wedge$ **fat**(y) $\rightarrow$ $\neg$ y$<$x] = 0

(30b) is true because any two instances of being fat conjoined would denote $[\![fat]\!]$. For (30c) to be true, the property-denoting variable (i.e. bare adjectives *without* degree-marking) y must not be a proper subpart of x. However, this is not the case in the Cantonese data. For example, the belly of a fat cat can be described as fat. The proper subpart does share the same denotation of its whole. We thus conclude that adjectives in Cantonese must be cumulative. Section 5.2 has shown how cumulativity accounts for verb reduplication under durative interpretation. Adjectival reduplication shows a similar pattern. That is, the reduplicated form

denotes a cumulative and non-quantized predicate. Cumulativity succeeds in preventing the wrong interpretation for reduplication to denote intensification in Cantonese. By extending the cumulativity analysis to adjectives, it can be seen that reduplication does not necessarily denote 'more' in the quantized sense, even though it denotes a summation function.

The apparent contradiction between summation and diminution comes from the wrong comparison. Since atomic bare adjectives do not denote any degree, it would be wrong to compare the degree denoted by reduplication and the non-existing degree denoted by the bare form. Instead, the reduplicated form should be compared to the default degree-marker *hou2* 'very', as in (25), when one is measuring the intensity or extent of the assertion. Recall that Cantonese requires overt degree-marking, as shown by the unacceptability of (27). Comparing the two options (25) and (26) to assert a positive degree, (25) with *hou2* would denote a neutral assertion of positive degree, but it can also be interpreted as emphasis or intensification, whereas (26) gives the diminutive, hedging reading ('slightly, fairly *Adj*'). Despite being a result of summation from the bare adjective, the degree denoted by reduplication should be compared to the canonical positive assertion, but not the atomic bare adjective. In other words, there is no contradiction between the summation formulation and the diminutive interpretation.

The present account is more powerful than the iconicity-based theory for two reasons. First, cumulativity is a property more widely observed across categories and languages, whereas iconicity is not as prominent in explaining behaviours of various constructions. The present account does not assume either iconicity or any form of symbolism and relies only on the notion of cumulativity, which is independently needed for count/mass distinction or durative events in the language. Second, the iconicity account does not explain the reduplication of adjectives that must describe the entity as a whole, but not a part, such as (26). On the contrary, cumulativity can handle such cases without relying on an intermediate dispersive reading, which is not always available.

The present cumulativity analysis makes the following two predictions: (i) in languages where reduplicated adjectives denote intensification, the adjectives are degree-marked and thus quantized;

(ii) in languages where reduplicated adjectives denote diminution, the adjectives are not marked with degree and thus cumulative. Cantonese adjectives would belong to type (ii). On the one hand, Cantonese adjective reduplication denotes diminution. On the other hand, Cantonese adjectives alone do not carry degree, as revealed by the observation that it requires degree marking.

This analysis does not exclude the possibility that the two options can co-exist in the same language, as we have already observed such cases in Cantonese verbs, where both cumulative and quantized predicates are possible within the same category. Our Cantonese adjectives are exclusively cumulative, but it does not mean that it is impossible for other languages to show category-internal variations in terms of cumulativity and quantization. What the present analysis predicts is that the two subtypes of adjectives would each display a different meaning in their respective reduplication forms, if they exist at all in such a language.

This section has explained that adjective reduplication in Cantonese should be treated as diminutive because the atomic bare adjective is cumulative. By showing that we should be comparing reduplication forms only to degree-marked adjectives, instead of the base form, we conclude that there is indeed no contradiction between the summation treatment to reduplication and its diminutive interpretation. By analogy, adjectives without degree-marking are similar to verbs without aspect-marking or nouns without classifiers or determiners, in the sense that bare verbs and bare nouns do not denote instantiated arguments, but only kinds of object or events in an abstract sense.

6 Implications

The present hypothesis that reduplication denotes summation is confirmed only with Cantonese data. However, it can also be tested by cross-linguistic data. Various pragmatic interpretation are discussed in the literature (Regier, 1994). Regier suggests notions like 'lack of specificity' and 'non-uniformity' as subtypes of meanings that can be denoted by reduplication. These can potentially be formalized as elements with fuzzy boundaries or multiple degrees along a scale. In languages where reduplication denotes intensification, the present analysis can also be extended to account for the increased degree through summation. This

would then predict that the reduplicated elements are quantized, since the sum would have a distinct denotation.

The advantage of the present proposal is that the notions of cumulativity and quantization are independently testable without reduplication. For languages that show reduplication, knowing the cumulativity and quantization properties can predict the reading of reduplication. For unreduplicated base forms that are cumulative, such as *paau2 bou6* 'lit: run step, i.e. to jog' in (31), the present proposal predicts that its reduplicated form would denote the same predicate, i.e. a durative, atelic event. On the other hand, in a base form that is punctual, such as *tiu3 sing2* 'jump rope' in (32), each instance of jump must be quantized because the sum of two jumps cannot be described as a jump. In this case, it correctly predicts that the felicitous reading in sentence (32) must be iterative, but not a reading of a single prolonged jumping-action.

(31) *keoi5 paau2 paau2 ha5 bou6*
     3sg   run   run   Asp step
     gok3dak3 tou5ngo6
     feel   hungry
     'S/he feels hungry while jogging.'

(32) *keoi5 tiu3 tiu3 ha5 sing2 gok3dak3*
     3sg   jump jump Asp rope feel
     tou5ngo6
     hungry
     'S/he feels hungry while jumping rope.'

The present analysis shows that reduplication can be formalized as a summation process[8], while the difference across categories in their respective interpretations can be resolved with the notions of cumulativity and quantization. This step allows us to apply semantic functions independently of syntactic categories. Since there can be variance of cumulativity and quantization within the same category, as observed in mass nouns and bare plural count nouns being cumulative and quantified count nouns being quantized, the cumulativity and quantization contrast in different cases of reduplication should not be solely attributed to a difference in category. This also raises the question

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[8]A natural next step is to extend the current analysis to the bisyllabic full reduplications, commonly known as the AABB and ABAB patterns. This is, however, beyond the scope of this study.

of the traditional notion of 'category'. More precisely, if the semantic functions are shared across categories, then what is the role of categories in grammar? Independently, there are decompositional proposals in syntax that explicitly suggest parallel structure between the nominal and the verbal domains (Borer, 2005a; Borer, 2005b; Megerdoomian, 2008) and between the verbal and adjectival domains (Kennedy and McNally, 2005; Beavers, 2008; Ramchand, 2012). Wouldn't it be desirable to have a unified theory across lexical categories? Due to the limited scope of this study, we will leave the issue here for future research.

7 Conclusion

The main goal of this paper is to explain the cross-categorial behaviour of reduplication in Cantonese.

This paper has shown that it is possible to interpret reduplicated forms in lexical categories (i.e. nouns, verbs and adjectives) under the same function, *summation*. Whenever reduplication occurs, the atomic elements are added up and put into a collection. We argue that the difference in interpretations depends solely on the cumulativity and quantization of the element, but not its category. Nominal reduplication returns a superset of its elements, which conforms with the fact that classifier phrases in Cantonese denote individuated elements and is thus quantized. Verbal reduplication can be either cumulative or quantized, depending on the aktionsart of the individual verbal predicate. Adjectival reduplication is cumulative, due to its divisibility into subparts. The present analysis bears two implications. It captures the cross-categorial behaviour in semantic terms and provides a basis for future research on the formal semantic properties of reduplication across languages.

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