Pluractionality via competition: VV in Mandarin Chinese[1]

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Abstract. This paper provides a pragmatic mechanism for deriving pluractionality of the Mandarin VV sequence formed with certain types of verbs. We propose: (i) Syntactically, VV is an instantiation of V-(NUMERAL)-CLASSIFIER, where the second V serves as a cognate verbal classifier. (ii) Semantically, VV denotes an unspecified quantity of events, with the unit of counting being the event itself. (iii) Based on this semantic analysis, pluractionality of VV formed with certain verbs can be derived through its competition with V-one-V. Meanwhile, we address the semantics of event-internal and event-external verbal classifiers (i.e., *xia* vs. *ci*). Our analysis of cognate classifiers can be further extended to the nominal domain.

Keywords: verbal classifiers, countability, atomicity, cumulativity

1. Introduction

Verbs in Mandarin Chinese can be followed by what appears to be a reduplicative morpheme, forming a sequence that contains two instances of the same verb (henceforth VV). VV formed with certain verbs expresses event-internal pluractionality (cf. Deng 2013). For example, *qiao qiao* 'knock knock' and *ti ti* 'kick kick' in (1) convey that there are several knocks or kicks required to be performed by the addressee.

(1) a. ni **qiao** **qiao** men.
you knock knock door
'You give some knocks on the door.'[2]

b. ni **ti** **ti** men.
you kick kick door
'You give some kicks to the door.'

While this seems to align with the cross-linguistic connection between pluractionality and verbal reduplication (see Newman 2012 for an overview), the structure and meaning of VV remain contested, particularly regarding (i) whether VV is formed via morphological reduplication (Li and Thompson 1981) or has a phrasal structure (Chao 1968), and (ii) whether VV expresses aspectual (Wang 1954) or quantitative meaning (Zhu 1982). Furthermore, we would like to point out that none of the previous analyses can fully account for the following puzzles.

Puzzle I: Numerals and aspectual markers can be inserted between the two Vs, such as the numeral *yi* 'one' and the aspectual marker *le* in (2).

(2) a. ni **qiao** yi **qiao** men.
you knock one knock door
'You give some knocks on the door.'[3]

b. ta **qiao**-le **qiao** men.
he knock-PERF knock door
'He gave some knocks on the door.'

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[2] Given that *time*-adverbials in English are ambiguous between event-internal and event-external readings (i.e., event-counting vs. occasion-counting), we circumvent translations like 'knock *n* times', but make use of translations such as 'give *n* knocks' to unambiguously indicate event-internal readings.

[3] In (2a), *yi* 'one' is unstressed and has the reading of 'at least one', merely indicating the existence of events. Further elaboration on the semantics of numerals will be provided in Section 4.2.

Puzzle II: Not all verbs can form VV. Activities can form VV, but statives and achievements cannot.[4] Compare (1) with (3).

(3) a.*ta **shi shi** haoren.
he be be good.person
Int.: 'He is a good person.'

b.*ta **dao dao** lundun.
he reach reach London
Int.: 'He reaches London.'

Puzzle III: Not all instances of VV express pluractionality. For example, *deng deng* 'wait wait' in (4a) and *xiang xiang* 'think think' in (4b) cannot be construed as multiple occurrences of waiting events or thinking events, but rather as a single event that extends over some time, implying a durative reading.

(4) a. ni **deng deng** wo.
you wait wait me
'You wait for me for a while.'

b. ni **xiang xiang** zhe ge wenti.
you think think this CL issue
'You think about this issue for a while.'

Puzzle IV: It remains unclear how pluractionality is derived in VV formed with certain activities. Note that the plural interpretation is not exclusive to VV formed with semelfactive verbs. VV formed with activities like *ca* 'wipe', *rou* 'rub', *mo* 'caress', *zhuai* 'tug', *dong* 'move', *bo* 'tuck', *tui* 'push', *la* 'pull', and *zhuan* 'turn' also exhibit pluractionality, as in (5).

(5) a. ta **ca**-le **ca** zhuozi.
he wipe-PERF wipe table
'He gave the table some wipes.'

b. ta **rou**-le **rou** houbei.
he rub-PERF rub back
'He gave his back some rubs.'

c. ta **mo**-le **mo** wo-de tou.
he caress-PERF caress I-MOD head
'He gave some caresses to my head.'

d. ta **zhuai**-le **zhuai** ziji-de xiuzi.
he tug-PERF tug self-MOD sleeve
'He gave his sleeve some tugs.'

This research aims to analyse the structure and meaning of VV and to derive pluractionality of certain VV. We first review the previous analyses (Section 2), then argue that VV is an instantiation of V-(NUMERAL)-CLASSIFIER (henceforth V-NUM-CL), with the second V serving as a cognate verbal classifier, addressing **Puzzle I** (Section 3). We further propose that VV denotes an unspecified quantity of events with the unit specified as the event itself (Section 4). **Puzzle II** and **Puzzle III** are attributed to cumulativity and stable atomicity of events, which are represented as functional heads in the projection of verbal classifiers. Our semantics then enables us to derive the pluractionality of VV formed with certain activities through pragmatic competition with V-one-V, thereby solving **Puzzle IV** (Section 5). Finally, we delve into the motivation for cognate verbal classifiers and extend our analysis to the nominal domain (Section 6).

2. Previous analyses

2.1. Structure of VV: Reduplication vs. Syntactic construction

VV has been viewed as reduplication (Li and Thompson 1981; Paris 2013) and assumed to be either stocked in the lexicon (Deng 2013) or morphologically derived (Zhu 1982). Nonetheless, the reduplication analysis encounters the challenges of **Puzzle I** and **Puzzle II**. First, the linearization problem of the inserted numerals and aspectual markers in (2) has been either left unresolved (Deng 2013) or simply ascribed to ad hoc phonological rules (Yang and Wei 2017). Second, the reduplication analysis struggles to account for the incompatibility of different verbs with VV in (3), since reduplication is not expected to be sensitive to the Aktionsart of verbs.

[4] Accomplishments in Mandarin Chinese are expressed by phrases rather than simplex verbs (Huang 2014). Given that VV typically applies to simplex verbs, our discussion will be focused on activities, achievements, and statives.

An alternative approach treats VV as a syntactic construction, with the first instance of V being a verb and the second, a verbal classifier (Fan 1964; Chao 1968; Xiong 2016). The syntactic approach essentially analyses VV as an instantiation of V-(NUM)-CL. The parallels between VV and V-NUM-CL will be discussed in Section 3.1. In Mandarin, verbal classifiers encode units for counting in the domain of events. For instance, the verbal classifier *xia* in (6a) provides a unit for counting kicks, comparable to the nominal classifier *ge* for pears in (6b).

(6) a. ti san **xia**
kick three CL
'give three kicks'

b. san **ge** li
three CL pear
'three pears'

Within the domain of events, there exists a distinction between events and occasions, resulting in two levels of counting: event-internal and event-external (Cusic 1981). In English, this distinction manifests as scopal difference of *time*-adverbials (Andrews 1983; Cinque 1999), as illustrated in (7). In Mandarin, this distinction is lexically encoded in two types of verbal classifiers (Deng 2013; Donazzan 2013; Zhang 2017; Liao 2018). As demonstrated by (8), *xia* provides a counting unit for events, whereas *ci* provides a counting unit for occasions. We will revisit this issue in Section 3.1 and 4.1.

(7) a. He kicked the door three times four times. (three events, four occasions)
b. Four times, he kicked the door three times.

(8) a. ta ti-le si **ci** men, mei ci ti san **xia**.
he kick-PERF four CL_{occ} door each CL_{occ} kick three CL_{evt}
'He kicked the door on four occasions, and on each occasion he gave three kicks.'
b.*ta ti-le si **xia** men, mei xia ti san **ci**.
he kick-PERF four CL_{evt} door each CL_{evt} kick three CL_{occ}
Int.: 'He kicked the door on four occasions, and on each occasion he gave three kicks.'

The syntactic approach holds two advantages over the reduplication analysis. First, it resolves the insertion issue of numerals and aspectual markers (**Puzzle I**) by treating the second V as a verbal classifier. Second, it may provide a potential explanation for the compatibility pattern of VV with different verbs (**Puzzle II**) through the s-selection of a functional head. The details of the explanation will be further explored in Section 4.2. [5]

2.2. Meaning of VV: Aspect vs. Quantity

Regarding the meaning of VV, it has been suggested that VV conveys particular aspectual information such as delimitativeness (Li and Thompson 1981), short duration (Wang 1954), or tentativeness (Chao 1968; Yang and Wei 2017).[6] According to the delimitativeness view, events conveyed by VV are either low in frequency or short in temporal length, whereas the short duration view emphasises only the latter. However, the denotation of VV is not necessarily tied to low frequency or short duration. As shown by (9) and (10), *ca ca* 'wipe wipe' and *xiang xiang* 'think think' can occur in contexts where the wiping events and the thinking events take a considerable amount of time. As for tentativeness, it is in fact a context-dependent

[5] Another potential analysis within the syntactic approach suggests that the second V is the phonological realisation of an aspectual head (cf. Yang and Wei 2017). This hinges on the idea that VV encodes certain aspectual information, an assumption that, as we will show in Section 2.2, lacks solid empirical support.

[6] While delimitativeness, short duration, and tentativeness are not conventionally considered as aspect, they have been classified as such in previous studies due to their pertinence to temporal properties.

reading of VV observed only in irrealis contexts. For instance, VV in (5) does not exhibit tentativeness. Even in irrealis contexts, (9) and (10) demonstrate that the events denoted by VV can be sufficient, certain, and decisive, contrary to the notion of tentativeness.

(9) diban zheme zang, dei ca yi ge xingqi, ni haohao **ca ca**.
floor this dirty require wipe one CL week you sufficiently wipe wipe
'A floor this dirty needs a week of wiping. Give it a sufficient number of wipes.'

(10) ni zixi **xiang xiang** zhe ge wenti, bu xiang qingchu jiu bie zou.
you carefully think think this CL issue not think clearly then not leave
'You think about this issue thoroughly. Otherwise, you won't be allowed to leave.'

This paper will entertain an alternative view, the quantity-based approach, which contends that the core meaning of VV is centred around counting/quantity rather than temporal properties of events. Within this approach, various proposals have been made regarding the meaning of VV, including conveying small quantity in occurrences (Zhu 1982), unspecified quantity (Li 1964), vague quantity (Cheng 1988), and event plurality (Deng 2013). For the small quantity view, as we have seen in (9), the denotation of VV is not necessarily small in quantity. The other three views acknowledge the pluractionality of certain VV like *qiao qiao* 'knock knock'. To support this point, we present three pieces of evidence: (i) such VV can be associated with *dou* that introduces universal quantification (cf. Lee 1986; Lin 1998; a.o.), as in (11); (ii) such VV can be referred back to by plural definites instead of singular definites, as in (12); (iii) such VV is unacceptable in singular-event scenarios, as shown by (13).

(11) ta **qiao**-le **qiao** men, dou qiao-zai-le boli-shang.
he knock-PERF knock door all knock-on-PERF glass-LOC
'He gave some knocks on the door, all of which were on the glass panel.'

(12) ta **qiao**-le **qiao** men. ta qiao-de na {ji / #yi} xia hen qing.
he knock-PERF knock door he knock-MOD the several one CL_{evt} very gentle
'He gave some knocks on the door. Those knocks were very gentle.'

(13) #baochi anjing. buyao qiao hao ji xia men, **qiao qiao** men.
keep quiet don't knock very several CL_{evt} door knock knock door
Int.: 'Keep quiet. Don't give multiple knocks on the door; give one knock on the door.'

Nevertheless, the quantity-based approach leaves **Puzzle III** and **IV** unresolved, namely, why *deng deng* 'wait wait' does not exhibit pluractionality, and why *qiao qiao* 'knock knock' does.

To summarise, for the structure of VV, the syntactic approach holds advantages over the reduplication analysis; for the meaning of VV, the quantity-based approach proves to be more solid than the aspect-based approach. On the basis of the syntactic approach and the quantity-based approach, we will further address the four puzzles introduced in Section 1. Now let us first elaborate on the syntactic structure of VV.

3. Syntax of VV

3.1. VV: V-(NUM)-CL under the guise of reduplication

As previously noted in Section 2.1, treating VV as reduplication falls short when addressing **Puzzle I** and **II**. More evidence from Mandarin and the earlier stages of its development suggests that VV has an internal syntactic structure.

First, more than one word is allowed to occur in between the two Vs, including the numeral *yi* 'one', the perfective marker *le*, and the resultative morpheme *shang*.

(14) ta **dan**-le yi **dan** shen-shang-de chentu.
he whisk-PERF one whisk body-LOC-MOD dust
'He gave some whisks to remove the dust from his body.'

(15) fanshi ren-de dongxi, beijingren dou neng **wan**-shang yi **wan**.
all human-MOD thing Beijinger all can play-RESULT one play
'For every handicraft, Beijingers can play with it for a while.'

Second, while the numeral between VV is limited to *yi* 'one' in Mandarin, numeral-insertion is rather productive in late Medieval and early Modern Chinese. [7]

(16) jiang mashaoer qu na menxian-shang **qiao** san **qiao**.
take spoon go that threshold-LOC knock three knock
'Use the spoon to give three knocks on that threshold.'
(*Taohuanv po fa jia Zhougong*, Drama, 1200s A.D.)

Numeral insertion suggests that the second V of VV is a verbal classifier. We would like to present additional evidence to demonstrate that VV is actually an instantiation of V-(NUM)-CL. First, the second V in VV exhibits a complementary distribution with NUM-CL.

(17) ta **qiao**-le **qiao** (***ji** **xia**) men jiu zou-le.
he knock-PERF knock several CL_{evt} door then leave-PERF
'He gave some knocks on the door and then left.'

Second, V-(one)-V and V-(one)-CL share the same licensing condition for *yi*-ellipsis. When the numeral *yi* 'one' is not focused, it solely conveys the existence of events (see Section 4.2), and thus can be omitted without changing the meaning.

(18) a. ni **qiao** (yi) **qiao** men.
you knock one knock door
'You give some knocks on the door.'

b. ni **qiao** (yi) **xia** men.
you knock one CL_{evt} door
'You give some knocks on the door.'

Third, both VV and V-(NUM)-CL allow for *le*-insertion, and the aspectual marker *le* cannot be attached to the whole construction, as shown in (19) and (20). The position of *le* suggests that only the first V of VV occupies the V head.

(19) a. ta **qiao**-le **qiao** men.
he knock-PERF knock door
'He gave some knocks on the door.'

b. *ta **qiao** **qiao**-le men.
he knock knock-PERF door
Int.: 'He gave some knocks on the door.'

(20) a. ta **qiao**-le **xia** men.
he knock-PERF CL_{evt} door
'He gave some knocks on the door.'

b. *ta **qiao** **xia**-le men.
he knock CL_{evt}-PERF door
Int.: 'He gave some knocks on the door.'

Fourth, the second V of VV aligns with the event-internal classifier *xia*, not the event-external classifier *ci* (see Section 2.1). As (21) illustrates, VV conveys event counting instead of occasion counting.

[7] In Mandarin, the numeral *yi* 'one' between VV does not have alternatives. Consequently, it cannot be focused or stressed, and it only gets the *at least* reading. By contrast, in late Medieval and early Modern Chinese, numerals between VV have alternatives and thus can get the *exactly* reading. This issue will be discussed in Section 4.2.

(21) a. ta **qiao**-le **qiao** men, mei {*ci / xia} dou hen qing.
he knock-PERF knock door each CL$_{occ}$ CL$_{evt}$ all very gentle
'He gave some knocks on the door, and each knock was very gentle.'

b. ta **qiao**-le ji **xia** men, mei {*ci / xia} dou hen qing.
he knock-PERF several CL$_{evt}$ door each CL$_{occ}$ CL$_{evt}$ all very gentle
'He gave several knocks on the door, and each knock was very gentle.'

Fifth, VV and V-NUM-CL$_{evt}$ exhibit a similar pattern in their compatibility with different verbs, as demonstrated by our investigation of 170 verbs summarised in Table 1. Specifically, statives are not compatible with VV or V-NUM-CL. Achievements are rejected by VV or V-NUM-CL$_{evt}$ yet compatible with V-NUM-CL$_{occ}$. Activities can be divided into two types: Activities I (*qiao* 'knock') can occur in VV and V-NUM-CL, and VV formed with Activities I is pluractional. Activities II (*deng* 'wait') can be found in VV and V-one-CL$_{evt}$ but not V-three-CL$_{evt}$, and VV formed with Activities II is not pluractional.

Class	Example	VV	V-one-CL$_{evt}$	V-three-CL$_{evt}$	V-NUM-CL$_{occ}$
Statives	*shi* 'be'	−	−	−	−
		**shi shi*	**shi yi xia*	**shi san xia*	**shi san ci*
Achievements	*dao* 'reach'	−	−	−	+
		**dao dao*	**dao yi xia*	**dao san xia*	*dao san ci*
Activities I	*qiao* 'knock'	$+_{pluractional}$	+	+	+
		qiao qiao	*qiao yi xia*	*qiao san xia*	*qiao san ci*
Activities II	*deng* 'wait'	$+_{not\,pluractional}$	+	−	+
		deng deng	*deng yi xia*	**deng san xia*	*deng san ci*

Table 1: Compatibility of counting constructions with verbs

Together, the evidence supports our claim that VV is in fact V-one-CL$_{evt}$ with an omitted unfocused *yi* 'one'. The second V of VV is a cognate verbal classifier providing a counting unit for events, akin to the event-internal verbal classifier *xia*.

3.2. NUM-CL is an adjunct

In line with Huang, Li, and Li's (2009) adjunct-based analysis, we argue that NUM-CL$_{evt}$ (including NUM-V) in V-NUM-CL$_{evt}$ is an adjunct rather than an argument of the verb. First, NUM-CL$_{evt}$ is optional.

(22) a. ni **qiao** (yi **qiao**) men.
you knock one CL$_{\text{KNOCK}}$ door
'You give some knocks on the door.'

b. ni **qiao** (yi **xia**) men.
you knock one CL$_{evt}$ door
'You give some knocks on the door.'

Second, NUM-CL$_{evt}$ can compose with predicates whose argument slots are saturated, such as ditransitive verbs with both direct and indirect objects, suggesting that NUM-CL$_{evt}$ is not an argument of the verb.

(23) a. ni **jiao** (yi) **jiao** wo shuxue.
you teach one CL$_{\text{TEACH}}$ me math
'You teach me math a bit.'

b. ni **jiao** (yi) **xia** wo shuxue.
you teach one CL$_{evt}$ me math
'You teach me math a bit.'

Third, in contrast with indefinite arguments, NUM-CL$_{evt}$ lacks the *de re* reading, indicating its adjunct status (Landman 2004, 2006). In (24a), the indefinite object can take either the narrow or the wide scope, while in (24b), NUM-CL$_{evt}$ can only take the narrow scope.[8]

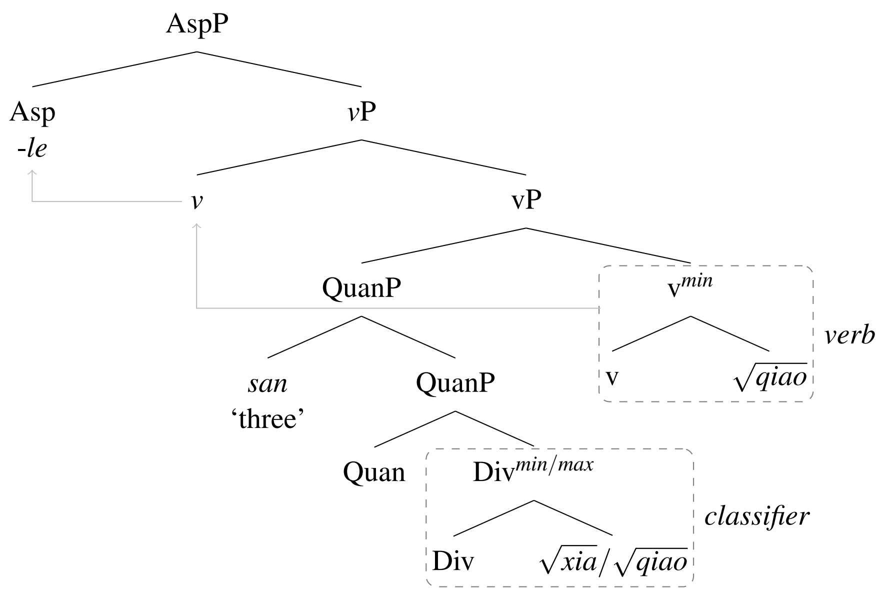
(24) a. mei ge ren dou xiang qu yi ge Beijing guniang.
every CL people all want marry one CL Beijing girl
'Everyone wants to marry a girl from Beijing.' *want* > 1
'There is a girl from Beijing who everyone wants to marry.' 1 > *want*

b. mei ge ren dou xiang qiao yi xia men.
every CL people all want knock one CL$_{evt}$ door
'Everyone wants to give a knock on the door.' *want* > 1
#'There is a knock which everyone wants to give on the door.' #1 > *want*

3.3. Structuring V-NUM-CL

We have argued that VV is an instantiation of V-(NUM)-CL$_{evt}$, and NUM-CL$_{evt}$ is an adjunct of V. Since NUM-CL$_{evt}$ encodes event counting, we assume that NUM-CL$_{evt}$ is situated structurally inside *v*P (cf. Cinque 1999; Zhang 2017). In the spirit of Borer (2005), we further propose that NUM-CL is represented as Quan(tity)P, as (25) illustrates.

(25)



QuanP is an adjunct to the verb. Internally, QuanP is headed by Quan, which takes a numeral as its specifier and a verbal classifier Div(ision)$^{min/max}$ as its complement.[9] For the linear order, we follow Huang et al.'s (2009) analysis and treat *le* as an affix at the Asp head; the verb moves up to *v*, eventually landing in the Asp head. This gives us the desired order of V-NUM-CL$_{evt}$ as well as the linear adjacency of the verb and the aspectual marker *le*, thereby resolving the

8 Manfred Krifka (p.c.) suggests that the observed absence of the *de re* reading for NUM-CL$_{evt}$ could be attributed to the inherent difficulty in identifying specific knocking events. Yet, this does not seem to be the case in Mandarin, as events can be identifiable, particularly with the use of demonstratives *zhe* 'this' and *na* 'that'.

(i) mei ge ren dou xiang qiao **na yi xia**.
every CL people all want knock that one CL$_{evt}$
'Everyone wants to give that knock.'

9 Following Chomsky (1995), a functional category can be both maximal and minimal. Hence, it is reasonable to postulate that Div$^{min/max}$ is a complex head which is simultaneously maximal and minimal.

le-insertion problem in **Puzzle I**.[10]

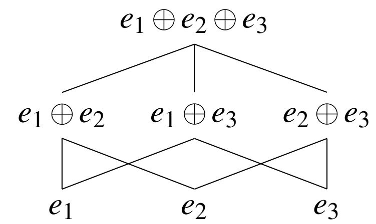
As for verbs and verbal classifiers, we adopt core assumptions from Distributed Morphology (Marantz 1997, 2007; Embick and Marantz 2008; a.o.) and assume that terminal nodes can be decomposed into roots and categorizers. A categorizer provides a categorial label for the root that it combines with, and the root carries lexical information. In this way, a verb and a verbal classifier are syntactically isomorphic, sharing the same template (categorizer + root). A root, e.g., $\sqrt{qiao}$ 'knock', can merge with the verbal categorizer (v) or the categorizer for classifiers (Div). This provides a feasible mechanism for deriving the identical lexical form of the cognate verbal classifier and the verb. The motivation for merging the same root with v and Div will be explored in Section 6.

4. Semantics of V-NUM-CL

4.1. Ontology of events

Before delving into the semantics of V-NUM-CL, let us lay out our background assumptions about events and verbs. First, following the general assumption that a verb denotes a set of events (Parsons 1990; Krifka 1992; a.o.), and Krifka's (1989) idea that there is a semi-lattice structure in the domain of events, we assume that a verb denotes a structured set of events, as schematised in (26). That is, the denotation of a verb may include atomic events and complex events. Atomic events have no sub-events, and complex events are sums of atomic events.[11]

(26)



Second, verbs with different lexical aspects can be characterised by different types of event sets, as in (27). Statives like *shi* 'be' denote a set of states (notated as *s*) rather than events (notated as *e*). Achievements like *dao* 'reach' denote a set of atomic events. Given that achievements express a single punctual event, two achievement events cannot be cross-temporally identical when they count as the same event for the purpose of enumerating events (Lund 2021). Therefore, there are no complex achievement events. Activities like *qiao* 'knock' and *deng* 'wait' denote a set of events that include both atomic events and complex events, since activity events can be cross-temporally identical.

(27) $[\![shi]\!] = \{s_{be1}, s_{be2}, s_{be3}, \ldots\}$ Statives
$[\![dao]\!] = \{e_{reach1}, e_{reach2}, e_{reach3}, \ldots\}$ Achievements
$[\![qiao]\!] = \{e_{knock1}, e_{knock2}, \ldots, e_{knock1} \oplus e_{knock2}, \ldots\}$ Activities
$[\![deng]\!] = \{e_{wait1}, e_{wait2}, \ldots, e_{wait1} \oplus e_{wait2}, \ldots\}$ Activities

Third, occasions, at least in Cusic's (1981) sense, can be characterised as groups of events with

[10] We do not treat the verbal classifier as a head in the Extended Projection of V, contra Zhang (2017). Empirically, we have argued that NUM-CL$_{evt}$ is an adjunct in Section 3.2. Technically, treating the verbal classifier as a head would block the V-to-*v*-to-Asp movement, thus failing to account for the linear adjacency of V and *le*, as in (19) and (20), and the linear order of V-NUM-CL$_{evt}$-O, as in (21b).

[11] We take verbs as born plural. Otherwise, this could be manipulated with Link's (1983) pluralising operator $*$.

the group forming operator ↑ (Link 1984; Landman 1989a, b).[12] A group of events is an atom that contains at least one atomic event or one complex event.

(28) Group of events: $\uparrow(e), \uparrow(e_1 \oplus e_2), \ldots$ Occasions

The widely recognized distinction between event-internal and event-external, which is lexically manifested in Mandarin verbal classifiers (Section 2.1), can now be recast in terms of events and groups of events. Specifically, *xia* (CL_{evt}) provides a counting unit for events, whereas *ci* (CL_{occ}) does so for groups of events.

4.2. Composition of V-NUM-CL

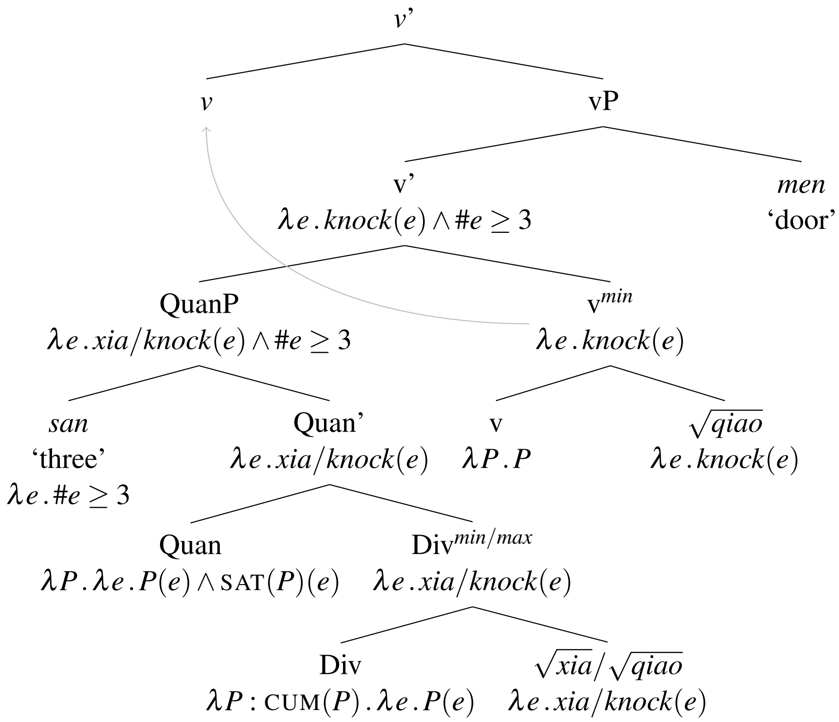
In this section, we deal with the semantic composition of V-NUM-CL_{evt}, taking *qiao san xia* and *qiao san qiao* in (29) as examples.

(29) a. ni **qiao san xia** men.
you knock three CL_{evt} door
'You give three knocks on the door.'

b. jiang mashaoer qu na menxian-shang **qiao san qiao**.
take spoon go that threshold-LOC knock three knock
'Use the spoon to give three knocks on that threshold.'
(*Taohuanv po fa jia Zhougong*, Drama, 1200s A.D.)

Adopting Neo-Davidsonian event semantics (Parsons 1990; Carlson 1984; a.o.), we treat verbs as one-place predicates of events. They are combined with the thematic arguments via predicate modification, with all arguments introduced by thematic role heads. (30) illustrates our proposal of the semantic composition of V-NUM-CL_{evt}.

(30)



[12] See also Wągiel (2018) for a mereotopological analysis of groups, which defines a group as a cluster, namely, a plurality of transitively connected entities.

4.2.1. Cumulativity and Puzzle II

Given the decomposition of a verb into a root and a categorizer, we assume, for simplicity, that the root denotes a set of events, and the verbal categorizer introduces an identity function. As for verbal classifiers, it is worth noting that they are grammaticalized out of verbs (Liu 1959), and especially, cognate verbal classifiers share the same lexical form as verbs. Hence, we put forward that verbal classifiers share the same semantic type as verbs. More precisely, the root of a verbal classifier also denotes a set of events, and the categorizer Div selects a certain type of roots, in light of the compatibility pattern of VV and V-NUM-CL in Table 2 (**Puzzle II**).

Class	Example	VV	V-one-CL$_{evt}$	V-NUM-CL$_{occ}$
Statives	*shi* 'be'	$-$	$-$	$-$
Achievements	*dao* 'reach'	$-$	$-$	$+$
Activities	*qiao* 'knock', *deng* 'wait'	$+$	$+$	$+$

Table 2: Compatibility of counting constructions with verbs (extracted from Table 1)

To account for the compatibility pattern, we propose that the categorizer Div s-selects roots via the cumulativity presupposition (cf. Scha 1981; Schein 1986), as in (31). The cumulativity presupposition requires the input of Div to contain complex events (i.e., divisible events).

(31) **Cumulativity of events**
$\textsc{cum}(P) \overset{\text{def}}{=} \forall e[P(e) \to \forall e'[P(e') \to P(e \oplus e')]]$

Essentially, the categorizer Div determines what types of roots can form a verbal classifier, which further results in the compatibility of VV and V-NUM-CL with different verbs. Given the cumulativity presupposition, Div exclusively selects activity roots, as only activity roots have complex events in their denotations. Specifically, only activity roots (e.g., $\sqrt{qiao}$ 'knock', $\sqrt{deng}$ 'wait') can form verbal classifiers; stative roots like $\sqrt{shi}$ 'be', denoting a set of states rather than events, do not match the type of the input of Div; achievement roots like $\sqrt{dao}$ 'reach' denote a set of events consisting only of atomic events, and thus fail to meet the cumulativity presupposition. Consequently, only activity roots can form VV.

One special case of activity roots selected by Div is $\sqrt{xia}$. In Ancient Chinese, the verb *xia* 'move down' denotes a set of events with a downward trajectory, as in (32a). Then, it undergoes semantic bleaching and is used as a dedicated verbal classifier. Since the verbal classifier *xia* provides a natural counting unit for all activity events, it is reasonable to assume that the denotation of bleached $\sqrt{xia}$ is the union of all the activity roots, as in (32b).[13]

(32) a. $[\![\sqrt{xia}]\!] = \{e_{down1}, e_{down2}, e_{down1} \oplus e_{down2}, \ldots\}$ (verb *xia*)

b. $[\![\sqrt{xia_{bleached}}]\!] = \{e_{activity1}, e_{activity2}, e_{activity1} \oplus e_{activity2}, \ldots\}$ (classifier *xia*)
$= \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots, e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

Now we can explain why V-one-CL$_{evt}$ (i.e., V-one-*xia*) only permits activities to serve as its main verb. In our analysis, one-CL$_{evt}$ and V are combined via predicate modification, as will be demonstrated in Section 4.2.2. Since the denotation of $\sqrt{xia_{bleached}}$ includes only activity events, and its intersection with the set of events denoted by V cannot be empty, the denotation of V must include activity events. As a result, V must be activities.

[13] The denotation of $\sqrt{xia_{bleached}}$ in (32b) satisfies the cumulativity presupposition in (31), as the sum operator only applies to entities of the same kind and there are no complex events like $e_{knock} \oplus e_{wait}$.

Note that there are no achievement events in the denotation of $\sqrt{xia}_{bleached}$. According to the cumulativity presupposition in (31), the input of Div must contain members that are summable. Since achievement events are not summable (Section 4.1), they are excluded from the denotation of $\sqrt{xia}_{bleached}$. Hence, for V-one-*xia*, V cannot be achievements.

As for V-NUM-CL$_{occ}$ (i.e., V-NUM-*ci*), the denotation of the verbal classifier *ci* is assumed to be as follows (cf. Liao 2018; Li 2019).

(33) $$\begin{aligned}[\![\sqrt{ci}]\!] = \{&\uparrow(e_{knock1}), \uparrow(e_{knock2}), \uparrow(e_{knock1} \oplus e_{knock2}), \uparrow(e_{knock1}) \oplus \uparrow(e_{knock2}), \ldots\\ &\uparrow(e_{wait1}), \uparrow(e_{wait2}), \uparrow(e_{wait1} \oplus e_{wait2}), \uparrow(e_{wait1}) \oplus \uparrow(e_{wait2}), \ldots\\ &\uparrow(e_{reach1}), \uparrow(e_{reach2}), \uparrow(e_{reach1}) \oplus \uparrow(e_{reach2}), \ldots\}\end{aligned}$$

The denotation of *ci* differs from that of *xia* in two aspects. First, *ci* targets groups of events (Section 2.1), so $\sqrt{ci}$ denotes a set of groups of events. Before merging with NUM-*ci*, V is first combined with the group forming operator ↑, rendering a set of groups of events. Since the intersection of NUM-*ci* and ↑V is a non-empty set, V cannot be statives, which do not match the type of NUM-*ci*. Second, the denotation of $\sqrt{ci}$ contains sums of groups of achievement events. As discussed in Section 4.1, there are no sums of achievement events within one occasion. However, among multiple occasions, there do exist sums of groupified achievement events like $\uparrow(e_{reach1}) \oplus \uparrow(e_{reach2})$. This is why achievements, in addition to activities, can serve as the main verb in V-NUM-*ci*.

4.2.2. Stable atomicity and Puzzle III

Let us proceed to the other functional head in (30), Quan, which takes the output of Div, namely, verbal classifiers formed with activity roots. Quan is related to the differences between the two types of activities with respect to the interpretation of VV and the restriction on numerals, as illustrated in Table 3. First, VV formed with Activities I (*qiao* 'knock') exhibits pluractionality, while VV formed with Activities II (*deng* 'wait') does not (**Puzzle III**). Second, Activities I are compatible with any numerals in V-NUM-CL$_{evt}$, whereas for Activities II, the numeral is limited to *yi* 'one'.[14]

Class	Example	VV	V-one-CL$_{evt}$	V-three-CL$_{evt}$	V-NUM-CL$_{occ}$
Activities I	*qiao* 'knock'	$+_{pluractional}$	$+$	$+$	$+$
Activities II	*deng* 'wait'	$+_{not\,pluractional}$	$+$	$-$	$+$

Table 3: Compatibility of counting constructions with activities (extracted from Table 1)

To account for the pattern above, we propose two flavours of Quan that diverge in terms of stable atomicity, that is, whether an atomic event remains atomic across contexts (cf. Chierchia 2010). As defined by (34) and (35), Quan$_1$ yields a set of events with members composed of stable atoms, whereas Quan$_2$ yields a set of events with members composed of unstable atoms.

(34) **Stable atomicity of events**

$$\textsc{sat}(P)(e) \stackrel{\text{def}}{=} \exists e'[e' \sqsubseteq e \wedge P(e') \wedge \forall c[\neg\exists e'' \text{ in } c[e'' \sqsubset e']]]$$

(35) a. $[\![\text{Quan}_1]\!] = \lambda P\,.\,\lambda e\,.\,P(e) \wedge \textsc{sat}(P)(e)$

b. $[\![\text{Quan}_2]\!] = \lambda P\,.\,\lambda e\,.\,P(e) \wedge \neg\textsc{sat}(P)(e)$

[14] The same pattern is also observed in V-NUM-V in early Modern Chinese. V-NUM-V formed with Activities I allows for any numerals, while V-NUM-V formed with Activities II is only compatible with *yi* 'one'.

For an intuitive illustration, consider knocking events (stable atoms) versus waiting events (unstable atoms). An atomic knocking event is stable in the sense that in different contexts it remains minimal and has no subevent that can be considered as a knocking event. By contrast, atomic waiting events vary across different contexts. For instance, imagine a scenario where John waited for Mary for an hour, then went to the restroom, and later returned to wait for her for an additional hour. In this case, John's waiting can be construed either as a single waiting event or as two distinct waiting events.

Events with stable atoms can be precisely counted, whereas events with unstable atoms are too vaguely specified to be counted. In our analysis, the difference in respect of the counting result can be represented as a requirement of Quan on the numerals in its specifier position. Following Horn (1972), Gazdar (1979), Levinson (1983), and others, we adopt an *at least* semantics for numerals, as in (36).[15] Consequently, Quan$_1$ allows for precise counting results and thus can take any numerals as its specifier; Quan$_2$ confines its specifier to the unfocused *yi* 'one' with an *at least* reading, which merely indicates the existence of events.

(36) a. $[\![\textit{yi} \text{ 'one'}]\!] = \lambda e\,.\,|\{e' \,|\, e' \leq_{atom} e\}| \geq 1 = \lambda e\,.\,\#e \geq 1$

b. $[\![\textit{san} \text{ 'three'}]\!] = \lambda e\,.\,|\{e' \,|\, e' \leq_{atom} e\}| \geq 3 = \lambda e\,.\,\#e \geq 3$

Note that we analyse NUM-CL$_{evt}$, as well as numerals, as intersective modifiers rather than quantifiers. The evidence comes from two facts. First, there is no observation of quantifier raising of NUM-CL$_{evt}$; see (24). Second, when combined with other plurals, NUM-CL$_{evt}$ gets a scopeless, cumulative reading (cf. Landman 2000, 2004, 2006), as shown by (37).

(37) a. ta qiao-le liang shan men si xia.
he knock-PERF two CL door four CL$_{evt}$
'He gave a total of 4 knocks on 2 doors.'

b. ta ti-le liang ge ren si xia.
he kick-PERF two CL people four CL$_{evt}$
'He gave a total of 4 kicks to 2 people.'

Now we are equipped to explain the differences between two types of activities. For V-NUM-CL$_{evt}$ (i.e., V-NUM-*xia*), recall that the denotation of $\sqrt{xia}_{bleached}$ contains all activity events and Div does not alter its input. When *xia* merges with Quan$_1$, the output is restricted to a set containing only the events composed of stable atoms, which is the union set of the events denoted by Activities I. In this case, the verb in V-NUM-CL$_{evt}$ can only be Activities I. Since Quan$_1$ can take any numerals as its specifier, V-NUM-CL$_{evt}$ formed with Activities I does not impose any constraints on numerals.

(38) Illustration of *qiao san*$_{\text{F}}$ *xia* 'knock three CL$_{evt}$'[16]

a. $[\![\text{Div}]\!]([\![\sqrt{xia}]\!]) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots, e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

b. $[\![\text{Quan}_1]\!]([\![\text{Div}]\!]([\![\sqrt{xia}]\!])) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots\}$

c. $([\![san_{\text{F}}]\!])([\![\text{Quan}_1([\![\text{Div}]\!]([\![\sqrt{xia}]\!]))) = \{e_{knock1} \oplus e_{knock2} \oplus e_{knock3}, \ldots\}$

d. $([\![qiao]\!])(([\![san_{\text{F}}]\!])([\![\text{Quan}_1([\![\text{Div}]\!]([\![\sqrt{xia}]\!])))) = \{e_{knock1} \oplus e_{knock2} \oplus e_{knock3}, \ldots\}$

When *xia* merges with Quan$_2$, the output is restricted to a set of events composed of unstable atoms, which is the union set of the events denoted by Activities II. In this case, the verb in V-NUM-CL$_{evt}$ can only be Activities II. Given that Quan$_2$ only allows for the unfocused *yi*

[15] See Bylinina and Nouwen (2020) for an overview of numeral semantics.

[16] Numerals with the subscript F are focused and have an *exactly* reading, whereas numerals with the subscript UF are unfocused and have an *at least* reading. See Section 4.2.3 for details.

'one' to be its specifier, the numeral in V-NUM-CL$_{evt}$ formed with Activities II is limited to the unfocused *yi* 'one'.

(39) Illustration of *deng yi*$_{\text{UF}}$ *xia* 'wait one CL$_{evt}$'

a. $[\![\text{Div}]\!]([\![\sqrt{xia}]\!]) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots, e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

b. $[\![\text{Quan}_2]\!]([\![\text{Div}]\!]([\![\sqrt{xia}]\!])) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

c. $([\![yi_{\text{UF}}]\!])([\![\text{Quan}_2([\![\text{Div}]\!]([\![\sqrt{xia}]\!]))) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

d. $([\![deng]\!])(([\![yi_{\text{UF}}]\!])([\![\text{Quan}_2([\![\text{Div}]\!]([\![\sqrt{xia}]\!])))) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

It is worth mentioning that for V-NUM-CL$_{occ}$ formed with Activities II, the numeral is not limited to the unfocused *yi* 'one'. For example, *deng san ci* 'wait three CL$_{occ}$' is grammatical, denoting three groups of waiting events. This is because groups possess the property of stable atomicity and can be precisely counted (Landman 1989a, b; Snyder and Shapiro 2022; a.o.).

As for VV, namely, V-(one$_{\text{UF}}$)-V, its pluractionality (**Puzzle III**) also hinges on the stable atomicity of events. In brief, with Activities I, V-(one$_{\text{UF}}$)-V denotes a set of events composed of stable atoms, and competes with the singular alternative V-one$_{\text{F}}$-V, resulting in pluractionality. With Activities II, V-(one$_{\text{UF}}$)-V denotes a set of events composed of unstable atoms that cannot be counted, and thus simply indicates the existence of events.[17] Consequently, VV formed with Activities II lacks singular alternatives like V-one$_{\text{F}}$-V for competition and does not exhibit pluractionality. The specifics of pragmatic competition will be further explored in Section 5.

(40) Illustration of *qiao yi*$_{\text{UF}}$ *qiao* 'knock one CL$_{\text{KNOCK}}$'

a. $[\![\text{Div}]\!]([\![\sqrt{qiao}]\!]) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots\}$

b. $[\![\text{Quan}_1]\!]([\![\text{Div}]\!]([\![\sqrt{qiao}]\!])) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots\}$

c. $([\![yi_{\text{UF}}]\!])([\![\text{Quan}_1([\![\text{Div}]\!]([\![\sqrt{qiao}]\!]))) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots\}$

d. $([\![qiao]\!])(([\![yi_{\text{UF}}]\!])([\![\text{Quan}_1([\![\text{Div}]\!]([\![\sqrt{qiao}]\!])))) = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots\}$

(41) Illustration of *deng yi*$_{\text{UF}}$ *deng* 'wait one CL$_{\text{WAIT}}$'

a. $[\![\text{Div}]\!]([\![\sqrt{deng}]\!]) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

b. $[\![\text{Quan}_2]\!]([\![\text{Div}]\!]([\![\sqrt{deng}]\!])) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

c. $([\![yi_{\text{UF}}]\!])([\![\text{Quan}_2([\![\text{Div}]\!]([\![\sqrt{deng}]\!]))) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

d. $([\![deng]\!])(([\![yi_{\text{UF}}]\!])([\![\text{Quan}_2([\![\text{Div}]\!]([\![\sqrt{deng}]\!])))) = \{e_{wait1}, e_{wait2}, e_{wait1} \oplus e_{wait2}, \ldots\}$

4.2.3. Denotation of V-NUM-CL

Eventually, in our analysis, V-NUM-CL$_{evt}$ denotes a certain number of events, where the counting unit is CL and the counting result is NUM. The verbal classifier can be either a general classifier that encodes the natural unit, or a cognate classifier taking the event itself as the unit.

(42) a. $[\![knock\ one\ xia]\!] = \lambda e\,.\,knock(e) \wedge \#e \geq 1$
There are at least one knock, the counting unit of which is the **natural unit**.

b. $[\![knock\ one\ knock]\!] = \lambda e\,.\,knock(e) \wedge \#e \geq 1$
There are at least one knock, the counting unit of which is the **knock** itself.

[17] Such an existential interpretation may give rise to a durative reading, as in (4); see also Donazzan (2013).

Numerals are assumed to have an *at least* semantics, from which the *exactly* reading can be derived as a Gricean scalar implicature (Horn 1972; Gazdar 1979; Levinson 1983; a.o.). For instance, when *yi* 'one' is not focused, it has the *at least* reading '≥ 1'. When focused, it triggers stronger alternatives such as '≥ 2' and '≥ 3' and negates them, yielding the *exactly* reading '$= 1$'. In the case of V-NUM-CL$_{evt}$, as discussed in Section 4.2.2, only the ones formed with Activities I (*qiao* 'knock') can have different numerals as alternatives to derive the scalar implicature. That is, only V-NUM-CL$_{evt}$ formed with Activities I can have the *exactly* reading. With Activities II (*deng* 'wait'), the numeral in V-NUM-CL$_{evt}$ is limited to the unfocused *yi* 'one' without numeral alternatives, and hence can only receive the *at least* reading.

(43) a. $[\![knock\ one_{\mathrm{UF}}\ xia]\!] = \lambda e\,.\,knock(e) \wedge \#e \geq 1$ — Activities I
$[\![knock\ one_{\mathrm{F}}\ xia]\!] = \lambda e\,.\,knock(e) \wedge \#e = 1$
b. $[\![wait\ one_{\mathrm{UF}}\ xia]\!] = \lambda e\,.\,wait(e) \wedge \#e \geq 1$ — Activities II
$^{*}[\![wait\ one_{\mathrm{F}}\ xia]\!] = \lambda e\,.\,wait(e) \wedge \#e = 1$

One special case of V-one$_{\mathrm{UF}}$-CL$_{evt}$ is VV. As demonstrated in Section 3.1, VV is in fact V-one$_{\mathrm{UF}}$-CL$_{evt}$ with an omitted *yi* 'one'. Thereby, VV denotes an unspecified quantity of events.

(44) a. $[\![knock\ (one_{\mathrm{UF}})\ knock]\!] = \lambda e\,.\,knock(e) \wedge \#e \geq 1$
b. $[\![wait\ (one_{\mathrm{UF}})\ wait]\!] = \lambda e\,.\,wait(e) \wedge \#e \geq 1$

5. Pluractionality via competition

Based on the semantics of V-NUM-CL$_{evt}$, we propose the following pragmatic mechanism for deriving the pluractionality of VV formed with Activities I (**Puzzle IV**).

(45) **Competition between VV and V-one$_{\mathrm{F}}$-V**
a. VV formed with Activities I denotes an unspecified quantity of events.
For example, $[\![knock\ knock]\!] = \lambda e\,.\,knock(e) \wedge \#e \geq 1$
b. V-one$_{\mathrm{F}}$-V formed with Activities I denotes exactly one event.
For example, $[\![knock\ one_{\mathrm{F}}\ knock]\!] = \lambda e\,.\,knock(e) \wedge \#e = 1$
c. With Activities I, V-one$_{\mathrm{F}}$-V is a stronger alternative of VV.
d. Using VV implicates that V-one$_{\mathrm{F}}$-V does not hold, i.e., VV denotes non-singular events.
For example, $[\![knock\ knock]\!]^{+} = \lambda e\,.\,knock(e) \wedge \#e > 1$

As mentioned in Section 3.1, V-NUM-V formed with Activities I is prevalent in late Medieval and early Modern Chinese (1200s – 1500s A.D.). For example, in (46) and (47), the numerals in V-NUM-V are focused and have the *exactly* reading.

(46) qu menxian-shang **qiao yi$_{\mathrm{F}}$ qiao**, zhuo zhougongjia si yi kou.
go threshold-LOC knock one CL$_{\mathrm{KNOCK}}$ make Mr. Zhou's die one CL
'If you give one knock on the threshold, one person in Mr. Zhou's family will die.'

Q: **qiao liang$_{\mathrm{F}}$ qiao** ne?
knock two CL$_{\mathrm{KNOCK}}$ Q
'How about giving two knocks?'

A: zhuo zhougongjia si liang kou.
make Mr. Zhou's die two CL
'Two people in Mr. Zhou's family will die.'

(*Taohuanv po fa jia Zhougong*, Drama, 1200s A.D.)

(47) wangming na-chu baobei lai, **qiao**-le **san**$_{\text{F}}$ **qiao**.
Wangming take-out precious.weapon come knock-PERF three CL$_{\text{KNOCK}}$
'Wangming took out the precious weapon and gave it three knocks.'
(*Sanbao taijian xiyang ji*, Novel, 1500s A.D.)

The pragmatic competition between VV and V-one$_{\text{F}}$-V is observed in early Modern Chinese (1500s A.D.), as shown by (48) and (49). V-one$_{\text{F}}$-V in (48) has the *exactly* reading, as the master delivers one knock to each servant. Meanwhile, VV in (49)[18] is pluractional, indicating Wangming's intention to perform multiple knocks. This is evidenced by the fact that he eventually gave two or three knocks. In Mandarin, the pluractionality of VV formed with Activities I is inherited from cases like (49), although V-NUM-V diminishes and V-one$_{\text{F}}$-V disappears.

(48) que you **qiao**-le **yi**$_{\text{F}}$ **qiao**, qiahao shi dier-ge changban jiao-qilai.
but again knock-PERF one CL$_{\text{KNOCK}}$ just is second-CL servant scream-up
'But (he) again gave one knock, and the second servant just screamed.'

jizhi zai **qiao**-le **yi**$_{\text{F}}$ **qiao**, disan-ge changban you jiaojiang-qilai.
until again knock-PERF one CL$_{\text{KNOCK}}$ third-CL servant also scream-up
'Until (he) gave another knock, the third servant also screamed.'
(*Sanbao taijian xiyang ji*, Novel, 1500s A.D.)

(49) 'bumian **qiao** ta **qiao**, kan shi zenme.' qiao-le liang san qiao.
have.to knock it CL$_{\text{KNOCK}}$ see is how knock-PERF two three CL$_{\text{KNOCK}}$
'(Wangming thought,) "it is necessary to give some knocks on the door to see what is happening inside." Then he gave two or three knocks.'
(*Sanbao taijian xiyang ji*, Novel, 1500s A.D.)

In contrast, with Activities II (*deng* 'wait'), VV lacks alternatives such as V-one$_{\text{F}}$-V, since the numeral inside V-NUM-V is limited to the unfocused *yi* 'one', as discussed in Section 4.2.2. Therefore, VV formed with Activities II does not enter the pragmatic competition in (45) and hence is not pluractional.

6. Motivation for cognate classifiers

We have advanced in Section 3 that the underlying structure of VV consists of a verb and its cognate verbal classifier, where the cognate classifier is base generated within the adjunct of the verb. In our analysis, the connection between the verb and the cognate classifier is not attributed to syntactic movement or copying. Instead, we propose that cognate classifiers are motivated by a semantic requirement.

Intuitively, the way of counting depends on the object being counted, which can be explicitly formulated in terms of the subset requirement in (50). For V-NUM-CL$_{evt}$, the choice of verbal classifiers is determined by the verbs, that is, the denotation of the verb is required to be a subset of the denotation of the verbal classifier. In principle, there are two possibilities: (i) The denotation of the verb is a proper subset of that of the classifier, as is the case with the general classifier *xia*. (ii) The denotation of the verb equals to that of the classifier, as is the case with a cognate classifier.

[18] Object insertion in such cases further demonstrates that the second V of VV is a verbal classifier (Fan 1964).

(50) **Subset requirement of dependency**
Let A and B be two sets. If A depends on B, then $B \subseteq A$.
In the case of V-NUM-CL$_{evt}$, $[\![\text{v}]\!] \subseteq [\![\text{Div}^{min/max}]\!]$.
(i) If $[\![\text{v}^{min}]\!] \subset [\![\text{Div}^{min/max}]\!]$, then $\text{Div}^{min/max}$ is realised as the general classifier *xia*.
(ii) If $[\![\text{v}^{min}]\!] = [\![\text{Div}^{min/max}]\!]$, then $\text{Div}^{min/max}$ is realised as a cognate classifier.

Overall, given the subset requirement, there are two strategies for specifying the counting unit: a general classifier representing the union set of all objects that can be counted, or a cognate classifier that is identical to the object being counted. This provides the semantic motivation for the existence of cognate classifiers in Mandarin.

The subset requirement is supported by the selectional restriction of classifiers. The general classifier *xia* is compatible with various verbs, as shown by (51a). By contrast, a cognate classifier, due to the absence of subset relations among different verbal roots, is only compatible with the verb that shares the same lexical form, as shown by (51b).

(51) a. {**da / qiao**} yi xia
hit knock one CL$_{evt}$
'to give a hit' / 'to give a knock'

b. {**da** /***qiao**} yi da
hit knock one CL$_{\text{HIT}}$
'to give a hit' / Int.: 'to give a knock'

Note that cases like (52) are ungrammatical in Mandarin, despite certain entailment relations between verbs and classifiers.[19] This suggests a distinction between the entailment relations and the subset relations defined in (50). The entailment relations between events are captured by conjunction, as originated in Davidson (1967). For instance, to capture the fact that *qiao* 'knock' entails *dong* 'act', we can analyse a knocking event as a modified acting event, as (53) illustrates. However, the subset relations pertain to event sets, and therefore are not guaranteed by the entailment relations between events. For instance, there is no subset relation between (53a) and (53b), that is, the denotation of *qiao* 'knock' is not a subset of the denotation of *dong* 'act'. This explains why *dong* 'act' cannot serve as a classifier for the verb *qiao* 'knock'.

(52) a. *qiao yi dong
knock one CL$_{\text{ACT}}$
Int.: 'to give a knock'

b. *da yi dong
hit one CL$_{\text{ACT}}$
Int.: 'to give a hit'

(53) a. $[\![\sqrt{qiao}]\!] = \{e_{knock1}, e_{knock2}, e_{knock1} \oplus e_{knock2}, \ldots\}$
$= \{(e_{act} \wedge e_{w/hand})_1, (e_{act} \wedge e_{w/hand})_2, (e_{act} \wedge e_{w/hand})_1 \oplus (e_{act} \wedge e_{w/hand})_2, \ldots\}$
b. $[\![\sqrt{dong}]\!] = \{e_{act1}, e_{act2}, e_{act1} \oplus e_{act2}, \ldots\}$

The subset requirement in (50) sheds light on nominal classifiers as well. Archaic Chinese features cognate classifiers that share the same lexical form as the noun, as in (54), whilst Old Chinese makes use of general classifiers that are compatible with various nouns, like *tou* in (55). These two strategies can also be viewed as motivated by the subset requirement.

(54) fu **niu** san bai wu shi wu **niu**, **yang** nian ba **yang**.
capture ox three hundred five ten five CL$_{\text{OX}}$ sheep twenty eight CL$_{\text{SHEEP}}$
'(The king) captured three hundred and fifty-five oxen and twenty eight sheep.'
(Bronze inscriptions on *Xiao Yu Ding*, 900s B.C.)

[19] Thanks to a reviewer for bringing this to our attention.

(55) huo **niu ma yang** shi wan yu **tou**.
obtain ox horse sheep ten ten.thousand more CL
'(The army) obtained over a hundred thousand oxen, horses, and sheep.'
(*Qian han ji*, 100s A.D.)

7. Conclusion

In this paper, we demonstrate that VV is an instantiation of V-(NUM)-CL_{evt}, and analyse NUM-CL_{evt} in V-NUM-CL_{evt} as an adjunct and an intersective modifier. Our syntax and semantics successfully resolve the four puzzles about VV introduced in Section 1.

For **Puzzle I**, VV allows for the insertion of numerals and aspectual markers, as it is V-CL_{evt} rather than verbal reduplication. For **Puzzle II**, given the cumulativity presupposition, only activity roots can form verbal classifiers and subsequently constitute VV. As for **Puzzle III** and **IV**, the observed pluractionality of VV is a result of its competition with V-one_F-V. Activities I (*qiao* 'knock') and Activities II (*deng* 'wait') differ in stable atomicity. VV formed with Activities I denotes a set of countable events, and competes with the singular alternative V-one_F-V. In contrast, VV formed with Activities II denotes a set of uncountable events, lacking singular alternatives like V-one_F-V for competition, and therefore does not display pluractionality.

Our analysis of VV in Mandarin offers not only a pragmatic mechanism for deriving pluractionality (cf. Lasersohn 1995; Newman 2012; Henderson 2017; Mattiola 2019; Lund 2021; Pasquereau 2021; a.o.), but also a semantic motivation for cognate classifiers in general. Yet, additional syntactic evidence is needed to argue that cognate classifiers are base generated. We leave this issue for further research.

References

Andrews, A. (1983). A note on the constituent structure of modifiers. *Linguistic Inquiry 14*(4), 695–697.

Borer, H. (2005). *Structuring Sense Volume I: In Name Only*. Oxford: Oxford University Press.

Bylinina, L. and R. Nouwen (2020). Numeral semantics. *Language and Linguistics Compass 14*(8), e12390.

Carlson, G. N. (1984). Thematic roles and their role in semantic interpretation. *Linguistics 22*(3), 259–280.

Chao, Y. R. (1968). *A Grammar of Spoken Chinese*. Berkeley, CA: University of California Press.

Cheng, R. (1988). Shiti, dongliang he dongci chongdie [Tense, aspect, quantity and verbal reduplication]. *Shijie Hanyu Jiaoxue [Chinese Teaching in the World]* (2), 73–80.

Chierchia, G. (2010). Mass nouns, vagueness and semantic variation. *Synthese 174*(1), 99–149.

Chomsky, N. (1995). Bare phrase structure. In G. Webelhuth (Ed.), *Government and Binding Theory and the Minimalist Program*, pp. 383–439. Oxford: Blackwell.

Cinque, G. (1999). *Adverbs and Functional Heads: A Cross-Linguistic Perspective*. New York: Oxford University Press.

Cusic, D. D. (1981). *Verbal Plurality and Aspect*. Ph. D. thesis, Stanford University.

Davidson, D. (1967). The logical form of action sentences. In N. Rescher (Ed.), *The Logic of Decision and Action*, pp. 81–95. Pittsburgh, PA: University of Pittsburgh Press.

Deng, D. (2013). *The Syntax and Semantics of Event Quantifiers in Mandarin Chinese*. Ph. D. thesis, The University of Wisconsin-Madison.

Donazzan, M. (2013). On counting and measuring events. In E. Chemla, V. Homer, and G. Winterstein (Eds.), *Proceedings of Sinn und Bedeutung 17*, pp. 219–236.

Embick, D. and A. Marantz (2008). Architecture and blocking. *Linguistic Inquiry 39*(1), 1–53.

Fan, F. (1964). Shi lun suowei dongci chongdie [A tentative analysis of the so-called verbal reduplication]. *Zhongguo Yuwen [Studies of the Chinese Language]* (4), 264–278.

Gazdar, G. (1979). *Pragmatics: Implicature, Presupposition and Logical Form*. London: Academic Press.

Henderson, R. (2017). Swarms: Spatiotemporal grouping across domains. *Natural Language & Linguistic Theory 35*(1), 161–203.

Horn, L. R. (1972). *On the Semantic Properties of Logical Operators in English*. Ph. D. thesis, University of California, Los Angeles.

Huang, C.-T. J. (2014). On syntactic analyticity and parametric theory. In W.-T. D. Tsai, A. Li, and A. Simpson (Eds.), *Chinese Syntax in a Cross-Linguistic Perspective*, pp. 1–48. New York: Oxford University Press.

Huang, C.-T. J., Y.-H. A. Li, and Y. Li (2009). *The Syntax of Chinese*. Cambridge: Cambridge University Press.

Krifka, M. (1989). Nominal reference, temporal constitution and quantification in event semantics. In R. Bartsch, J. van Benthem, and P. van Emde Boas (Eds.), *Semantics and Contextual Expression*, pp. 75–115. Dordrecht: Foris Publications.

Krifka, M. (1992). Thematic relations as links between nominal reference and temporal constitution. In I. A. Sag and A. Szabolcsi (Eds.), *Lexical Matters*, pp. 29–53. Stanford: CSLI Publications.

Landman, F. (1989a). Groups, I. *Linguistics and Philosophy 12*(5), 559–605.

Landman, F. (1989b). Groups, II. *Linguistics and Philosophy 12*(6), 723–744.

Landman, F. (2000). *Events and Plurality*. Dordrecht: Springer Netherlands.

Landman, F. (2004). *Indefinites and the Type of Sets*. Oxford: Blackwell Publishing.

Landman, F. (2006). Indefinite time-phrases, in situ-scope, and dual-perspective intensionality. In S. Vogeleer and L. Tasmowski (Eds.), *Non-Definiteness and Plurality*, pp. 237–266. Amsterdam: John Benjamins Publishing Company.

Lasersohn, P. (1995). *Plurality, Conjunction and Events*. Dordrecht: Kluwer Academic Publishers.

Lee, T. H.-T. (1986). *Studies on Quantification in Chinese*. Ph. D. thesis, University of California, Los Angeles.

Levinson, S. C. (1983). *Pragmatics*. Cambridge: Cambridge University Press.

Li, A. (2019). On the semantics of verbal classifiers. In E. Ronai, L. Stigliano, and Y. Sun (Eds.), *Proceedings of the Fifty-fourth Annual Meeting of the Chicago Linguistic Society*, pp. 261–269. Chicago Linguistic Society.

Li, C. N. and S. A. Thompson (1981). *Mandarin Chinese: A Functional Reference Grammar*. Berkeley: University of California Press.

Li, R. (1964). Guanyu dongci chongdie [On verbal reduplication]. *Zhongguo Yuwen [Studies of the Chinese Language]* (4), 255–263.

Liao, H.-C. D. (2018). Event counting with Chinese *ci*. *Concentric: Studies in Linguistics 44*(2), 31–68.

Lin, J.-W. (1998). Distributivity in Chinese and its implications. *Natural Language Semantics 6*(2), 201–243.

Link, G. (1983). The logical analysis of plurals and mass terms: A lattice-theoretical approach. In R. Bäuerle, C. Schwarze, and A. von Stechow (Eds.), *Meaning, Use and Interpretation of Language*, pp. 303–323. Berlin: Walter de Gruyter.

Link, G. (1984). Hydras. On the logic of relative clause constructions with multiple heads. In F. Landman and F. Veltman (Eds.), *Proceedings of the Fourth Amsterdam Colloquium*, pp. 245–257. Foris Publications.

Liu, S. (1959). Hanyu donglaingci de qiyuan [Origin of Chinese verbal classifiers]. *Zhongguo Yuwen [Studies of the Chinese Language]* (6), 263–264.

Lund, G. N. (2021). *Pluractionality in Progress*. Ph. D. thesis, Harvard University.

Marantz, A. (1997). No escape from syntax: Don't try morphological analysis in the privacy of your own lexicon. *University of Pennsylvania Working Papers in Linguistics 14*(2), 201–225.

Marantz, A. (2007). Phases and words. In S.-H. Choe (Ed.), *Phases in the Theory of Grammar*, pp. 191–222. Seoul: Dong-In Publishing Co.

Mattiola, S. (2019). *Typology of Pluractional Constructions in the Languages of the World* (First ed.). Amsterdam/Philadelphia: John Benjamins Publishing Company.

Newman, P. (2012). Pluractional verbs: An overview. In P. Cabredo-Hofherr and B. Laca (Eds.), *Verbal Plurality and Distributivity*, pp. 185–210. Berlin: De Gruyter.

Paris, M.-C. (2013). Verbal reduplication and verbal classifiers in Chinese. In G. Cao, H. Chappell, R. Djamouri, and T. Wiebusch (Eds.), *Breaking down the Barriers : Interdisciplinary Studies in Chinese Linguistics and Beyond*, Volume 1, pp. 257–278.

Parsons, T. (1990). *Events in the Semantics of English*. Cambridge, MA: MIT Press.

Pasquereau, J. (2021). A unique operator for verbal pluractionality and numeral distributivity. In P. Grosz, L. Martí, H. Pearson, Y. Sudo, and S. Zobel (Eds.), *Proceedings of Sinn und Bedeutung 25*, pp. 702–719.

Scha, R. J. H. (1981). Distributive, collective and cumulative quantification. In J. Groenendijk, T. M. V. Janssen, and M. Stokhof (Eds.), *Truth, Interpretation and Information: Selected Papers from the Third Amsterdam Colloquium*, pp. 131–158. Dordrecht: Foris Publications.

Schein, B. (1986). *Event Logic and the Interpretation of Plurals*. Ph. D. thesis, Massachusetts Institute of Technology.

Snyder, E. and S. Shapiro (2022). Groups, sets, and paradox. *Linguistics and Philosophy 45*(6), 1277–1313.

Wągiel, M. (2018). *Subatomic Quantification*. Ph. D. thesis, Masaryk University.

Wang, L. (1954). *Zhongguo Xiandai Yufa [Modern Chinese Grammar]*. Beijing: Zhonghua Book Company.

Xiong, Z. (2016). Dongci chongdie de jufa fenxi [A syntactic analysis of verbal reduplication]. *Shijie Hanyu Jiaoxue [Chinese Teaching in the World] 30*(2), 156–169.

Yang, Y. and W. Wei (2017). Verbal reduplication in Mandarin Chinese: An analysis at the syntax-phonology interface. In M. Y. Erlewine (Ed.), *Proceedings of GLOW in Asia XI (Volume I)*, pp. 227–242. MIT Working Papers in Linguistics.

Zhang, N. N. (2017). The syntax of event-internal and event-external verbal classifiers. *Studia Linguistica 71*(3), 266–300.

Zhu, D. (1982). *Yufa Jiangyi [Lecture Notes on Grammar]*. Beijing: The Commercial Press.