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Telicization in Mandarin Chinese[1]

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This paper investigates aspectual meanings that resultative morphemes in Mandarin Chinese contribute to interpretations of the entire predicates, and in particular the culmination readings they bring out of the originally non-culminating accomplishments. Two resultative morphemes are studied: *-wán* and *-diào*. I argue that while both morphemes give rise to culmination readings, the culmination readings are derived in different ways. I propose that *-wán* expresses termination, which comments on the progress of an event. The culmination readings of the telicized accomplishments by *-wán* are obtained indirectly. By contrast, *-diào* expresses culmination, commenting directly on the resulting culmination state. The proposed analysis for the two morphemes is couched in the framework defined by Krifka (1989, 1992, 1998), which models the relations between events, individuals, and times as a series of homomorphic relations between mereological part structures. Following Zucchi & White (2001), I analyze *-diào* in terms of a maximalization over patient, which transfers mereological properties from the individual structure to the event structure, explaining the culmination reading, and *-wán* a maximalization over time, which transfers mereological properties from the time structure to the event structure, explaining termination, and then transfers the mereological properties to the individual structure, explaining the culmination reading.

KEYWORDS: lexical aspect, Mandarin Chinese, telicity

1. INTRODUCTION

It has been noticed that a telic interpretation of some dynamic event predicates in English is largely determined by the verb and its argument(s) such as accomplishments like *eat an apple* where the quantized predicate *an apple* determines the aspectual class of the entire verbal predicate, entailing culmination (e.g. Vendler 1957; Verkuyl 1972, 1993; Dowty 1977, 1979; Krifka 1989, 1992, 1998; Rothstein 2004; Beavers 2012). However, it has also been found that the corresponding accomplishments in many other languages do not yield culmination interpretations

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unless some other element is considered (e.g. Filip 2001, 2008; Rothstein 2004 for Russian; Kratzer 2004 for Finnish; Singh 1991 for Hindi; Kardos 2016 for Hungarian; also see Filip 2017 for more examples). Mandarin Chinese (Chinese hereafter) is one of such languages where the accomplishment predicates do not entail culmination, even when the perfective aspect is used,[2] unless the verb is compounded with a resultative morpheme (Tai 1984; Smith 1990, 1997; Sybesma 1997, 1999; Klein, Li & Hendriks 2000; Soh & Kuo 2005). In this study, I look into the details of two of such resultative morphemes and investigate how they telicize predicates and give rise to culmination interpretations.

As an illustration of accomplishments in Chinese not entailing culmination, consider the following discourse, which is not considered contradictory by native speakers.

(1) *Mǎlì chī-le yī-gè píngguǒ, hái shèng liǎng-kǒu, bèi wǒ chī-le.*
Mary eat-PFV one-CLF apple still left two-bite PASS I eat-PFV
'Mary ate an apple. There was some left over and I ate it.'

The intuition in prior studies is that the accomplishment needs to be expressed in a complex construction called resultative verb compound (RVC; Li & Thompson 1981: 54–70), where the verb is suffixed with a resultative morpheme, in order to get a culmination interpretation. The most discussed morpheme is *-wán.* Such an interpretive effect is shown in (2) which is judged contradictory. (The resultative morpheme *-wán* is glossed as TERM(INATION). See the discussion below.)

(2) *#Mǎlì chī-wán-le yī-ge píngguǒ, hái shèng liǎng-kǒu, bèi wǒ chī-le.*
Mary eat-TERM-PFV one-CLF apple still left two-bite PASS I eat-PFV
'Mary finished eating an apple. Part of it was left over and I ate it.'

The culmination reading of the accomplishment brought out by *-wán* seems to indicate that the semantic contribution of *-wán* to the ultimate aspectual meaning is culmination or completion, an analysis assumed in many prior aspectual studies. However, I argue here that this is not what *-wán* means. I show below that *-wán* is not a morpheme that expresses culmination or completion per se but a morpheme that expresses TERMINATION. To be specific, it introduces information about the progress of the denoted event without setting any direct requirement on the involved patient. It ultimately derives culmination when it is combined with an accomplishment but it does not express culmination by itself.

Note that other than *-wán*, there are several other RVC morphemes commonly used to telicize accomplishment predicates and give rise to culmination interpretations. For example, the morpheme *-diào*, which literally means 'drop' but is grammaticalized as a suffix, is a common RVC morpheme used for consumption predicates. An example is shown in (3).

[2] But see Section 2.1 where I argue that *-le* might be a relative past tense marker.

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(3) *#Mǎlì chī-diào-le yī-ge píngguǒ, hái shèng liǎng-kǒu, bèi*
Mary eat-CULM-PFV one-CLF apple still left two-bite PASS
wǒ chī-le.
I eat-PFV
'#Mary ate up an apple. Part of it was left over and I ate it.'

I propose that *-diào* expresses culmination or completion. It requires that the patient that undergoes the change of state must be affected entirely and entails culmination with respect to the entire patient. In this study, I also investigate how *-diào* telicizes accomplishment predicates.

Predicates with *-wán* and *-diào* are telic. This can be shown by applying the test of *for/in*-adverbial modification (Dowty 1979: 56–58). The data involving *-wán* are presented below. The same pattern holds for *-diào*.

(4) (a) **Mǎlì chī-wán-le wǔ fēnzhōng píngguǒ.*
Mary eat-TERM-PFV five minute apple
(b) **Mǎlì chī-wán-le yī-ge píngguǒ wǔ fēnzhōng.*
Mary eat-TERM-PFV one-CLF apple five minute

(5) *Mǎlì wǔ fēnzhōng nèi chī-wán-le (yī-ge) píngguǒ.*
Mary five minute within eat-TERM-PFV one-CLF apple
'Mary finished eating an apple/apples in five minutes.'

As shown above, the complex construction is incompatible with *for*-adverbials as in (4), and compatible with *in*-adverbials as in (5), which is consistent with the modification pattern of telic predicates. Note that the construction is telic regardless of whether the object is a bare noun or a classifier construction.

In this study, we largely focus on the kind of events of which the patients play a role called incremental theme (Dowty 1991: 567–571) such as the events described by *eat an apple*. For such events, the patients 'measure out' the events gradually or incrementally as they undergo change of state, so a specific quantity of the patient defines the boundary of the event. In a series of influential works, Krifka (1989, 1992, 1998) developed a mereological model to account for the incremental theme effects. He modeled the event and the corresponding incremental theme as two algebraic part structures which are homomorphically related via a θ-relation wherein the mereological properties of one structure are reflected in the other. With this model, Krifka analyzed incremental theme effects as a transfer of mereological properties from the structure of the patient to the structure of the event. Depending on how specific the nominal predicate is about the quantity of the incremental theme, the homomorphic θ-relation determines how specific it is about the boundedness of the event.

I follow Krifka's homomorphic approach to telicity for an analysis of the telicity associated with *-wán* and *-diào*. The intuition behind my analysis is quite straightforward. The morpheme *-diào* represents a canonical case of obtaining telicity through the patient, in which case an incremental theme 'measures out' the event.

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For *-wán*, since it is associated with a bounded time interval (see the discussion in Section 2.2), which is the event time, we might construe it as a case where the event progresses incrementally along a specific amount of times toward the end point, that is, an incremental time 'measures out' the event. With the homomorphic relations between structures, we can obtain a bounded event by putting a constraint on either the time structure or the patient structure.

Note that the case studied here is different from those expressions telicized by temporal adverbials as discussed in Krifka (1998) such as *walk for one hour*. On one hand, what *-wán* shows to us is that natural languages may grammatically develop a morphological marker that specifically bounds temporal intervals. On the other hand, as an analysis for *-wán*, I show that we may not just derive telicity from time, an analysis Krifka assumed for those expressions telicized by temporal adverbials, but we can also construe quantization for event predicates from time, which was not considered in Krifka's study.[3] Also note that what I aim to do in this study is not to study termination and culmination as formal notions. Instead, my purpose here is to show a case of a telicity marker that introduces a temporal boundary on events, which has a semantic effect of entailing a culmination reading with respect to the patient if there is a patient.

The rest of the paper is structured as follows. In Section 2, I informally characterize termination and culmination and provide data to illustrate them. In Section 3, I provide an overview of some previous studies of telicity with a focus on Krifka (1989, 1992, 1998) and Zucchi & White (2001), which lay out the theoretical framework for the current study. Zucchi & White (2001) proposed an analysis of maximalization of participants to fix a problem in Krifka's analysis. I assume their analysis and extend it to times. In Section 4, I propose an analysis for *-wán* and *-diào* rooted in Zucchi & White (2001) while referring to the homomorphically related structures defined by Krifka. In addition, a short account for the non-culmination reading of non-RVC accomplishments is provided. In Section 5, I provide a summary and conclusion of this study.

2. The data

We have three goals in this section. In Section 2.1, I present a set of data of *-wán* and *-diào* to familiarize the readers of the distribution of the two morphemes. Based on these data, I provide a brief argument that at least for the data involved in this study *-le* is a relative past tense marker (Comrie 1976; Ross 1995). In Section 2.2, I provide an informal characterization of termination and culmination and discuss how they are attested.

[3] According to Krifka, quantization is a stricter notion than telicity. A quantized predicate is telic but a telic predicate may not be quantized. In his analysis, the expressions *walk for one hour* and *walk from 4 p.m. to 5 p.m.* are telic predicates but not quantized predicates. See a discussion in Section 3.

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2.1 *Distribution of -wán and -diào*

The RVC predicates grammatically behave quite similar to normal verbs. For example, they can be passivized:

(6) *píngguǒ bèi Mǎlì chī(-wán/diào)-le.*
apple PASS Mary eat-TERM/CULM-PFV
'The apple was eaten by Mary.'

They can be used in future tense and with deontic modals, in which case *-le* is not used:

(7) *Mǎlì míngtiān huì chī(-wán/diào) yī-ge píngguǒ.*
Mary tomorrow will eat-TERM/CULM one-CLF apple
'Mary will eat an apple tomorrow.'

(8) *Mǎlì bìxū chī(-wán/diào) yī-ge píngguǒ.*
Mary must eat-TERM/CULM one-CLF apple
'Mary must eat an apple.'

The resultative morphemes can be used with predicates taking NP objects with quantifiers:

(9) *Mǎlì míngtiān huì chī(-wán/diào) yīxiē/suǒyǒude/yībùfèn/zhìshǎo*
Mary tomorrow will eat-TERM/CULM some/all/part.of/at.least
liǎng-ge píngguǒ.
two-CLF apple
'Mary will eat some/all of the/part of the/at least two apples tomorrow.'

Moreover, the resultative morphemes cannot co-occur regardless of *-le*:

(10) **Mǎlì chī-diào-wán(-le) yī-ge píngguǒ.*
Mary eat-TERM/CULM-PFV one-CLF apple
(Intended) 'Mary ate an apple.'

There are many proposals for *-le* in the literature, including perfective aspect marker, relative past tense marker, verbalizer, neutral resultative marker, quantity marker, etc. The most common view nowadays is that it is a perfective aspect marker. According to Li & Thompson (1981), *-le* is a perfective aspect marker which expresses boundedness. It could be temporal boundedness, spatial boundedness, and a kind of boundedness in an abstract sense. However, this analysis makes several incorrect predictions for the data. For example, as pointed out by Klein et al. (2000), if *-le* expresses boundedness, then we should expect that *-le* and resultative morphemes like *-wán* and *-diào* are incompatible since the resultative morphemes also indicate boundedness for the event. Moreover, the analysis should predict that with *-le* the accomplishments should entail culmination, and that *-le* and

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for- adverbials[4] are generally incompatible if boundedness entails telicity. But none of these predictions is borne out.

In this study, I follow the typological observation from Comrie (1976), which says that in many languages, the perfective aspect marker is also a marker of relative past tense (as opposed to absolute past tense) – also see Ross (1995) – for such a dual analysis for *-le* (see Sybesma 1997; Wang 2018, among others, for alternative proposals), and assume that when used with the resultative morphemes, the suffix *-le* is a relative past tense marker. This view is also motivated by the fact that without *-le*, the sentence is non-finite, regardless of the resultative morpheme, as shown in (11), and when *-le* is used, a past tense interpretation is obtained by default.

(11) *Mǎlì chī(-diào/wán) yī-ge píngguǒ.*
Mary eat-TERM/CULM one-CLF apple
'for Mary to eat that apple' or 'Mary's eating that apple'

So, in this study I assume that *-le* is a relative past tense marker. However, following the general literature, I gloss it as a perfective marker.

2.2 *Termination and culmination*

A termination predicate ensures termination of an event, entailing that the event stops progressing at some particular time. It presupposes that the event the verbal predicate denotes has duration, otherwise there would be no event progress to terminate. A culmination predicate ensures completion of an event with respect to the patient, entailing that the patient undergoes a change of state completely. It presupposes a certain quantity of patient, whose complete affectedness defines the delimitation of culmination of an event. The two types of predicates are illustrated below with the data involving *-wán* and *-diào*.

First, if a predicate P entails termination of an event, then when put in a temporal sequence with another event, the former must fully precede the latter. Therefore, if *-wán* expresses termination, then when combining it with an eventive predicate the denoted event must fully precede another event that occurs in temporal sequence. Consider the discourse in (12). It consists of two sequential events, one that Mary ate a certain amount of apples and the other that she wanted to eat a banana.

(12) *Mǎlì chī-wán-le píngguǒ, hái bú gòu, hái xiǎng chī xiāngjiāo.*
Mary eat-TERM-PFV apple still not enough still want eat banana
'Mary finished eating apples. It was not enough. She still wanted to eat a banana.'

[4] In fact, the *for*- adverbial requires *-le*. Consider the example below.

(i) *Mǎlì chī*(-le) wǔ fēnzhōng píngguǒ.*
Mary eat-PFV five minute apple
'Mary ate apples for five minutes.'

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This discourse gives rise to the inference that the event of Mary eating apples has terminated before she wants to eat a banana. The first event fully precedes the second one. The morpheme *-diào* shows similar pattern with *-wán* in this respect, also giving rise to an inference of full precedence. Consider the discourse in (13).

(13) *Mǎlì chī-diào-le píngguǒ, hái bú gòu, hái xiǎng chī xiāngjiāo.*
Mary eat-CULM-PFV apple still not enough still want eat banana
'Mary ate up the apple. It was not enough. She still wanted to eat a banana.'

This discourse entails that the event of eating up the apple fully precedes the event of wanting to eat a banana.

Second, if a predicate P entails culmination, then there is a non-cancelable inference that the relevant result state has obtained. Therefore, if *-diào* expresses culmination, then when it is combined with an eventive predicate, the denoted event must entail that the result state with respect to the patient is obtained. This can be verified by the following discourse.

(14) *#Mǎlì chī-diào-le (yī-gè) píngguǒ, hái shèng liǎng-kǒu, bèi*
Mary eat-CULM-PFV one-CLF apple still left two-bite PASS
wǒ chī-le.
I eat-PFV
'#Mary ate up an/the apple. Part of it was left over and I ate it.'

In this example, the bare noun object *píngguǒ* 'apple' has a definite reading, which is an effect of the meaning of *-diào*, and it entails that the apple must be consumed entirely. Culmination is also entailed if the object is *yī-gè píngguǒ* 'one apple'. The discourse is unacceptable because it is contradictory. The morpheme *-wán* implies culmination with respect to the patient as well. Consider (15).

(15) *#Mǎlì chī-wán-le (yī-gè) píngguǒ, hái shèng liǎng-kǒu, bèi*
Mary eat-TERM-PFV one-CLF apple still left two-bite PASS
wǒ chī-le.
I eat-PFV
'#Mary finished eating an/the apple. Part of it was left over and I ate it.'

This discourse is unacceptable regardless of whether the object is a classifier construction or a bare noun. When the object is *yī-gè píngguǒ* 'one apple', the interpretation is that the apple was consumed entirely, so the discourse is contradictory. When the object is a bare noun *píngguǒ* 'apple', which refers to an unspecified amount of apples, the interpretation is that the amount of apples was consumed entirely. The noun phrase *liǎng-kǒu* 'part of some food' in the second sentence is anaphoric, referring to part of the amount of apples denoted by the bare noun *píngguǒ* 'apple' in the first sentence. So the discourse is contradictory as the first part entails culmination with respect to an unspecified amount of apples while the second part contradicts the culmination inference.

Third, since most events terminate at a particular time point regardless of whether they are denoted by predicates that have an inherent endpoint or not, we should expect

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that *-wán* can be combined with eventive predicates that have no inherent endpoints as well. The prediction is borne out. First consider the case of activity verbs. An example is provided in (16) where *-wán* is combined with the activity verb *xiào* 'laugh'.

(16) *tā xiào-wán-le jiù zǒu le.*
he laugh-TERM-PFV then leave SFP
'He laughed and then left.'

The morpheme *-wán* is also compatible with semelfactives, which may refer to a single-event activity or a multiple-event activity (Smith 1997: 29–30). However, the interpretation is somewhat coerced into activity. Consider the example in (17), which normally has an iterative interpretation. It also allows an interpretation of a single-event activity. However, in this case, the interpretation is that the predicate *qiāo-mén* 'knock on the door' describes a series of phases surrounding the act of knocking on the door rather than the instantaneous act of knocking.[5] We can see such an effect of coercion from the case where the aspectual expression *yíxià* 'once' is overtly used, as shown in (18). The sentence in (18) is acceptable but it cannot be used to describe the situation where the person rapidly knocked twice on the door.

(17) *tā qiāo(-wán)-le mén jiù pǎo-kāi le.*
he knock-TERM-PFV door then run-away SFP
'After knocking on the door, he ran away.'

(18) *tā qiāo(-wán)-le yíxià yòu qiāo-le yíxià.*
he knock-TERM-PFV once again knock-PFV once
'After he knocked once, he knocked once again.'

Fourth, since termination presupposes duration for the event, we may expect that *-wán* cannot be compounded with achievements since instantaneous events denoted by achievements have no duration. This is also borne out. Consider (19) which involves the achievement verb *dào* 'arrive'. The sentence is unacceptable if the verb *dào* 'arrive' is compounded with *-wán.*

(19) *tā dào(*-wán)-le jiā jiù shuì le.*
he arrive-TERM-PFV home then sleep SFP
'When he arrived home, he went to bed.'

Fifth, a terminative predicate takes a dynamic eventive predicate as its complement, and thus we should expect that it is incompatible with stative predicates.[6] This is

[5] Thanks to one of the reviewers.

[6] But note that *-wán* sometimes can be combined with some stage-level predicates. An example is presented as follows.

(i) *tāmen zài wǔtīng-lǐ kāixīn-wán-le yòu qù-le dǔchǎng.*
they LOC dance.hall-in happy-TERM-PFV also go-PFV casino
'After they had fun in the dance hall, they went to the casino.'

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largely true with the use of *-wán*. Consider an example in (20) where *-wán* is compounded with the stative verb *zhōngchéng* 'be loyal to'.

(20) *Yuēhàn zhōngchéng-wán lǎobǎn jiù líkā-le gōngsī.
John be.loyal.to-TERM boss then leave-PFV company
(Intended) 'When John stopped being loyal to his boss, he left the company.'

However, it is notable that compounding *-wán* with a stative predicate is not entirely excluded in Chinese. Such combinations can be licensed by some pragmatic rule. In such a case, the purpose of using such expressions is not to convey the literal meaning that a certain state stops holding at a particular time, though it does convey the literal meaning, instead, it creates certain pragmatic effect that a non-literal meaning is what the speaker intends to convey. An example is provided in (21).

(21) *Yuēhàn zhōngchéng-wán zhè-ge lǎobǎn yòu zhōngchéng nèi-ge lǎobǎn.*
John be.loyal.to-TERM this-CLF boss then be.loyal.to that-CLF boss
'John became loyal to that boss when he stopped being loyal to this boss.'

In this example, the speaker is being sarcastic. The sentence literally says the state that John is loyal to this boss stopped holding at a particular time when he became loyal to that boss, and what the speaker is trying to convey is that John is a person who has no loyalty to his boss. To account for the compounding behavior with statives, I assume that *-wán* does not just require durative but also dynamic property for the predicate it is compounded with, so it is normally incompatible with statives but the compounding can be licensed by some pragmatic condition.

Finally, note that the morpheme *-diào* is semantically more restricted than *-wán* in forming RVC constructions. While *-wán* can be compounded with almost any eventive verb as long as the event in the denotation has duration, *-diào* is usually restricted to the type of eventive predicates which denote the kind of events in which the patient disappears at the end. For example, other than consumption verbs such as *chī* 'eat' and *hē* 'drink', the verbs that *-diào* is commonly combined with include transitive verbs such as *shāo* 'burn', *cā* 'wipe', *rēng* 'throw', *kǎn* 'cut', *chōng* 'flush (with water)', *mài* 'sell', *shā* 'kill', and *pòhuài* 'destroy, damage', as well as intransitive verbs such as *pò* 'break', *zǒu* 'walk, leave', and *pǎo* 'run'. The range of eventive predicates it may combine with also varies across Chinese dialects (Chao 1968: 466). Note that *diào* can also be used as a contentful intransitive verb which literally means 'drop'. So when it is used as an RVC morpheme, it seems that the requirement that the patient disappears as the result of the event is a metaphoric

Following Kratzer (1989), I assume that stage-level predicates have an event argument in their argument structure. Also note that the predicate *kāixīn* 'happy, joy' in (i) might be interpreted as a coerced activity predicate, meaning 'to do something happily'. In either case, it is compatible with our analysis that *-wán* expresses termination. Thanks to one of the reviewers.

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use of the literal meaning 'drop', for example, the food is conceptualized as having been 'dropped' or gone at the end of a consumption event. Also note that *-diào* is not restricted to the kind of events where a physical change of state occurs, as shown by these examples, but it can also be used in an abstract sense of change of state. In the current study, I limit my concern to the cases where incremental themes are involved in which the patient is physically affected such as a consumption event.

To sum up, in this subsection, I characterize termination and culmination predicates informally and show with Chinese data how they might be attested. However, the purpose of the current study is not to analyze termination and culmination as formal notions. Instead, the purpose is to show that there are two different avenues to telicity, which are revealed to us by the meanings of *-wán* and *-diào*, and propose an analysis accordingly. So next we return to telicity.

3. Previous studies of telicity

A number of aspectual studies have proposed a variety of models to calculate telicity. A central question that these studies try to answer is how to account for the interaction of the inherent aspectual features of verbs and the features inherent in other elements that give rise to synthetic aspects such as arguments (especially incremental theme discussed in Dowty 1991), adverbs, prepositions, and so forth. The highly influential proposals include Dowty's result state model (Dowty 1979), Tenny's aspectual theory (Tenny 1994), and Krifka's event-argument homomorphism model (Krifka 1989, 1992, 1998). It is notable that not all accounts for telicity assume telicity is due to semantic effects, for example, in Borer (2005) and Ramchand (2008), it is assumed that telic interpretation is originated from some syntactic configuration rather than an interaction of semantic meanings of different components. In the more recent trend of aspectual studies, telicity is characterized in terms of scalar properties (Hay, Kennedy & Levin 1999; Kennedy & McNally 2005; Wechsler 2005; Kennedy & Levin 2008; Rappaport Hovav 2008). In this approach, a telic predicate is understood as a bounded scale associated with some property/dimension which indicates the scalar change which represents the progress of the denoted event along certain direction. If there is no bounded scale, the predicate is interpreted as atelic. Another influential study of telicity as in Filip & Rothstein (2005) and Filip (2008) concerns the case in which some verb-external element makes an important contribution to telicity in addition to the meanings of verbs and incremental themes such as the perfective aspectual marker in Russian (see also Kardos 2016 for a telicity-marking particle in Hungarian). In their analysis, they assume telicity is due to an effect of the application of an event maximalization operator, which operates at different syntactic levels for different telicizing markings in different languages, picking out a set of maximal events that designates the denotation of a telic predicate.

The analysis proposed in the current study for *-wán* and *-diào* is couched in the event semantic framework proposed by Krifka to account for aspectual composition (Krifka 1989, 1992, 1998). Krifka's characterization of telic predicates like *eat an*

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apple hinges on the property of *quantization*: a quantized predicate is a predicate that cannot apply to a proper part of an entity in its denotation. This property provides a criterion for re-categorizing mass and count nouns in the nominal domain and atelic and telic predicates in the verbal domain into a category of quantized predicates (count nouns and telic predicates) and a category of non-quantized (or cumulative) predicates (mass nouns and atelic predicates). The correlation between a quantized nominal predicate (e.g. *an apple*) and a quantized verbal predicate (e.g. *eat an apple*) is formally explained in terms of a transfer of mereological property from the structure of patient to the homomorphically related structure of event. In the current study, I also assume that the telicity readings associated with many expressions are due to quantization, and I propose that we may analysis the telicity associated with RVC expressions of *-wán* and *-diào* in terms of quantization as well.

It is notable that, as pointed out by Zucchi & White (2001), Krifka's account for telicity in terms of quantization runs into problems when the object is an indefinite noun phrase like *a sequence*, *a twig*, *a quantity of N*, and *some N*s, which are not quantized predicates, according to the definition. In this case, an event of writing a sequence, for example, may have a proper part which is still an event of writing a sequence, and thus according to Krifka's analysis, the predicate *write a sequence* should be a non-quantized, atelic predicate, yet it is telic. The same issue holds for what is known as the quantization puzzle in the literature (also see Filip 2008), for example, the predicate *drink a large quantity of water* applies to a proper part of the denoted event, yet it is telic. Zucchi & White (2001) provided a solution to this problem while still maintaining a quantization analysis in this case. They proposed that the referent of the patient is all the relevant participants involved in the denoted event at the referent time, which is formally characterized by a maximal relation introduced by the determiner and also predicts quantization. In Filip's (2008) analysis, the quantization puzzle is solved by applying the maximalization operator over events, picking out the largest relevant set of events at a given situation. In the current study, I follow Zucchi & White's (2001) solution and assume that participants that give rise to quantization are associated with a maximal relation relative to the referent time. I will further propose that it is not just patient participants that can give rise to quantization via a maximal relation but the runtime of an event can also give rise to quantization in the same way.

Note that Krifka did not consider the case of generating telicity from quantization over the runtime of an event. He discussed some telic predicates that involve a run time of event such as *walk for one hour* (Krifka 1998: 214–215), however, to him, these predicates only suggest that while quantized predicates are necessarily telic predicates, telic predicates are not necessarily quantized predicates. The predicate *walk for one hour* is not quantized because, according to Krifka, it might apply to two contemporaneous events and their sum. However, this issue actually is similar to the issue addressed by Zucchi & White (2001) as we discussed above: the predicate *write a sequence* can also apply to a proper part of its denoted event,

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yet it is telic. Similar to the fact that the quantizing effect of noun phrases of a form like *an N* is not simply because the predicate N itself is quantized, the quantizing effect of the durative phrase, if we assume a quantization analysis for *walk for one hour*, is not simply determined by the quantizedness of the durative phrase. The quantization of the predicate *walk for one hour* should be analyzed in a different way. To do so, we may make a similar assumption as the one made by Zucchi & White (2001): the referent of the runtime of an event is all the relevant time points/intervals involved in the event. With this assumption, *walk for one hour* is quantized for a similar reason as *write a sequence*, which is discussed below. In this way, we can unify our analyses of different kinds of telic predicates in terms of quantization.

In the rest of this section, I review the framework proposed by Krifka (1989, 1992, 1998) and the extension provided by Zucchi & White (2001), which provide the basis for the current proposed analysis.

3.1 *Krifka's model on aspectual composition*

Krifka (1989, 1992, 1998) proposed a model to account for the influence of reference types of nominal arguments on temporal properties of verbal predicates. He connected two types of predicates in the nominal domain to the contrast between telic and atelic predicates in the verbal domain by proposing a contrast between two types of predicates, namely, cumulative and quantized. A cumulative predicate is such a predicate that if the predicate can apply to both entities, it can apply to their sum. A quantized predicate is such a predicate that if the predicate applies to *x*, it cannot apply to a subpart of *x*. The definitions of the two predicates are provided in (22) and (23) respectively (Krifka 1998: 200).

(22) *Cumulative predicates*
$\forall X[CUM(X) \leftrightarrow \exists x,y[X(x) \wedge X(y) \wedge \neg\, x = y] \wedge \forall x,y[X(x) \wedge X(y) \rightarrow X(x \sqcup y)]]$
'A predicate X is cumulative iff X applies to at least two entities, for any x and y to which X applies to, X also applies to the sum of x and y.'

(23) *Quantized predicates*
$\forall X[QUA(X) \leftrightarrow \forall x,y[X(x) \wedge X(y) \rightarrow \neg\, y \subset x]]$
'A predicate X is quantized iff for any x and y to which X applies, y is not a proper part of x.'

In the nominal domain, a cumulative predicate can be a mass noun (e.g. *beer*) or a bare plural noun (e.g. *books*) since two quantities of beer (or books) are still beer (or books). A nominal quantized predicate can be a count noun (e.g. *a book*) or a noun phrase that specifies the quantity of the entity (e.g. *a glass of beer*) since the two predicates cannot apply to a subpart of the entities they denote. This distinction is also reflected in the verbal domain and the cumulative/quantized referential property of the object is correlated with the aspectual property of the eventive predicate. When a verb like *eat* is combined with a cumulative noun phrase like

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apples, it yields an atelic predicate as in (24a), which is cumulative since two events of eating apples is still an event of eating apples. When the verb is combined with a quantized noun phrase like *an apple*, it yields a telic predicate as in (24b), which is quantized since a proper part of an event of eating an apple is not an event of eating an apple.

(24) (a) John ate apples (for/??in ten minutes). (atelic)
(b) John ate an apple (?for/in ten minutes). (telic)

This correlation between the referential type of the object and the aspectual property of the verbal predicate is explained in terms of an effect of a homomorphic relation between two part structures that formally characterize object and event. The internal arguments of verbs like *drink* and *eat* are characterized as bearing a special thematic role called INCREMENTAL THEME (Dowty 1991). The homomorphic θ-relation relates the extent of the incremental theme to the progress of the event by tying each part of the incremental theme with a corresponding part of the event so that the homomorphism allows transferring of mereological properties between the two structures. To have more specific properties for incremental relations, homomorphism further requires the thematic role of incremental theme to have a number of properties, including UNIQUENESS OF OBJECTS, UNIQUENESS OF EVENTS, MAPPING TO SUBEVENTS and MAPPING TO SUBOBJECTS. These properties are collapsed into two properties MAPPING TO UNIQUE SUBOBJECTS and MAPPING TO UNIQUE SUBEVENTS in Beavers (2012: 28) and the definitions are repeated in (25). Note that these properties define a strict homomorphism θ that Krifka called strictly incremental relation (SINC), which, as Beavers pointed out, is an isomorphism of subparts that defines being an incremental theme.

(25) *Strictly incremental relation (SINC)*
Event e is θ-related to patient x such that every unique part of e corresponds to a unique part of x and vice versa, i.e. θ has the MUSO and MUSE properties:
(a) *Mapping-to-unique-subobjects (MUSO)*
$\forall x,e,e'[\theta(x,e) \wedge e' \subset e \rightarrow \exists !y[y \subset x \wedge \theta(y,e')]]$
'For all x θ-related to e, for all $e' \subset e$ there is a unique θ-related $x' \subset x$.'
(b) *Mapping-to-unique-subevents (MUSE)*
$\forall x,x',e[\theta(e,x) \wedge x' \subset x \rightarrow \exists !e'[e' \subset e \wedge \theta(e', x')]]$
'For all e θ-related to x, for all $x' \subset x$ there is a unique θ-related $e' \subset e$.'

The MUSO and MUSE properties ensure a strict one-to-one mapping between the proper parts of e and the proper parts of x. It predicts that the event predicate like in (26) is quantized, or telic.[7]

[7] I assume Krifka's (1998) analysis of *for-* adverbials wherein *for-* adverbials presuppose the predicate it applies to is atelic. Analogously, I assume that *in-* adverbials presuppose the predicate it applies to is telic.

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(26) John drank a glass of wine in/?for an hour.

For an event e of drinking a glass of wine x, any proper subpart event $e' \subset e$ is an event of drinking a proper subpart of the glass of wine $x' \subset x$, by the SINC that holds between e and x. However, *a glass of wine* has quantized reference, therefore no x' satisfies this description. This means that no $e' \subset e$ satisfies the description of *drink a glass of wine* since e' is an event of drinking less than a glass of wine. So according to the definition of quantized predicate in (23), *drink a glass of wine* is quantized (and also telic). SINC also predicts that the event predicate like *drink wine* is cumulative, or atelic.

(27) John drank wine for/??in an hour.

For an event e of drinking some amount of wine x, any proper subpart event $e' \subset e$ is an event of drinking a proper subpart of that amount of wine $x' \subset x$ by the SINC that holds between e and x. Since *wine* has cumulative reference, x' satisfies this description. So $e' \subset e$ satisfies the description of *drink wine*. Given the definition of cumulative predicate in (22), *drink wine* is cumulative, or atelic.

The analysis predicts that event predicates like *push a cart* are not telic, though the nominal predicate is quantized. The explanation provided by this model is as follows: for a subevent of an event of *push a cart*, there is no proper part of the object *a cart* that is the patient of a subevent of the event *push a cart*. Instead, the patient of the subevent is the same as the patient of the event. In other words, the non-quantized property of the event predicate *push a cart* is due to that the verb *push* does not assign the thematic role of incremental theme to its internal argument. Therefore, the difference between *eat x* and *push x* boils down to the difference in the thematic role each verb assigns to *x*.

So far, the analysis can provide an adequate account for events where a subpart of the patient is isomorphically related to a unique subpart of the event, for example, *eat an apple*. However, it is inadequate to account for events such as *read a book* where some subparts of the patient can be affected iteratively. To deal with this issue, Krifka made a distinction between two types of homomorphism, namely the strict incremental relation (SINC) and the incremental relation (INC). The SINC is an isomorphism of subparts which consists of the two properties defined in (25). In this case, progress of an event is isomorphically related to the extent of the incremental theme, so each subpart of event corresponds to a unique subpart of the theme, and event ends when the theme is entirely affected. By contrast, in the case of INC, an event is incrementally related to the theme in such a way that some subparts of the theme can be affected more than once, so some subparts of an event may correspond to the same subparts of the theme of some other subparts of the event. In the former case, each subpart of the object is a theme of a unique subpart of the event; in the latter case, a subpart of the object can be mapped to more than one subpart of the event.

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In Krifka (1998), he further extended the analysis to account for motion events such as *walk from the university to the capitol.* He treated paths of motion as incremental themes as well and defined a θ-relation called strict movement relation (SMR) which is isomorphic in subparts, relating the event *e* to the path *p* in their subparts. SMR also preserves the spatial/temporal adjacency: two subparts of *e* in temporal adjacency corresponds to two subparts of *p* in spatial adjacency, and vice versa.[8]

Krifka's model has received a number of criticisms as it is insufficient to account for a number of empirical linguistic phenomena, and subsequent analyses have been proposed to tackle these issues. Below I will review one of these studies, which will lead to the analysis I propose for the telicizing morphemes of *-wán* and *-diào*.

3.2 *Zucchi & White's (2001) maximal participants*

Zucchi & White (2001) noted that Krifka's account for telicity is problematic if the object is an indefinite noun phrase like *a sequence*, *a twig*, and *some Ns*. According to Krifka's definition of quantization, such nominal predicates are not quantized since, for example, a subpart of a sequence is still a sequence and a subpart of *some Ns* is still *some Ns*. However, these nominal predicates yield quantized verbal predicates. For example, *write a sequence* is compatible with *in-* adverbs but not *for-* adverbs.

(28) John wrote a sequence in/??for ten minutes.

They argued that the assumption that the quantizing effect of NPs of the form *an N* follows from the fact that the predicate *N* itself is quantized is problematic. It is not just that it cannot explain why NPs like *a sequence* yield the quantizing effect but also it ignores our intuition that the fact that plural indefinites of the form *some Ns* (as well as some other forms of NPs such as *most Ns* and *less than n Ns*) yield the same effect should be explained by the same reason.

In their solution to the problem of Krifka's analysis, they still assumed the model and maintained the idea that quantization leads to telicity.[9] The intuition that

[8] Krifka (1998: 207) also provided a weaker version of the definition of telic predicate:

$$\forall X \subseteq U_E[TEL_E(X) \leftrightarrow \forall e,e' \in U_E[X(e) \wedge X(e') \wedge e \subseteq_E e' \rightarrow INI_E(e',e) \wedge FIN_E(e',e)]]$$

It says a predicate is telic iff for any event it applies to it does not apply to any initial or final subevent of that event. According to this definition, quantized predicates are telic but telic predicates may not be quantized. This weaker notion of telicity can solve some problems of telic motion predicates. For example, a motion from point A to point B may involve irrelevant detours in the middle, but all the events in the denotation have the same initial and final points.

[9] They also proposed another solution, which is based on the analysis of indefiniteness proposed by Kamp (1981) and Heim (1982). The assumption of this solution is that indefinite noun phrases do not introduce existential quantifiers immediately, instead, the variable *x* introduced by the object is treated as a constant by the variable assignment function until at a later stage the variable *x* is

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motivates their analysis is that an event of writing a particular object *x*, be it a sequence or a letter, does not have events of writing *x* as proper parts. In other words, the referent of the object is all the relevant patients involved in the event that the speaker refers to. For example, for an event of John's writing a sequence, the reference of the object is for all intents and purposes a kind of specific reference, i.e. John wrote a specific thing at a reference time t_r that is a list of ordered numbers. Since no proper subpart of a specific sequence involved in a particular writing event is the same sequence, then the predicate *write a sequence* is quantized because given the property of mapping to unique subobjects and mapping to unique subevents defined in (25), no proper subpart of an event of writing a given sequence is the same event of writing that sequence at the reference time t_r. In this analysis, the noun phrase is treated like a definite noun phrase which denotes the maximal entity involved in the event.

They modified the definition of quantized predicate and included an assignment function to keep the assignment of individuals fixed. The definition is presented below, where the individuals include both events and ordinary individuals (Zucchi & White 2001: 236).

(29) QUA(P) iff for every model *M*, assignment *g*, and individual *a*, *b*,
If $[\![P]\!]_{M,g}(a)=1$ and $[\![P]\!]_{M,g}(b)=1$, then *a* is not a proper part of *b*.

According to this definition, nominal predicates like *a sequence* and *a letter* are quantized in the sense that the specific individual, a sequence or a letter, for a single assignment, has no proper part that the predicate can apply to. They also defined a *Max* relation, which is encoded in the meaning of quantifiers, to handle the specific individuals involved in an event, which they call *maximal participants* (Zucchi & White 2001: 254):

(30) $\forall x[Max(P, x) \leftrightarrow [P(x) \wedge \neg\exists y[P(y) \wedge x \subset y]]]$
'An individual is a maximal P iff it is P and it is not a proper part of another P.'

Now consider the example of *write a letter*. The translation provided by Zucchi & White (2001: 259) is presented in (31).[10] The *Max* operator is introduced by the indefinite quantifier.

(31) $[\![\text{write a letter}]\!] = \lambda y \lambda e \exists x[\text{write}(e) \wedge \textsc{ag}(y, e) \wedge \textsc{pat}(x, e) \wedge Max(\lambda z \exists e'[\text{write}(e') \wedge \textsc{ag}(y, e') \wedge \textsc{pat}(z, e') \wedge \text{letter}'(z) \wedge \tau(e') \subseteq t_r], x)]$
'An event of writing a letter is a writing event whose patient is maximal among the individuals in the denotation of letter written at the time t_r.'

According to Zucchi & White (2001), there might be more than one maximal element in the denotation of $Max(\lambda z \exists e'[\text{write}(e') \wedge \textsc{ag}(y, e') \wedge \textsc{pat}(z, e') \wedge \text{letter}'$

assigned a value. In this analysis, there is only one assignment to the variable *x* as opposed to multiple assignments, which results in a quantized predicate according to the definition of (29).

[10] The agent of the event is ignored in the original representation in Zucchi & White (2001).

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(z) ∧ τ(e′)⊆t_r], x) since any singular letter that was written during the interval t_r is counted as a maximal element. But the denotation of the predicate *write a letter* as in (31) is restricted to a writing event whose patient is a singular letter at t_r. Given that the object role of *write* has the property of mapping to objects, a proper subevent e' of the event of writing a given letter is not an event of writing that letter since a proper subpart of a given letter is not itself. This means that e' is not in the denotation of *write a letter*. Therefore, according to the definition of quantization, *write a letter* is quantized.

Zucchi & White (2001) also provided an account for the quantization puzzle. For example, for the semantics of DPs like *most Ns*, they assume that they denote a generalized quantifier that takes the verb as an argument and the verb's patient argument is saturated by a variable that picks the maximal participants with respect to the reference time t_r, which is conditioned by the cardinality being greater than one half of the total number. The representation of *most letters* they provided is repeated as follows (Zucchi & White 2001: 254):

(32) [[most letters]] = λPλe∃x[P(x)(e) ∧ *Max*(λz∃e′[P(z)(e′) ∧ letters′(z) ∧ τ(e′)⊆t_r],x) ∧ |x| > 1/2Σ(λz[letter′(z)])]

Thus the nominal predicate *most letters* introduces a set of letters which are the maximal participants in some event described by its first argument P. Translation of the event predicate *write most letters* they provided is repeated as follows (Zucchi & White 2001: 254):

(33) [[write most letters]] = λe∃x[write(e) ∧ PAT(e, x) ∧ *Max*(λz∃e′[write(e′) ∧ PAT (e′, z) ∧ letters′(z) ∧ τ(e′)⊆t_r],x) ∧ |x| > 1/2Σ(λz[letter′(z)])]
'An event of writing most letters is a writing event whose patient is the maximal set of letters written by the agent at the reference time t_r and the cardinality of this set is greater than one half the number of the letters.'

This analysis predicts that *write most letters* is quantized. Assuming that the object of *write* is an incremental theme which has the property of mapping to objects, the maximal sum of letters written by an agent during a given reference time has no proper part which is also the maximal sum of letters written during the reference time, and thus the event of writing such a maximal sum of letters during the reference time does not have a proper part that is an event of writing the maximal sum of letters during the reference time. Therefore, the predicate *write most letters* is quantized.

Zucchi & White (2001) also extended their analysis to account for activity predicates such as *rule most countries* in terms of maximal participants. The atelicity of such an activity predicate is accounted for as follows: the patient of an event of ruling most countries is the sum of all the countries ruled at reference time t_r. But since *rule* does not have the property of mapping to objects, a subevent may have as its patient the same sum of countries that are ruled at reference time t_r, therefore the predicate *rule most countries* is not quantized.

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However, Rothstein (2004: 152–154) pointed out that this analysis may fail to predict atelic readings for activity predicates which have maximalization as part of the meaning of the object. One of her illustrating sentences is provided as follows (Rothstein 2004: 153).

(34) John has owned more than half the houses on this street for the last five years, and he is adding to his property every few months.

Zucchi & White's (2001) analysis makes the incorrect prediction that this sentence is telic. In a possible context where John has been buying up houses on this street incrementally, the event of owning 30 out of 40 houses during the reference time has a subevent of owning 29 houses, both of which can be described as owning more than half the houses but have different maximal sum of participants. Therefore, according to Zucchi & White's (2001) analysis, it is a telic predicate. Yet it is atelic. Thus Rothstein (2004) concluded that quantization of the theme argument does not determine telicity of accomplishment predicates. However, Beavers (2012) noted that this conclusion is too strong. He pointed out that what seems to be relevant for quantized theme arguments calculating telicity is whether the verb introduces incrementality, and *own* does not.

In the next section, I first provide an analysis for the two telicizing RVC morphemes *-wán* and *-diào* under the framework defined by Krifka and assuming the remedy provided by Zucchi & White (2001), and then present a short account for the non-culmination reading of non-RVC accomplishments in Chinese.

4. The analysis

The proposed analysis for *-wán* and *-diào* is cast in the model developed by Krifka (1989, 1992, 1998). Following Krifka as well as Zucchi & White (2001), I also assume a quantizational analysis for the kind of telicity associated with each of the two morphemes, assuming that they create a quantizing effect when they occur with eventive predicates. I adopt Zucchi & White's (2001) assumption that a maximalization of participants implemented by some operator introduced by indefinites or any other formatives yields the quantizing effect. For the Chinese data, I assume that such an operator is not introduced by determiners such as the classifier construction, but it is introduced by RVC morphemes. Specifically, I propose that *-wán* denotes a maximalization function over the time points/intervals that make up the event time of the denoted event, and *-diào* a maximalization function over the patients. Both yield quantization over event via homomorphisms.

Following Krifka (1989, 1992, 1998), I assume that all entities fall into domains of individuals, events, paths, and times, and they form mereological part structures of individuals, events, paths, and times which are related to each other via a series of homomorphic relations. The homomorphic relations preserve the part/whole structures in such a way that the mereological properties of one structure may transfer to another one. For example, for an event that involves an incremental theme

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(e.g. *drink a glass of wine*), the specified quantity of the theme (*a glass of wine*) determines the boundedness of the event, which is due to an effect of a transfer of the mereological property of the structure of theme to the structure of event via a homomorphism θ that is a SINC.

For purposes of the current study, we only need to assume a ternary framework, which consists of the structures of events, times, and individuals that are homomorphically related. Since we have discussed above the properties of the homomorphic relation (SINC) between the individual structure and the event structure, which include MAPPING-TO-UNIQUE-SUBOBJECTS and MAPPING-TO-UNIQUE-SUBEVENTS, as defined in (25), here we only concern ourselves with the relation between the time structure and the event structure as well as the relation between the time structure and the individual structure.

We first consider the relation between time and event. Since every non-punctual event has a duration and is related to a stretch of time, I assume that event holds a semantic relation to its runtime in a similar way to event thematically related to patient, and I use the symbol τ instead of θ to represent this semantic relation. I call the homomorphic relation between event and time temporal incremental relation (TINC) in order to make it parallel to the strictly incremental relation (SINC), though incrementality might not be a precise term to describe the progress of an event, especially an activity. Following Beavers (2012), I assume that τ is an isomorphism that has the property of mapping subevents to their corresponding unique subparts of the event runtime and the property of mapping subparts of the event runtime to their unique subevents. The definition of TINC is presented as follows:

(35) *Temporal incremental relation (TINC)*
Event *e* is τ-related to runtime *t* such that every unique part of *e* corresponds to a unique part of *t* and vice versa, i.e. τ has the MUST and MUSE_T properties:
(a) *Mapping-to-unique-subruntimes (MUST)*
$\forall t,e,e'[\tau(t,e) \wedge e' \subset e \rightarrow \exists !s[s \subset t \wedge \tau(s,e')]]$
'For all *t* τ-related to *e*, for all $e' \subset e$ there is a unique τ-related $t' \subset t$.'
(b) *Mapping-to-unique-subevents (MUSE_T)*
$\forall t,t',e[\tau(e,t) \wedge t' \subset t \rightarrow \exists !e'[e' \subset e \wedge \tau(e', t')]]$
'For all *e* τ-related to *t*, for all $t' \subset t$ there is a unique τ-related $e' \subset e$.'

The MUST and MUSE_T properties also ensure a strict one-to-one mapping between the proper parts of *e* and the proper parts of *t*. It predicts that the predicate *eat apples from 3:01 to 3:05* is quantized, though the object *apples* is not a quantized predicate. I assume that temporal expressions like *from 3:01 to 3:05* are time-denoting expressions. It is a quantized predicate since no subpart of the time *from 3:01 to 3:05* is also a time *from 3:01 to 3:05*. Assuming Zucchi & White's (2001) definition of quantization, the assignment function assigns the predicate *eat apples from 3:01 to 3:05* a set of events of eating apples, run times from 3:01 to

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3:05, and particular but unspecified amounts of apples. For an event *e* of eating apples from 3:01 to 3:05 *t* at a reference time t_r, any proper subpart event $e' \subset e$ is an event of eating apples at a proper subpart of the duration from 3:01 to 3:05 $t' \subset t$, by the TINC that holds between *e* and *t*. However, *from 3:01 to 3:05* has quantized reference, therefore no t' satisfies this description. This means that no $e' \subset e$ satisfies the description of *eat apples from 3:01 to 3:05* since e' is an event of eating apples at a subpart of the duration *from 3:01 to 3:05*. So the predicate is quantized (and also telic).

Now we consider the relation between time and individual. We actually do not have any motivation to define a relation that directly connects time to individual. Intuitively, it is reasonable to say an event happens at a particular time and has a duration if it is not punctual, and it is also reasonable to say an individual is involved in an event as the patient, but it is quite odd to talk about temporal duration of an individual without referring to the event. For example, we may have the predicate *eat apples from 3:01 to 3:05*, but *apples from 3:01 to 3:05* hardly makes any sense. So, for the ternary framework, we assume that the event structure is homomorphically related to the individual structure and the time structure, the individual structure and the time structure are not directly related to each other, instead, they are homomorphically related to each other in an indirect way by the event structure.

What follows from the ternary framework is that a quantization over time will lead to a quantization over time via homomorphism, which gives rise to a quantization over individual via another homomorphism. This explains why the predicate *eat apples from 3:01 to 3:05* entails that there is a certain amount of apples, which is the maximal participant, that are consumed during the entire event, although the object *apples* is not quantized. Similarly, a quantization over individual will eventually lead to a quantization over time, which explains entailment of endpoint for predicates like *eat an apple*, which quantizes over individual.

In the three subsections below, I first present analyses for *-wán* and *-diào*, assuming the framework defined above, and give an account for the Chinese data presented above, and then provide a short account for the non-culminating reading of non-RVC accomplishments.

4.1 *Analyzing -wán*

The proposed analysis for *-wán* is based on the assumption that event time is a semantic argument of an eventive predicate. It is reasonable to treat event time as one of the semantic arguments of a verbal predicate, though it is apparently different from a regular semantic argument. As pointed out by Krifka (1998), a predicate establishes a relation of a specific type between some number of semantic arguments, and the number and types of the semantic arguments involved in a predication may vary in different cases. For example, the sentence *John slept* establishes a SLEEP-type relation between the individual John and some event; *Mary ate the*

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apple establishes an EAT-type relation between Mary, a particular apple, and some event; and *John walked from the campus to the capitol* establishes a WALK-type relation among John, some event, and some path in space between the campus and the capitol. A semantic argument might be expressed by a syntactic argument such as the subject and the object, and it might also be expressed by a syntactic adjunct such as *from the campus to the capitol.* Krifka did not consider event time as a semantic argument; however, for the purpose of the current study, I propose that we may take event time as a semantic argument.

In the semantic representation, we may treat event time as a special semantic argument like the semantic argument of event *e* we normally assume for a verbal predicate in the (neo-)Davidsonian approach to verb meaning, that is, it is saturated by existential closure at the end of composition. For example, the translation of the verb *chī* 'eat' is represented as follows:

(36) $[\![\text{chi}]\!] = \lambda x \lambda y \lambda t \lambda e[\text{eat}'(e) \wedge \textsc{ag}(e, y) \wedge \textsc{pat}(e, x) \wedge \textsc{time}(e, t)]$
Where $\textsc{time}(e, t) = 1$ iff $t = \tau(e)$

In this representation, the eventive predicate *chī* 'eat' is analyzed as a four-place relation that relates a patient *x*, an agent *y*, and an event time *t* to an event *e*. Event time is defined as the run time of the denoted event, which is the output of the temporal trace function τ mapped onto the domain of event.

The proposed analysis for *-wán* is an extension of the maximal participant account proposed by Zucchi & White (2001) from the domain of entity of patient to the domain of entity of time. I propose that *-wán* presupposes the predicate it applies to is durative and dynamic, and it denotes a function that maps the event time onto a maximal set of times, which I call the maximal time participant. The representation of *-wán* that I propose is presented as follows:[11]

(37) $[\![wan]\!] = \lambda P \lambda t \lambda e[P(t,e) \wedge \mathit{Max}(\lambda s \exists e'[P(s,e') \wedge \tau(e') \subseteq t_r], t)]$

The translation says that *-wán* is a function that takes a durative, eventive predicate as its argument and saturates the predicate's time argument with a variable that picks out the maximal time interval involved in the event at reference time t_r.

I propose that *-wán* structurally applies at the level of VP denotation. The structure is shown in (38) where I assume certain movements occur in PF, giving rise to the observed word order at the surface level.

[11] A reviewer asks what the *Max* operator does. Here, I assume the hypothesis proposed by Filip & Rothstein (2006) which says the application of the maximalization operator prerequires an ordering criterion that orders objects on a scale. The operator maps sets of events that are (partially) ordered by the ordering criterion onto sets of maximal events. For *-wán*, as well as for *-diào*, I assume that they introduce ordering criteria that order runtimes of events and objects respectively on a scale. However, in the two cases, the *Max* operator does not apply to the sets of ordered events directly, instead, it maps the ordered sets of runtimes of events (or the sets of objects) onto sets of maximal runtimes of events (or maximal objects), and via the homomorphic relations to events, maximal events are also obtained.

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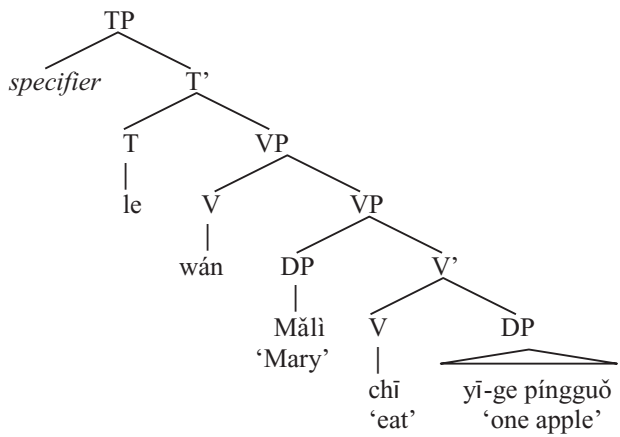
(38)



The reason why I assume *-wán* applies at the VP level rather than the V level is that it makes a right prediction about the data. If we assume it applies at the VP level, it predicts that *-wán* cannot co-occur with the progressive formative *(zhèng)zài*, provided that *-wán* is an aspectual marker ('outer aspect'), which moves to the functional projection of AspP in PF. This is because formal expressions of members that belong to the same category should be in complementary distribution (see Filip & Rothstein 2005 for the same reasoning for the aspectual expressions in Slavic languages). Both the progressive formative *(zhèng)zài* and *-wán* belong to the category of outer aspect, and thus they should not co-occur. This prediction is borne out. Consider (39).

(39) *Mǎlì zhèngzài chī(*-wán) yī-ge píngguǒ.*
Mary PROG eat-TERM one-CLF apple

By contrast, as shown below, *-diào* applies at the V level (or 'inner aspect'), and the analysis successfully predicts that it is compatible with the progressive form.

The analysis of *-wán* makes another valid prediction about the data. It predicts that we cannot apply *-wán* to the VP telicized by *-diào* because it would amount to telicizing what already is a telic predicate, but this kind of aspectual operation is generally excluded, for example, the application of progressive to a progressive form generally results in ungrammatical expressions: **John was being running* (Filip & Rothstein 2005). This prediction is borne out. Consider (10), which is repeated in (40).

(40) *Mǎlì chī-diào(*-wán)-le yī-ge píngguǒ.*
Mary eat-CULM-TERM-PFV one-CLF apple

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As mentioned above, I assume that *-le* is largely a relative past tense marker when used with RVC predicates. I adopt the tense rule formulated by Zucchi & White (2001: 250) as the denotation for *-le*, which is presented as follows.

(41) $[_{TP[past]}\ S] \Rightarrow \lambda e \lambda t_r[t_r < now \wedge \tau(e) \subseteq t_r \wedge S'(e)]$

The representation says that past tense is a precedence relation held between the reference time t_r, which contains the runtime of the denoted event, and the speech time. Note that Zucchi & White (2001) used the same variable t_r for the reference time introduced by the tense node as the one introduced in the *Max* operator. This follows the common treatment of tense in DRT, that is, using the same variable for the reference time at various stages when constructing the semantic representation of the sentence. In a simple case where the sentence refers to a particular event such as (38), the variable t_r introduced by *-le* and the variable t_r are bound by the same existential quantifier. In the derivations presented below, for the space, I will only present the composition of *-le* for the first derivation in (42) and skip for the rest.

A derivation of the sentence in (38) is provided below. Following Krifka (1995), I assume classifiers denote a NU (natural unit) function which measures the number of objects. I treat the classifier construction like a normal indefinite noun phrase, and assume the analysis that the variable introduced by it is existentially bound immediately as opposed to the Kamp–Heim analysis for English indefinite NPs which says such a variable is bound at the discourse level.

(42) (a) *apple*
$[\![\text{pingguo}]\!] = \lambda x[\text{apple}'(x)]$

(b) *one apple*
$[\![\text{yi-ge pingguo}]\!] = \lambda P \lambda y \lambda t \lambda e \exists x[P(x,y,t,e) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1]$

(c) *eat*
$[\![\text{chi}]\!] = \lambda x \lambda y \lambda t \lambda e[\text{eat}'(e) \wedge \textsc{ag}(e, y) \wedge \textsc{pat}(e, x) \wedge \textsc{time}(e, t)]$

(d) *eat one apple*
$[\![\text{chi yi-ge pingguo}]\!] = \lambda P \lambda y \lambda t \lambda e \exists x[P(x,y,t,e) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1]$
$(\lambda x \lambda y \lambda t \lambda e[\text{eat}'(e) \wedge \textsc{ag}(e, y) \wedge \textsc{pat}(e, x) \wedge \textsc{time}(e, t)])$
$= \lambda y \lambda t \lambda e \exists x[\text{eat}'(e) \wedge \textsc{ag}(e, y) \wedge \textsc{pat}(e, x) \wedge \textsc{time}(e, t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1]$

(e) *Mary*
$[\![\text{Mali}]\!] = \lambda P \lambda e[P(M,e)]$

(f) *Mary eats one apple*
$[\![\text{Mali chi yi-ge pingguo}]\!] = \lambda P \lambda e[P(M,e)](\lambda y \lambda t \lambda e \exists x[\text{eat}'(e) \wedge \textsc{ag}(e, y) \wedge \textsc{pat}(e, x) \wedge \textsc{time}(e, t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1])$
$= \lambda t \lambda e \exists x[\text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1]$

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(g) *-wan*
$= \lambda P \lambda t \lambda e[P(t, e) \wedge \mathit{Max}(\lambda s \exists e'[P(s, e') \wedge \tau(e') \subseteq t_r], t)]$

(h) *-wan* (*Mary eats one apple*)
$[\![\textit{wan}$ Mali chi yi-ge pingguo$]\!] = \lambda P \lambda t \lambda e[P(t,e) \wedge \mathit{Max}(\lambda s \exists e'[P(s,e') \wedge \tau(e') \subseteq t_r], t)]$
$(\lambda t \lambda e \exists x[\text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1])$
$= \lambda t \lambda e \exists x[\text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1 \wedge \mathit{Max}(\lambda s \exists e' \exists x[\text{eat}'(e') \wedge \textsc{ag}(e',M) \wedge \textsc{pat}(e',x) \wedge \textsc{time}(e',s) \wedge \text{apple}'(x) \wedge \tau(e') \subseteq t_r], t)]$

(i) *-le*
$= \lambda e \lambda t_r[t_r < \mathit{now} \wedge \tau(e) \subseteq t_r \wedge S'(e)]$

(j) *-le* (*-wan* (*Mary eats one apple*))
$[\![\textit{le wan}$ Mali chi yi-ge pingguo$]\!] = \lambda e \lambda t_r[t_r < \mathit{now} \wedge \tau(e) \subseteq t_r \wedge S'(e)]$
$(\lambda t \lambda e \exists x[\text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1 \wedge \mathit{Max}(\lambda s \exists e' \exists x[\text{eat}'(e') \wedge \textsc{ag}(e',M) \wedge \textsc{pat}(e',x) \wedge \textsc{time}(e',s) \wedge \text{apple}'(x) \wedge \tau(e') \subseteq t_r], t)])$
$= \lambda t \lambda e \lambda t_r \exists x[t_r < \mathit{now} \wedge \tau(e) \subseteq t_r \wedge \text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1 \wedge \mathit{Max}(\lambda s \exists e' \exists x[\text{eat}'(e') \wedge \textsc{ag}(e',M) \wedge \textsc{pat}(e',x) \wedge \textsc{time}(e',s) \wedge \text{apple}'(x) \wedge \tau(e') \subseteq t_r], t)]$

(k) Existential Closure:
$\exists t_r \exists e \exists t \exists x[t_r < \mathit{now} \wedge \tau(e) \subseteq t_r \wedge \text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textsc{nu}(\text{apple})(x)=1 \wedge \mathit{Max}(\lambda s \exists e' \exists x[\text{eat}'(e') \wedge \textsc{ag}(e',M) \wedge \textsc{pat}(e',x) \wedge \textsc{time}(e',s) \wedge \text{apple}'(x) \wedge \tau(e) \subseteq t_r], t)]$
'A past event of Mary eating an apple is an eating event which occurs at a reference time before the speech time and the runtime of the event is included in the reference time, and whose event time is the maximal time interval during which Mary was eating an apple at reference time.'

According to this translation, combining an event predicate *chī yī-ge píngguǒ* 'eat one apple' with *-wán* gives rise to a quantized predicate. Specifically, given the homomorphic relation between the event structure and the time structure, a proper part e' of an event e in the denotation of *chī-wán yī-ge píngguǒ* 'finish eating one apple' can only correspond to a proper part of the time interval during which the event progresses at the reference time t_r. But this means that e' is not in the denotation of *chī-wán yī-ge píngguǒ* 'finish eating one apple' since by the definition of quantization provided in (29), events in this denotation must have the entire time interval at t_r as the time participant. So the resulting predicate is quantized.

When *-wán* combines with atelic predicates like *chī píngguǒ* 'eat apples', which do not specify for the quantity of patient, the resulting predicate is still telic. The final representation of a sentence that contains such a complex predicate is provided as follows:

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(43) *-wan* (*Mary eats apples*)
[[Mali chi pingguo *wan*]] = ∃e∃t∃x[eat′(e) ∧ AG(e,M) ∧ PAT(e,x) ∧ TIME(e,t) ∧ apple′(x) ∧ *Max*(λs∃e′∃x[eat′(e′) ∧ AG(e′,M) ∧ PAT(e′,x) ∧ TIME(e′,s) ∧ apple′(x) ∧ τ(e′)⊆t_r], t)]
'An event of Mary eating apples is an eating event whose event time is the maximal time interval during which Mary was eating apples at reference time.'

According to this translation, combining the atelic predicate *chī píngguǒ* 'eat apples' with *-wán* also gives rise to a quantized predicate with respect to the time participant. The reason is the same as the one above. A proper part *e′* of an event *e* in the denotation of *chī-wán píngguǒ* 'finish eating apples' only corresponds to a proper part of the time interval during which the event progresses at the reference time t_r. This means that *e′* is not in the denotation of *chī-wán píngguǒ* 'finish eating apples' since by definition events in this denotation must have the entire time interval at t_r as the time participant.

As noted above, expressions with *-wán* always entail termination for the denoted event, which is shown by the entailment of full precedence when two events are put in a temporal sequence. Consider (12), which is repeated in (44). As mentioned above, the discourse entails that the event of eating apples fully precedes the event of wanting to eat a banana.

(44) *Mǎlì chī-wán-le píngguǒ, hái bú gòu, hái xiǎng chī xiāngjiāo.*
Mary eat-TERM-PFV apple still not enough still want eat banana
'Mary finished eating apples. It was not enough. She still wanted to eat a banana.'

In the current analysis, the termination entailment is explained as follows. The function of maximalization over time that *-wán* denotes necessarily takes the entire run time of the event as the input, which includes the initial and the final points of the event time. This gives rise to an effect such that we can infer that the event reaches some specific final point, which is the point at which the event terminates. So *-wán* entails termination of the event. To account for the full precedence entailment in (44), we may postulate that terminated events are treated like units and by default they prohibit an overlapping interpretation with other events expressed in discourse.

We also noted above that the morpheme *-wán* does not just entail termination for the denoted event but also culmination with respect to the patient, regardless of whether the patient is expressed by a classifier construction *yī-ge píngguǒ* 'one apple', which specifies the quantity, or a bare noun *píngguǒ* 'apple', which does not specify the quantity. The example is presented in (45), which is repeated from (15).

(45) *#Mǎlì chī-wán-le (yī-ge) píngguǒ, hái shèng liǎng-kǒu, bèi wǒ chī-le.*
Mary eat-TERM-PFV one-CLF apple still left two-bite PASS I eat-PFV
'#Mary finished eating an/the apple. Part of it was left over and I ate it.'

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The culmination reading in this case comes as a surprise at first thought since we normally would expect quantization over time should be effective only in the temporal domain. However, this effect in the nominal domain follows naturally in the current framework. I first assume that the two noun phrases are just normal noun phrases in the sense that they have the properties that we normally assume noun phrases have, such as referentiality, definiteness, and specificity. Given the definition of the framework we assume here, transferring mereological properties from one structure to another via homomorphism would have an effect that maximalization over one argument also obtains for the other. In the case of (45), maximalization over time, a function of *-wán*, puts a constraint on the time structure, whose mereological properties are then transferred to the event structure by the homomorphic relationship between them. But since the event is in turn homomorphically related to the patient, this will in turns ensures that we get constraints on the patient such that it will have a kind of maximal reading of the patient as well. If the noun phrase is *yī-ge píngguǒ* 'one apple', it is one apple that is picked out as the maximal patient. If it is a bare noun *píngguǒ* 'apple', it is a contextually specific amount of apples that is picked out as the maximal patient. In either case, the patient is maximal, which means all parts of it are affected in the event, and the event culminates with respect to it.

The proposed analysis of *-wán* also allows it to be compounded with atelic predicates such as activities e.g. *xiào* 'laugh' and *yóu-yǒng* 'swim', and semelfactives e.g. *qiāo* 'knock' and *késòu* 'cough'. In this case, the patient structure is irrelevant as there is no patient involved in those types of events or the patient is not an incremental theme (e.g. *qiāo* 'knock'). Such a predicate compounded with *-wán* is quantized because, for example, a proper part e' of an event of swimming e can only correspond to a proper part of the time interval during which the swimming event e progresses at reference time, which means e' is not in the denotation of the predicate *yóu-wán-yǒng* 'finish swimming' as it does not have the entire time interval at reference time as the time participant.

4.2 *Analyzing -diào*

As mentioned above, *-diào* is restricted to the type of eventive predicates which denote the kind of events in which the patient undergoes change of state and disappears as a natural ending. So I assume that *-diào* presupposes the verb it compounds with is a verb that takes an object of incremental theme. The entire compound depicts two stages of a dynamic event: a process subevent, in which the patient undergoes gradual change of state as the event progresses, and a result subevent, in which the patient's state of not existing is obtained. What *-diào* specifically describes is the transition of the patient from being in the state of existing to the state of being not existing.[12] For the semantics of telicity

[12] Thanks to one of the reviewers.

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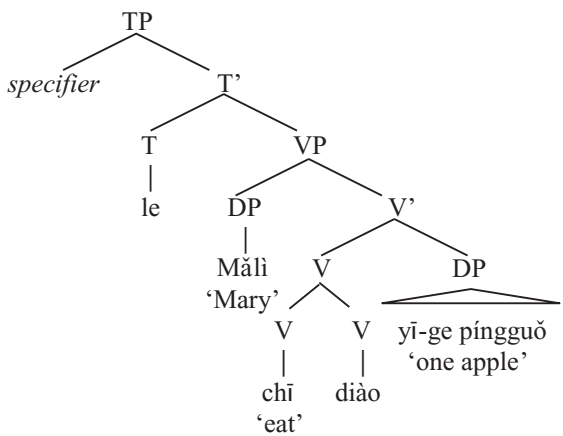
that *-diào* contributes to the entire compound, I assume it arises from maximalization over patient, following Zucchi & White (2001). Specifically, I propose that it denotes a function that also contains such a *Max* operator that maps the patient involved in the event at reference time t_r onto a maximal entity, which I call the maximal patient participant. The formalization for *-diào*, as presented in (46), is derived from Zucchi & White's (2001) translation of maximal patients (see Section 3.2). It is decomposed from their translation by introducing a λ-abstraction over the predicate while remaining the *Max* operator that picks out the maximal patient participant.

(46) $[\![\text{diao}]\!] = \lambda P \lambda y \lambda x \lambda t \lambda e[P(y,x,t,e) \wedge \mathit{Max}(\lambda z \exists e' \exists s[P(y,z,s,e') \wedge \tau(e') \subseteq t_r], x)]$

The definition says that *-diào* is a function that takes the verb for the process subevent as an argument and saturates the verb's patient argument with a variable that denotes the maximal patient involved in the event at reference time t_r. The structure is presented in (47) where I also assume movements occur in PF.

(47)



This is different from the syntactic representation for the corresponding sentence with *-wán* as I assume that the maximalization operator introduced by *-diào* applies at the V level rather than the VP level. This is motivated by the fact that different from predicates with *-wán*, the predicates with *-diào* can co-occur with the progressive form, as shown in (48).[13]

[13] It is not quite common for the RVC construction to be used in a progressive form. I consulted several Chinese linguists and we all agree that predicates with *-wán* cannot co-occur with the progressive for a natural use of the termination meaning, whereas predicates with *-diào* are significantly better in acceptability when used with the progressive, and are also attested on Google.

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(48) *Mǎlì zhèngzài chī(-diào) yī-ge píngguǒ.*
Mary PROG eat-CULM one-CLF apple

As argued above, if *-diào* applied at the VP level, like *-wán*, then we would expect that it was such kind of aspectual marker ('outer aspect') that could not co-occur with the progressive formative since they belonged to the same category and should be in complementary distribution. However, this prediction is not valid as (48) shows.

For the composition, I assume the same denotations for the components *Mǎlì* 'Mary', *chī* 'eat', and *yī-ge píngguǒ* 'one apple' as those in the *-wán* sentence. The composition of the rest is presented as follows:

(49) (a) *eat-diao*
⟦chi-diao⟧ = λPλyλxλtλe[P(y,x,t,e) ∧ *Max*(λz∃e′∃s[P(y,z,s,e′′) ∧ τ(e′)⊆t$_r$], x)] (λxλyλtλe[eat′(e) ∧ AG(e,y) ∧ PAT(e,x) ∧ TIME(e,t)])
= λxλyλtλe[eat′(e) ∧ AG(e,y) ∧ PAT(e,x) ∧ TIME(e,t) ∧ *Max*(λz∃e′∃s[eat′(e′) ∧ AG(e′,y) ∧ PAT(e′,z) ∧ TIME(e′,t) ∧ τ(e′)⊆t$_r$], x)]

(b) *eat-diao one apple*
⟦chi-diao yi-ge pingguo⟧ = λPλyλtλe∃x[P(x,y,t,e) ∧ apple′(x) ∧ NU(apple)(x)=1]
(λxλyλtλe[eat′(e) ∧ AG(e,y) ∧ PAT(e,x) ∧ TIME(e,t) ∧ *Max*(λz∃e′∃s[eat′(e′) ∧ AG(e′,y) ∧ PAT(e′,z) ∧ TIME(e′,s) ∧ τ(e′)⊆t$_r$], x)])
= λyλtλe∃x[eat′(e) ∧ AG(e,y) ∧ PAT(e,x) ∧ TIME(e,t) ∧ apple′(x) ∧ NU(apple)(x)=1 ∧ *Max*(λz∃e′∃s[eat′(e′) ∧ AG(e′,y) ∧ PAT(e′,z) ∧ TIME(e′,s) ∧ τ(e′)⊆t$_r$], x)]

(c) *Mary eat-diao one apple*
⟦Mali chi-diao yi-ge pingguo⟧ = λPλe [P(M,e)](λyλtλe∃x[eat′(e) ∧ AG(e,y) ∧ PAT(e,x) ∧ TIME(e,t) ∧ apple′(x) ∧ NU(apple)(x)=1 ∧ *Max*(λz∃e′∃s[eat′(e′) ∧ AG(e′,y) ∧ PAT(e′,z) ∧ TIME(e′,s) ∧ apple′(z) ∧ τ(e′)⊆t$_r$], x)])
= λtλe∃x[eat′(e) ∧ AG(e,M) ∧ PAT(e,x) ∧ TIME(e,t) ∧ apple′(x) ∧ NU(apple)(x)=1 ∧ *Max*(λzλe′∃s[eat′(e′) ∧ AG(e′,M) ∧ PAT(e′,z) ∧ TIME(e′,t) ∧ τ(e′)⊆t$_r$], x)]

(d) *Existential closure*
∃e∃t∃x[eat′(e) ∧ AG(e,M) ∧ PAT(e,x) ∧ TIME(e,t) ∧ apple′(x) ∧ NU(apple)(x)=1 ∧ *Max*(λzλe′∃s[eat′(e′) ∧ AG(e′,M) ∧ PAT(e′,z) ∧ TIME(e′,s) ∧ τ(e′)⊆t$_r$], x)]
'An event of Mary eating one apple is an eating event whose patient is the sum of all parts of the apple eaten by Mary at the reference time and the apple Mary ate was one apple.'

According to this translation, the derived event predicate *chī-diào yī-ge píngguǒ* 'eat up one apple' is quantized. Specifically, given that the thematic role of the object assigned by the verb *chī* 'eat' has the property of mapping to object, a proper

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part e' of an event e in the denotation of *chī-diào yī-ge píngguǒ* 'eat up one apple' corresponds to a proper part of the object, which, however, is not the maximal participant of the event e with respect to the reference time. This means that e' is not in the denotation of *chī-diào yī-ge píngguǒ* 'eat up one apple', so by the definition of quantization, the predicate is quantized.

When the object is a bare noun, it receives a specific or definite interpretation. We may explain this interpretation as an effect of the maximalization over patient introduced by the meaning of *-diào.* The final representation of the sentence is presented as follows.

(50) *Mary eat-diao apples*
[[Mali chi-diao pingguo]] = $\exists e \exists t \exists x[\text{eat}'(e) \wedge \textsc{ag}(e,M) \wedge \textsc{pat}(e,x) \wedge \textsc{time}(e,t) \wedge \text{apple}'(x) \wedge \textit{Max}(\lambda z \exists e' \exists s[\text{eat}'(e') \wedge \textsc{ag}(e',M) \wedge \textsc{pat}(e',z) \wedge \textsc{time}(e',s) \wedge \tau(e') \subseteq t_r], x)]$
'An event of Mary eating some/the apple(s) is an eating event whose patient is the sum of all parts of the apple(s) eaten by Mary at the reference time.'

According to the translation, the predicate *chī-diào píngguǒ* 'eat up some/the apple(s)' is quantized. This is because a proper part e' of an event e in the denotation of *chī-diào píngguǒ* 'eat up some/the apple(s)' corresponds to a proper part of the object, which is not the maximal patient participant of the event e at the reference time. So e' is not in the denotation of *chī-diào píngguǒ* 'eat up some/the apple(s)' and thus the predicate is quantized.

As mentioned above, culmination is always entailed when the expression is compounded with *-diào,* regardless of whether the object is a classifier construction *yī-ge píngguǒ* 'one apple' or a bare noun *píngguǒ* 'apple'. In the former case, it entails that the event culminates with respect to a certain apple. In the latter case, the bare noun receives a specific or definite interpretation owing to maximalization of the patient and the sentence entails culmination with respect to the patient. The culmination entailment in the two cases is illustrated by the contradiction of the discourse in (51), which is repeated from (14).

(51) *#Mǎlì chī-diào-le (yī-ge) píngguǒ, hái shèng liǎng-kǒu, bèi wǒ chī-le.*
Mary eat-CULM-PFV one-CLF apple still left two-bite PASS I eat-PFV
'#Mary ate up an/the apple. Part of it was left over and I ate it.'

The culmination entailment in this case, as opposed to the culmination entailment in the case when *-wán* is compounded with an accomplishment (see above), is explained as follows: The function of maximalization over patient that *-diào* denotes necessarily takes all parts of the patient as the input, entailing that all parts of whatever the contextually defined patient at t_r is are affected. This gives rise to an effect such that we can infer that the event culminates with respect to the entire patient. In a consumption event, it entails that all parts of the food are

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consumed. So we can infer that the event culminates with respect to (all parts of) the patient.

We also noted above that expressions compounded with *-diào* entail termination as well, which is shown by the entailment of full precedence when two events are put in a temporal sequence. The example from (13) is repeated in (52). As mentioned above, the discourse entails that the event of eating an apple fully precedes the event of wanting to eat a banana.

(52) *Mǎlì chī-diào-le píngguǒ, hái bú gòu, hái xiǎng chī xiāngjiāo.*
Mary eat-CULM-PFV apple still not enough still want eat banana
'Mary ate up the apple. It was not enough. She still wanted to eat a banana.'

Our model of the ternary framework can provide an account for the entailment of full precedence in this discourse. Given the homomorphic relation between the three structures of event, patient, and time, maximalization over the patient would cause a transfer of mereological properties from the patient structure to the event structure, picking out the maximal event, and then a transfer of mereological properties from the event structure to the time structure, picking out the maximal time of the event, which is a time stretch that includes the initial and final points of the event, therefore event termination is entailed. So by using *-diào*, which directly expresses culmination, the speaker indirectly expresses termination. This explains why (52) entails the event of eating an apple terminates before Mary wanted to eat a banana.

4.3 *Accounting for the non-culmination reading of non-RVC accomplishments*

Recall that the non-RVC accomplishments do not entail culmination when used with *-le*. This is explained as follows: The culmination reading arises due to an effect of maximalization, which is contributed by an external source such as the RVC morphemes *-wán* and *-diào*; since *-le* is a relative past tense marker which contains no maximal relation, it cannot provide any maximalization and thus cannot give rise to culmination. But note that such accomplishments do not exclude culmination interpretations. When the context and world knowledge provide certain clues, they may allow culmination interpretations, which, however, are conversational implicatures and are cancelable.[14]

5. Conclusion

This study investigates the semantics of two telicizing morphemes in Mandarin Chinese, *-wán* and *-diào*. It starts out with findings in previous studies which said

[14] Due to the limitation of space, see Tatevosov (2008), Koenig & Chief (2008), Demirdache & Martin (2015), and Beavers & Lee (2020), among others, for more discussion on non-culmination interpretations of accomplishments.

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that accomplishments in Chinese do not entail culmination but the culmination reading is obtained if they are compounded with a resultative morpheme such as *-wán*. The *for/in-* adverbial diagnostics do show that compounding with *-wán* results in a telic predicate. However, I argue that *-wán* does not express completion or culmination, which would make it a case of telicization that has no difference from the kind of telicity that has been the focus of much prior work, that is, telicity obtained through a constraint on the patient. I argue that *-wán* actually expresses terminative – the event comes to an end, which does not even require the verb to select for a patient. Such a predicate is telic because the event with respect to a particular runtime (i.e. event time) does not have a proper part that is the same event with respect to the same runtime. I specifically analyzed this as time maximalization, following Zucchi & White's (2001) maximalization over patient. This morpheme suggests that there is another avenue to telicity, namely, the runtime of event, which has not received much attention in previous studies. In addition to *-wán*, I also studied the resultative morpheme *-diào*, which is also a common morpheme used to telicize accomplishments. The morpheme *-diào* shows a more canonical case of telicization – it requires the verb it compounds with selects for a maximal patient and expresses culmination with respect to the patient. So the two morphemes *-wán* and *-diào* show us two different avenues to telicity.

The analysis is cast in the mereological framework developed by Krifka (1989, 1992, 1998). Following Zucchi & White (2001) as well as Filip & Rothstein (2005), Filip (2008, 2017), and Kardos (2016), I also adopt a maximalization analysis and extend it to time. The proposed analysis is based on a ternary framework which consists of three homomorphically related structures, namely, event, patient, and time. Telicity through time is analyzed as a quantized reference to time with an assumption that the run time of event is a semantic argument. Such a predicate is quantized because the maximal run time does not have a proper part that is still the maximal run time at reference time, given homomorphic relations, no proper part $e' \subset e$ bears the same predicate applied to e with respect to the run time at reference time. In parallel, telicity through patient is analyzed in terms of quantized reference for a patient DP. Such a predicate is quantized because the maximal patient does not have a proper part that is still the maximal patient at reference time, given the homomorphic relations, no proper part $e' \subset e$ bears the same predicate applied to e with respect to the same amount of patient.

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