Semantic Constraint on Preposition Incorporation of Postverbal Locative PPs in Mandarin Chinese

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Abstract
Other than subcategorized argument locative PPs (e.g. 放在桌子上 *fàng zài zhuōzi-shàng* 'put on the table'), the postverbal position in Modern Mandarin Chinese can only be filled by limited types of adjunct locative prepositional phrases (e.g. 跳在桌子上 *tiào zài zhuōzi-shàng* 'jump onto the table'). Among these postverbal adjunct locative PPs, only a small set of PPs permits the incorporation of the preposition into the preceding verb to form a V-P compound ("preposition incorporation"), yielding their previous prepositional object to surface as the object of the compound verb V-P. Previous studies claim that adjunct phrases which quantify an event, such as event delimiters, may behave like arguments ("the delimiter hypothesis"). Yet, our observation of Chinese finds that adjunct locative PPs that are not an event delimiter (e.g. directional 向 *xiàng*/往 *wǎng* 'toward' PPs or non-directional 在 *zài* 'at' PPs) can also allow their prepositional object to appear as the verbal object. This thus calls for a modification of the widely accepted delimiter hypothesis. We argue that the semantic characterization of the postverbal locative PPs permitting PI can be generalized as being associated with the denotation of a scalar result. Specifically, we understand "result" from the perspective of "scale structure" proposed in recent studies and argue that in addition to delimiting an event (that is, introducing a closed scale to the event from the scalar perspective), such PPs can also add directional information (an open scale) to the event that they modify or further specify scalar information for the event denoted by the VP. This work not only provides a unified analysis of most types of preposition incorporation that involve the postverbal locative PPs in Mandarin Chinese, but is also the first study that provides a comprehensive analysis of the scalar properties and functions of Chinese locative PPs. Our findings from the Chinese data will also contribute to the cross-linguistic semantic generalization of internal adjuncts and the domain of extended direct case assignment.

Keywords: postverbal locative PP, scale, internal adjunct, added argument, preposition incorporation, result, event delimiter, word order

1. Introduction

1.1 Background: Locative NPs appearing as the object of V-P compound and the delimiter hypothesis

Object is syntactically realized differently across different languages. For instance, object NPs often have accusative case marking in languages such as Korean (1), whereas in

languages with fewer morphological markers, word order may play the key role in object marking. For example, as Modern Mandarin Chinese (hereafter "Chinese") is mainly an SVO language (Sun & Givón 1985, cf. Li & Thompson 1974, among many others), an object argument is usually found in the position after the verb in a prototypical transitive sentence (2).

(1) 그녀가 사과를 먹었다
Geunyeo-ga *sagwa-leul* *meogeo-ssda.*
3SG-NOM apple-ACC eat-PAST
'She ate an apple.'[1]

(2) 她吃了一個蘋果
tā *chī-le* *yī* *ge* *píngguǒ*
3SG eat-PFV one CLF apple
'She ate an apple.'

This paper uses the term "locative" to cover all spatial expressions including both non-directional (e.g. PPs headed by 在 *zài* 'at') and directional phrases (e.g. PPs head by 向 *xiàng* 'toward'). While themes and patients frequently appear as object arguments, locatives that are not inherent arguments of intransitive verbs or transitive verbs can appear as added arguments of these verbs in Chinese. In (3a), the PP 在桌子上 *zài zhuōzi shàng* 'on the table' that occurs after the verb 跳 *tiào* 'jump' is not subcategorized by the verb. Instead, the locative 桌子上 *zhuōzi shàng* 'the table' becomes the added argument, after the verb 跳 *tiào* and the preposition 在 *zài* form one constituent V-P.[2] The compounding of V and P is evidenced by the fact that the verbal suffix for perfective aspect 了 *le* attaches to P 在 *zài* in (3b) and cannot intervene between V and P in (3c). As such, the NP 桌子上 *zhuōzi shàng* 'table-on' appears as the object of the compound verb 跳在 *tiào-zài* 'jump-at' (Li 1990:59).

(3) a. 小貓**跳**在桌子上
xiǎomāo ***tiào*** *zài zhuōzi-shàng*
kitten jump at table-on
'The kitten jumped onto the table.'
b. 小貓**跳**在了桌子上
xiǎomāo ***tiào-zài-le*** *zhuōzi-shàng*
kitten jump-at-PFV table-on
'The kitten jumped onto the table.'

[1] Abbreviations: 1/3 SG/PL = 1st/3rd person singular/plural; ACC = Accusative; ADV = Adverbial marker; BA = Object marker; ASP = Aspect marker; CLF = Classifier; COMP = Complement marker; CONT = Continuous marker; CRS = Currently relevant state; NAME = Person name; NOM = Nominative; PASS = Passive marker; PAST = Past tense; PFV = Perfective; POSS = Possessive marker; POT = Potential marker; REL = Relative clause marker; SP = Subject prefix.

[2] Previous studies have proposed that the compounding of V and P occurs to meet constraints of the postverbal structure in Chinese from different perspectives, including Case assignment constraint (Li 1990), prosodic constraint (Feng 2003) or economy constraint (Peck 2008).

c. *小貓**跳**了在桌子上
xiǎomāo* ***tiào-le* *zài zhuōzi-hàng*
kitten jump-PFV at table-on

The above examples illustrate a general phenomenon in which the preposition is incorporated into the preceding verb ("preposition incorporation (PI)", Baker 1988), and the remaining locative NP, which originally is the prepositional object, appears as the verbal object of a complex verb V-P in Chinese (Li 1990: 59).[3]

It is worth noting that the added arguments of the complex verb V-P via the process of PI are distinguished from locative PPs that are inherent arguments of V. For instance, the locative PP 在桌子上 *zài zhuōzi shàng* 'on the table' is an inherent argument of the three-valence verb 放 *fàng* 'put', and such a PP always allows PI when the verb and the preposition are adjacent, as evidenced by the insertion of the verbal suffix 了 *le* in (4a). One major difference between locative PPs being an inherent argument and an adjunct lies in the fact that the deletion of P is permitted in the former (4b), but not in the latter (4c).[4]

(4) a. 張三把書**放**在了桌子上。
ZhāngSān bǎ shū ***fàng-zài-le*** *zhuōzi-shàng*
NAME BA book put-at-PFV table-on
'Zhang San placed the book on the table.'
b. 張三把書**放**（在）桌子上。
ZhāngSān bǎ shū ***fàng*** *(zài) zhuōzi-shàng*
NAME BA book put (at) table-on
'Zhang San placed the book on the table.'
c. 小貓**跳***(在)桌子上。
xiǎomāo ***tiào*** **(zài) zhuōzi-shàng*
kitten jump *(at) table-on

[3] A reviewer raised the question as to whether the original prepositional object can be treated as an object of the compound V-P, because not all elements in the post-verbal position can be taken as an object, and the prepositional objects following V-P do not demonstrate typical syntactic behaviors of object in Chinese, such as null object phenomenon, topicalization, or passivation. The authors are grateful that the reviewer pointed out this issue. As suggested by the reviewer, the discussion of whether the locative NP following V-P after PI can be regarded as a typical object is beyond the scope of our study. For easier discussions, this study treats them as the 'object' of V-P complex verb following Li (1990), who proposes that the locative NP receives Case from the complex verb V-P. What is more relevant to this study is that the locatives appearing as the object of V-P is syntactically closer to verbs than the locatives appearing in the full PP in the postverbal position.

The reviewer also insightfully pointed out that some verbs would semantically not allow collocation with 了 *le,* and questioned whether for these verbs, [V P NP] involves PI. This paper would not explore this question in detail because it is beyond the scope of our study. Our study investigates the semantic conditions that allow verbs and PPs to be reanalyzed as [[V-P]$_V$-*le* NP]. Thus, this study treats only the form of [[V-P]$_V$-*le* NP] as instances of PI. That is, if 了 *le* can appear between the complex verb V-P and the prepositional object, then we regard the given sequence as PI, i.e., [[V-P]$_V$ NP]. If not, we assume the given sequence as having a full postverbal PP within VP, i.e., [V [P-NP]$_P$].

[4] See Peck (2008, Ch4) for a detailed analysis of locative PPs which are analyzed as inherent arguments, added arguments, and adjuncts.

Most importantly, it should be noted that not all adjunct locative PPs can occur in the postverbal position and allow PI. In fact, adjunct locative PPs usually occur in the preverbal position, as illustrated by the source PP and route PP in (5-6) respectively.

(5) a. 我們則**從後門**離開 (BCC)
*wǒmen zé **cóng** **hòu-mén** líkāi*
1PL then from back-door leave
'We then left from the back door.'
b. *我們則離開**從後門**
* *wǒmen zé líkāi **cóng** **hòu-mén***
1PL then leave from back-door

(6) a. 孩子們**沿著大街**跑 (BCC)
*háizimen **yánzhe** **dàjiē** pǎo*
children along street run
'The children ran along the street.'
b. *孩子們跑**沿著大街**
háizimen pǎo **yánzhe **dàjiē***
children run along street

Even when some adjunct locative PPs can also appear in the postverbal position, PI is only available for a small set of locative PPs and verbs. For instance, while PI is allowed with the postverbal 在 *zài* 'at' PP in (3), it is not allowed with the postverbal 在 *zài* PP in (7a).

(7) a. 晚上一個人走在路上不怕嗎 (BCC)
wǎnshàng yī-gè-rén zǒu-zài lù-shàng bùpà ma
night one-CLF-person walk-at road-on not.scared Q
'Aren't you afraid to walk alone at night?'
b. 晚上一個人走在(*了)路上不怕嗎
wǎnshàng yī-gè-rén zǒu-zài (*le) lù-shàng bùpà ma
night one-CLF-person walk-at (*PFV) road-on not.scared Q

What then conditions the range of verbs and adjunct locative PPs that permit PI and that allow locative NPs to surface as the object of V-P compound in Chinese? Cross-linguistic semantic generalizations have been made for the range of adjunct phrases that may behave like arguments, such as accusative adjuncts in Korean (Wechsler & Lee 1996) and Finnish (Karlsson 1983), postverbal adjunct temporal NPs and postverbal adjunct locative PPs in Chinese (Klipple 1991; Peck 2008; Peck 2011; Nam 2012, among others). For example, according to Wechsler and Lee (1996: 651-654), in Korean, only the temporal adjuncts that delimit an event (e.g., durative and iterative adverbials, but not frequency adverbials) can be marked by an accusative case marker, and thus these "event-delimiting adverbials behave like arguments for the purpose of direct case-marking rules." In particular, for the postverbal locative phrases in Chinese, Peck (2008) also argues that the event-delimiting adjunct locative PPs of intransitive verbs or transitive verbs become added arguments of these verbs through PI, and locative phrases are

reanalyzed as the object of the compound V-P. For convenience, this paper uses the term "the delimiter hypothesis" for the proposal put forth in these previous studies.

1.2 Research questions and hypothesis

This study, however, shows counter-examples that call for a modification of the delimiter hypothesis. For instance, some locative phrases appear as the object of the complex verb V-P through PI, even though these PPs are not clear-cut event delimiters. As illustrated in (8a-b), 向王陽明 *xiàng Wáng Yángmíng* 'toward Wang Yangming' denotes a direction for the motion event but does not impose the arrival of the moving object at the endpoint (i.e. the location where Wang Yangming is located); 在外面的椅子上 *zài wàimian de yǐzi shàng* 'on the chair outside' does not delimit the temporal course of the sitting event either, because the 在 *zài* 'at' PP itself denotes a non-directional location. However, the constituency between V and P, which is evidenced by the position of the perfective marker 了 *le*, suggests that the locative NPs surface as the object of compound V-P.

(8) a. [藍靈]蹦蹦跳跳地跑**向了王陽明**，卻在他面前三寸處緊急剎車
(http://m.quledu.com/wcxs-21757-5501053/, accessed 15/11/2016)
*[Lán Líng] bèngbèngtiàotiào de pǎo-**xiàng-le** **WángYángmíng***
NAME bouncing ADV run-toward-PFV NAME
què zài tā miànqián sān cùn chù jǐnjí shāchē
but at 3SG in.front.of three CLF spot emergency brake
'[Lan Ling] ran toward Wang Yangming in a bouncing manner but stopped suddenly three inches in front of him.'

b. [池翠]坐**在了外面的椅子上**，等候醫生的結果 (BCC)[5]
*[Chí Cuì] zuò-**zài-le** **wàimian** **de** **yǐzi-shàng***
NAME sit-at-PFV outside POSS chair-on
děnghòu yīshēng de jiéguǒ
wait doctor POSS result
'[Chi Cui] sat onto the chair outside, waiting for results from the doctor.'

In this study, we will primarily focus on Chinese locative PPs. Following from the perspective of scale structure (Hay et al. 1999; Kennedy 2001; Rappaport Hovav 2008; Rappaport Hovav & Levin 2010, among others), we expand the notion of "result" to include a wider range of semantic denotations and functions of prepositional phrases, in addition to the telicity or the event delimitation. We propose that Chinese adjunct locative PPs can allow its prepositional object to appear as the object of the compound verb V-P through PI if the locative PPs are associated with the denotation of a scalar result. We argue that locative PPs with three types of modifying functions, as in (9), can meet this semantic constraint.

[5] The BCC corpus (http://bcc.blcu.edu.cn/) was developed by the Beijing Language and Culture University Corpus Centre (Xun et al. 2016). When it is not explicitly specified, the data of this study is from the assorted subcorpus of BCC, which is around one billion characters in size. The searches in the BCC corpus were conducted over the course of three periods: November 2015, November 2016, and March 2018.

(9) The three types of locative PPs permitting PI in Chinese
a. a locative PP that introduces a closed scale to the preceding V, e.g., 升到天空 *shēng dào tiānkōng* 'ascend to the sky', 跑到門口 *pǎo dào ménkǒu* 'run to the door'
b. a locative PP that introduces an open scale to the preceding V, e.g., 走向山頂 *zǒu xiàng shāndǐng* 'walk toward the mountain summit', 跑往教室 *pǎo wǎng jiàoshì* 'run toward the classroom'
c. a locative PP that further specifies the scale denoted by the preceding VP, e.g., 睡在床上 *shuì zài chuáng shàng* 'sleep on the bed', 把標語寫在了火車上 *bǎ biāoyǔ xiě-zài-le huǒchē-shàng* 'write the slogan on the train', 跳在桌子上 *tiào zài zhuōzi-shàng* 'jump onto the table'

The traditional notion of "result" in studies such as Vendler (1957) and Dowty (1979) often refers to telicty, boundedness, or delimitation. However, the notion of "result" in this study has a larger coverage. For distinguishing purpose, this paper will use the term "scalar information" to refer to the three types of scalar result information, as outlined in (9). Among the three classes of scalar result meaning associated with locative PPs, only (9a) corresponds to delimitation, whereas (9b) and (9c) are the two additional types of scalar results proposed in this study.

The rest of this paper is structured as follows. In §2, we will introduce the notion of scale and the different scalar properties of Chinese locative PPs. Next, in §3 through 5, we will demonstrate respectively how the three types of locative PPs permitting PI are associated with the denotation of scalar result of the event structure. §6 concludes this study.

2. Scale and the scalar property of PPs

In order to provide a scale-based analysis for the modification of VP by adjunct PPs, we will begin by introducing the notion of scale, using examples such as adjectives, deadjectival verbs and motion verbs in English and Chinese.

2.1 The notion of scale

The notion of "scale" has been proposed in a number of recent studies. A scale can be understood as a set of degrees in the form of points or intervals ordered along dimensions such as distance, length, height, and temperature (Hay et al. 1999; Kennedy 1999; 2001; Kennedy & McNally 2005; Kennedy & Levin 2008; Rappaport Hovav 2008; Beavers 2008; Rappaport Hovav & Levin 2010, among others). An entity with a scalar attribute can be measured by the degrees on the dimension. For instance, the adjective *long* lexicalizes a scale with degrees ordered along the dimension of length. In the sentence "the skirt is long", *long* maps the length of skirt onto degrees ordered along the dimension of length and specifies its value of length to be some degree that exceeds the standard length of skirts. Adjectives that express such relations are called "gradable adjectives" (Paradis 2001; Rotstein & Winter 2004; Kennedy & McNally 2005; Kennedy 2007; among others) or "scalar adjectives" (Lin & Peck 2016).

Previous studies also propose the notion of "scalar change" for the change that occurs along a scale, i.e. a directed change on a particular dimension (Hay et al. 1999; Kennedy

& Levin 2008; Rappaport Hovav 2008; Rappaport Hovav & Levin 2010). For instance, the verb *lengthen* denotes changes along the scale of length toward the direction of "longer degrees". Such verbs are called "scalar change verbs" in literature such as Rappaport Hovav (2008) and Rappaport Hovav and Levin (2010).

The notion of "scale" also exists in the domain of motion events. Specifically, a scale is understood on the dimension of distance, i.e. the distance of the moving object with respect to the reference object. Furthermore, a scale is composed of spatial points that form a path of motion and these points are ordered in the direction of movement (Rappaport Hovav & Levin 2010). A motion verb lexicalizing scalar changes denotes motion that is measurable on the path of motion. For example, *ascend* denotes spatial change along a path against the direction of gravity, and if a moving object ascends, the value on the scale increases.

Verbs can be classified into different types, according to whether or not they denote scalar change and whether or not the scalar change is bounded (see Beavers 2008, and Rappaport Hovav & Levin 2010 for English verbs; Koenig & Chief 2008, Lin 2011, Lin & Peck 2011, Peck et al. 2013 for Chinese verbs, cf. the traditional aspectual classification of verbs such as Vendler 1967 and Dowty 1979 for English, and Tai 1984, Teng 1985, Chen 1988, Xiao & McEnery 2004 for Chinese). Take Chinese motion verbs for example. 退 *tuì* 'recede' and 回 *huí* 'return' are scalar change verbs because they both denote motion on directed paths, whereas 跑 *pǎo* 'run' and 走 *zǒu* 'walk' are nonscalar change motion verbs as the events of running and walking that they denote can be in any direction.

Depending on whether or not the change is bounded, scalar change verbs can be further divided into two types: closed scalar verbs and open scalar verbs. Closed scalar verbs lexicalize an endpoint, whereas open scalar verbs do not. Take motion verbs as examples again. The open scalar motion verb 升 *shēng* 'ascend' expresses an event without any endpoint, so the event of ascending can be continued along the scale without limitation, as in (10); on the contrary, 回 *huí* 'return' is associated with a closed scale, so when the subject arrives at an endpoint, the event of returning is finished, and this event cannot be continued, as in (11) (Lin 2011; Lin & Peck 2011).

(10) 氣球5分鐘前就向上升了，現在應該**升得更高**了
qìqiú *5-fēnzhōng-qián* *jiù* *xiàng* *shàng* *shēng* *le*
balloonin 5-minute-before then toward up ascend CRS
xiànzài yīnggāi ***shēng de gèng gāo*** *le*
now must ascend COMP more high CRS
'The balloon began ascending five minutes ago, now it must have ascended higher.' (Lin & Peck 2011: 350, (24a))

(11) 他五分鐘前就回家了，*現在應該**回得更遠**了
tā *5-fēnzhōng-qián* *jiù* *huí* *jiā* *le*
he 5-minute-before then return home CRS
xiànzài* *yīnggāi* ***huí de gèng yuan* *le*
now must return COMP more far CRS
'He began returning home five minutes ago, #now he must have returned further.' (Lin & Peck 2011: 350, (25a))

"Scale" and "scalar change" have been related to or equated with the notion of "result" and "result verb" in studies of aspectuality (Rappaport Hovav 2008; Rappaport Hovav & Levin 2010, cf. Goldberg 2010; Beavers & Koontz-Garboden 2012; 2017). According to these studies, a verb that lexicalizes scalar change denotes result information, which can be either telic (i.e. closed scalar verbs such as 回 *huí* 'return') or atelic (i.e. open scalar verbs such as 退 *tuì* 'recede'). Previous studies (Rappaport Hovav 2008; Rappaport Hovav & Levin 2010) propose the result diagnostic to differentiate scalar verbs from nonscalar verbs. Scalar verbs (both closed scalar and open scalar verbs) lexicalize a certain kind of result in the dimension of the scale which they are associated with, so they are not compatible with result XPs that specify results on other dimensions;[6] rather, scalar verbs can only collocate with result XPs that specify a point on the same dimension of the scalar change lexicalized in the verb. Take motion verbs as examples again. The closed scalar verb 回 *huí* only allows the resultatives that further specify the result of motion in the path dimension, such as 到 *dào* 'to' PP in (12a), while resultatives other than the spatial dimension such as 丢了鞋子 *diū le xiézi* 'lost shoes' or 累了 *lèi le* 'became tired' (12b-c) are not allowed syntactically, even though it is possible in the real world that the subject can lose her shoes or become tired as a result of a returning event.[7]

(12) a. 她**回**到了學校
tā ***huí****-dào-le* *xuéxiào*
3SG return-arrive-PFV school
'She returned to school.'
b. *她**回**丢了鞋子
tā* ***huí**-diū-le* *xiézi*
3SG return-lost-PFV shoes
(intended) 'She lost her shoes as a result of returning.'
c. *她**回**累了
tā* ***huí**-lèi* *le*
3SG return-tired CRS
(intended) 'She became tired as a result of returning.'

Similarly, the open scalar verb 退 *tuì* is only compatible with a limited type of resultatives that specify the path of motion, as in (13).[8]

[6] This diagnostic is based on the widely observed phenomenon that "an event described by a verb may only have one measuring-out and be delimited only once" ("single delimiting constraint", Tenny 1994: 79, among others).

[7] Refer to Rappaport Hovav (2008) and Rappaport Hovav and Levin (2010) for the more details, regarding resultative diagnostics for English verbs, and refer to Lin (2011), Lin and Peck (2011), Peck et al. (2013), regarding resultative diagnostics for Chinese verbs.

[8] One reviewer raised the question that (12c) and (13c) sound possible. (ia) and (ib) are two examples given by the reviewer.

(i) a. 她最近回家回累了。
Tā *zuìjìn* *huí* *jiā* *huí-lèi* *le*
3SG recently return home return-tired CRS
'She became tired of going back home (frequently) recently.'

(13) a. 敵人**退**到了學校
dírén ***tuì***-*dào-le* *xuéxiào*
enemy recede-arrive-PFV school
'The enemies retreated back to school.'
b. *敵人**退**丟了武器
dírén* ***tuì*-*diū-le* *wǔqì*
enemy recede-lost-PFV weapon
(intended) 'The enemies lost their weapons as a result of retreating.'
c. *敵人**退**累了
dírén* ***tuì*-*lèi* *le*
enemy recede-tired CRS
(intended) 'The enemies became tired as a result of retreating.'

On the contrary, the collocation restriction does not hold for nonscalar verbs as they do not lexicalize any result in any dimension. In other words, nonscalar verbs can collocate with a variety of resultatives. For instance, the resultatives that are not compatible with 回 *huí* 'return' in (12) and 退 *tuì* 'recede' in (13) can occur with the nonscalar motion verb 跑 *pǎo* 'run', as in (14).

(14) a. 她**跑**到了學校
tā ***pǎo***-*dào-le* *xuéxiào*
3SG run-arrive-PFV school
'She ran to school.'
b. 她**跑**丟了鞋子
tā ***pǎo***-*diū-le xiézi*
3SG run-lost-PFV shoes
'She lost her shoes as a result of running.'
c. 她**跑**累了
tā ***pǎo***-*lèi* *le*
3SG run-tired CRS
'She became tired as a result of running.'

To summarize, closed and open scalar verbs differ from nonscalar verbs in that only

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b. 我們一直退，都退煩了！
Wǒmen *yīzhí* *tuì,* *dōu* *tuì-fán* *le*
1SG always recede already recede-tired CRS
'We have been receding all the time, and we are already tired of this.'

The reviewer also points out that resultatives in (ia) and (ib), if permitted in Chinese, modify multiple events of returning or retreating, and thus are different from the type of resultatives described in (12c) and (13c). The authors agree that given supportive context, (ia) and (ib) sound acceptable. However, this study finds that such usages are rarely used in natural language. For instance, we searched in the assorted corpus of BCC (1 billion Chinese characters) for the collocation of "回 *huí* 'recede' / 退 *tuì* 'recede' + 累 *lèi* 'tired/ 煩 *fán* 'tired'/病 *bìng* 'sick'", but no example is retrieved. This search result suggests that 回 *huí* and 退 *tuì* tend not to collocate with a resultative in a non-spatial scale and that the compatibility tests proposed in this study is reliable.

the former lexicalize result information, as illustrated in (12-14). Furthermore, closed scalar verbs differ from open scalar verbs in that the former are inherently telic, whereas the latter are not, as demonstrated by (10) and (11).

2.2 Scalar attributes of PPs and their aspectual function in event composition

It has been argued that PPs can be distinguished from each other in terms of their aspectual properties such as telicity (boundedness) in a way analogous to the aspectual analysis of VPs and NPs (Zwart 2005: 741-742). For example, according to Zwart (2005), sentences with *toward* and *along* PPs describe atelic events, whereas those with *onto* and *out of* PPs have telic interpretations. The difference can be observed from the fact that a VP modified by the former type of PPs is only compatible with *for* adverbials and the VP modified by the latter type of PPs is only compatible with *in* adverbials, as in (15) (see Kearns 2000 for more discussion of the tests with *in*/*for* adverbials).

(15) a. Alex drove **toward the mountains/along the river** **in/for a day*.
b. Alex walked **onto the platform/out of the hotel** *in/*for ten minutes*.
(Zwart 2005:741)

While recent studies have shown that the scale-based analysis is finer-grained than the traditional framework of aspect in explaining the syntactic behavior of verbs, adjectives, and nouns, the scalar attributes and functions of prepositions and PPs are seldom explored. Rappaport Hovav and Levin (2010) are among the first in pointing out that some locative prepositions (e.g. *above, below, near*) lexicalize scalar attributes by locating a theme with respect to a ground. They also point out that unlike scalar motion verbs, scalar prepositions do not denote scalar *changes* in space but only express scalar attributes, and that in this respect scalar prepositions are similar to scalar adjectives (e.g., *cool, warm*). More specifically, it is stated that "being at a position on a path is comparable to having a particular value along a scalar attribute with a change of state verb" (Rappaport Hovav and Levin 2010:9). However, a more comprehensive analysis of the scalar attributes of prepositions and the scalar functions of PPs in the event composition is yet to be carried out.

In what follows, we will discuss the scalar attributes of PPs headed by locative prepositions in Chinese. Based on their scalar properties, we propose a three-way aspectual classification of PPs. The proposed classification is finer-grained than the traditional binary distinction between the bounded and the unbounded PPs in previous studies (Zwart 2005). Among the three types of PPs that we present below, bounded PPs in previous studies correspond to closed scalar PPs; the unbounded PPs in previous studies are further divided into open scalar PPs and nonscalar PPs in this study. We argue that these two types of unbounded PPs should be distinguished from each other because nonscalar PPs do not express any result information, whereas open scalar PPs are resultative.

2.2.1 Bounded PPs: Closed scalar PPs

Bounded PPs are formed from telic prepositions such as *to, out of,* and *onto* (Zwart

2005). These PPs have been generally analyzed as event delimiters (Pustevjosky 1991:63; Tenny 1994:77; Nam 2005:106; among others). As illustrated in (16), a bounded PP such as *to school* adds a direction and a goal (or endpoint) to the path of motion and turns an atelic event into a telic one. The event type (or aspectual class) of the sentence changes after the modification by PPs. This phenomenon has been known as type-shifting (Bach 1986).

(16) a. He walked *for an hour/*in an hour*. (Tenny 1994:77)
b. Carmen walked to school **for an hour/in an hour*. (Tenny 1994:77)

Cross-linguistically, it has been observed that goal locatives tend to participate in the composition of event structure by delimiting the event, as opposed to source or non-directional locatives (for 'source-goal asymmetry' hypothesis, refer to Nam 2005). Goal locatives delimit the event structure of motion event because the path traversed between the beginning and the end point of the motion event corresponds to the temporal course of the event.

In Chinese, 到 *dào* 'to' PP is a typical bounded PP.[9] The modification by 到 *dào* PP type-shifts a previously unbounded event to a scalar event with an explicit bound. Like the English bounded PPs as shown in (16b), when a nonscalar verb 跑 *pǎo* 'run' takes 到 *dào* PP, it is only compatible with *in* adverbials (18b), but not with *for* adverbials (17b).

(17) a. 他跑了一個小時
tā pǎo-le yī ge xiǎoshí
3SG run-PFV one CLF hour
'He ran for an hour.'
b. *他跑**到學校**一個小時了
tā pǎo **dào **xuéxiào** yī ge xiǎoshí le*
3SG run to school one CLF hour CRS
(intended) 'He ran to school for an hour.'

(18) a. *她在一個小時內跑
**tā zài yī ge xiǎoshí-nèi pǎo*
3SG in one CLFhour-inside run
(intended) 'She ran in an hour.'
b. 她在一個小時內跑**到學校**了

[9] Previous studies are not consistent with regard to the grammatical status of post-verbal 到 *dào*. 到 *dào* is analyzed either as a verb, a directional complement (Liu 1998, Lü 1980) or a preposition/coverb (Li & Thompson 1981; Yiu 2014). This study treats the post-verbal 到 *dào* as a preposition because 到 *dào* behaves differently from other directional complements such as 回 *huí* 'return', 過 *guò* 'across', 上 *shàng* 'on', and 下 *xià* 'below'. For example, 到 *dào* must take a locative NP, before it can be followed by a deictic complement 來 *qù*/去 *lái* (see more details in Tang and Lamarre 2007; Lin 2011; Yiu 2014: 545-546).

In addition to 到 *dào* 'to' PP, 至 *zhì* 'to' PP also expresses a closed scale. However, 至 *zhì* 'to' PPs are used with low frequency in Modern Mandarin Chinese, and they are usually limited to the more classical and written variety of Chinese. This paper will mainly focus on the more typical closed scalar PPs headed by 到 *dào* 'to'.

tā *zài yī* *ge* *xiǎoshí-nèi* *pǎo* ***dào*** ***xuéxiào*** *le*
3SG in one CLF hour-inside run to school CRS
'She ran to school in an hour.'

To summarize, when appearing with nonscalar or open scalar verbs, a closed scalar PP introduces a closed-scalar denotation to the event, which makes the given motion event measurable on the closed path.

2.2.2 Unbounded PPs: Nonscalar PPs and open scalar PPs

As introduced earlier, our study further classifies unbounded PPs into two subtypes --- nonscalar PPs and open scalar PPs --- based on their scalar properties and functions. This section details these two subtypes.

2.2.2.1 Nonscalar PPs

In English, non-directional locative PPs headed by prepositions such as *on*, *in*, and *at* are categorized as nonscalar PPs. For instance, (19) shows that the collocation of the PP *in the park* with the nonscalar verb *run* does not specify any particular direction or the endpoint of motion event. Rather, this locative PP only expresses a location where the running event takes place.

(19) a. He ran **in an hour/for an hour*.
b. He ran **in the park** **in an hour/for an hour*.

Similar to English examples, in Chinese, the PPs headed by prepositions such as 在 *zài* 'at', 沿 *yán* (著 *zhe*) 'along', and 繞 *rào* (著 *zhe*) 'around' belong to the category of nonscalar PPs. When these PPs modify a nonscalar motion verb such as 跑 *pǎo* 'run', these collocations do not specify a motion event with any particular direction. As illustrated in (20-21), these collocations are compatible with various types of resultatives.

(20) a. 他**在公園裏**跑累了
tā ***zài gōngyuán-lǐ*** *pǎo-lèi* *le*
3SG at park-inside run-tired CRS
'He was tired as a result of running in the park.'
b. 他**在公園裏**跑丟了鞋子
tā ***zài gōngyuán-lǐ*** *pǎo-diū-le* *xiézi*
3SG at park-inside run-lost-PFV shoes
'He lost his shoes as a result of running in the park.'

(21) a. 他**沿著小河**跑累了
tā ***yánzhe*** ***xiǎohé*** *pǎo-lèi* *le*
3SG along stream run-tired CRS
'He was tired as a result of running along the stream.'
b. 他**沿著小河**跑遠了
tā ***yánzhe*** ***xiǎohé*** *pǎo-yuan* *le*

3SG along stream run-far CRS
'He was further away as a result of running along the stream.'

The result diagnostic used in (20-21) together confirm that PPs headed by prepositions such as 在 *zài*, 沿 *yán* (著 *zhe*), and 繞 *rào* (著 *zhe*) are nonscalar PPs, that is, they do not add any scalar result denotation to the motion events described by verbs (refer to our test for scalar result verb in (12-14)).

Furthermore, the collocation is compatible with *for* adverbials (22), which suggests that the PPs do not add any endpoint to the event.

(22) a. 他**在公園裏**跑了一個小時了
tā ***zài gōngyuán-lǐ*** *pǎo-le* *yī* *ge* *xiǎoshí* *le*
3SG at park-inside run-PFV one CLF hour CRS
'He has been running in the park for an hour.'

b. 他**沿著小河**跑了一個小時了
tā ***yánzhe*** ***xiǎohé*** *pǎo-le* *yī* *ge* *xiǎoshí* *le*
3SG along stream run-PFV one CLF hour CRS
'He has been running along the stream for an hour.'

In Chinese, the modification by these nonscalar PPs do not type-shift the event types denoted by the VPs they modify. In other words, nonscalar PPs do not participate in the event composition.

2.2.2.2 Open scalar PPs

Open scalar PPs are PPs headed by prepositions which denote an open-ended direction, such as *toward* in English. For instance, *walk toward the store* denotes a motion event on an unbounded path scale, in contrast to *walk to the store* that denotes a motion event on a bounded path (Rappaport Hovav 2008: 7). According to the BCC assorted subcorpus, 向 *xiàng* 'toward' and 往 *wǎng* 'toward' are the most frequently used prepositions expressing unbounded direction in Chinese.[10] The distributions of 向 *xiàng* PPs and 往

[10] In Modern Chinese, 朝 *cháo* 'toward' is another preposition that denotes unbounded direction, and it is less frequently used than 向 *xiàng* and 往 *wǎng*. While 向 *xiàng* and 往 *wǎng* appear both preverbally and postverbally, 朝 *cháo* predominantly occurs in the preverbal position. In terms of grammaticalization, 朝 *cháo* developed into a directional preposition in a way different from 向 *xiàng* 'toward' and 往 *wǎng* 'toward'. According to Ma (2002), both 向 *xiàng* and 往 *wǎng* were motion verbs in Old Chinese and appeared before or after another verb. After 向 *xiàng* and 往 *wǎng* were grammaticalized from verbs into prepositions, the prepositions 向 *xiàng* and 往 *wǎng* continued to appear in either the preverbal or the postverbal positions and modify motion verbs as well as verbs in other domains. In contrast, 朝 *cháo* originally was a transitive verb referring to 'visit (god, king, etc.) with respect'; in Yuan and Ming dynasties, the preposition 朝 *cháo* was used to specify the direction in which an agent is facing, rather than the direction toward which a motion event progresses, as in (i).

(i) 宋江便向杌子上**朝著床邊**坐了 (《水滸》, cited from Ma 2002: 88)
SòngJiāng *biàn* *xiàng* *wùzi-shàng* ***cháozhe*** ***chuángbiān*** *zuò* *le*
NAME then toward stool-on toward bedside sit CRS
'Song Jiang then sat onto the stool facing the bedside.'

wǎng PPs have been discussed in a variety of studies (Lü 1980; Fan 1990; Zhao 2002; Fang 2004; Wang 2004; Liu & Zhao 2005; Cui 2007; Lamarre 2007; 2013; Tang & Lamarre 2007, among others). Where the compatibility with verbs is concerned, previous studies (e.g., Lü 1980; Zhao 2002; Fang 2004; Wang 2004) observe that 向 *xiàng* PP is the least restricted in terms of the verbs they can modify, whereas 往 *wǎng* PP typically only modifies spatial motions and describes the direction of the spatial changes that involve the whole body of the subject (23). Furthermore, the verbs that can occur with the postverbal 往 *wǎng* are even more restricted --- only about 20-30 verbs according to Lü (1980) and Fang (2004).

(23) a. 他**向/往我**走來
tā ***xiàng / wǎng*** ***wǒ*** *zǒu* *lái*
3SG toward/toward 1SG walk come
'He walked toward me.'
b. 他的腿**向/*往我**踢來
tā *de* *tuǐ* ***xiàng/ *wǎng*** ***wǒ*** *tī* *lái*
3SG POSS leg toward/toward 1SG kick come
'His leg kicked toward me.'

Despite the differences between the range of verbs that can collocate with 向 *xiàng* 'toward' PPs and 往 *wǎng* 'toward' PPs, both PPs lexically denote open scalar attributes. Like nonscalar PPs, open scalar PPs are unbounded and thus do not impose any endpoint, unlike bounded/closed scalar PPs.[11] The examples in (24-25) show that the motion events modified by the open scalar 向 *xiàng* PP are unbounded and do not entail the arrival at an endpoint: In (24), the collocation of the 向 *xiàng* PP and the nonscalar verb 跑 *pǎo* 'run' can be followed by *for* adverbials (一個時辰 *yī ge shíchen* 'two hours'); In (25), the implication of the arrival at the potential endpoint can be cancelled.

(24) a. [他們]**向山上**又跑了大約一個時辰。
[tāmen] *xiàng* *shān-shàng* *yòu* *pǎo* *le* *dàyuē* *yī* *ge* *shíchen*
3PL toward mountain-on again run PFV about one CLF two.hour
'They ran toward the mountain for about two hours.' (BCC)
b.*他們在一個時辰內**向山上**跑了。
**tāmen* *zài* *yī* *ge* *shíchen-nèi* *xiàng* *shān-shàng* *pǎo* *le*
3PL in one CLF two.hour-inside toward mountain-on run CRS

朝 *cháo* functioning as a preposition that modifies motion verbs and specifies the direction of motion is a very recent development. A search in the BCC corpus returns only a few examples where 朝 *cháo* occurs after motion verbs, as in (ii).

(ii) 有如巨鷹飛**朝天空** (BCC)
yǒurú *jù* *yīng* *fēi* ***cháo*** ***tiānkōng***
like giant eagle fly toward sky
'[She] flew toward the sky like a giant eagle.'

[11] Traditionally 'toward' has been analyzed as denoting "the initial subpaths of the paths of *to*" and having the 'partitive' property of the preposition *to* (Jackendoff 1991; Pinon 1993; Krifka 1998, see more details in Zwart 2005).

(intended) ‘They ran toward the mountain within two hours.’

(25) 一會兒後羅布回來了，**向餐桌**走來的半路上停了下來，轉身到水池洗幹淨雙手 (BCC)

yīhuìr *hòu* *LuóBù* *huí-lai* *le*
in.a.moment after NAME return-hither CRS
xiàng cānzhuō *zǒu-lái* *de* *bànlù-shàng* *tíng* *le* *xià-lai*
toward dining.table walk-hither REL halfway-on stop PFV desceond-come
zhuǎn-shēn *dào* *shuǐchí* *xǐ-gānjìng* *shuāng-shǒu*
turn.body arrive sink wash-clean two-hands
‘Luo Bu came back in a moment. On his way walking toward the dining table, he stopped and turned around to wash his hands in the sink.’

However, albeit expressing an unbounded direction, a ‘toward’ PP can introduce a scale, when it modifies a motion verb. As illustrated in (26), the collocation of a motion verb and a 向 *xiàng* ‘toward’ PP can only be followed by resultatives that further specify the path or provide an endpoint of the path, but not resultatives on other dimensions, in contrast to the nonscalar PPs in (20-21).

(26) a. [許多人]**向南**跑到河下遊的貝亞丁種植園 (BCC)

[*xǔduō* *rén*] ***xiàng nán*** *pǎo* *dào* *hé* *xiàyóu* *de*
Many people toward south run to river downstream POSS
Bèiyàdīng *zhòngzhíyuán*
NAME plantation
‘Many people ran southward to Beiyading plantation at the downstream.’

b. *__向南__跑丟了鞋子

xiàng nán *pǎo-diū-le* *xiézi*
toward south run-lost-PFV shoes

c. *__向南__跑累了

xiàng *nán* *pǎo-lèi* *le*
toward south run-tired CRS

Through a search of the sequence consisting of 向 *xiàng* ‘toward’ PP followed by 跑 *pǎo* ‘run’ in the BCC assorted corpus, we find that of the 3,906 results, all the resultatives that can follow the sequence tend to be directional or goal complements that is compatible with the same path dimension specified by the 向 *xiàng* PP, e.g., 出去 *chūqù* ‘out’, 回去 *huíqu* ‘back’, 到 *dào* ‘to’, 來 *lái* /去 *qù* ‘hither/thither’. As in (27a), 回去 *huíqu* ‘back’ further specifies the direction of running, and the goal location denoted by 到 *dào* A, B 之間 *zhījiān* ‘to the middle of A and B’ in (27b) delimits the event of running with an endpoint.

(27) a. 我立刻**向客棧的方向**跑回去了 (BCC)

wǒ *lìkè* ***xiàng kèzhàn de fāngxiàng*** *pǎo* *huí-qu* *le*
1SG immediate toward guest.house POSS direction run return-thither CRS
‘I ran toward the direction of the guest house immediately.’

b. **向前**跑到 A、B 之間 (BCC)
xiàng qián *pǎo dào A, B zhījiān*
toward front run to A, B between
'Run forward into the middle of A and B.'

The corpus investigation confirms that the collocation of motion verb 跑 *pǎo* 'run' and 向 *xiàng* 'toward' PPs expresses a scalar result. Recall that in (14), the bare nonscalar verb 跑 *pǎo* can occur with resultatives of different dimensions, but when the verb is modified by the open scalar PPs, as in (26-27), the PPs type-shift the nonscalar events to open-scalar change events. Specifically, the addition of 'toward' PPs to motion verbs allows the traversed distance to become measurable on the path scale. As the motion proceeds over time, the moving object gets further away from the source and proceeds along the given path scale. In this sense, we argue that it is necessary to distinguish open scalar PPs from nonscalar PPs which do not introduce any scale to the verbs they modify.

In what follows, we will show that Chinese adjunct locative PPs can allow their prepositional object to appear as the object of the compound verb V-P through PI when these adjunct PPs are associated with the denotation of a scalar result. In §3-5, we will demonstrate that the locative PPs with three types of modifying functions (as mentioned in (9) in §1.2) can meet this semantic condition: locative PPs introducing a closed scale to an event (§3), locative PPs introducing an open scale to an event (§4), and locative PPs further specifying a scale expressed in the preceding VP (§5). Note that the first and the second types of the adjunct locative PPs directly participate in the event composition with their type-shifting functions, whereas the third type of adjunct locative PPs modifies a subpart of the event expressed by their preceding scalar change VPs.

3. Locative PP introducing a closed scale

Not only can a closed scalar 到 *dào* 'to' PP follow nonscalar verbs (as shown in §2.2.1), it can also follow open scalar motion verbs such as 升 *shēng* 'ascend' and 退 *tuì* 'recede' and add telicity to these originally atelic VPs. For instance, the verb 升 *shēng* denotes the upward motion against the direction of gravity but does not impose an endpoint of the motion event. As illustrated in (28), the event of ascending obtains an endpoint (i.e. 天空 *tiānkōng* 'sky'), only when 升 *shēng* co-occurs with the endpoint denoting 到 *dào* PP.

(28) a. *氣球在一個小時之內升了
qìqiú *zài yī ge xiǎoshí zhīnèi shēng le*
balloon at one CLF hour within ascend CRS
(intended) 'The balloon ascended within an hour.'
b. 氣球在一個小時之內升**到天空**
qìqiú zài yī ge xiǎoshí zhīnèi shēng ***dào tiānkōng***
balloon at one CLF hour within ascend to sky
'The balloon ascended to the sky within an hour.'

到 *dào* PPs with such a delimiting function are only found in the postverbal position. As illustrated in (29a), when 到 *dào* occurs before the motion verb 跑 *pǎo* 'run', the whole

sequence "到 *dào* + NP + 跑 *pǎo*" denotes two successive motion events, that is 'arrive at the school' and 'run'. Such a sequence is usually analyzed as a serial verb construction where 到 *dào* 'arrive' functions as an independent verb rather than a preposition. For example, as illustrated in (29b), 到 *dào* can be suffixed by the perfective marker 了 *le*. Furthermore, 到 *dào* in the preverbal position is not semantically compatible with some motion verbs due to world knowledge, e.g., (30), which does not sound natural because a balloon usually does not go to the sky first before it ascends.

(29) a. 她**到學校**跑
tā ***dào*** ***xuéxiào*** *pǎo*
3SG arrive school run
'She arrived at school and ran there.'
b. 她**到了學校**跑
tā ***dào*** ***le*** ***xuéxiào*** *pǎo*
3SG arrive PFV school run
'She arrived at school and ran there.'

(30) ? 氣球**到天空**升
qìqiú ***dào*** ***tiānkōng*** *shēng*
balloon arrive sky ascend
(intended) 'The balloon arrived at the sky and ascended there.'

When the preposition 到 *dào* 'to' appears in the postverbal position, 到 *dào* is incorporated into the preceding verb and form a compound verb. The constituency of V-到 *dào* is confirmed by the attachment of the perfective aspect marker 了 *le* to the V-到 *dào,* as shown in (31-32). Furthermore, with 到 *dào* being incorporated, the locative NP appears as the object of the compound verb V-到 *dào*, as in (31a) and (32a).

(31) a. 她跑**到了學校**
tā *pǎo-**dào**-le* ***xuéxiào***
3SG run-to-PFV school
'She ran to school.'
b. *她跑了**到學校**
tā *pǎo-le* ***dào*** ***xuéxiào***
3SG run-PFV to school

(32) a. 氣球升**到了天空**
qìqiú *sheng-**dào**-le* ***tiānkōng***
balloon ascend-to-PFV sky
'Balloon ascends to the sky.'
b. *氣球升了**到天空**
qìqiú *sheng-le* ***dào*** ***tiānkōng***
balloon ascend-PFV to sky

Regarding the semantic constraint for the postverbal locative PPs that allow PI in

Chinese, previous studies propose that event-delimiting locative adjuncts, as in (31-32), may appear as the added arguments (the delimiter hypothesis, see Klipple 1991; Peck 2008; Nam 2012). While the PI case of 到 *dào* 'to' PPs in Chinese can be accounted for by the delimiter hypothesis, we observe that there is a much wider range of adjunct locative PPs that allow PI, including PPs that do not introduce a closed scale to an event. Thus, we need a finer-grained analysis of the semantic constraint on these PI phenomena. The analysis for these PPs will be provided in the following two sections.

4. Locative PP introducing an open scale

In §2.2.2.2, we have shown that when open scalar 向 *xiàng* 'toward' PPs occur with nonscalar motion verbs, these PPs add an open scale (i.e. unbounded scale) to an event and shift the originally nonscalar event to an open scalar event. The combination of these open scalar PPs and nonscalar motion verbs expresses a motion event which proceeds along a path scale without an inherent endpoint.

In addition to the preverbal position as shown in §.2.2.2, 向 *xiàng* /往 *wǎng* 'toward' PPs can also occur in the postverbal position, as in (33).

(33) a. 婷婷說完便跑**向電梯** (BCC)
Tíng Tíng *shuō* *wán* *biàn* *pǎo* ***xiàng*** ***diàntī***
NAME say finish then run **toward** **elevator**
'Ting Ting ran toward the elevator after she's finished with what she is saying.'

b. 隊員們乘飛機飛**往上海** (BCC)
duìyuánmen *chéng* *fēijī* *fēi* ***wǎng*** ***Shànghǎi***
teammates ride airplane fly **toward** **Shanghai**
'The team members took the flight to Shanghai.'

Through a survey of a novel, Lamarre (2007: 52-54) finds that the frequencies of the preverbal 向 *xiàng* /往 *wǎng* 'toward' PP and the postverbal 向 *xiàng* /往 *wǎng* PP are 159 and 0 instances respectively.[12] Based on this result, the author proposes that the postverbal 向 *xiàng* /往 *wǎng* PPs are the remnants of classical and written style of Chinese and rarely used in Modern Standard Chinese (also see Cui 2006; Tang & Lamarre 2007).[13] However, as shown in (33), we observe that postverbal 向 *xiàng* /往

[12] The novel analyzed in Lammarre (2007) is *Kan Shangqu Hen Mei* 'Little Red Flowers' (2004), written by Wang Shuo.

[13] In another study of 往 *wǎng* 'toward' adverbials in Northern Mandarin, Lamarre (2013) observes that 往 *wǎng* can take localizers (e.g., 往裏 *wǎng lǐ* and 往外 *wǎng wài*) or directional verbs (e.g., 往回 *wǎng huí*, 往起 *wǎng qǐ*) as its object to form a lexically compounded adverbial and to express the path of the motion such as 'up/down/in/out/across', e.g., 往外走 *wǎng wài zǒu* 'walk out' and 往起立 *wǎng qǐ lì* 'rise up'. Lamarre (2013) argues that such 往 *wǎng* adverbials do not impose a bounding effect on the event they modify and that they can only occur in the preverbal position. On the contrary, when the same directional verbs (e.g., 起 *qǐ*, 回 *huí*) occur after another verb and function as directional complements, e.g., 撿起來 *jiǎn qilai* 'pick up' and 走回去 *zǒu huíqu* 'walk back', they function like resultative complements and "have a perfectivizing effect on the verb they compound with" (Lamarre 2013: 904). Therefore, according to Lamarre (2013), Northern Mandarin, including Beijing Mandarin and Northwest Mandarin dialect, behaves in the way that is predicted by the delimiter hypothesis. However, our data shows that in Standard

wǎng PPs are indeed frequently used in Modern Standard Chinese. Table 1 presents the frequencies of the preverbal and postverbal 向 *xiàng* /往 *wǎng* PPs in the assorted sub-corpus of BCC. Even though there are indeed more tokens of 向 *xiàng* /往 *wǎng* PPs in the preverbal position than in the postverbal position, the occurrence frequencies of the postverbal 向 *xiàng* /往 *wǎng* PPs are not neglectable.

Table 1 Frequencies of 向 *xiàng* /往 *wǎng* PP in the preverbal and postverbal positions in the assorted sub-corpus of BCC

	Preverbal	Postverbal
向 *xiàng* PP	366,510	279,811
往 *wǎng* PP	156,485	68,675

Furthermore, we find that with certain verbs, 向 *xiàng* /往 *wǎng* PPs occur in the postverbal position even more frequently than the preverbal. For example, the corpus data contains 4,525 instances of "飛 *fēi* 'fly'+往 *wǎng* PP" but only 2,225 instances of "往 *wǎng* PP+飛 *fēi*".

More importantly, when 向 *xiàng* /往 *wǎng* PPs occur in the postverbal position, they allow PI: 向 *xiàng* /往 *wǎng* is incorporated into the preceding verb and form a compound V-P, and the locative NP of the PP becomes the object of the compound verb V-P. As illustrated in (34-35), the perfective marker 了 *le* is suffixed to the compounded V-P, rather than directly to the verb 跑 *pǎo* 'run' and 飛 *fēi* 'fly'.

(34) a. 她跑**向**了**電梯** (BCC)
tā *pǎo-**xiàng**-le* ***diàntī***
3SG run-toward-PFV elevator
'She ran toward the elevator.'
b. *他跑了**向電梯**
tā *pǎo-le* ***xiàng*** ***diàntī***
3SG run-PFV toward elevator

(35) a. 她直接就飛**往**了**海南** (BCC)
tā *zhíjiē* *jiù* *fēi-**wǎng**-le* ***Hǎinán***
3SG directly then fly-toward-PFV Hainan
'She took the flight to Hainan directly.'
b. *她直接就飛了**往海南**
tā *zhíjiē* *jiù* *fēi-le* ***wǎng*** ***Hǎinán***
3SG directly then fly-PFV toward Hainan

Therefore, the occurrence of the postverbal 向 *xiàng* /往 *wǎng* 'toward' PPs cannot be simply treated as exceptions to the delimiter hypothesis. In the rest of this section, we will provide our account, i.e. the postverbal 向 *xiàng* /往 *wǎng* PPs introduce an open

Mandarin, 向 *xiàng* /往 *wǎng* PPs occur highly frequently in the post-verbal position, which thus cannot be accounted for by the delimiter hypothesis.

scale to the preceding verb.

First, similar to their preverbal counterparts, 向 *xiàng* /往 *wǎng* 'toward' PPs in the postverbal position express unbounded information and do not delimit the event they modify. For instance, like the preverbal 向 *xiàng* /往 *wǎng* PPs in (25), when the postverbal 向 *xiàng* /往 *wǎng* PPs modify a motion verb, the implication of the arrival at a potential goal can be cancelled, as in (36).

(36) a. 中年人撲**向吳強的身形**剎那間停住了 (BCC)
*zhōngnián rén pū **xiàng WúQiáng***
middle-age.man throw.oneself.at toward NAME
***de shēnxíng** chànàjiān tíngzhù le*
REL figure an.instant stop CRS
'In that instant, when throwing himself at Wu Qiang, the middle-aged man's figure came to a halt.'

b. 瑞琦在走**往门口**的中途停住，提起笨拙的黑色礼服裙摆转过身去 (BCC)
*Ruìqí zài zǒu **wǎng ménkǒu** de zhōngtú tíng-zhù,*
NAME at walk toward door REL half.way stop-stay
tí-qǐ bènzhuō de hēi-sè lǐfú qúnbǎi zhuǎn-guò
raise-up clumsy RELblack-colour gown hem turn-across
shēn qù
body thither
'While walking toward the door, Ruiqi stopped halfway to pick up the hem of her bulky gown and turned her body around.'

Furthermore, the preposition 向 *xiàng* /往 *wǎng* can take NP objects which literally refer to directions, such as 西方 *xīfāng* 'westward' (37a) or 前方*qiánfāng* 'forward' (37b). In these cases, 向 *xiàng* /往 *wǎng* PPs do not include a specific location NP which can be hinted to as a potential endpoint and it is not likely that a potential endpoint gets derived from the context. In other words, the motion verbs modified by the postverbal 向 *xiàng* /往 *wǎng* PPs express unbounded motion events, which can continue in a direction without an endpoint.

(37) a. 炸機…掠過他們地頭頂，繼續飛**向西方** (BCC)
zhàjī lüè-guò tāmen de tóu-dǐng
bomber flit-across 3PL POSS head-top
*jìxù fēi **xiàng xīfāng***
continue fly toward westward
'The bombers flitted across their heads and continued flying westward.'

b. 龔丹點點頭，忙加快速度沖**往前方** (BCC)
GōngDān diǎn-diǎn-tóu máng jiākuài sùdù
NAME nod-nod-head hurriedly accelerate speed
*chōng **wǎng qiánfāng***
rush toward the.front
'Gong Dan nodded and rushed even faster to the front.'

Second, even though the collocation of the motion verbs and the postverbal 向 *xiàng* /往 *wǎng* 'toward' PPs denotes unbounded events, they still denote a scalar result, i.e., the change of location of a moving object on a 'directed' path, as the modification by the postverbal 向 *xiàng* /往 *wǎng* PPs introduce a scale. In the following, we will provide evidences that support this point.

To begin with, only durative motion verbs whose denotations are compatible with the path dimension can appear with the postverbal 向 *xiàng* /往 *wǎng* 'toward' PPs, e.g., 跑 *pǎo* 'run', 飛 *fēi* 'fly', and 開 *kāi* 'drive' (Lü 1980; Fan 1990; Zhao 2002; Fang 2004; Wang 2004, among others). While 往 *wǎng* PPs collocate only with motion verbs (in both preverbal and postverbal positions), 向 *xiàng* PPs collocate not only with motion verbs but also with non-motion verbs, such as 笑 *xiào* 'smile', 報告 *bàogào* 'report', 介紹 *jièshào* 'introduce', and 下跪 *xiàguì* 'kneel down'. However, 向 *xiàng* PPs modify these non-motion verbs in the preverbal position only, denoting the direction in which the agent is facing, as in (38-39). This kind of direction is external to the event composition and the modification of the non-motion events by 向 *xiàng* does not type-shift nonscalar events to scalar change events. In other words, when 向 *xiàng* PPs do not introduce a scale, they are restricted to the preverbal position. Such a distribution is consistent with our hypothesis that the adjunct locatives introducing a scale to the events can appear as objects of V-P.

(38) a. 她**向我**微笑
tā ***xiàng wǒ*** *wēixiào*
3SG toward 1SG smile
'She smiled at me.'
b. *她微笑**向我**
tā *wēixiào* ***xiàng wǒ***
3SG smile toward 1SG

(39) a. 她**向我**報告
tā ***xiàng wǒ*** *bàogào*
3SG toward 1SG inform
'She reported to me.'
b. *她報告**向我**
tā *bàogào* ***xiàng wǒ***
3SG inform toward 1SG

Next, recall that we have introduced earlier how the preposition 向 *xiàng* /往 *wǎng* 'toward' can take nominal objects which refer to locations (e.g., 北京 *Běijīng* 'Beijing') or directions (e.g., 北方 *běifāng* 'northward'). We observe that even though both the preverbal 向 *xiàng* /往 *wǎng* PPs and the postverbal 向 *xiàng* /往 *wǎng* PPs can modify motion verbs, the postverbal position is preferred when 向 *xiàng* /往 *wǎng* PPs express more specific result information. The evidence comes from the distributions of location NPs and direction NPs in the pre- and postverbal 向 *xiàng* /往 *wǎng* PPs (Table 2). Our corpus study finds that location NPs are preferred by the postverbal 向 *xiàng* /往 *wǎng*,

whereas direction NPs are preferred by the preverbal 向 *xiàng* /往 *wǎng* (cf. Wang 2004).[14] In the BCC assorted subcorpus, we randomly took 100 instances of pre- and postverbal 向 *xiàng* /往 *wǎng* PPs respectively for each of the five motion verbs 走 *zǒu* 'walk', 飛 *fēi* 'fly', 沖 *chōng* 'rush', 逃 *táo* 'escape', and 退 *tuì* 'recede', and examined whether the NPs taken by 向 *xiàng* and 往 *wǎng* denote a location or direction. The results are presented in Table 2 and Table 3 for 向 *xiàng* and 往 *wǎng* respectively.[15]

Table 2. The distribution of location and direction NPs in pre- and postverbal 向 *xiàng* PPs

	Preverbal 向 *xiàng* PP		Postverbal 向 *xiàng* PP		Total
verb	direction NP	location NP	direction NP	location NP	
走 *zǒu*	47	53	3	97	200
冲 *chōng*	44	56	13	87	200
逃 *táo*	69	31	34	66	200
飛 *fēi*	50	50	23	77	200
退 *tuì*	96	4	50	50	200
Total	**306 (61.2%)**	**194 (39.8%)**	**123 (24.6%)**	**377 (75.4%)**	**1000**

Table 3. The distribution of location and direction NPs in pre- and postverbal 往 *wǎng* PPs

	Preverbal 往 *wǎng* PP		Postverbal 往 *wǎng* PP		Total
verb	direction NP	location NP	direction NP	location NP	
走 *zǒu*	81	19	21	79	200
冲 *chōng*	60	40	16	84	200
逃 *táo*	63	37	14	86	200
飛 *fēi*	61	39	8	92	200
退 *tuì*	95	5	32	68	200
Total	**360 (72%)**	**140 (26%)**	**91 (18.2%)**	**409 (81.8%)**	**1000**

[14] Wang (2004) points out that in "V + 往 *wǎng* 'toward'+ NP" construction, the NP should refer to a place name (e.g., 北京 *Běijīng* 'Beijing') or a specific location (e.g., 計算中心 *jìsuàn zhōngxīn* 'computing center'), but the location NPs cannot take localizers, e.g., 廚房裏 *chúfáng-lǐ* 'inside the kitchen'. Wang (2004) further states that such a constraint does not hold for the preverbal variant, i.e. "往 *wǎng* + NP + V" construction. However, in contrast to Wang (2004), in our search in BCC, we find location NPs taking localizers in both preverbal and postverbal 往 *wǎng* PPs.

[15] While for most of the examples we were able to easily determine whether an NP denotes a direction (e.g., 北方 *běifāng* 'the north') or a goal location (e.g., 北京 *Běijīng* 'Beijing'), sometimes the boundary between the two is vague. For instance, neither 山上 *shānshàng* 'on the mountain' nor 山下 *shānxià* 'down the mountain' is very specific about an endpoint. In the analysis, we treated NPs that denote a converging point as a location (e.g., 山上 *shānshàng*), but a diverging open space as a direction (e.g., 山下 *shānxià*). For instance, a construction such as 向山下跑 *xiàng shānxià pǎo* does not entail that the motion will end right at the foot of the mountain, so we analyzed 山下 *shānxià* as a direction.

The two tables illustrate two distributional tendencies: (a) in the preverbal position, there are more "direction NPs" than "location NPs"; (b) in the postverbal position, there are more "location NPs" than "direction NPs." This is verified by Chi-square tests (Fisher's exact tests), which suggest a significant correlation (p <.0001) between the position (pre- and postverbal positions) and the type of NPs (direction and location NPs) for both 向 *xiàng* and 往 *wǎng*. Furthermore, Table 2 and Table 3 show that there is a stronger tendency for the postverbal PPs to prefer locative NPs over directional NPs, as opposed to the reverse in preverbal PPs. The distributional differences indicate that the postverbal 向 *xiàng* /往 *wǎng* PPs tend to express more specific goals than the preverbal 向 *xiàng* /往 *wǎng* PPs do. In other words, even though a 向 *xiàng* /往 *wǎng* PP does not lexicalize the endpoint and does not impose the arrival at the goal, the location NP can imply the bound of the event when such interpretation is derived contextually, whereas a direction NP is less likely to yield such interpretation.

So far, we have shown that the modifications by open scalar PPs type-shift previously nonscalar events to open-scalar events and these PPs appear in the postverbal position and allow PI. Based on our analysis, we modify the delimiter hypothesis and propose that adjunct locative PPs introducing scale can appear as the object of V-P through PI.

5. Locative PPs further elaborating a scale

In this section, we introduce the third type of locative PPs that meet the semantic constraint for PI. Such PPs do not directly introduce a scale; rather, they further specify a scale denoted by the preceding VP.

Recall in §4, we showed that 向 *xiàng* /往 *wǎng* 'toward' PPs can type-shift an originally nonscalar VP to a scalar change VP by introducing an open scale. Here we introduce another function of 向 *xiàng* /往 *wǎng* PPs, that is, reinforcing an existing scale.

向 *xiàng* /往 *wǎng* 'toward' PPs can appear after open scalar motion verbs such as 退 *tuì* 'recede'. In (40), the preceding V 退 *tuì* already lexicalizes an unbounded path scale, and the 向 *wǎng*/往 *wǎng* PPs further elaborate the implicit bound of the scale. In these cases, the 向 *wǎng* PPs and 往 *wǎng* PPs allow PI and the locative NPs are realized as the object of V-P as in (40).

(40) a. 我們退向[了]森林邊緣 (BCC)
wǒmen *tuì-xiang-[le]* *sēnlín* *biānyuán*
1PL recede-toward-[PFV] forest edge
'We retreated to the edge of the forest.'

b. 受到了猛烈攻擊的大助被迫退往[了]後方 (BCC)
shòudào-le *měngliè* *gōngjī* *de* *Dà Zhù*
suffer-PFV fierce attack REL NAME
bèi *pò* *tuì-wǎng-[le]* *hòufāng*
PASS force recede-toward-[PFV] rear
'Da Zhu, who suffered a fierce attack, was forced to retreat to the back.' (BCC)

While scale-denoting PPs such as 向 *xiàng* /往 *wǎng* 'toward' PPs can either

introduce a scale to nonscalar change verbs or further specify the existing scale denoted by scalar change verbs, a 在 *zài* 'at' PP does not denote scale lexically (as shown in §2.2.2.1), and thus does not introduce a scale to an event and cannot type-shift the aspectual class of the modified VP.

Meanwhile, the adverbial modification of a 在 *zài* 'at' PP can be classified into two types, depending on whether the scope of its modification covers the entire event or only the subpart of the event that denotes the scalar result. We propose that the 在 *zài* PPs for the latter type of modification elaborate the scale, whereas the 在 *zài* PPs for the former type do not. Our classification of the two different modification scopes of 在 *zài* PPs is developed on Maienborn's (2001) notions of "internal locatives" and "external locatives" and Pustejovsky's (1991:52) subeventual analysis of adverbial modification. As illustrated in (41), the external modifier *in Argentina* in (41a) refers to the place where the whole event of Eva's signing the contract took place. The internal modifier *on the last page* in (41b) refers to the location that is only relevant to the subpart of the event, i.e., Eva's signature (Maienborn 2001:191).

(41) a. Eva signed the contract *in Argentina.* (Maienborn 2001: 191)
b. Eva signed the contract *on the last page.* (Maienborn 2001:191)

Building on Maienborn (2001) and Pustejovsky (1991), in what follows, we will take two steps to show that only the scale-elaborating 在 *zài* 'at' PPs, i.e. internal locatives, permit PI in the postverbal position. In §5.1, we will show that the 在 *zài* PPs allowing PI tend to be preceded by scalar change VPs, and thus these 在 *zài* PPs specify a location on the same dimension of the scalar change lexicalized in the VP. In §5.2, we will show that when collocating with scalar change VPs, scale-elaborating 在 *zài* PP tend to appear in the postverbal position, whereas the 在 *zài* PPs that modify the event structure as a whole tend to be restricted to the preverbal position.

5.1 Only scale-denoting VP allow the PI of the postverbal 在 *zài* PPs

A large number of studies have discussed the possible verbs that can collocate with the postverbal 在 *zài* 'at' PPs (e.g., Zhu 1981; Li & Thompson 1981; Liu 2009; Tham 2013, among many others). However, little attention has been paid to the semantic conditions of verbs which permit adjunct locatives in the postverbal 在 *zài* PPs to appear as added arguments through PI. Even though a large number of verbs or VPs can collocate with the postverbal 在 *zài* PP, not all of these collocations allow PI, as illustrated in (42) and (43).

(42) a. Two point closed scalar V
其中一名傷者被確認**死**在了醫院裏 (BCC)
*qízhōng yī míng shāngzhě bèi quèrèn **sǐ**-zài-le yīyuàn-lǐ*
among one CLF casualty PASS confirm die-at-PFV hospital-inside
'One of the casualties was confirmed dead in the hospital.'
b. Incremental theme change VP
把標語寫在了火車上 (adapted from Zhu 1981: 11)

bǎ biāoyǔ xiě- *zài-le* *huǒchē-shàng*
BA slogan write-at-PFV train-on
'(I) wrote the slogan on the train.'

c. Open scalar V
火箭帶著衛星一下子**升**在了高空，最後升到了衛星軌道
huǒjiàn *dài-zhe* *wèixīng* *yīxiàzi* ***shēng-zài-le***
rocket carry-CONT satellite in.a.short.while ascend-at-PFV
gāokōng *zuìhòu* *shēng-dào-le* *wèixīng* *guǐdào*
high.altitude finally ascend-to-PFV satellite orbit
'The rocket carrying the satellite ascended on the high altitude in a short while, and finally ascended into orbit.'

d. Atypical manner of motion V
我從窗臺爬下去，**跳**在了他的懷裏 (BCC)
wǒ *cóng* *chuāngtái* *pá* *xià-qu*
1SG from window.sill climb descend-thither
tiào-zài-le *tā* *de* *huáilǐ*
jump-at-PFV 3SG POSS embrace
'I climbed down from the window and jumped into his arms.'

(43) Nonscalar manner V

a. **游**在(*了) 游泳池裏
yóu *-zài-(*le)* *yóuyǒngchí-lǐ*
swim-at-PFV swimming.pool-inside
'swim in the swimming pool'

b. **漂**在(*了)大海
piāo-zài-(*le) *dàhǎi*
float-at-PFV sea
'float on the sea'

This study finds that there are four major types of verb (phrases) that can collocate with the postverbal 在 *zài* PPs and allow PI, as exemplified in (42a-d), whereas the verb type found in (43) does not allow PI. In the rest of this section, we will show that the restriction in collocation is due to the scale-denoting nature of the verb (phrases) --- all four types of verb (phrases) in (42) denote scalar changes, whereas the one in (43) does not.

Two-point closed scalar verbs

The first type of verbs that allow the PI of 在 *zài* 'at' PPs are verbs lexicalizing two-point closed scales, i.e., achievement verbs such as 死 *sǐ* 'die' and 坐 *zuò* 'sit', which are compatible with the implications of inchoative aspect.[16] For example, in (42a), the verb

[16] Closed scalar verbs can be further classified into two types, depending on whether the scale they denote consists of only two points (the starting and ending points) or multiple points (the starting point, the ending point, and many points in between) (Rappaport Hovav & Levin 2010; Lin 2011; Lin and Peck 2011). Two-point closed scalar verbs are equivalent to achievements in that both are telic and punctual.

死 *sǐ* expresses an instantaneous change from being alive to dead. The 在 *zài* PP denotes the location where the resultant state (i.e. being dead) continues on. The 在 *zài* PP itself is nonscalar and does not introduce a new scale, but it elaborates the endpoint of the closed scale lexicalized by the preceding V 死 *sǐ*.

Incremental theme verb phrases

The second type of verbs that allows the PI of postverbal 在 *zài* 'at' PPs are those that co-occur with incremental theme objects. For instance, 寫字 *xiězì* 'write characters', 吃餃子 *chī jiaozi* 'eat dumplings', and 看書 *kànshū* 'read book' are incremental theme VPs headed by the verb of creation 寫 *xiě* 'write', the verb of consumption 吃 *chī* 'eat', and the verb of affection 看 *kàn* 'read', respectively.

As proposed in previous studies (Rappaport Hovav 2008; Levin & Rappaport; Hovav 2010), incremental theme verbs by themselves do not lexicalize scalar change and it is thus the object NPs that determine the scalar property and telicity of the events (Kennedy 2012: 108). Building on Krifka (1989; 1992) and Cresswell (1976), Kennedy (2012: 117) assumes that the measure of change function is introduced by the semantics of incremental argument NPs, especially the referential properties of the incremental theme argument.

Nouns in Mandarin Chinese are basically mass nouns (Chierchia 1998). Peck et al. (2016), following Kennedy's (2012) analysis of mass nouns in English, argue that Chinese incremental theme denotes scalar change and typically, the measure of change function is encoded in the modifiers of the head nouns in the argument NPs. Specifically, when the incremental theme object is a quantized mass noun, e.g., modified by the sequence of numeral and classifier in Chinese, the incremental theme VP expresses a multi-point closed scalar event. For instance, the NPs in the incremental theme VP in (44a) "encode measure of change functions whose scales also include maximal degrees" (Kennedy 2012: 111). Thus, the VP denotes closed scalar change and it is compatible with the *in*-adverbial. On the contrary, when an incremental theme object is not quantized, i.e., a bare mass noun, the incremental theme VP expresses an open scalar event. For instance, the VP 吃蛋糕 *chī dàngāo* 'eat cakes' in (44b) describes a scalar change event that does not have a maximal value to meet and thus is not compatible with the *in*-adverbial.

(44) a. 我在一个小时内吃了**兩個蛋糕**

wǒ	*zài yī*	*ge*	*xiǎoshízhīnèi*	*chī-le*	***liǎng***	***gè***	***dàngāo***
1SG	at one	CLF	hour within	eat-PFV	two	CLF	cake

'I ate two cakes in one hour.'

b. *我在一个小时内吃**蛋糕**了

wǒ	*zài yī*	*ge*	*xiǎoshízhīnèi*	*chī dàngāo le*
1SG	at one	CLF	hour within	eat cake CLF

(intended) 'I ate cakes in one hour.'

This study treats verbs such as 坐 *zuò* 'sit' and 站 *zhàn* 'stand' as achievements (or two-point close scalar verbs) if they denote a change of posture from being not seated to being seated and vice versa. Meanwhile, these verbs are state verbs if they denote the state of being seated or standing. In other words, these verbs belong to two aspectual types (Chen 1988).

It is worth noting that in Chinese, an incremental verb cannot be followed by both an object argument and a locative adjunct, as in (45).[17] However, when the incremental theme objects are preposed to the topic position of a sentence or appear in the preverbal position marked by 把 *bǎ*, the incremental theme verb can be adjacent to 在 *zài* 'at' PP and PI is allowed, as in (42a-b).

(45) *寫標語在火車上
xiě biāoyǔ zài huǒchē-shàng
write slogan on train-on
(intended) 'wrote the slogan on the train'

Open scalar verbs

The third type of verbs that allow the PI of 在 *zài* 'at' PPs are open scalar verbs such as 退 *tuì* 'recede' and 升 *shēng* 'ascend'. For example, the verb 升 *shēng* expresses motion on an upward directed path (§2.1). As illustrated in (42c), 升 *shēng* can precede a 在 *zài* PP, and allow PI. In this example, the elaboration by the location 在高空 *zài gāokōng* 'in the high altitude' indicates the location at which the unbounded directed motion gets terminated. The postverbal 在 *zài* PP further specifies the unbounded upward path scale lexicalized in the motion verb 升 *shēng* 'ascend.' The event of ascending might have continued on until the rocket and the satellite reach their intended destination in the space orbit, without stopping at a certain point in upper airspace.

The traditional aspectual classification based on Vendler (1967) typically does not distinguish the completed motion on a bounded directed path from the terminated motion on an unbounded directed path.[18] However, within the scalar analysis, the endpoint on the bounded path and the terminated point on the unbounded path can be distinguished. The elaboration of the open scalar verbs by the postverbal 在 *zài* 'at' PP yields an interpretation of a terminated point, as in (42c).

Atypical manner-of-motion verbs

The last type of verbs that allow the PI of 在 *zài* PPs are atypical manner of motion verbs such as 跳 *tiào* 'jump', 飛 *fēi* 'fly', 滾 *gǔn* 'roll', and 滑 *huá* 'slide.' We consider this

[17] Different proposals have been given for the grammaticality of sentences with the postverbal PP, as in example (45). According to "The Postverbal Structure Constraint" by Huang (1982), a verb can be followed by either its subcategorized complements or a postverbal adjunct (expressing frequency, duration, result, manner), but not by both. The PSC would allow V NP PP or V PP NP if PP is also the argument subcategorized by V (e.g., 放 *fang* 'put'), but would not allow both NP and PP to occupy the postverbal position if PP is the adjunct of V (e.g., 寫 *xiě* 'write'). Studies such as Feng (2003) also proposes a prosodic constraint for the grammaticality of the postverbal PP.

[18] Two examples given in (i) for completed motion and terminated motion respectively:

(i) a. In December, Americans led by Bob Martin plan to launch the Odyssey from Alice Springs in central Australia, and **ascend into** the stratosphere." (*The great balloon race*, Robert Gannon, 1996, accessed via https://corpus.byu.edu/coca/)
b. You could go at it backwards, **ascend on** the more stair-stepped side, then **descend at** a steeper rate, but that felt dicey to us both, him with his bad knees, me with my sack full of baby." (*Palisades*, Antonya Nelson, 1999, accessed via https://corpus.byu.edu/coca/)

group of manner verb as atypical, because the combination of these verbs and the postverbal 在 *zài* 'at' PP shows a strong tendency to express directed motion, and the object NP of 在 *zài* denotes the changed location of the moving agent after the motion event has progressed (Tai 1975; Liu 2009; Tham 2013,). In contrast, the collocation of the typical manner of motion verbs such as 走 *zǒu* 'walk', 游 *yóu* 'swim' and the postverbal 在 *zài* PPs do not express motion event along a directed path, as in (43).[19]

However, it is not immediately clear why and how these sequences express directional meanings, as these verbs alone are generally assumed to denote manner only and 在 *zài* 'at' PP itself is nonscalar. In other words, it is generally assumed that no lexical component of the "V + 在 *zài* 'at' PP" sequence expresses any directional meaning. In what follows, we will first introduce two different approaches to this question.

The first approach seeks the answer from the lexical semantics of the given verbs in question. For example, Liu (2009: 15) argues that these atypical manner of motion verbs impose a change of location, because "rolling, sliding and jumping must involve displacement"; in contrast, the typical activity verbs (e.g., 走 *zǒu* 'walk', 游 *yóu* 'swim') do not lexicalize such denotation, because "walking, running and floating can happen without displacement (e.g. march in place)."

In addition, Beavers and Koontz-Garboden's (2017) account of English verbs which denote manner and path is relevant to the Chinese case here. While some motion verbs in English (e.g., *slide, ski, roll,* and *drag*) are traditionally analyzed as manner verbs (e.g., Talmy 1985; 2000), they are identified in Beavers and Koontz-Garboden as verbs that denote both manner and path information simultaneously (cf. manner/result complementarity hypothesis in Rappaport Hovav & Levin 2010). The authors argue that these verbs denote scalar change (i.e. motion on a path) without specifying any result.[20] They claim that such verbs entail a transition and progress along the path scale, but do not always entail a new result. Given that the meanings expressed by these English verbs, to a large extent, correspond to the atypical activity verbs which impose change of location in Chinese (Liu 2009: 14-16, e.g., 跳 *tiào* 'jump', 飛 *fēi* 'fly', 滾 *gǔn* 'roll', and 滑 *huá* 'slide'), the directional interpretation of the string of V-在 *zài* (e.g. 跳在 *tiào zài* 'jump to') may come from the scale lexically specified in the verbs if the analysis of Beavers and Koontz-Garboden is applicable to these particular Chinese verbs.

[19] Another piece of evidence showing that some manner of motion verbs are atypical is that when they are used as transitive verbs, the sequences consisting of verbs such as 跳 *tiào* and 飛 *fēi* and their objects express directed motion, e.g., 跳河 *tiào hé* 'jump into the river' and 飛美國 *fēi Měiguó* 'fly to United States'. On the contrary, the sequences consisting of verbs such as 走 *zǒu* 'walk' and 跑 *pǎo* 'run' and their objects do not express directed motion, e.g., 走小路 *zǒu xiǎolù* 'walk on the narrow path', 跑操場 *pǎo cāochǎng* 'run in the playground.'

[20] If we follow manner/result complementarity hypothesis (Rappaport Hovav & Levin 2010), "result" is considered to be a notion equivalent to "scalar change". On the other hand, Beavers and Koontz-Garboden (2017) further classify the notion of "scalar change" into "scalar change without result" and "scalar result", and they distinguish verbs like *slide* denoting "scalar change without result" from "scalar result" verbs such as open scalar verbs and closed scalar verbs. In addition, open scalar verbs only denote path but not manner, whereas verbs like *slide* are claimed to denote path and manner simultaneously. On the other hand, verbs like *slide* and open scalar verbs have in common that both types of verbs denote "nonquantized" scalar change, i.e., atelic scalar change. See Beavers and Koontz-Garboden (2017) for more details.

The second approach argues that a contextual-pragmatic factor is accountable for the directional interpretation of "manner verb + 在 *zài* 'at' PP." Based on a corpus study, Tham (2013) finds that manner verbs in Chinese do not always express directional motion when they are followed by a 在 *zài* PP; furthermore, various manner verbs followed by 在 *zài* PP show a different degree of tendency for the directional interpretation. According to Tham's (2013) investigation, 99% of "跳 *tiào* 'jump'+ 在 *zài* PP" express directed motion, followed by 越 *yuè* 'leap' (89%), 撲 *pū* 'throw oneself at' (77%), 流 *liú* 'flow' (59%), 滾 *gǔn* 'roll' (39%), 飛 *fēi* 'fly' (27%), 爬 *pá* 'crawl' (18%), and 滑 *huá* 'slide' (9%) in the V+ 在 *zài* PP environment. Tham (2013) explains that when a verb denotes motion that is punctual, less specific, or has a shorter path, it tends to yield a directional interpretation when followed by the postverbal 在 *zài* PP.

In this study, we adopt Tham's (2013) account because it better captures the Chinese data. For instance, even though "跳 *tiào* 'jump' + 在 *zài* PP" tends to express directed motion, not all cases of this sequence are directional, as in (46). In other words, (46) suggests that the directional meaning is not lexicalized in the verb 跳 *tiào*.[21]

(46) 跳在陽光裏的透明珠子 (Tham 2013: 348)[22]
tiào *zài* *yangguāng-lǐ* *de* *tòumíng* *zhūzi*
jump at sunlight-inside REL transparent pearl
'transparent pearls jumping in the sunlight'
(music.douban.com/review/1132356/ - China)

To summarize, we have shown that the verbs and the VPs in (42) that allow the PI of postverbal 在 *zài* 'at' PPs all denote scalar events, be it through the scale lexically specified by the verbs (42a) and (42c) or incremental theme VPs (42b) or derived from contextual-pragmatic factors (42d). In contrast, as 在 *zài* PPs neither denote a scalar attribute nor introduce a scale to the event they modify, when occurring after verbs which do not denote scalar change (i.e. nonscalar verbs such as 游 *yóu* 'swim' and 漂 *piāo* 'float'), the construction "V+ 在 *zài* PP" as a whole does not denote a scalar events, fails to meet the semantic constraint in (9c), and thus PI is not allowed, as in (43).[23] The

[21] However, it is worth noting that the interpretation of the sequence 跳在 *tiào zài* 'jump at' in (46) changes to a directed motion when the perfective marker 了 *le* is added, as in (i). This difference illustrates that the PI of "V + 在 *zài* PP" yields a directional interpretation.

(i) 透明珠子彈起來，跳在了陽光裏
tòumíng *zhūzi* *tán-qilai* *tiào-zài-le* *yángguāng-lǐ*
transparent pearl jump-up jump-at-PFV sunlight-inside
'the pearls jumped up and jumped into the sunlight'

[22] Chinese characters are added by this paper.

[23] Liu (2009: 14-15) proposed that postverbal 在 *zài* 'at' PP functions to change an atelic predicate into a telic one, by providing a bound for both atypical atelic dynamic verbs that entail 'displacement' (e.g., 跳 *tiào* 'jump', 滾 *gǔn* 'roll', 滑 *huá* 'slide', and 飛 *fēi* 'fly') and typical atelic dynamic verbs which do not entail 'displacement' (e.g., 跑 *pǎo* 'run', 漂 *piāo* 'float', and 跟 *gēn* 'follow'). In contrast to Liu (2009), we consistently analyze 在 *zài* PP as non-scalar and atelic for all types of verbs (42-43). When the preceding verb is scalar (or has a directional understanding) as in (40), the postverbal 在 *zài* PP only functions to elaborate the scale denoted by the verb and does not introduce a bound for the event.

contrast between the scalar denotation of preceding VPs that permit PI and that do not permit PI supports our analysis that the PI-allowing postverbal 在 *zài* PPs is correlated with the scalar denotation.

5.2 The external modification by preverbal 在 *zài* PPs and the internal modification by postverbal 在 *zài* PPs for scalar change VPs

A large number of studies have discussed the semantic differences of preverbal and postverbal 在 *zài* 'at' PPs (Tai 1975; Fan 1982, among many others). However, when it comes to the postverbal 在 *zài* PPs, few studies distinguish the PPs that can undergo PI from those that cannot. In §5.1, we have shown that only scale-denoting VPs allow the PI of postverbal 在 *zài* PPs. In this section, we will further demonstrate that with these scale-denoting VPs, the preverbal and the postverbal 在 *zài* PPs tend to yield different interpretations. We argue that such semantic differences are due to the different modification scopes of 在 *zài* PPs for scale-denoting VPs. When different interpretations arise, the preverbal 在 *zài* PPs tend to be external modifiers (Maienborn 2001) which modify the event structure of VP as a whole ("wide scope", Pustejovsky 1991), whereas the postverbal 在 *zài* PPs tend to be internal modifiers (Maienborn 2001) which modify a subpart of the event structure denoted by the VP ("narrow scope", Pustejovsky 1991).

Different from scale-denoting VPs, when verbs denote a nonscalar change, i.e., typical activity motion verbs such as 走 *zǒu* 'walk', 跑 *pǎo* 'run' and 飘 *piāo* 'float', the modifications by preverbal 在 *zài* 'at' PPs or postverbal 在 *zài* PPs produce almost the same semantic interpretation. For instance, both (47a) and (47b) describe an event where the agent walks on the street, i.e. a motion event without a particular direction.

(47) a. **在路上**走
zài ***lù-shang*** *zǒu*
at road-on walk
'walk on the road'
b. 走**在**(*了)**路上**
*zǒu-**zài**-(*le)* ***lù-shang***
wall-at-PFV road-on
'walk on the road'

Nonscalar change verbs have simple event structures, and the adverbial modifications can scope only the entirety of the event structure (Pustejovsky 1991). As a result, with nonscalar change verbs, both preverbal and postverbal 在 *zài* 'at' PPs modify the event of walking as a whole and have the identical interpretation. However, it is worth noting that as shown in the previous section, in such case, even though the 在 *zài* PP can appear in the postverbal position, PI is not allowed, as in (47b).

On the other hand, when a preceding VP denotes an event of scalar change, the sentence with a postverbal 在 *zài* 'at' PP yields a different interpretation from its preverbal counterpart, as in (48-49).[24]

[24] Among the four types of verb (phrases) collocating with the PI-ed postverbal 在 *zài* 'at' PP as introduced

(48) a. 小猴子**在馬背上**跳 (Tai 1975: 158)
xiǎo hóuzi ***zài mǎbèi-shàng*** *tiào*
little monkey at horseback-on jump
'The little monkey was jumping on the horse's back.'
b. 小猴子跳**在馬背上** (Tai 1975: 158)
xiǎo hóuzi tiào ***zài*** ***mǎbèi-shàng***
little monkey jump at horseback-on
'The little monkey jumped onto the horse's back.'

(49) a. **在火車上**寫標語 (Zhu 1981: 11)
zài huǒchē-shàng*xiě biāoyǔ*
on train-on write slogan
(i) 'Write slogan while sitting inside the train.'
(ii) 'Write slogan on the surface of the train.'
b. 把標語寫**在火車上** (Zhu 1981: 11)
bǎ biāoyǔ xiě ***zài huǒchē-shàng***
BA slogan write on train-on
'Write slogan on the surface of the train.'

---

in (42a-d), a 在 *zài* 'at' PP often does not occur naturally before an open scalar change verb such as 退 *tuì* 'recede' and 降 *jiàng* 'descend', as in (ia). In (ib), the post-verbal 在 *zài* PP narrowly modifies the scalar result, rather than modifying the event of snowfall as a whole.

(i) a. ?雪在山峰上降
xuě zài shānfēng-shàng jiàng
snow at mountain.peak-on descend
b. 雪降在山峰上 (BBC)
xuě jiàng zài shānfēng-shàng
snow descend at mountain.peak-on
'The snow fell onto the mountain peak.'

In addition, it is less natural to have a 在 *zài* 'at' PP to occur before the achievement verb 死 *sǐ* 'die'. Rather, a 在 *zài* PP tends to occur after 死 *sǐ* and modifies the resultant state by specifying the location associated with changed state (being dead). For instance, when we searched the collocation of 死 *sǐ* and 在醫院/在家裏 *zài yīyuàn / zài jiālǐ* 'at hospital/home' in the assorted subcorpus of BCC, we found that preverbal 在 *zài* 'at' PPs are rarely used: there are only two instances of 在醫院死 *zài yīyuàn sǐ* 'die at the hospital', but 87 instances of 死在醫院 *sǐ zài yīyuàn sǐ* 'die at the hospital'; there are only two instances of 在家裏死 *zài jiālǐ sǐ* 'die at home', but 108 instances of 死在家裏 *sǐ zài jiālǐ sǐ* 'die at home'.

While the two sequences 在 *zài* PP+V and V+ 在 *zài* PP express almost the same meaning with verbs like 睡 *shuì* 'sleep', 住 *zhù* 'live', 坐 *zuò* 'sit' and 躺 *tǎng* 'lie', Tai (2011) argues that PP+V expresses the Focus on the V and serves as an answer for questions like (i), whereas V+PP expresses the Focus on the PP and can be used as an answer for questions like (ii).

(i) 他在做什麼？ 他在床上睡 (Tai 2011: 76)
tā zài zuò shénme? tā zài chuáng-shàng shuì
3SG at do what 3SG at bed-on sleep
'What is he doing? He is sleeping on the bed.'
(ii) 他在什麼地方？他睡在床上 (Tai 2011: 76)
tā zài shénme dìfāng? tā shuì zài chuáng-shàng
3SG at what place 3SG sleep at bed-on
'Where is he at? He is sleeping on the bed.'

In both (48) and (49), the preverbal 在 *zài* 'at' PP in (a) examples are interpreted as a place where the entire event takes place. On the other hand, in (48b), the location 'horse's back' in the postverbal PP is associated only with a changed location of a moving object, and in (49), the location 'train' in the postverbal PP is associated only with a slogan that has been written. The location denoted in the postverbal variant cannot be understood as a place where the entire event takes place, such as a place in which an agent is jumping or writing a slogan in (49a-i).

According to Maienborn (2001: 191-192), locative modifiers might yield different interpretations depending on which type of functions that they serve: external modifiers are related to the verb's eventuality argument and express the location where the event take place; internal modifiers are also related to the verb's eventuality argument but only refer to a location for one part of the event. In terms of the event structure of modified VP, Pustejovsky (1991: 52) argues that for events with complex event structure, adverbial modification can scope either one of the subevents (i.e. narrow scope) or an entire event (i.e. wide scope). Based on Maienborn (2001) and Pustejovsky (1991), we argue that the preverbal 在 *zài* 'at' PP in (48a) and (49a) are external locatives which widely modify the entire event structure of modified VP, whereas the postverbal 在 *zài* 'at' PPs in (48b) and (49b) are internal locatives which narrowly modify the subevent denoting the scalar result of the modified VP.

Furthermore, as observed in previous studies (Tai 1975; Wang 1980; Fan 1982; Klipple 1991; Liu 2009), there is a semantic restriction for the type of location nouns that can occur in the postverbal 在 *zài* 'at' PPs. For instance, in (50-52), all VPs denote scalar change and all 在 *zài* PPs denote locations, but only the location nouns in the (a) examples are acceptable.

(50) a. 把標語寫**在火車上** (Zhu 1981: 11)
bǎ biāoyǔ xiě ***zài huǒchē-shàng***
BA slogan write at train-on
'Write the slogan on the train.'
b.?? 把標語寫**在美國**。
Bǎ biāoyǔ xiě ***zài Měiguó***
BA slogan write at US
(intended) 'Write the slogan in the United States.'

(51) a. 別把那臟東西吃**在嘴裏/肚裏** (Liu 2009: 8)
bié bǎ nà zāng dōngxi chī ***zài zuǐlǐ/dù-lǐ***
don't BA that dirty stuff eat in mouth-inside/stomach-inside
'Don't put that dirty stuff into the mouth/stomach.'
b. ?? 別把那臟東西吃**在餐廳/桌上** (Liu 2009: 8)
bié bǎ nà zāng dōngxi chī ***zài canting /zhuō-shàng***
don't BA that dirty stuff eat on restaurant/table-on
(intended) 'Don't eat that dirty stuff in the restaurant/on the table.'

(52) a. 他睡**在床上** (Klipple 1991: 80)

tā *shuì* ***zài chuáng-shàng***
3SG sleep at bed-on
'He sleeps in the bed.'

b. ?? 他睡**在纽约** (Klipple 1991: 80)
tā *shuì* ***zài Niǔyuē***
3SG sleep at New York
(intended) 'He sleeps in New York.'

We argue that the differences in acceptability between (a) and (b) examples in (50-52) is due to the fact that only postverbal 在 *zài* PPs in (a) examples are directly associated with the scale denoted in the preceding VP and thus these PPs can further specify the scale as resultatives. For example, the train in (50a) is a part of the location on which the object (the slogan) was created; the mouth in (51a) is the physical part of the agent in which the filthy thing gets consumed; the bed in (52a) is the immediate location related with the change of posture. On the other hand, the postverbal 在 *zài* PPs in the (b) examples denote locations that are not or directly associated with the given scale denoted in the preceding VPs.[25] The locations such as 'the United States,' 'restaurants,' and 'New York' are much less closely associated with the incremental change of objects or change of posture, than the locations in (a) examples. We argue that such phenomenon supports our claim that when collocating with scalar change VPs, only scale-elaborating 在 *zài* 'at' PPs, rather than any type of adjunct PPs, can appear in the postverbal position. In other words, the preverbal position tends to be associated with external adverbial modification (wide scope) and the postverbal with internal adverbial modification (narrow scope).[26]

Finally, note that our analysis does not conflict with the situations where a scale-elaborating 在 *zài* 'at' PP occurs in the preverbal position. When an object argument or an event delimiting adjunct occurs in the postverbal position, the scale-elaborating 在 *zài* PP usually moves to the preverbal position. As illustrated in (53), the durative adverbial 二十分钟 *èrshí fēnzhōng* 'twenty minutes' temporally delimits the event of sleeping and occurs in the postverbal position, and in such a case, the 在 *zài* PP moves to the preverbal

[25] A reviewer questioned whether the postverbal 在 *zài* 'at' PPs in 他睡在床上 *tā shuì zài chuáng-shàng* 'He sleeps on the bed' could be an external modifier, since a person might have been located on the bed before a change of state occurs. We think that even if the person was already located on the bed before falling into sleep, 'the bed' is still directly associated with the changed state of being asleep, and 'on the bed' still can narrowly scope over the scalar result part of the event. The association between the postverbal position and the internal locative modification becomes clearer, if compared with (52b) where an external locative is not acceptable in the postverbal position.

[26] There are observations on other languages supporting the claim that the internal locatives allow PI, whereas the external locatives do not. For example, according to Kimenyi (1980), in Kinyarwanda, the verbal compound consisting of the verb *iica* 'sit' and the applicative suffix *-ho* 'on' is formed through PI when the locative is an internal modifier as in (ia), but not when the locative is an external modifier as in (ib). Also refer to Baker (1988) and Nam (2005), among others, for similar analysis.

(i) a. *Abaana b-iica-ye-**ho** ameeza* (Kimenyi 1980: 191)
children SP-sit-ASP-on table
'The children are sitting on the table.'

b. **Abaana b-iica-ye-**ho** umusozi* (Kimenyi 1980: 191)
children SP-sit-ASP-on mountain
'The children are sitting on the mountain.'

position.

(53) 在床上睡了二十分钟 (BCC)
Zài ***chuáng-shàng****shuì-le* *èrshí* *fēnzhōng*
at bed-on sleep-PFV twenty minute
'[I] slept twenty minutes on the bed.'

So far, we have shown that when modifying a nonscalar change verb, be it in the preverbal or postverbal position, 在 *zài* 'at' PPs function the all the same, i.e. modifying a given event as a whole and denoting locations which frame the occurrence of the event, and such 在 *zài* PPs do not undergo PI, even if they occur in the postverbal position. On the contrary, when a VP denotes scalar change, postverbal 在 *zài* PPs narrowly modifying a subevent denoting scalar result permit PI (i.e., internal locatives), whereas 在 *zài* PPs widely modify the event structure of the VP as a whole (i.e., external locatives) occur in the preverbal position.

6. Conclusion

In this work, we focused on the Chinese data where a locative preposition is incorporated into a preceding verb to form a compound verb and the location NP within the original PP becomes the object of the compounded V-P. We found that not all postverbal locative PPs can undergo the PI process and analyzed the semantic constraints that allow PI. We proposed that PI is allowed if the postverbal PP is associated with scalar result meaning in one of the following three ways: (a) a locative PP introduces a closed scalar attribute to the event; (b) a locative PP introduces an open scalar attribute to the event; (c) a locative PP reinforces or further elaborate the (un)specified endpoint of the scale denoted by their preceding verb (phrases).

The contributions of this study can be found in several aspects. First, by providing a scalar analysis of all major Chinese PPs, we observed a wider range of PPs that allow PI, including directional (向 *xiàng*/往 *wǎng* 'toward') PPs, non-directional (在 *zài* 'at') PPs as well as goal PPs (到 *dào* 'to') in Chinese, while previous studies typically dealt with the distributions and functions of individual PPs. More importantly, unlike previous studies, we focused on the underlying semantic differences between the locative PPs that can undergo PI and those that cannot. By doing so, we showed that only when the VPs modified by the postverbal adjunct PPs denote scalar change (e.g., nonscalar verbs collocating with scale denoting PPs, or scalar VPs collocating with scale-elaborating PPs), can the adjunct locatives appear as added arguments through PI.

Second, in comparison to the delimiter hypothesis in previous studies (e.g., Klipple 1991; Tenny 1994; Wechsler & Lee 1996; Peck 2008; Nam 2012, among others), this study proposed an analysis that is finer-grained to predict the semantic constraints for the PI phenomena where oblique adjuncts appear as object of compounded verb V-P. Since the delimiter hypothesis limits the notion of "result" to "delimitation", the distribution of directional PPs and non-directional PPs in the postverbal position were considered as counter examples or exceptions. However, within our approach, the PPs with delimiting functions, directional PPs and non-directional PPs all can be accounted for in a unified manner. Specifically, we expanded the notion "result" using the perspective of "scale"

and identified three types of scalar semantic functions of PPs. That is, in addition to introducing a closed scale (which corresponds to delimitation), the other semantic functions associated with scalar change, including introducing an open scale and further elaborating a scale, allow PI too.

Third, through the comparisons between the preverbal and postverbal variants of adjunct PPs that collocate with scalar change VPs, we showed that in Modern Chinese, the preverbal adjunct PPs tend to modify the event structure as a whole, and their semantic function tends to be outside the event composition. On the other hand, the postverbal adjunct PPs that either introduce a scale or further elaborate a scale permit PI. These postverbal adjunct PPs either directly participate in the event composition, or narrowly modify a subpart of the event denoting scalar result. Our analysis on the semantic functions of the PI-allowing locative PPs is consistent with Rappaport Hovav (2008: 9) that the "result XPs are scale denoting; they either introduce a scale or provide a further specification of a lexically specified scale."

Such semantic and functional differences of preverbal and postverbal adjunct PPs may shed light on questions such as why Chinese displays two different orderings between V and locative PPs, i.e., PP+V (the feature of OV languages such as Korean) and V+PP (the feature of VO languages such as English). In addition, the findings of this study also shed light on the argument realization of other non-subcategorized adjuncts such as durative and iterative NPs in natural languages.

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