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Encoding motion events in Chinese and the “scalar specificity constraint”

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Abstract

Mandarin Chinese often expresses motion events with more than one verbal motion morpheme, e.g., 退 *tui* ‘recede’ and 回 *hui* ‘return’ in 退回房間裏 *tui-hui fangjian-li* ‘recede-return room-inside’ ‘return into the room’. Building on recent work on “scale structure”, this paper proposes a “Motion Morpheme Hierarchy” that can be used to better predict the order of co-occurring motion morphemes: specifically, Chinese motion morphemes can be classified into four types based on the scale information they lexicalize, and the order of co-occurring motion morphemes tends to be closely related to the type of scale they lexicalize. The hierarchy is then verified using two corpus studies drawing on naturally occurring Chinese data: the first study examines the order of motion morphemes found in all motion constructions from selected recent Chinese novels, and the second study investigates the order of eight highly frequently used motion morphemes with respect to their co-occurring motion morphemes in the CCL Corpus; both corpus studies show that the hierarchy holds for most Chinese motion morphemes. Furthermore, this paper proposes a semantic constraint named the “Scalar Specificity Constraint” to account for the morpheme order predicted by the hierarchy: the morpheme with more information about the path of motion tends to occur after the morphemes with less information. For instance, 回 *hui* ‘recede’ lexicalizes an endpoint for the path and thus, is preceded by 退 *tui* ‘recede’ which does not indicate any endpoint. The constraint not only provides better coverage of the data involving Chinese motion constructions, but also indicates the role that the path information a motion morpheme lexicalizes plays in the morpheme’s distribution. This study provides new insight into the distribution of motion morphemes in Chinese MMMCs and a more fine-grained analysis of the semantic relationships between the morphemes in these constructions, and thus contributes to an increased understanding of how motion events are expressed in Chinese. The findings of this study may also illuminate the distribution of motion verbs in other languages, as well as constructions in domains beyond motion.

Keywords: Order of Chinese motion morphemes; Scale structure; Motion Morpheme Hierarchy; Scalar specificity constraint

1 Background

Mandarin Chinese often expresses motion events through a concatenation of verbal motion morphemes, and the orders of these contiguous morphemes are usually fixed, as illustrated in 1 and 2.

- (1) a. 不斷有懸石**滾**落下來 (CCL Corpus)^a
 buduan__you__xuanshi__**gun-loo**__xia-lai
 continuously__have__hanging.stone__**roll-fall**__descend-come
There were hanging stones continuously rolling and falling.
- b. 汽車**滾**進了山溝 (CCL Corpus)
 qiche__**gun-jin**-le__shangou
 car__**roll-enter**-ASP__valley
The car rolled into the valley.
- c. 一塊石子**落**進了水裡 (CCL Corpus)
 yi-kuai__shizi__**luo-jin**-le__shui-li
 one-CLF__pebble__**fall-enter**-ASP__water-inside
A pebble fell into the water.
- (2) a. *落滾
 *luo-gun
 fall-roll
- b. *進滾
 *jin-gun
 enter-roll
- c. *進落
 *jin-luo
 enter-fall

This paper calls such motion constructions “multi-morpheme motion constructions” (MMMCs). MMMCs are traditionally categorized as a type of resultative verbal compounds (RVCs) (Li and Thompson 1981), i.e. directional RVCs (more discussion on identifying MMMCs in Section “Special” motion constructions). Previous studies fall short of providing a systematic account of the relative order and the semantic relationships of the motion morphemes in all possible types of Chinese MMMCs. Drawing on recent work on “scale structure” (Rappaport Hovav and Levin 2010, Kennedy 2001, Hay et al. 1999, among others), this paper proposes a “Motion Morpheme Hierarchy” and a semantic constraint called “Scalar Specificity Constraint” that can be used to account for the order of verbal motion morphemes. The hierarchy and constraint provide a more comprehensive account for the relative order of motion morphemes in Modern Chinese as well as a finer-grained analysis of the semantic relationships between the co-occurring motion morphemes in Chinese. The approach introduced in this paper is also expected to be extended to motion verbs in other serial verb languages and to constructions in domains other than motion.

Section 2 reviews previous studies and shows that a more refined proposal is still necessary. Section 3 introduces the notion of scale structure and a previous study that

classifies Chinese motion morphemes into four types based on the kind of scale that the morphemes lexicalize. Building upon the scale-structure-based four-way classification of motion morphemes, Section 4 proposes a Motion Morpheme Hierarchy that can better predict the order of Chinese motion morphemes. Section 5 presents two corpus studies that verify the hierarchy. A semantic constraint is proposed in Section 6 to explain why the hierarchy does hold for most Chinese MMMCs. Conclusion is presented in Section Conclusion.

2 Previous studies

This section reviews previous studies of the order of Chinese motion morphemes and the semantic relationships among them.

2.1 RVC and the morpheme order

Resultative verbal compounds (RVCs) are compounds consisting of two elements in which the second element expresses some result of the action denoted by the first element (Li and Thompson 1981: 54–55). For instance, in 打破杯子 *da-po beizi* hit-break cup ‘break the cup’, the second verbal morpheme 破 *po* ‘break’ signals the result of the action 打 *da* ‘hit’. As mentioned in Section Background, MMMCs are traditionally treated as a type of RVC; specifically the second morpheme of the construction specifies “the direction in which the subject moves as the result of the displacement [denoted by the preceding motion morpheme]” (Li and Thompson 1981: 58, also Hashimoto 1964, Ross 1990, Xiao and McEnery 2004, among others, cf. Lu 1977). For instance, the second morphemes 落 *luo* ‘fall’ in 1a and 進 *jin* ‘enter’ in 1b are understood as the results of the event of rolling denoted by 滾 *gun* ‘roll’, the morpheme precedes them. However, the RVC account is not sufficiently fine-grained to reflect the relationship between all co-occurring motion morphemes: it cannot explain why when 落 *luo* ‘fall’ and 進 *jin* ‘enter’ co-occur, only 進 *jin* ‘enter’ is preceded by 落 *luo* ‘fall’ (1c), i.e. only 進 *jin* ‘enter’ can be the result of 落 *luo* ‘fall’, given that each morpheme can have a result understanding in 1a and 1b.

2.2 Temporal sequence and the morpheme order

Tai (1985) and Li (1993) propose that in Chinese, the order of two syntactic units follows the temporal order of the (sub)events they denote (cf. Huang and Lin 1992, Huang 1990). The proposal holds for two syntactic units with a temporally sequential relationship. For instance, 3a describes a situation where a person weeps as a result of being tired, whereas 3b describes a situation where a person becomes tired as a result of weeping (Li 1993).

- (3) a. Youyou 累哭了
 youyou__**lei-ku**__le
 Youyou__tired-weep__ASP
 Youyou was so tired she wept. (Li 1993: 499, (35))
- b. Youyou 哭累了
 youyou__**ku-lei**__le
 Youyou__weep-tired__ASP
 Youyou wept for so long that she became tired. (Li 1993: 499, (36))

However, the temporal iconicity assumption is unable to justify the morpheme order of some MMMCs where the motion morphemes denote simultaneous subevents. For instance, running and ascending can happen simultaneously, especially if the moving object stands at the lower ends of the stairs before the running starts. But as illustrated in 4, 跑 *pao* ‘run’ precedes 上 *shang* ‘ascend’.

- (4) a. 他跑上樓梯
 ta __pao-shang__ louti
 he __run-ascend__ stairs
 He went up the stairs running.
 b. *他上跑樓梯
 ta __shang-pao__ louti
 he __ascend-run__ stairs

2.3 A two-way classification of motion morphemes and the morpheme order

Talmy (1975, 1985, 2000) classifies motion verbs into two types: (a) manner-of-motion verbs that lexicalize how a motion event takes place (e.g., *walk, run, fly*); (b) path verbs that lexicalize the direction in which a motion event takes place (e.g., *descend, come, return*). In Chinese, when a manner-of-motion morpheme (e.g., 滾 *gun* ‘roll’) and a path morpheme (e.g., 落 *luo* ‘fall’, 進 *jin* ‘enter’) co-occur, the former tends to precede the latter, as in 1a-1b. However, as illustrated in 1c, the path morphemes 落 *luo* ‘fall’ and 進 *jin* ‘enter’ can occur together and this two-way classification cannot explain why a particular path morpheme precedes another.

3 A four-way classification of motion morphemes based on scale structure

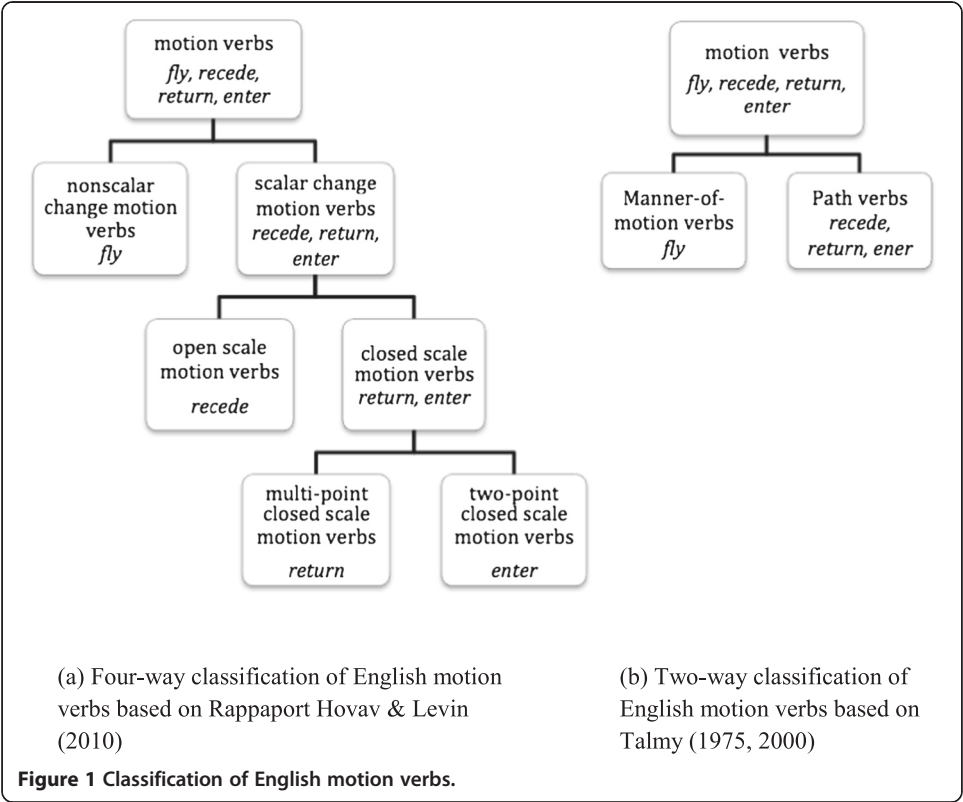
Building on previous studies on “scale structure” (Rappaport Hovav and Levin 2010, Rappaport Hovav 2008, Kennedy and Levin 2008, Kennedy and McNally 2005, Beavers 2008, Kennedy 2001, Hay et al. 1999), Lin and Peck (2011) propose that Chinese motion morphemes can be classified into four types. This section introduces the notion of “scale” and the classification of Chinese motion morphemes. In Motion Morpheme Hierarchy, we will show that the order of motion morphemes in MMMCs can be predicted based on the four classes of motion morphemes.

According to Rappaport Hovav and Levin (2010: 28), a scale is “a set of degree—points or intervals indicating measurement values—on a particular dimension (e.g., height, temperature, cost), with an associated ordering relation” (also Kennedy 2001, Kennedy and McNally 2005, among others). Rappaport Hovav and Levin (2010) point out that the path of a motion event is composed of continuous points ordered between the moving object and a reference object, and the ordered points indicate measurement values on the dimension of distance, so that the path can be understood as a spatial scale. Furthermore, they state that when the moving object moves along the path, its relative distance with respect to the reference object changes too, so the change can be understood as a scalar change that is measurable on the dimension of distance. For instance, according to them, the verb *ascend* lexicalizes a scale with its

points ordered in the direction against gravity; the distance between the moving object and the reference object (e.g., the ground) keeps increasing as the moving object continues ascending.

Rappaport Hovav and Levin (2010) identify three properties of scales that can classify motion verbs into four types. The first property is existence of a scale, i.e. whether a verb denotes motion in a particular direction. This property classifies all motion verbs into two types: scalar change motion verbs (e.g., *recede*, *return*, *enter*) and nonscalar change motion verbs (e.g., *fly*, *walk*). Their second property is boundedness, that is, whether a scale has an endpoint or not, i.e. whether the motion event denoted by the motion morpheme has an inherent endpoint or not, which classifies scalar change motion verbs into two types: open scale (e.g., *recede*, *ascend*) and closed scale motion verbs (e.g., *return*, *enter*). The third proposed property is punctuality; that is, whether a scale is understood as having multiple points so that the motion along the scale is durative, or as having only two points (the starting and end points) so that the motion is punctual. The property of punctuality divides closed scale motion verbs into multi-point (e.g., *return*, *come*) and two-point closed scale motion verbs (e.g., *enter*, *arrive*).

Figure 1 illustrates the four-way classification of English motion verbs based on Rappaport Hovav and Levin (2010) and the two-way classification given by Talmy (1975, 2000), respectively. The former can be understood as a finer-grained classification built on the latter: nonscalar change motion morphemes are equivalent to Talmy’s manner-of-motion morphemes, whereas the other three types are subtypes of Talmy’s path morphemes, each with a different scale structure.

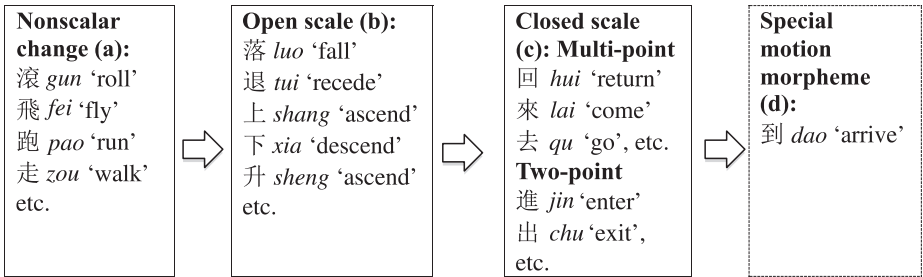


Following Rappaport Hovav and Levin (2010), Lin and Peck (2011) propose that Chinese motion morphemes can also be classified into four types based on the three properties of scales. In addition, they argue that the approach can also be applied to bound motion morphemes, that is, non-prepositional motion morphemes that are no longer used as main verbs in Modern Chinese (e.g., 入 *ru* ‘enter’, 起 *qi* ‘rise’, and 歸 *gui* ‘return’). Unlike Talmy’s two-way classification, which classifies verbs mainly based on linguists’ intuition, Lin and Peck (2011: 347–353) propose a set of independent diagnostics to determine which type each motion morpheme falls into. Table 1 and Table 2 list the scalar types and examples of each type in Chinese, respectively.

4 Motion Morpheme Hierarchy

(5) presents the Motion Morpheme Hierarchy that predicts the order of motion morphemes in Chinese MMMCs (cf. Lin and Peck 2011).

(5)



The hierarchy consists of the four scalar types of Chinese motion morphemes. It predicts that when semantically compatible (cf. Huang and Chang 1996) motion morphemes from different classes co-occur in a motion construction, they will tend to be ordered from left to right according to how their types appear in the hierarchy in 5. Because a multi-point and a two-point closed scale motion morpheme usually do not occur together in a motion construction and both occur in the same position in sequences of multiple motion morphemes, these two types are grouped together as one, i.e. closed scale motion morphemes, in the hierarchy. Note that 來 *lai* ‘come’ and 去 *qu* ‘go’ are frequently found after other closed scale motion morphemes such as 回 *hui* ‘return’, 進 *jin* ‘enter’, and 出 *chu* ‘exit’, but such 來 *lai* ‘come’ and 去 *qu* ‘go’ are no longer full-fledged multi-point closed scale motion morphemes (See more discussion in Section Motion morphemes from

Table 1 Three scalar properties determine four types of Chinese motion morphemes (Lin and Peck 2011: 353)

Types of motion morphemes	Existence of a scale	Boundedness	Punctuality
Nonscalar change (飛 <i>fei</i> ‘fly’)	-	-	-
Open scale (退 <i>tui</i> ‘recede’)	+	-	-
Multi-point closed scale (回 <i>hui</i> ‘return’)	+	+	-
Two-point closed scale (進 <i>jin</i> ‘enter’)	+	+	+

Table 2 Examples of Chinese motion morphemes of different scalar types

Types	Nonscalar change motion morpheme	Open scale motion morpheme	Multi-point closed scale motion morpheme	Two-point closed scale motion morpheme
Free motion morphemes	跑 <i>pao</i> 'run'	升 <i>sheng</i> 'ascend'	回 <i>hui</i> 'return'	進 <i>jin</i> 'enter'
	飛 <i>fei</i> 'fly'	降 <i>jiang</i> 'descend'	來 <i>lai</i> 'come'	出 <i>chu</i> 'exit'
	走 <i>zou</i> 'walk'	落 <i>luo</i> 'fall'	去 <i>qu</i> 'go'	過 <i>guo</i> 'cross'
	衝 <i>chong</i> 'rush'	退 <i>tui</i> 'recede'	過 <i>guo</i> 'cross'	到 <i>dao</i> 'arrive'
	流 <i>liu</i> 'flow'	上 <i>shang</i> 'ascend'		
	飄 <i>piao</i> 'float'	下 <i>xia</i> 'descend'		
	etc.	etc.		
Bound motion morphemes	翔 <i>xiang</i> 'fly'	撤 <i>che</i> 'recede'	越 <i>yue</i> 'cross'	越 <i>yue</i> 'cross'
	奔 <i>ben</i> 'run'	起 <i>qi</i> 'rise'	歸 <i>gui</i> 'return'	入 <i>ru</i> 'enter'
	行 <i>xing</i> 'walk'	墮 <i>duo</i> 'fall'	返 <i>fan</i> 'return'	至 <i>zhi</i> 'arrive'
	etc.	etc.	etc.	etc.

different scalar classes but in an order reverse to the Motion Morpheme Hierarchy). In addition, the two-point closed scale motion morpheme 到 *dao* 'arrive' is treated as a special motion morpheme and positioned in the rightmost of the hierarchy because it does not behave all the same with other motion morphemes such as 進 *jin* 'enter' and 出 *chu* 'exit' from the same type. The rest of this section will elaborate on the hierarchy.

4.1 The operation of the Motion Morpheme Hierarchy

This section first provides examples of two-morpheme MMMCs to demonstrate how the hierarchy is used to predict morpheme order. Then it presents examples of MMMCs with three or more motion morphemes.

In two-morpheme MMMCs, the first morpheme tends to come from a type that is located to the left of the type that the second morpheme comes from. For instance, nonscalar change motion morphemes occupy the leftmost position of the hierarchy in 5. Therefore, a morpheme such as 飛 *fei* 'fly' from this type is predicted to precede any motion morphemes that belong to the other types in the hierarchy, as long as these morphemes are semantically compatible. 6 provides examples of 飛 *fei* 'fly' preceding the open scale motion morpheme 退 *tui* 'recede', the multi-point closed scale motion morpheme 回 *hui* 'return', the two-point closed scale motion morpheme 進 *jin* 'enter', and the special motion morpheme 到 *dao* 'arrive', whereas the reverse orders are not acceptable.

- (6) a. 向後飛退的黃土(CCL Corpus)
xiang_hou_fei-tui_de_huangtu
toward_back_fly-recede_REL_yellow.dust
The yellow dust that is flying back
- b. 野鴨剛飛回北方(CCL Corpus)
yeya_gang_fei-hui_beifang
wild.duck_just_fly-return_north
The wild ducks just flew back to the north.

- c. 一只燕子飛進教室(CCL Corpus)
 yi_zhi_yanzi_**fei-jin**_jiaoshi
 one_CLF_swallow_**fly-enter**_classroom
A swallow flew into the classroom.
- d. 那群小鳥飛到樹上(CCL Corpus)
 na_qun_xiaoniao_**fei-dao**_shu-shang
 that_group_little.bird_**fly-arrive**_tree-on
That group of birds flew onto the tree.

Similarly, the class of open scale motion morphemes is located to the left of the class of closed motion morphemes (both multi-point and two-point) and 到 *dao* 'arrive'. Therefore, an open scale motion morpheme, e.g., 退 *tui* 'recede', is predicted to precede morphemes from the latter, whereas the reverse orders are not allowed.

- (7) a. 軍隊退回陝西(CCL Corpus)
 jundui_**tui-hui**_Shanxi
 army_**recede-return**_Shaanxi
The army receded back to Shaanxi.
- b. 露露慢慢退進了裏屋(CCL Corpus)
 lulu_manman_**tui-jin**-le_liwu
 Lulu_slowly_**recede-enter**-ASP_back.room
Lulu slowly receded into the back room.
- c. 球員退到了場外(CCL Corpus)
 qiuyuan_**tui-dao**-le_chang-wai
 player_**recede-arrive**-ASP_court-outside
The players receded outside of the court.

Finally, as the hierarchy predicts, although closed scale motion morphemes usually do not co-occur, most of them can occur before the special motion morpheme 到 *dao* 'arrive', as in 8^b.

- (8) a. 我們回到樹村(CCL Corpus)
 women_**hui-dao**_shu_cun
 we_**return-arrive**_tree_village
We returned to Tree Village.
- b. 杜心進到房間裏(CCL Corpus)
 duxin_**jin-dao**_fangjian-li
 DuXin_**enter-arrive**_room-inside
Du Xin went into the room.

In a three-morpheme MMMC with each morpheme coming from a different class in the hierarchy, the order of the three motion morphemes also tends to follow the hierarchy. For instance, the three morphemes in 9a, 退 *tui* 'recede', 回 *hui* 'return', and 到

dao ‘arrive’, conform to the hierarchy in the order “open scale motion morpheme + closed scale motion morpheme + special motion morpheme 到 *dao* ‘arrive,’” whereas the morphemes 飄 *piao* ‘drift’, 落 *luo* ‘fall’, and 回 *hui* ‘return’ in 9b are in the order “nonscalar change motion morpheme + open scale motion morpheme + closed scale motion morpheme,” which is also expected from the hierarchy.

(9) a. 默默地退回到自己的床上(CCL Corpus)

momo__de__tui-hui-dao__ziji-de__chuang-shang
silently__MOD__recede-return-arrive__self-POSS__bed-on.top.of
[She] returned to her own bed silently.

b. 飛揚的灰塵漸漸飄落回地面^c

feiyang__de__huichen__jianjian__piao-luo-hui__dimian
flying__MOD__dust__gradually__drift-fall-return__ground
The flying dust gradually fell onto the ground in a drifting manner.

As will be shown in Section Corpus studies, MMMCs with four or more contiguous motion morphemes are seldom found in the two corpus studies^d. The three scalar classes of motion morphemes and the special motion morpheme 到 *dao* ‘arrive’ account for most of the natural Chinese data found in the two corpora.

4.2 “Special” motion constructions

This section introduces motion constructions that seem to be the counterexamples to the Motion Morpheme Hierarchy. We will show that these constructions do not really challenge the hierarchy.

4.2.1 Motion morphemes from the same scalar class

As introduced in Section The operation of the Motion Morpheme Hierarchy, only predicts the order of motion morphemes from different classes, i.e. it does not predict morphemes from the same class. From the two corpus studies that will be introduced in Section Corpus studies, two types of combinations are observed in which the motion morphemes come from the same scalar class.

The first type of motion constructions consists of coordinating synonymous motion morphemes, e.g., 奔跑 *ben-pao* rush-run ‘run’, 降落 *jiang-luo* descend-fall ‘descend’, 飛騰 *fei-teng* fly-rise ‘soar’, and 攀登 *pan-deng* climb-mount ‘climb’. Such constructions can be grouped into two types according to whether the relative order of the motion morphemes is fixed or not. Constructions such as 奔跑 *ben-pao* rush-run ‘run’ and 降落 *jiang-luo* descend-fall ‘descend’ usually have fixed order (e.g., *跑奔 *pao-ben* run-rush, *落降 *luo-jiang* fall-descend), whereas constructions such as 飛騰 *fei-teng* fly-rise ‘soar’, and 攀登 *pan-deng* climb-mount ‘climb’ are found in both orders (e.g., 騰飛 *teng-fei* rise-fly ‘soar’ and 登攀 *deng-pan* mount-climb ‘climb’). However, the hierarchy is not intended to be used to predict their order because they should not be treated as MMMCs for two reasons. First, the two co-occurring morphemes in each of these combinations denote exactly the same components of motion, e.g., both 奔 *ben* ‘run’ and 跑 *pao* ‘run’ lexicalize a manner of running. In contrast, two morphemes

in an MMMC denote different information, e.g., 跑回 *pao-hui* run-return ‘run back’ specifies a running manner and a returning direction respectively. Second, these combinations do not allow potential markers to occur in between their morphemes, but MMMCs do, cf. *奔得跑 *ben-de-pao* rush-POT-run and 跑得進 *pao-de-jin* run-POT-enter ‘be able to run into some place’. In this sense, these combinations are lexical words, and thus are structurally different from the MMMCs being investigated in this study (Discussion of the morpheme order in these disyllabic coordinating combinations can be found in Zheng 郑奠 1964, Chen and Yu 陈爱文, 于平 1979, among others).

The second type has only two combinations, i.e. 退上 *tui-shang* recede-ascend ‘recede upward’ and 退下 *tui-xia* recede-descend ‘recede downward’, where 退 *tui* ‘recede’, 上 *shang* ‘ascend’, and 下 *xia* ‘descend’ are all open scale motion morphemes. 退上/下 *tui-shang/xia* recede-upward/downward ‘recede upward/downward’ are different from the first type and should be treated as MMMCs for the following reasons: (a) although 退 *tui* ‘recede’ and 上/下 *shang/xia* ‘ascend/descend’ belong to the same scalar class, they denote different information about motion, i.e. 退 *tui* ‘recede’ denotes backward motion, whereas 上/下 *shang/xia* ‘ascend/descend’ denotes motion in a vertical direction; (b) 退上/下 *tui-shang/xia* recede-upward/downward ‘recede upward/downward’ allow a potential marker 得 *de* to occur in between them, e.g., 退得上/下 *tui-de-shang/xia* recede-POT-ascend/descend ‘be able to recede upward/downward’. The relative order of 退上/下 *tui-shang/xia* recede-upward/downward ‘recede upward/downward’ is also fixed, but the order is not predicted by the Motion Morpheme Hierarchy. However, the existence of this sequence can be justified by the “Scalar Specificity Constraint” proposed in Section The encoding of Chinese motion events and the scalar specificity constraint; we will come back to them in Section 退上/下 *tui-shang/xia* ‘recede upward/downward’ and the scalar specificity constraint.

4.2.2 Motion morphemes from different scalar classes but in an order reverse to the Motion Morpheme Hierarchy

The corpus search also finds motion constructions where the motion morphemes come from different scalar classes but can appear in both orders, e.g., 回流 *hui-liu* return-flow ‘flow backward’ and 流回 *liu-hui* flow-return ‘flow back’, 回落 *hui-luo* return-fall ‘fall backward’ and 落回 *luo-hui* fall-return ‘fall back’, 下滑 *xia-hua* descend-slide ‘slide downward’ and 滑下 *hua-xia* slide-descend ‘slide down’, and 起飞 *qi-fei* rise-fly ‘take off’ and 飞起 *fei-qi* fly-rise ‘fly up’. In these pairs, only the second construction of each pair follows the order of the Motion Morpheme Hierarchy; the first construction, however, shows an order reverse to the hierarchy (e.g., in 回流 *hui-liu* return-flow ‘flow backward’, the multi-point closed scale motion morpheme 回 *hui* ‘return’ occurs before the nonscalar motion morpheme 流 *liu* ‘flow’).

Nonetheless, the latter do not challenge the hierarchy in that they are structurally different from the former and should not be treated as MMMCs. These constructions (i.e. 回流 *hui-liu* return-flow ‘flow backward’, 回落 *hui-luo* return-fall ‘fall backward’, *xia-hua* descend-slide ‘slide downward’, and 起飞 *qi-fei* rise-fly ‘take off’) do not allow potential markers to occur in between the morphemes (e.g., *回得流 *hui-de-liu* return-POT-flow vs. 流得回 *liu-de-hui* flow-POT-return ‘be able to flow back to some place’). The first morpheme in these constructions functions as an adverbial and

specifies the direction of the event denoted by the second morpheme. For instance, 回 *hui* ‘return’ in 回流 *hui-liu* return-flow ‘flow backward’ specifies a backward direction for the event of flowing. Furthermore, if a motion morpheme lexicalizes a closed-scale (i.e. being bounded with an inherent endpoint), it loses the boundedness feature when occurring as the first morpheme in these constructions. For example, although 回 *hui* ‘return’ is bounded, 回流 *hui-liu* return-flow ‘flow backward’ does not necessarily entail the returning to an endpoint (cf. Chang 張麗麗 2010), as illustrated in 10a, cf. 10b.

- (10) a. 雨水回流了, 可是還沒到達回流槽裡
 yushui__hui-liu-le, keshi__hai__mei__daoda__huiliucuo-li
 rainwater__return-flow-ASP, but__still__NEG__arrive__reflux.tank
The rainwater flew back, but had not arrived at the reflux tank.
- b. 雨水流回了大海, *可是還沒到達大海裡。
 yushui__liu-hui-le__dahai, *keshi__hai__mei__daoda__dahai-li
 rainwater__flow-return-ASP__sea, *but__still__NEG__arrive__sea-inside
*The rainwater flew back, *but had not arrived at the sea yet.*

4.2.3 Motion constructions ending with 來 *lai* ‘come’/去 *qu* ‘go’

Many Chinese motion constructions end with 來 *lai* ‘come’ or 去 *qu* ‘go’, e.g., 跑進房間來 *pao-jin-fangjian-lai* run-enter-room-come ‘run into the room (towards the deictic center)’, 飄落回去 *piao-luo-hui-qu* drift-fall-return-go ‘drift and fall back (away from the deictic center)’. However, although 來 *lai* ‘come’ and 去 *qu* ‘go’ are multi-point closed scale motion morphemes according to the diagnostics in Lin and Peck (2011), when occurring in construction-final position, they are not typical motion morphemes in that they no longer possess scalar properties such as boundedness and punctuality (cf. Lin and Peck 2011). Rather, the boundedness and punctuality of a motion event is determined by the motion morphemes preceding 來/去 *lai/qu* ‘come/go’. For example, the motion event is unbounded if the preceding motion morpheme is unbounded, and punctual if the preceding morpheme is punctual. Evidence is presented in the rest of this section.

來/去 *lai/qu* ‘come/go’ are multi-point closed scale motion morphemes when they occur as the only verbs in a sentence, so they do not allow ‘towards’ PPs: a ‘toward’ PP is usually only compatible with an unbounded event (Lamarre 2008, Hsiao 2009, among others), because it does not entail the arrival at the endpoint of the path at the end of a motion event; rather, the moving object can stop at any position in the path. Therefore, as illustrated in 11, 來/去 *lai/qu* ‘come/go’ is usually incompatible with the PP 向教室裏 *xiang jiaoshi-li* toward classroom-inside ‘towards the classroom’, whereas a nonscalar change motion morpheme such as 跑 *pao* ‘run’ is unbounded and collocates with the PP.

- (11) a. *他向教室裏來/去
 ta__xiang__jiaoshi-li__lai/qu
 he__towards__classroom-inside__come/go
 intended: *He came/went towards the classroom.*

b. 他向教室裏跑

ta__xiang__jiaoshi-li__**pao**he__towards__classroom-inside__**run***He ran towards the classroom.*

However, when 來/去 *lai/qu* ‘come/go’ occur after another motion morpheme, the boundedness of the whole construction is determined by the boundedness of the motion morpheme preceding 來/去 *lai/qu* ‘come/go’: if 來/去 *lai/qu* ‘come/go’ follow a nonscalar change (走 *zou* ‘walk’) or open scale motion morpheme (升 *sheng* ‘ascend’), which does not lexicalize an inherent endpoint, a ‘towards’ PP is allowed to co-occur, as in 12; in contrast, if they follow a closed scale motion morpheme (回 *hui* ‘return’, 進 *jin* ‘enter’), a ‘towards’ PP is not allowed, as illustrated in 13.

(12) a. 向學校走來 (CCL Corpus)

xiang__xuexiao__**zou-lai**towards__school__**walk-come***[They] walked towards the school.*

b. 這篇濃霧慢慢地向天上升去 (CCL Corpus)

zhe__pian__nongwu__manmande__xiang__tian-shang__**sheng-qu**this__piece__thick.fog__slowly__towards__sky-top__**ascend-go***The thick fog went up toward the sky slowly.*

(13) * 向學校回/進來

xiang__xuexiao__**hui/jin-lai**towards__school__**return/enter-come**

來/去 *lai/qu* ‘come/go’ also has lost the property of punctuality when they occur after another motion morpheme. As illustrated in 14, the motion construction is durative when a durative motion morpheme (回 *hui* ‘return’) precedes 來/去 *lai/qu* ‘come/go’, but punctual when the motion morpheme (進 *jin* ‘enter’) is punctual.

(14) a. 他8點鐘回來/去, 可是現在還沒到家

ta__8__dianzhong__**hui-lai/qu**, keshi__xianzai__hai__mei__dao__jiahe__8__o'clock__**return-come/go**__but__now__yet__NEG__arrive__home*He has been on the way returning home (toward/away from the speaker) since 8 o'clock, but he has not arrived home yet.*

b. 他8點鐘進來/去了, *可是現在還沒到

ta__8__dianzhong__**jin-lai/qu**__le, *keshi__xianzai__hai__mei__daohe__8__o'clock__**enter-come/go**__ASP__but__now__yet__NEG__arrive*Intended: He has been entering [a place toward/away from the speaker] at 8 o'clock, but he still has not arrived at [that place] yet.*

The examples above show that when occurring at the end of a motion construction, 來/去 *lai/qu* ‘come/go’ no longer denote information about boundedness, nor are they specific about whether the scales they lexicalize are multi-point. In other words, construction-final *lai/qu* have been grammaticalized and only indicate deictic information (toward/away from speaker) about a motion event.

Furthermore, when deictic information is not necessary for the description of a motion event, the use of construction-final 來/去 *lai/qu* ‘come/go’ becomes optional. Motion morphemes such as 回 *hui* ‘return’, 進 *jin* ‘enter’, 出 *chu* ‘exit’, 過 *guo* ‘cross’, 上 *shang* ‘ascend’, and 下 *xia* ‘descend’ usually require explicitly expressed information about the reference object (cf. Ju 居红 1992, Liu 刘月华 1998, Qi 齐沪扬 1998, Lamarre 2008). If no locative NP is available, these motion morphemes require 來/去 *lai/qu* ‘come/go’ because the deictic meanings of 來/去 *lai/qu* ‘come/go’ provide locative information and thus satisfy this requirement, as in 15a; however, if locative NPs are present, the use of 來/去 *lai/qu* ‘come/go’ is optional, as in 15b (I will come back to the constraint on locative information when 上/下 *shang/xia* ‘ascend/descend’ are discussed in Section 退上/下 *tui-shang/xia* ‘recede upward/downward’ and the scalar specificity constraint).

- (15) a. 他回*(來/去)了
 ta__hui-*(lai/qu)__le
 he__return-come/go__ASP
 He went back (towards/away from the deictic center).
- b. 他回學校(來/去)了
 ta__hui__xuexiao__(lai/qu)__le
 he__return__school__come/go__ASP
 He returned to the school (towards/away from the deictic center).

Therefore, construction-final 來/去 *lai/qu* ‘come/go’ are no longer typical motion morphemes^c. In this sense, 跑進房間來 *pao-jin-fangjian-lai* run-enter-room-come ‘run into the room (towards the speaker)’ and 飄落回去 *piao-luo-hui-qu* drift-fall-return-go ‘drift down back (away from the speaker)’ are treated as two-morpheme (跑 *pao* ‘run’ and 進 *jin* ‘enter’) and three-morpheme (飄 *piao* ‘drift’, 落 *luo* ‘fall’, and 回 *hui* ‘return’) MMMCs, respectively. The Motion Morpheme Hierarchy proposed to predict the order of motion morphemes does not take into account construction-final 來/去 *lai/qu* ‘come/go’.

5 Corpus studies

Section 4 proposes the Motion Morpheme Hierarchy to predict the existence of a strong distribution tendency of motion morphemes in Modern Mandarin Chinese. Since linguistic rules are more often strong distribution tendencies and different tendencies (or exceptions) can be possible (Bresnan and Ford 2010), it is necessary to verify how well the Motion Morpheme Hierarchy holds for Modern Chinese MMMCs. Two corpus studies are carried out to investigate the morpheme order in Modern Chinese MMMCs: the first study examines all MMMCs from selected recent Chinese novels and the second study examines MMMCs that contains one of the eight most

frequently used motion morphemes (1,000 MMMCs for each motion morpheme) from the CCL Corpus. Both studies show that the hierarchy holds for most MMMCs investigated, which suggests that the MMMCs predicted by the Motion Morpheme Hierarchy are the highly probable constructions in Modern Chinese (cf. Bresnan and Ford 2010).

5.1 Corpus study 1

In the first study, all MMMCs were collected from selected chapters of four recent Chinese novels (Table 3). The motion morphemes in these MMMCs were investigated to determine whether they occur in the order predicted by the hierarchy. Information of the four novels is given in Of the four novels, the first two are revolutionary stories of workers and soldiers, and thus are written in a language style of these people, whereas the other two are urban stories with the language closer to that of urbanites. In addition, only part of the first two novels is selected in order to keep the length of material from each novel relatively balanced. The size and diverse style of these novels provide a reasonable basis for a comprehensive investigation of motion constructions.

The study found 260 two-morpheme MMMCs and one three-morpheme MMMC. Among them, 259 two-morpheme MMMCs are consistent with the hierarchy. The only exception is given in 16, where the open scale motion morpheme 升 *sheng* ‘ascend’ occurs before the nonscalar change motion morpheme 飛 *fei* ‘fly’.

- (16) 一無所有地飄飄升飛 (空中小姐 *Kongzhong Xiaojie*)
yiwusuoyou__de__piaopiao__sheng-fei
with.nothing__MOD__drifting__ascend-fly
[She] is ascending and flying in a drifting manner; nothing is with her.

According to the hierarchy, 飛 *fei* ‘fly’ should precede 升 *sheng* ‘ascend’. However, 升飛 *sheng-fei* ascend-fly in 16 does not represent a strong challenge to the hierarchy for two reasons. First, the corpus has in total 35 MMMCs consisting of a nonscalar change motion morpheme (e.g., 走 *zou* ‘walk’, 跑 *pao* ‘run’, 跳 *tiao* ‘jump’) and an open scale motion morpheme (e.g., 上 *shang* ‘ascend’, 下 *xia* ‘descend’, 走 *zou* ‘away’). 升飛 *Sheng-fei* ascend-fly is the only instance in which the open scale motion morpheme precedes the nonscalar change motion morpheme, whereas in all other 34 instances, the order of the morphemes follows the hierarchy, i.e. an open scale motion morpheme is preceded by a nonscalar change motion morpheme.

Second, in order to determine whether 升 *sheng* ‘ascend’ tends to precede 飛 *fei* ‘fly’ whenever *sheng* ‘ascend’ and 飛 *fei* ‘fly’ occur together, both orders, 升飛 *sheng-fei* ascend-fly and 飛升 *fei-sheng* fly-ascend, were searched for in the CCL Corpus. 119 instances of

Table 3 Data selected for corpus study 1

Novel	Author	Year	Selection analyzed	Number of characters
1. 地球的紅飄帶 <i>Diqiu de Hong Piaodai</i> (The Earth's Red Flying Ribbon)	魏巍 Wei Wei	1988	First six chapters	34,108
2. 太陽照在桑干河上 <i>Taiyang Zhao zai Sanganghe-shang</i> (The Sun Shines over the Sanggan River)	丁玲 Ding Ling	1952	First twelve chapters	28,935
3. 太陽出世 <i>Taiyang Chushi</i> (The Sun was Born)	池莉 Chi Li	1992	Entire novel	35,433
4. 空中小姐 <i>Kongzhong Xiaojie</i> (Flight Attendant)	王朔 Wang Shuo	1985	Entire novel	29,185

飛升 *fei-sheng* fly-ascend and only one instance of 升飛 *sheng-fei* ascend-fly were found in the corpus. This one instance is exactly the one found in the novel 空中小姐 *Kongzhong Xiaojie*, i.e. 16, because this novel is part of the novel collection in the CCL Corpus. Therefore, it is likely that the instance of 升飛 *sheng-fei* in 15 is an accidental use by the author and does not represent the usual order of 升 *sheng* ‘ascend’ and 飛 *fei* ‘fly’.

Except for this instance of 升飛 *sheng-fei* ascend-fly, all other MMMCs found in the data sources are consistent with the hierarchy. Figure 2 presents the frequencies of the types of two-morpheme MMMCs. There are in total seven types attested in the data. Among them, the first six (starting from the left edge of the figure; 259 out of 260 instances) are predicted by the hierarchy.

As mentioned above, the corpus study also found the three-morpheme MMMC given in 17.

- (17) 生怕她滑落到地上 (太陽出世 *Taiyang Chushi*)
 shengpa__ta__**hua-luo-dao**__di-shang
 fear__she__**slip-fall-arrive**__floor-on.top.of
 [They were] afraid that she would slip and fall onto the floor.

In 17, the first morpheme 滑 *hua* ‘slip’ is a nonscalar motion morpheme with no inherent direction, the second morpheme 落 *luo* ‘fall’ is an open scale motion morpheme, which is in turn followed by 到 *dao* ‘arrive’. Therefore, their relative order is also consistent with the Motion Morpheme Hierarchy.

The results of this corpus study show that the Motion Morpheme Hierarchy can predict most naturally occurring MMMCs in a corpus of Chinese, which indicates that a motion morpheme’s order in an MMMC with respect to other motion morphemes is determined by the type of scale lexicalized in the morphemes.

5.2 Corpus study 2

The purpose of this second corpus study is to verify the Motion Morpheme Hierarchy once again by investigating MMMCs in another corpus. For each scalar class in the hierarchy, the first two most frequently used motion morphemes in Corpus Study 1 were selected for study (three motion morphemes are selected for the class of open scale motion morphemes; see explanation below). These morphemes were searched for in a larger corpus, the novel category of the CCL Corpus, to investigate whether they and their co-occurring motion morphemes follow the order expected from the

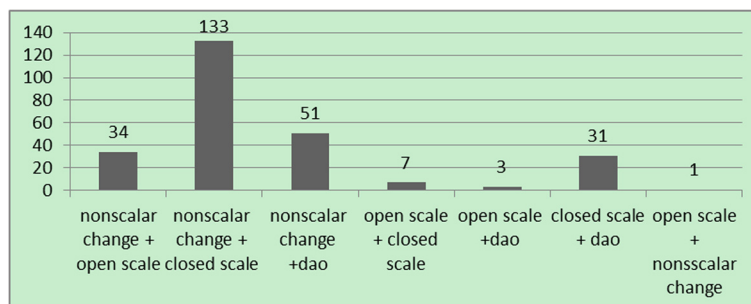


Figure 2 Different types of two-morpheme MMMCs found in corpus study 1.

hierarchy. To make the study feasible, only the first 1,000 instances retrieved from the search of each motion morpheme were collected for further analysis.

The most frequently used motion morphemes in each class in the hierarchy found in Corpus Study 1 are listed in 18^f.

- (18) a. Nonscalar change motion morphemes: 走 *zou* 'walk', 跑 *pao* 'run'
 b. Open scale motion morphemes: 上 *shang* 'ascend', 下 *xia* 'descend', 退 *tui* 'recede'
 c. Closed scale motion morphemes: 回 *hui* 'return', 出 *chu* 'exit'
 d. Special motion morpheme: 到 *dao* 'arrive'

上 *shang* 'ascend' and 下 *xia* 'descend' are the first two most frequently used open scale motion morphemes found in Corpus Study 1. As mentioned in "Special" motion constructions, the two motion morphemes can follow another open scale motion morpheme 退 *tui* 'recede' and present as exceptions to the Motion Morpheme Hierarchy (the hierarchy cannot predict their relative order), so the third most frequently used motion morpheme 退 *tui* 'recede' is also investigated in the study.

1,242 MMMCs were collected in the corpus search, with 1,231 (99.1%) two-morpheme MMMCs and 11 (0.09%) three-morpheme MMMCs^g. In what follows, the morpheme order of two-morpheme MMMCs is analyzed first, followed by the MMMCs with three motion morphemes.

Figures 3, 4, 5, 6, 7, 8, 9 and 10 display the distribution of each key morpheme in two-morpheme MMMCs. In each figure, there are three columns, with the middle column representing the key morpheme searched for in the corpus, the column to its left representing the number of occurrences of different types of motion morphemes that precede the key morpheme, and the column to its right representing the number of occurrences of different types of motion morphemes that follow the key morpheme in MMMCs. Take Figure 3, for example: the motion morpheme in the middle column is 走 *zou* 'walk', which is the key morpheme. In total, 334 instances of 走 *zou* 'walk' were found to occur in MMMCs. The column to its right represents the different types of motion morphemes that occur after 走 *zou* 'walk': 99 instances of 到 *dao* 'arrive', 201 instances of closed scale motion morphemes (including both multi-point and two-point

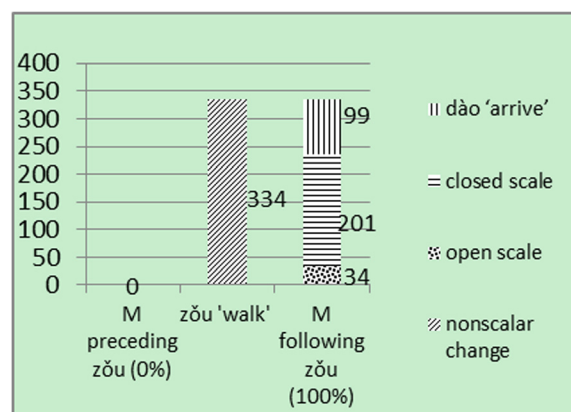


Figure 3 走 *zou* 'run'.

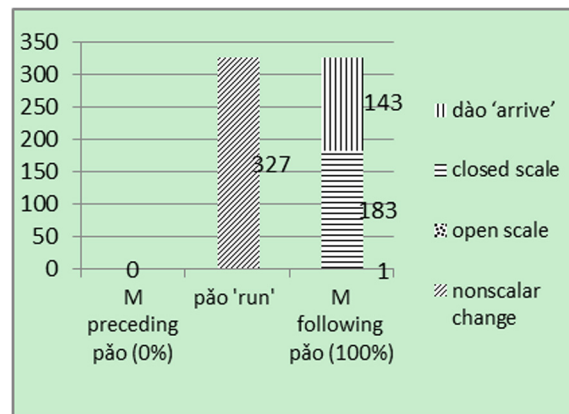


Figure 4 跑 *pao* 'walk'.

closed scale motion morphemes, e.g., 回 *hui* 'return' in 走回來 *zou hui-lai* walk return-come 'walk back (towards the speaker)', 進 *jin* 'enter' in 走進商店 *zou-jin shangdian* walk-enter store 'walk into the store', and 34 instances of open scale motion morphemes (e.g., 上 *shang* 'ascend' in 走上車 *zou-shang che* walk-ascend car 'walk into the car'). The column to the left of the 走 *zou* 'walk' column represents the types of motion morphemes that precede 走 *zou* 'walk' in MMMCs. However, as illustrated in Figure 3, no motion morpheme occurring before 走 *zou* 'walk' was found in the corpus search.

Figure 4 illustrates the order of the nonscalar change motion morpheme 跑 *pao* 'run' and its co-occurring motion morphemes. Like 走 *zou* 'walk', there is no motion morpheme preceding 跑 *pao* 'run'. In addition, 跑 *pao* 'run' is found to precede all other types of motion morphemes, as shown in the column to the right of the 跑 *pao* 'run' column. Therefore, both the distributions of 走 *zou* 'walk' and 跑 *pao* 'run' are consistent with the hierarchy. Furthermore, for both 走 *zou* 'walk' and 跑 *pao* 'run', closed scale motion morphemes are the most frequent co-occurring type, followed by 到 *dao* 'arrive' and then open scale motion morphemes.

Figures 5, 6 and 7 display the distribution of 上 *shang* 'ascend', 下 *xia* 'descend', and 退 *tui* 'recede', the most frequently used open scale motion morphemes in Corpus Study 1.

The three figures indicate that 上 *shang* 'ascend' and 下 *xia* 'descend' are used less frequently than 退 *tui* 'recede', and they indeed behave differently from 退 *tui* 'recede'.

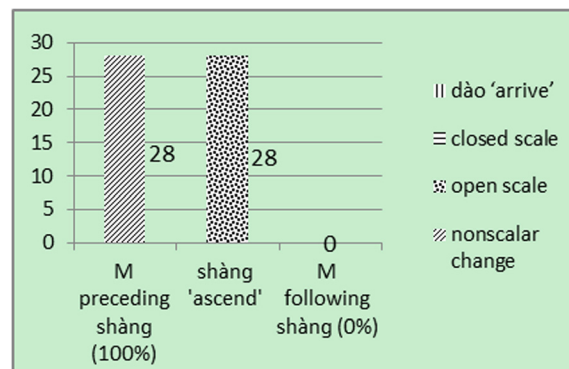


Figure 5 上 *shang* 'ascend'.

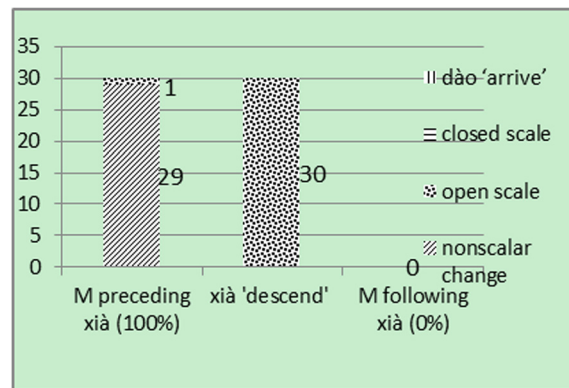


Figure 6 下 *xia* 'descend'.

Although according to the hierarchy, all three morphemes can be preceded by nonscalar change motion morphemes, in this corpus study, only 上 *shang* 'ascend' and 下 *xia* 'descend' are found to be so (e.g., 蹬 *deng* 'climb' in 登上山頂 *deng-shang shanding* climb-ascend summit 'climb up to the summit' and 跳 *tiao* 'jump' in 跳下車 *tiao-xia che* jump-descend car 'jump off the car'). In addition, the hierarchy also suggests that all three morphemes should be followed by 到 *dao* 'arrive', but only 退 *tui* 'recede' is followed by 到 *dao* 'arrive', as in 退到門外 *tui-dao men-wai* recede-arrive door-outside 'recede to the outside of the door'. However, as illustrated in 19, when these three morphemes were searched for in the whole CCL Corpus, examples could be found in which 退 *tui* 'recede' is preceded by nonscalar change motion morphemes, and 上 *shang* 'ascend' and 下 *xia* 'descend' are followed by 到 *dao* 'arrive', which is predicted by the hierarchy.

- (19) a. 向後飛退的黃土 (CCL Corpus) (=6a)
 xiang_hou_fei-tui_de_huangtu
 towards_back_fly-recede_REL_yellow.dust
the yellow dust which is flying backward
- b. 沿山路一直上到山頂 (CCL Corpus)
 yan_shanlu_yizhi_shang-dao_shanding
 along_mountain.road_straight_ascend-arrive_summit
Go up to the summit all the way along the mountain road.
- c. 他們下到山溝裏 (CCL Corpus)
 tamen_xia-dao_shangou-li
 they_descend-arrive_valley-inside
They went down into the valley.

Figures 5, 6 and 7 indicate that the three morphemes have preferences for co-occurring with certain types of motion morphemes. Specifically, 上 *shang* 'ascend' and 下 *xia* 'descend' prefer to occur with nonscalar change motion morphemes, whereas 退 *tui* 'recede' prefers closed scale motion morphemes. Due to space limitation, I do not discuss the possible reasons for the divergences between 退 *tui* 'recede' and 上/下 *shang/xia* 'ascend/descend' in this paper. Nonetheless, the figures show that the order of the three morphemes and morphemes from other scalar types are consistent with the hierarchy.

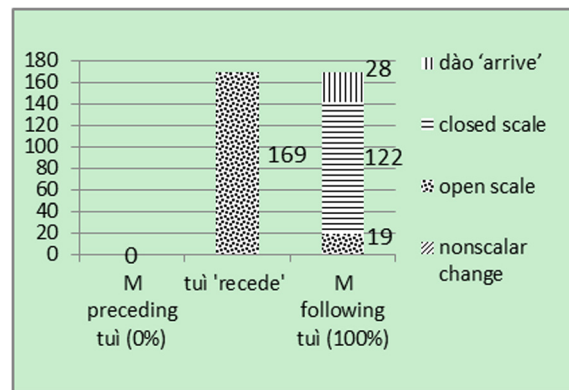


Figure 7 退 *tui* 'recede'.

Furthermore, the corpus finds that 下 *xia* 'descend' occurs with 退 *tui* 'recede', the other open scale motion morpheme investigated: one instance in Figure 6, and nineteen in Figure 7. In all twenty instances, 退 *tui* 'recede' always precedes 下 *xia* 'descend', as in 20. The existence of 退下 *tui-xia* recede-descend 'recede down' is not predicted by the hierarchy in 5. Further discussion will be provided in 退上/下 *tui-shang/xia* 'recede upward/downward' and the Scalar Specificity Constraint.

(20) 潮水一批批退下去 (CCL Corpus)

chaoshui_yipipi_ **tui-xia**-qu

tide_one.CLF_ **recede-descend**-go

The tides receded down (away from the speaker) one by one.

Figures 8 and 9 display the distribution of multi-point closed motion morpheme 回 *hui* 'return' and the two-point closed motion morpheme 出 *chu* 'exit'.

Figure 8 indicates that 回 *hui* 'return' may be preceded by both open scale motion morphemes, e.g., 退 *tui* 'recede' in 退回来 *tui hui-lai* recede return-come 'recede back (towards the speaker)' and nonscalar change motion morphemes, e.g., 赶 *gan* 'rush' in 赶回杭州 *gan-hui Hangzhou* rush-return Hangzhou 'rush back to Hangzhou', and followed

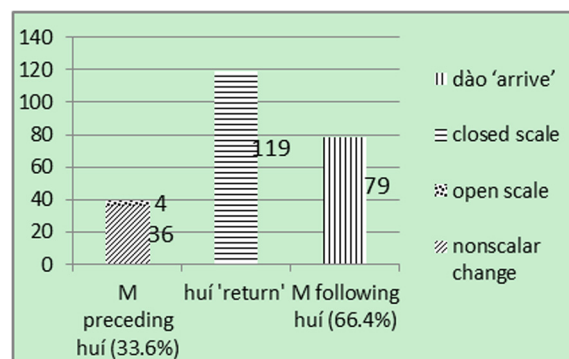


Figure 8 回 *hui* 'return'.

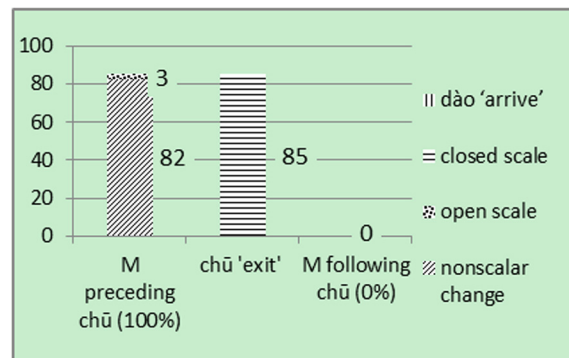


Figure 9 出 *chu* 'exit'.

by 到 *dao* 'arrive', as in 回到家裏 *hui-dao jia-li* return-arrive home-inside 'return home'. In addition, 回 *hui* 'return' does not co-occur with other closed scale motion morphemes.

As illustrated in Figure 9, 出 *chu* 'exit' is also preceded by both open scale motion morphemes and nonscalar motion morphemes, as in 退出舞場 *tui-chu wuchang* return-exit dancing-court 'recede outside of the dancing court' and 衝出駕駛室 *chong-chu jiashishi* rush-exit operating-room 'rush outside of the operating room' respectively. In addition, similar to 回 *hui* 'return', 出 *chu* 'exit' is not found to co-occur with closed scale motion morphemes. The distribution of 回 *hui* 'return' and 出 *chu* 'exit' is thus consistent with the hierarchy.

Figure 10 shows the distribution of 到 *dao* 'arrive'. All three types of motion morphemes are found before 到 *dao* 'arrive', whereas no motion morpheme follows it.

Besides the two-morpheme MMMCs, eleven three-morpheme MMMCs are found in the study. Three types of morpheme order are observed in the eleven MMMCs, as given in 21-23, respectively; all of them are consistent with the hierarchy.

- (21) "nonscalar change + open scale + 到 *dao* 'arrive'" (one instance)

鴨舌帽從病床無聲地滑落到水泥地上 (CCL Corpus)

yashemao__cong__bingchuang__wusheng_de__**hua-luo-dao**__shuinidi-shang

peaked.hat__from__sickbed__silently__MOD__**slip-fall-arrive**__concrete.floor

The peaked hat slid and fell onto the concrete floor silently.

- (22) "nonscalar change + closed scale + 到 *dao* 'arrive'" (six instances)

一步一步地躲回到辦公台旁 (CCL Corpus)

yibu__yibu__de__**duo-hui-dao**__bangongtai-pang

one.step__one.step__MOD__**stroll-return-arrive**__office.desk-side

[He] strolled back to the office desk, one step by one step.

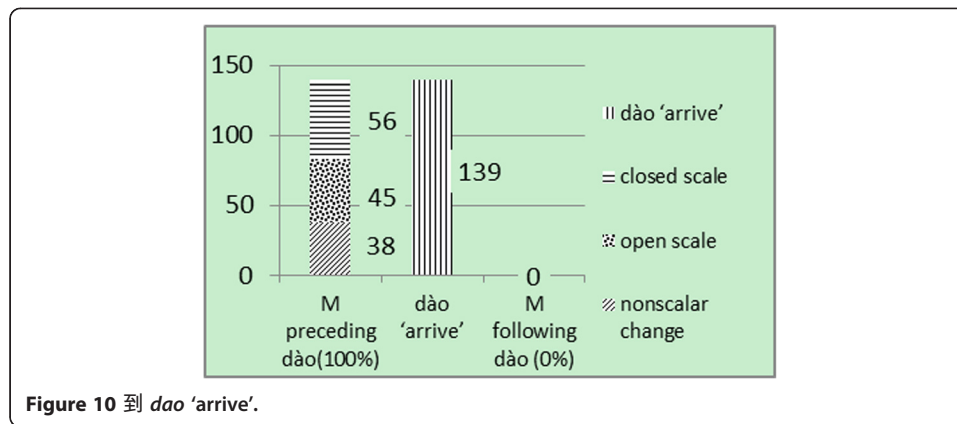
- (23) "open scale + closed scale + *dao* 'arrive'" (four instances)

默默地退回到自己的床上 (CCL Corpus) (=9a)

momo__de__**tui-hui-dao**__ziji-de__chuang-shang

silently__MOD__**recede-return-arrive**__self-POSS__bed-on.top.of

[She] returned to her own bed silently.



In conclusion, except for the twenty instances of 退下 *tui-xia* recede-descend 'recede downward', the results of Corpus Study 2 again show that the distribution of the key motion morphemes in MMMCs is consistent with the hierarchy, especially with the fact that 到 *dao* 'arrive' can follow any type of motion morphemes, and two non-到 *dao* 'arrive' closed scale motion morphemes do not co-occur.

6 The encoding of Chinese motion events and the Scalar Specificity Constraint

The corpus studies in Motion Morpheme Hierarchy show that the Motion Morpheme Hierarchy holds for most of the natural Chinese data: 1,482 of the 1,503 MMMCs (98.6%) found in the corpus have their morpheme order consistent with the proposed hierarchy; among the 21 instances of exceptions, one is taken to be an accidental use by the author (升飛 *sheng-fei* ascend-fly 'ascend and fly' in Corpus Study 1) and the other twenty instances are 退下 *tui-xia* recede-descend 'recede downward'. A natural question to ask is why Chinese MMMCs display such an order tendency as presented in the hierarchy. The question is explored in this section.

Both the corpora in Section 4 imply that MMMCs consisting of three or more motion morphemes (not including construction-final 來/去 *lai/qu* 'come/go') are very rare in Chinese. Only twelve of the 1,503 MMMCs consist of three motion morphemes, and all of them have the third motion morpheme being 到 *dao* 'arrive'. In other words, Chinese MMMCs primarily consist of only two motion morphemes. In addition, when two morphemes occur together in an MMMC, their relative order is in one of the three orders allowed by the Motion Morpheme Hierarchy:

- (24) a. nonscalar change morpheme + open scale morpheme, e.g., 滾 *gun* 'roll' + 落 *luo* 'fall'
 b. nonscalar change morpheme + closed scale morpheme, e.g., 滾 *gun* 'roll' + 進 *jin* 'enter'
 c. open scale morpheme + closed scale morpheme, e.g., 落 *luo* 'fall' + 進 *jin* 'enter'

In each of the three orders, the second morpheme is always more specific than the first in terms of the information it provides about the scale associated with a motion

event: in 24a, the second morpheme is more specific in that it indicates the existence of a scale in the motion event, whereas the first morpheme provides no information about a scale; in 24b, the second morpheme is more specific in that it indicates that the motion event has a scale and the scale is bounded, whereas the first morpheme provides no information about a scale; in 24c, although both morphemes lexicalize the existence of a scale in the motion event, the second morpheme is more specific because it indicates that the scale is bounded, whereas the first morpheme provides no information about boundedness. Therefore, the order of motion morphemes in a Chinese MMC conforms to a constraint that the morpheme that adds more specific information about the scale in a motion event tends to occur after the morpheme with less information. This paper calls the constraint the “Scalar Specificity Constraint”.

In the rest of this section, I show that the Scalar Specificity Constraint is able to provide a more comprehensive account for the morpheme order of MMCs than the RVC account and the temporal iconicity account introduced in Section 2. The constraint also explains the ordering in three-morpheme MMCs, why two closed scale motion morphemes typically do not co-occur, as well as why 退上/下 *tui-shang/xia* recede-ascend/descend ‘recede upward/downward’ exist in Chinese. This section also briefly discusses the special motion morpheme 到 *dao* ‘arrive’.

6.1 The scalar specificity constraint vs. the RVC account

Section RVC and the morpheme order shows that treating MMCs as a type of RVC cannot explain why the result morpheme 落 *luo* ‘fall’ precedes the other result morpheme 進 *jin* ‘enter’, as in 1c, repeated as 25.

- (25) 一塊石子落進了水裏 (CCL Corpus)
 yikuai_shizi_luo-jin-le_shui-li
 one.CLF_pebble_fall-enter-ASP_water-inside
A pebble fell into the water.

The Scalar Specificity Constraint is able to provide an explanation. While both 落 *luo* ‘fall’ and 進 *jin* ‘enter’ are scalar change motion morphemes, 落 *luo* ‘fall’ lexicalizes an open scale, whereas 進 *jin* ‘enter’ lexicalizes a scale with an endpoint and provides more specific information about the scale than 落 *luo* ‘fall’ does (more specifically, about telicity and boundedness). The Scalar Specificity Constraint requires the motion morpheme with more specific information about the scale to follow the morpheme with less specific information, so 進 *jin* ‘enter’ tends to follow 落 *luo* ‘fall’, but not vice versa.

6.2 The Scalar Specificity Constraint vs. the temporal iconicity account

As discussed in Section 2.2, the temporal iconicity account (Tai 1985, Li 1993) cannot account for the order of morphemes denoting simultaneous events, as in 4a, repeated as 26.

- (26) 他跑上樓梯
 ta_pao-shang_louti
 he_run-ascend_stairs
He went up the stairs running.

However, according to the Scalar Specificity Constraint, the open scale motion morpheme 上 *shang* ‘ascend’ tends to occur after the nonscalar change motion morpheme 跑 *pao* ‘run’ because the former is more specific in that it lexicalizes a scale, whereas the latter does not.

6.3 The Scalar Specificity Constraint and three-morpheme MMMCs

The corpus studies in Section 4 indicate that three-morpheme MMMCs are seldom used in Chinese, and most of them end with the special motion morpheme 到 *dao* ‘arrive’ (more discussion of 到 *dao* ‘arrive’ will be given in Section 6.6). However, for three-morpheme MMMCs without 到 *dao* ‘arrive’, their relative order also conforms to the Motion Morpheme Hierarchy and the Scalar Specificity Constraint, i.e. the morpheme denoting the least specific information about the scale tends to occur as the leftmost of the three morphemes, whereas the morpheme denoting the most specific information about the scale tends to occur as the rightmost. As illustrated in 9b, repeated as 27, 飄 *piao* ‘drift’, which does not specify a scale, is followed by 落 *luo* ‘fall’, which specifies an open scale, and then followed by 回 *hui* ‘return’, which specifies a scale with an endpoint.

- (27) 飛揚的灰塵漸漸飄落回地面 (=9b)
 feiyang_de_huichen_jianjian_piao-luo-hui_dimian
 flying __MOD__dust_gradually_drift-fall-return_ground
The flying dust gradually fell onto the ground in a drifting manner.

6.4 The incompatibility of closed scale motion morphemes and the Scalar Specificity Constraint

As illustrated in Section 5 and the corpus studies in Section 6, unless one of the two morphemes is 到 *dao* ‘arrive’, two closed scale motion morphemes typically do not occur together in an MMMC. Both multi-point closed scale motion morphemes (e.g., 回 *hui* ‘return’) and two-point closed scale motion morphemes (e.g., 進 *jin* ‘enter’) are associated with a bounded scale. Although the two types of motion morphemes differ from each other as to whether they lexicalize a multi-point or two-point scale, morphemes of either type are able to express a single delimited motion event in which a moving object moves along a path in a certain direction to an endpoint. In other words, in terms of the degree of specification of a scale, a two-point closed scale motion morpheme is not more specific than a multi-point closed scale motion morpheme, or vice versa: both specify the existence of a scale and the existence of an endpoint for the scale. Therefore, the incompatibility is also consistent with the Scalar Specificity Constraint.

6.5 退上/下 *tui-shang/xia* ‘recede upward/downward’ and the Scalar Specificity Constraint

As discussed in Section 4.2, 退上 *tui-shang* recede-ascend ‘recede upward’ and 退下 *tui-xia* recede-descend ‘downward’ are not predicted by the Motion Morpheme Hierarchy because their components are of the same scalar type, i.e. open scale motion morphemes. However, the existence of 退上/下 *tui-shang/xia* recede-ascend/

descend ‘recede upward/downward’ can be justified by the Scalar Specificity Constraint.

Unlike other open scale motion morphemes such as 退 *tui* ‘recede’ and 降 *jiang* ‘descend’ that usually cannot be directly followed by elements expressing information about reference object, 上/下 *shang/xia* ‘ascend/descend’ require explicitly expressed information about the reference object (Ju 居红 1992, Liu 刘月华 1998, Qi 齐沪扬 1998, Lamarre 2008), as in 28 and 29, respectively.

- (28) a. 敵人退了
 diren__tui__le
 enemy__recede__ASP
 The enemy receded.
 b. *敵人退營地了
 diren__tui__yingdi__le
 enemy__recede__camp __ASP
 Intended: *The enemy receded to the camp.*

- (29) a. ??他上了
 ta__shang__le
 he__ascend__ASP
 b. 他上二樓了
 ta__shang__erlou__le
 he__ascend __second.floor__ASP
 He went up to the second floor.

In addition, if a locative NP is not available, 上/下 *shang/xia* ‘ascend/descend’ will require the information of the reference object to be filled in by 來/去 *lai/qu* ‘come/go’, which specify deictic information about a motion event (also see Section “Special” motion constructions about construction-final 來/去 *lai/qu* ‘come/go’), as in 30.

- (30) 他上來了
 ta__shang-lai__le
 he__ascend-come__ASP
 He went up (to the deictic center).

Therefore, the ascending/descending events described by 上/下 *shang/xia* ‘ascend/descend’ and their required complements (i.e. locative NP or 來/去 *lai/qu* ‘come/go’) are usually specific in terms of the endpoint for a motion event. For instance, although an ascending event is by default understood as an unbounded event, in which a figure can ascend without limit, the locative NP 二樓 *erlou* ‘second floor’ required by 上 *shang* ‘ascend’ in 29b delimits the ascending event, so it ends at the second floor; similarly, the deictic morpheme 來 *lai* ‘come’ in 30 delimits the event at the deictic center. In other words, the ascending event stops when the figure moves to the second

floor 29b or when the figure arrives at the deictic center 30. In this sense, “上/下 *shang/xia* ‘ascend/descend’ + ground NP/來 *lai* ‘come’/去 *qu* ‘go’” can be understood as a combination that specifies the existence of a scale and an endpoint for the scale. Thus, compared with 退 *tui* ‘recede’ which only specifies the existence of scale, the construction “上/下 *shang/xia* ‘ascend/descend’ + ground NP/來 *lai* ‘come’/去 *qu* ‘go’” denotes more specific information about the scale of motion. Therefore, the fact that 上/下 *shang/xia* ‘ascend/descend’ not only can co-occur with 退 *tui* ‘recede’ but also follow 退 *tui* ‘recede’ further supports the Scalar Specificity Constraint: the morpheme with more specific information about the scale tends to follow the one with less specific information.

Because 退 *tui* ‘recede’ is the only motion morpheme in the class of open scale motion morphemes that denotes non-vertical motion, 退上/下 *tui-shang/xia* recede-ascend/descend ‘recede upward/downward’ is the only motion construction in which 上/下 *shang/xia* ‘ascend/descend’ may follow an open scale motion morpheme^h. However, according to the Scalar Specificity Constraint, if Chinese were to have other non-vertical open scale motion morphemes, 上/下 *shang/xia* ‘ascend/descend’ should be able to co-occur with and follow them.

6.6 到 *dao* ‘arrive’ as a special motion morpheme

The two-point closed scale motion morpheme 到 *dao* ‘arrive’ can follow other closed scale motion morphemes, as in 回到房間 *hui-dao fangjian* return-arrive room ‘return to the room’ and 進到房間 *jin-dao fangjian* enter-arrive room ‘enter the room’, whereas other two-point closed scale motion morphemes such as 進 *jin* ‘enter’ and 出 *chu* ‘exit’ cannot, as in **hui-chu fangjian* return-exit room and ?*dao-jin fangjian* arrive-enter room. In terms of the degree of specification of scale information, 到 *dao* ‘arrive’ is as specific as other two-point closed scale motion morphemes, i.e. they all specify the existence of a scale, as well as the existence of an endpoint for the scale. Therefore, the fact that 到 *dao* ‘arrive’ can follow closed scale motion morphemes seems to represent an exception to the Scalar Specificity Constraint. However, I will show that 到 *dao* ‘arrive’ is a special type of two-point closed scale motion morphemes.

Although 到 *dao* ‘arrive’ lexicalizes a closed scale, it does not specify information about the direction in which a moving object moves to the reference object, nor what kind of reference object is involved in the motion event (Lin 2013). In contrast, the other two-point closed scale motion morphemes such as 進 *jin* ‘enter’ and 出 *chu* ‘exit’ are highly specific about the reference object and path: 進 *jin* ‘enter’ expresses a boundary-crossing motion event involving motion from the outside to the inside of an enclosed area, whereas 出 *chu* ‘exit’ expresses a similar event in a reverse direction. For instance, 進 *jin* ‘enter’ and 出 *chu* ‘exit’ only select NPs expressing enclosed regions (e.g., house, but not table) as their complements, as in 31, whereas 到 *dao* ‘arrive’ can take any kind of reference object NPs as its complements, as in 32.

(31) 小貓進房子裏/*桌子上

xiaomao__jin__fangzi-li/*zhuozi-shang__le

kitty__enter__house-inside/table-on.top.of__ASP

*The kitty entered the house/*The kitty entered on top of the table.*

(32) 小貓到房子裏/桌子上了

xiaomao__dao__fangzi-li/zhuozi-shang__le

kitty__arrive__house-inside/table-on.top.of__ASP

The kitty went inside the house/The kitty went onto the table.

For this reason, when 到 *dao* 'arrive' occurs with another closed scale motion morpheme, it does not add new information about the reference object or path that may be different from or incompatible with the information denoted by the co-occurring motion morpheme. This explains why 到 *dao* 'arrive' can follow all kinds of motion morphemes, whereas 進 *jin* 'enter' and 出 *chu* 'exit' cannot. It also indicates that 到 *dao* 'arrive' should be treated as a special motion morpheme that the Scalar Specificity Constraint does not apply to. Further study will be necessary to explore the property and distribution of 到 *dao* 'arrive' (also see studies in Liu 刘月华 1998, Lü 吕叔湘 1980, Lamarre 2008, Poteet 1987, Peck 2008, among many others).

7 Conclusions

This paper proposes the Motion Morpheme Hierarchy to predict order constraints of verbal morphemes in motion constructions attested in natural Chinese data. It also proposes the Scalar Specificity Constraint to account for this hierarchy. This study shows that, in the process of event encoding, the lexicalization of scalar specificity of a motion morpheme determines its distribution tendency. This scalar approach can be extended to the ordering of motion verbs or morphemes in other serial verb languages such as Thai and Ewe. It could also be applied to other lexical semantics-syntax interaction domains beyond motion, as shown in recent exploration of the properties of Mandarin verbs and RVCs in general (Peck et al. 2013), incremental theme VPs, adjectives (Lin and Peck 2013), and boundedness in Mandarin Chinese (Lin and Peck 2014).

Endnotes

^aCCL Corpus refers to the corpus of Modern Mandarin Chinese constructed by the Center for Chinese Linguistics at Peking University (<http://ccl.pku.edu.cn/>). The corpus has 307,317,060 characters updated on 20 July 2009.

^b出到 *chu-dao* exit-arrive 'exit and arrive' rarely occurs probably because 出 *chu* 'exit' usually takes a source NP complement whereas 到 *dao* 'arrive' takes a goal NP complement.

^c9b is an example from <http://book.xxs8.com/90390/7787.html> (accessed 16 January 2014).

^dMMMCs with more than three motion morphemes are rarely found. There are cases in which multiple morphemes appear together, as the five morphemes in i. However, these morphemes are actually from two independent MMCs, 跳出來 *tiao-chu-lai* jump-exit-come 'jump out' and 走進...旅店 *zou-jin ... liudian* walk-enter...hotel 'walk into... a hotel', because a pause or conjunction can be inserted in between them.

(i) 普希金跳出來走進了路旁的一家小旅店 (CCL Corpus)

Puxijin__tiao__chu-lai__zou-jin-le__lu-pang__de__yi-jia__xiao__liudian

Pushkin__jump__exit-come__walk-enter-ASP__road-side__REL__one-CLF__small__hotel

Pushkin jumped out; walked into a small hotel on the roadside.

^eA number of studies have discussed the meanings and functions of 來 *lai* ‘come’/去 *qu* ‘go’. For instance Chao (1968), Lü 吕叔湘 (1980), and Lu 陆俭明 (1985) compare 來 *lai* ‘come’/去 *qu* ‘go’ in constructional-final position (usually treated as “VP + 來 *lai* ‘come’/去 *qu* ‘go’”) and construction-initial position (usually treated as “來 *lai* ‘come’/去 *qu* ‘go’ + VP”). Due to limited space, this paper only provides evidence showing that construction-final 來 *lai* ‘come’/去 *qu* ‘go’ in Modern Chinese motion constructions are no longer typical motion morphemes (cf. Chao 1968, Lü 吕叔湘 1980, Lu 陆俭明 1985), but leave questions such as the phonetic features, syntactic status, and pragmatic functions of construction-final 來 *lai* ‘come’/去 *qu* ‘go’ for future discussion.

^fA search of the motion morphemes in 18 in the entire CCL corpus also finds that these morphemes are highly frequently used: all occur with more than 220,000 times except for 跑 *pao* ‘run’ (45,555 tokens) and 退 *tui* ‘recede’ (48,340 tokens). Although the search results also include tokens where these motion morphemes are used in metaphorical senses, the large total numbers of tokens indicate they are also frequently used in motion constructions.

^gThere are cases in which the same MMMCs appeared in the search results of different key morphemes. For instance, the MMMC 退出舞場 *tui-chu wuchang* ‘recede-exit ballroom’ ‘recede from the ballroom’ was found in both the searches for 退 *tui* ‘recede’ and 出 *chu* ‘exit’. However, the number of repeated MMMCs is not large. For example, in the first 1,000 instances of 退 *tui* ‘recede’, there are 80 instances of MMMCs consisting of 退 *tui* ‘recede’ and 出 *chu* ‘exit’, but in the first 1,000 instance of 出 *chu* ‘exit’, there are only three instances consisting of 退 *tui* ‘recede’ and 出 *chu* ‘exit’, so only three repeated MMMCs are found in the searches for these two morphemes. For convenience, this study did not delete the repeated MMMCs, but included them in the results for each key morpheme.

^h上 *shang* ‘ascend’/下 *xia* ‘descend’ can follow other semantically compatible vertical motion morphemes, e.g., 升 *sheng* ‘ascend’ 降 *jiang* ‘descend’, 坠 *zhui* ‘fall’. This study treats such combinations as instances of juxtaposed motion synonyms rather than as instances of MMMCs as 退上/下 *tui-shang/xia* ‘recede-ascend/descend’ ‘recede upward/downward’ is.

Competing interests

The author declares that he has no competing interest.

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