

**THE PLACEMENT OF LOCATIVE PREPOSITIONAL PHRASES IN
CANTONESE: PROCESSING AND ICONICITY***

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ABSTRACT

Cantonese is unusual as a VO language in having [PP V] as the dominant order instead of [V PP]. Dryer (1992) found that VO order correlates strongly with [V PP] order. Hawkins (1994) offered an explanation in arguing that VO language and [V [PP P NP]] order can be processed with optimal processing efficiency. This paper investigates the reasons why Cantonese still employs the [PP V] order despite its lower processing efficiency. While [[PP P NP] V] order in Cantonese conforms to iconicity, the inefficiency of the [[PP P NP] V] order is circumvented due to the availability of the topic PP construction, which is shown to have higher processing efficiency when compared to [[PP P NP] V] by Hawkins' (1994) metric of Early Immediate Constituents (EIC). Corpus findings show that the heavier the PP, the larger the percentage appearing in topic position. As I will argue, the topic PP construction which exhibits both iconicity and processing efficiency shows that the two seemingly competing functional motivations, iconicity and processing are compatible with each other.

* This paper is based on my MPhil thesis (Kwan, 2005). Parts of this paper have been presented at the 4th Postgraduate Research Forum on Linguistics (PRFL-4) in Hong Kong, the 16th North American Conference on Chinese Linguistics (NACCL-16) in Iowa City and 12th Annual Meeting of the International Association of Chinese Linguistics (IACL-12) in Tianjin. I would like to thank Stephen Matthews and Chinlung Yang for their support in my graduate study. I also thank Adams Bodomo, Danqing Liu, K. K. Luke, Xiaochuan Peng, Rint Sybesma, James Tai, Sze-Wing Tang, Foong-Ha Yap, Virginia Yip and Wei Zhang, who have kindly discussed my research with me.

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Key words: Cantonese, prepositional phrase, word order, topic, iconicity, processing efficiency

1. INTRODUCTION

This study investigates the placement of locative prepositional phrases in Cantonese. The essential idea of the paper is that while iconicity plays a role in governing the word order [PP V] and [V PP] in Cantonese, the topic PP construction which exhibits higher processing efficiency is an alternative to the less efficient [PP V] construction in processing. [PP V] is the dominant order of the locative *hai2* prepositional phrases in Cantonese. Cantonese is unusual as a VO language in having [PP V] order as the dominant order. Dryer (1992) established that VO order correlates strongly with [V PP] order. Hawkins (1994) argued that VO languages with [V [PP P NP]] can be processed with optimal processing efficiency, hence the correlation. The [[PP P NP] V] order in Cantonese and Mandarin has relatively lower processing efficiency. This paper explores why Cantonese still employs the [[PP P NP] V] order despite its relative inefficiency in processing. The corpus findings suggest that the topic PP construction occupies a relatively high percentage when compared to the dominant order [PP V] and this percentage rises with the length of the PP. The inefficiency of the [[PP P NP] V] order is circumvented due to the availability and high frequency of use of the topic PP construction. On the other hand, the [[PP P NP] V] order in Cantonese is motivated by iconicity, although this order is less favourable in terms of processing. The two seemingly competing functional motivations, processing and iconicity, can thus be reconciled. As I will argue, the topic PP construction which exhibits both iconicity and processing efficiency shows that the two functional motivations are compatible with each other.

2. RESEARCH ISSUE

The word order of [PP V] as seen in Cantonese is rare among VO languages in the world. Dryer (1992) established 8 correlation pairs by examining a balanced sample of languages from all language families and geographical

areas. One of the correlation pairs is that VO goes with [V PP] order and OV with [PP V] order. In fact, the correlation pair of verb and adpositional phrase¹ is the strongest correlation pair that Dryer (1992) examined in his study. Among 199 VO languages, only 3 VO languages have [PP V] order and they are all Chinese languages, namely Mandarin, Cantonese and Hakka (Dryer, 2003). This correlation pair bears high statistical significance, and there are processing motivations behind it. In terms of the Principle of Early Immediate Constituents (EIC) (Hawkins, 1994), the pairs VO & V PP, OV & PP V have highest processing efficiency. Mandarin Chinese was described by Hawkins (1994:281) as ‘unique in this regard’ among VO languages. Hawkins did not offer any explanations to this particular puzzle in Chinese, but he called for further investigation into the issue.

Apart from processing, another functional motivation, iconicity, also plays a role in governing the placement of PP before and after the verb in Cantonese. Cantonese has both [PP V] and [V PP] orders, like Mandarin. Tai (1975) suggested for Mandarin that there are different semantic functions associated with the two orders. Both orders are used to encode the temporal sequence of events, these orders being a form of iconicity. The preverbal PP indicates the location of action, while the postverbal PP indicates the location of the participant after the action (Tai, 1975). I will examine how these iconicity principles can be applied in Cantonese. Examples of locative *hai2* prepositional phrases of Cantonese in [PP V] and [V PP] are shown below:

- (1) [PP V] 我 喺 屋企 食 早餐
ngo5 hai2 uk1kei2 sik6 zou2caan1
I at home eat breakfast
‘I have breakfast at home.’

¹ PP in Dryer’s (1992) article refers to adpositional phrase, encompassing both prepositional phrases and postpositional phrases. PP would mean prepositional phrase in the context of Cantonese.

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- (2) [V PP] 佢 掉咗 本 書 喺 地下
keoi5 deu6zo2 bun2 syu1 hai2 dei6haa2
s/he throw ASP² CL book at floor
'S/he threw the book onto the floor.'

This paper aims to address the issue from two functional perspectives: processing and iconicity. Processing and iconicity are potentially two perspectives that can offer solutions to the issue. Newmeyer (1998) specifically identified processing and iconicity as two vital functional motivations which shape grammar.

'I argue that not only are the three autonomy hypotheses compatible with external (functional) explanation, but that central aspects of grammars *have* been motivated functionally. I identify parsing pressure and pressure for structure and meaning to be in iconic alignment as two central functional influences on grammars.' (Newmeyer, 1998:19)

In the case of PP placement, the two functional principles seem to be in conflict with each other. [PP V] has its own semantic function with regard to the principle of iconicity but this order is not desirable in terms of processing efficiency. I will investigate how the seeming competition between the two functional motivations is resolved, and we will see in section 4 that one solution is the topic PP construction. I will also see how the functional principles take effect in shaping grammar.

² The abbreviations used in this paper are: ASP=aspect marker; AUX=auxiliary; CL=classifier; CRC=Cantonese Radio Corpus; CRD=Constituent Recognition Domain; EIC=Early Immediate Constituents; GEN=genitive; HKCAC=Hong Kong Cantonese Adult Language Corpus; IC=immediate constituent; NP_{object}=object noun phrase; NP_{subject}=subject noun phrase; PP=adpositional phrase (prepositional phrase in the context of Cantonese); PRT=particle; PRT_{topic}=topic particle; REL Clause=relative clause; S=sentence.

3. ICONICITY

A number of linguists including Haiman (1980, 1983) and Givon (1985) provided evidence that linguistic form is to a certain extent iconic with the way humans conceptualize the world. A linguistic structure is iconic if it corresponds to the conceptual structure of the mind for an entity. Locative PPs in Cantonese occur in both [PP V] and [V PP] orders. Iconicity, to some extent, can explain why both orders exist and the semantic difference between them. According to Pierce's (1960) definition, there is a relationship of similarity or resemblance between an icon and the things it represents. As an example of iconicity, Tai (1975) discussed how the placement of locative adverbials in Mandarin observes the temporal sequence of events. Locative adverbials can be placed before or after the verb according to the order of action and location. Motivation to follow the temporal sequence of representing events in mind is observed in the order of elements within a sentence. According to Tai (1975), the placement of preverbal and postverbal *zai* phrases in Mandarin is governed by a semantic principle:

While the function of a preverbal locative is to denote the location of the action itself, that of a postverbal locative is to denote the location of the participant 'affected' by the action. (Tai, 1975:160)

Examples given by Tai³ (1975:155-156) are:

- (3) a. ta zai chufang-li ku
he be at kitchen-inside cry
'He cried in the kitchen.'
b. *ta ku zai chufang-li
he cry be at kitchen inside
'He cried in the kitchen.' (intended meaning)

³ Some glossings and modifications to the transcription are added to Tai's (1975:155,156) original examples to enable non-Mandarin speakers to view the examples more conveniently.

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- (4) a. *yu zai di-shang xia
rain be at ground-top fall
'The rain fell on the ground.' (intended meaning)
- b. yu xia zai di-shang
rain fall be at ground-top
'The rain fell on the ground.'

In (3a), the participant cried in the kitchen. The preverbal PP denotes the location of the action of crying: the participant should be in the kitchen before the action of crying in the kitchen occurs. Temporal sequence is observed since the PP denoting the location stands before the verb which denotes the action. In (4b), PP is placed in the postverbal position, matching the temporal sequence of events: the rain ends up on the surface of the ground after the action of falling.

3.1 Semantics of [PP V] and [V PP] in Cantonese

Cheung (1990) provided a description of Cantonese PPs in her study on the acquisition of locatives in Cantonese-speaking monolingual children. Cheung (1990:20) defined static location (LOC_{at}) as 'the location at which a state or an event takes place'. Locative source (LOC_{from}) is the 'starting point of a moving entity' and a locative goal (LOC_{to}) is the 'end-point of a moving entity' (Cheung, 1990:20). Cheung (1990) further suggested that static location and locative source go before the verb, while a locative goal stands after the verb in Cantonese.

My investigation into the placement of locative *hai2* phrases in Cantonese, using both corpus data and intuition, shows that iconicity is involved. Similar to Mandarin, the placement of *hai2* prepositional phrases (*hai2* PPs) is governed by the semantic principle, which is a form of iconicity as suggested by Tai (1975).

- (5) a. 我 嚟日 [PP 喺 公園] [V 玩]
ngo5 cam4jat6 hai2 gung1jyun waan2
I yesterday at park play
'I played in the park yesterday.'

- b. *我 嚟日 [V 玩] [PP 喺 公園]
ngo5 cam4jat6 waan2 hai2 gung1jyun2
 I yesterday play at park
 ‘I played in the park yesterday.’ (intended meaning)
- (6) a. 你 食 曬 啲 防腐劑 喺 個 肚度
lei5 sik6 saai3 di1 fong4fu6zai1 hai2 go3 tou5 dou6
 you eat all CL preservative at CL stomach localizer
 ‘You get all the preservatives in your stomach (by eating food containing them).’
- b. *你 喺 個 肚度 食 曬 啲 防腐劑
lei5 hai2 go3 tou5 dou6 sik6 saai3 di1 fong4fu6zai1
 you at CL stomach localizer eat all CL preservative
 ‘You get all the preservatives in your stomach (by eating food containing them).’ (intended meaning)

(5a) is well-formed: the preverbal *hai2* phrase denotes the location in which the action 玩 *waan2* (play) is performed, i.e. 喺公園 *hai2 gung1jyun2* (in the park). (5b) is ill-formed since the location 公園 *gung1jyun2* (park) cannot be the location of the participant as a result of the action 玩 *waan2* (play). According to the temporal sequence, the participant should be in the park before s/he plays. Therefore, the *hai2* PP should stand before the verb as in (5a). (6a) is a well-formed sentence in which the semantic function matches the syntactic position of the PP. The preservatives end up in the stomach after eating, and the PP is placed after the verb to denote the resulting location of the theme after eating. (6b) is ill-formed since the semantic function and the position of the PP do not match.

The scope of this study is limited to the PPs headed by the locative preposition *hai2*. There are PPs headed by other prepositions conveying other semantic functions like the instrumental preposition *jung6* in Cantonese (Matthews & Yip, 1994). In the Cantonese Radio Corpus (CRC) and the Hong Kong Cantonese Adult Language Corpus (HKCAC), three main semantic types of PPs can be found using *hai2*, namely: 1) spatial, 2) temporal and 3) abstract locative. A spatial PP is defined as indicating a concrete location and the action is done either in a place or on/at/in/beside a

physical entity. A temporal PP indicates a time, a moment or a stage of performing an action. An abstract locative indicates an abstract area or domain, including a setting, a circumstance, a situation, a realm, an institution or a process⁴. The number of occurrences of these three kinds of *hai2* PP in the two corpora⁵, CRC and HKCAC is shown in the following.

Table 1. Number of occurrences of three semantic types of *hai2* PP in CRC and HKCAC

Semantic types of <i>hai2</i> PP	spatial	temporal	abstract
Number of instances	172	104	276

Comparing locative PPs (處所介詞詞組) and instrumental PPs (工具介詞詞組), which introduce an instrument for an action, Zhang (2002) found that in the Qin Dynasty and the Western Han Dynasty locative PPs mainly occurred in the postverbal position, while the instrumental PPs occupied the preverbal position more often than the postverbal position in the usual case. After that, in the Eastern Han Dynasty, the shift of the placement of PP to preverbal position started. Then in *Wei Jin Nanbeichao* (Wei, Jin, Northern and Southern Dynasties), the locative PPs moved to the preverbal position in great quantity, and the semantic difference between preverbal and postverbal PPs developed (Zhang, 2002)⁶. Locative PPs expressing the goal of an action cannot be placed in the preverbal position. This semantic difference manifesting the iconicity principle became established and remains until now in modern Chinese. Iconicity applies to all three semantic types of PPs within the class of locative *hai2* PPs in Cantonese, which can occur in both preverbal and postverbal position. All instances of *hai2* [PP V] and [V PP] found in the corpora obey the iconicity constraint.

⁴ An example of an abstract locative PP:

keoi5 hai2 tau4zi1 si5coeng4 maai5 gu2piu3 (佢喺投資市場買股票)
 s/he at investment market buy shares
 'S/he buys shares in the investment market.'

⁵ The data of the two corpora are combined for computation.

⁶ Zhang (2002) added that the semantic difference between preverbal and postverbal PPs is only applicable to the PP of 'preposition + location' (介詞 + 場所). The reasons for the change of other kinds of PPs to preverbal position are to be found elsewhere (Zhang, 2002).

Apart from the establishment of the semantic difference, the complexity of the VP is a factor governing the change of PP placement. Different kinds of verbal complements developed gradually in Chinese history. In *Wei Jin Nanbeichao*, a certain amount of resultative complements emerged. As Zhang (2002) mentioned, Chinese has a tendency not to let the constituents in the postverbal position become too complicated. In modern Mandarin, there is a constraint known as the postverbal constraint, defined by Light (1979:170) as follows: ‘normally, there will be only one constituent after the verb in a clause’. However, a number of constructions in Cantonese pose a challenge to the postverbal constraint. Cantonese allows more constituents in the postverbal position than Mandarin does. For example,

- (7) 佢 擺咗 隻 杯 喺 檯
keoi5 baai2zo2 zek3 bui1 hai2 toi2
s/he put ASP CL cup at table
‘S/he put a/the cup on the table.’

The postverbal constraint may just be a tendency, rather than an absolute constraint. Iconicity seems to be more robust as being applicable to both Mandarin and Cantonese. Iconicity with its basis on cognitive representation is also more explanatory in this sense.

3.2 Iconicity: Topic PP

A topic PP is placed before the predicate to set a scene before an action is performed. Iconicity is therefore shown since the placement of topic PP matches its scene-setting function. In the following example, the scene (i.e. the hall) is set before the action, holding a party, is performed.

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- (8) 喺 呢個 咁 大 嘅 禮堂, 佢地 舉辦咗
hai2 nei1go3 gam3 daai6 ge3 lai5tong4 keoi5dei6 geoi2baan6zo2
at this CL such big GEN hall they hold ASP
一個 舞會
jat1go3 mou5wui2
one CL party
'In this big hall, they held a party.'

3.3 Iconicity: Source PP

The argument initially made by Tai (1975) can be extended to another case in Cantonese, namely PPs indicating a locative source in Cheung's (1990) categorization. In one set of cases, involving motion events, the use of *hai2* PPs in Cantonese extends beyond that of *zai4* PPs in Mandarin. Apart from denoting the location of an action, the preverbal *hai2* PP can also denote the location of the participant before the action, i.e. the source, as in the following example:

- (9) a. 個 髮夾 [PP 喺 我 頭 上面] [V 跌咗] 落 嚟
go3 faat3gep2 hai2 ngo5 tau4 soeng6min6 dit3zo2 lok6 lai4
CL hair-clip at I head above fall ASP fall come
'The hair clip fell down from my head.'

The placement of source *hai2* PPs also shows iconic properties. Source *hai2* PPs are placed in the preverbal position, encoding the location of the participant before the action, while goal PPs are placed after the verb to encode the location of the participant after the action, as discussed above.

- b. 塊 樹葉 [V 跌咗] [PP 喺 我 頭 上面]
faai3 syu6jip6 dit3zo2 hai2 ngo5 tau4 soeng6min6
CL leaf fall ASP at I head above
'The leaf fell onto my head.'

3.4 Iconicity as Manifested in the Syntax of Chinese

Iconicity is supposed to be a language-independent factor. However, iconicity is manifested in languages in different ways according to the nature of the language. While some languages exhibit iconicity in morphology (Bybee, 1985), Chinese is an isolating language with little inflectional morphology. Iconicity is prominent in the syntax of Chinese since it allows a certain degree of freedom in its word order to encode different semantic functions, as shown in the case of PP placement. There is no such freedom in languages like English which does not allow preverbal PPs. In addition, the fact that Chinese allows both [PP V] and [V PP] is part of its typologically mixed profile, with both head-initial and head-final structures. Chinese is situated between two linguistic areas, the Altaic area and mainland Southeast Asia. Hashimoto (1986) argued there has been altaicization of northern Chinese and the variation among Chinese dialects follows a north-south cline.

4. USE OF CORPORA FOR DATA COLLECTION

In this section, I will demonstrate that the topic PP construction as an alternative to the [PP V] construction occurs with high frequency. Corpora are employed to collect instances of *hai2* PPs. Quantitative analysis is conducted by computing the frequency of occurrence of [PP V] and [V PP] orders. We will see how the frequency of [PP V] and [V PP] differs. The corpora can also provide qualitative data which shows, for example, what semantic types of PPs there are. The corpora used are the Cantonese Radio Corpus (CRC) and the Hong Kong Cantonese Adult Language Corpus (HKCAC)⁷. CRC, developed by Elaine Francis, Stephen Matthews, Winnie S. M. Yiu and Gene Y. F. Chu, contains Cantonese spoken conversations from four radio programmes. The corpus consists of 43283 lines of text. The

⁷ HKCAC was developed by a research grant awarded to Sam-Po Law, Suk-Yee Fung and Man-Tak Leung from the Research Grants Council of Hong Kong. The URL of the HKCAC website is: <http://shs.hku.hk/corpus/main.htm>

four programmes cover a variety of genres including interviews of renowned people, discussion on social issues and phone-in-programmes discussing personal matters. HKCAC consists of Cantonese conversations in the format of discussion forum and phone-in programs on the radio. There are altogether 170,000 characters in this corpus (Leung and Law, 2001).

4.1 Categorization of Corpus Data

The purpose of this paper is to explore the factors governing the placement of prepositional phrases relative to the verb in Cantonese. All instances of *hai2* PPs were collected in the two corpora, CRC and HKCAC. Irrelevant tokens such as *hai2* PPs modifying a noun were discarded.⁸ An example is:

- (10) [NP [PP 喺 呢度] 嘅 中國 人] 好 團結
hai2 nei1dou6 ge3 zung1gwok3 jan4 hou2 tyun4git3
at here GEN Chinese people very united
'The Chinese people here are very united.'

Hai2 acting as the main verb was also discarded. An example is:

- (11) 佢 而家 喺 香港
keoi5 ji4gaal hai2 hoeng1gong2
s/he now at Hong Kong
'S/he is now in Hong Kong.'

Each token of target *hai2* PP was categorized into a template (a term following Hawkins, 1994:103). The template specifies the exact structure the PP appears in⁹. Template A is the order with the PP placed before the verb it

⁸ However, 喺呢度住嘅中國人好團結 *hai2 nei1dou6 zyu6 ge3 zung1gwok3 jan4 hou2 tyun4git3* (The Chinese people who live here are very united) is counted since the PP '*hai2 nei1dou6*' modifies the verb *zyu6* (live).

⁹ In constructing the templates, for simplicity's sake, only the verb (V), the subject noun phrase (NP_{subject}), the object noun phrase (NP_{object}), the PP and the topic particle (PRT_{topic}) are shown. Adverb phrases, verbal particles, aspect markers, negation morphemes and modal verbs are not specified in the templates.

modifies. Template B is the order with PP placed after the verb as its complement. Both PPs in templates A and B are embedded within the VP. Template C is a topic PP construction while template D is the right-dislocated PP construction.

Template A (core [PP V] order): [_{VP} PP V (NP_{object})]

- (12) 佢 [PP 喺 學校] 參加 書法班
keoi5 hai2 hok6haau6 caam1gaa1 syu1faat3baan1
s/he at school attend calligraphy class
'S/he attends the calligraphy class in school.'

Template B (core [V PP] order): [_{VP} V (NP_{object}) PP]

The postverbal PP construction [_{VP} V (NP_{object}) PP] allows a NP to act as the complement of the verb. The NP stands before the PP in the VP in Cantonese. An example with an overt NP is:

- (13) 佢 擺咗 件 衫 [PP 喺 衣櫃]
keoi5 baai2zo2 gin6 saam1 hai2 ji1gwai6
s/he put ASP CL clothes at wardrobe
'S/he puts a/the piece of clothing in the wardrobe.'

Template C (topic PP construction): includes templates C.1, C.2 and C.3.

A topic PP is identified by having one or more of the following features:

- 1) A subject following the PP (Li and Thompson, 1981:88)
- 2) A topic particle (Matthews and Yip, 1994, Lee, 2000) after the PP
- 3) A null-subject sentence or a complex sentence after the PP

Li and Thompson (1981:15,85) characterized topic as 'what the sentence is about.' The topic can be followed by a pause optionally.

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Template C.1¹⁰ With subject NP after PP: [PP (PRT_{topic}) NP_{subject} VP]

An example of *hai2* PP with the subject NP after the PP:

- (14) 因為 [PP 喺 過去 嘅 日子], 我 盡咗
jan1wai6 hai2 gwo3heoi3 ge3 jat6zi2 ngo5 zeon6zo2
because at past GEN days I endeavour ASP
我 能力
ngo5 nang4lik6
my ability
'Because in the past, I have tried my best.' (CRC)

Template C.2 Topic PP with topic particle: [(NP_{subject}) PP PRT_{topic} VP]

An example of a topic PP identified by a topic particle¹¹ is shown in the following:

- (15) 即係 我 [PP 喺 佢 身邊] 呢 成日 提點
ze1hai6 ngo5 hai2 keoi5 san1bin1 ne1 seng4jat6 tai4dim2
that is I at s/he besides PRT all-the-time advise
佢 咁樣 咁樣 呢
keoi5 gam2joeng2 gam2joeng2 ne1
s/he so so PRT
'I am always with him to remind him so and so.' (CRC)

Template C.3 Topic PP with a null-subject sentence or complex sentence after PP:

[PP null-subject sentence or complex sentence]

¹⁰ The categorization of template C.1 is simplified for a clearer representation of this category.

¹¹ Most of the topic particles (after PP) found in the two corpora are 呢 *ne1*. There are only a few instances in which the topic particles are 啦 *laal* and 囉 *lo1*.

In this template, there is either a null-subject sentence or a complex sentence after the topic PP. The topic PP has scope over the null-subject sentence or the complex sentence after the PP. An example is shown in the following:

- (16) [PP 喺 個 開放 嘅 空間] 咁 你 行過
hai2 go3 hoi1fong3 ge3 hung1gaan1 gam2 lei5 haang4gwo3
at CL open GENspace such you walk pass
你 都 可以 參加 架
lei5 dou1 ho2ji5 caam1gaa1 gaa3
you too can participate PRT
'in a public place, well, even passers-by can participate.' (CRC)

The complex sentence here consists of two clauses, 咁你行過 *gam2 lei5 haang4 gwo3* (when you walk past) and 你都可以參加架 *lei5 dou1 ho2ji5 caam1gaa1 gaa3* (you can participate). The topic PP has scope over the whole complex sentence.

Template D (right-dislocated PP construction)

The right-dislocated PP construction is a construction in which the PP is dislocated to the right. Cheung (1997:6) formulated the surface structure of dislocation in Cantonese as:

$$\alpha \text{ (SP)} \beta \quad (\alpha, \beta = \text{components of the sentence; SP} = \text{Sentence Particle})$$

A right-dislocated PP constitutes a β -string in this sense:

Template D: [VP (PRT) # PP]

The pause is normally present as an intonation break between the VP and the PP, whereas the particle can be present but is not obligatory. An example of template D is shown in the following:

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- (17) 好多 人 都 會 咁 做 # [PP 喺 呢 種
hou2do1 jan4 dou1 wui5 gam2 zou6 hai2 nei1 zung2
 very_much people too AUX such do at this sort
 情況]
cing4fong3
 situation
 ‘Many people will act in this way, in such a situation.’

4.2 Findings from Corpus

Tables 2 and 3 show the frequency of occurrences of the four templates in the two corpora.

Table 2. Percentage of occurrences of templates A to D in CRC

Template no.	Template description	Structure	No. of instances in sub-template	No. of instances in template	%
A	[PP V]	[_{VP} PP V (NP _{object})]	51	51	53.13
B	[V PP]	[_{VP} V (NP _{object}) PP]	8	8	8.33
C.1	Topic PP: (with subject NP after PP)	[PP (PRT _{topic}) NP _{subject} VP]	21	37	38.54
C.2	Topic PP: with topic particle	[(NP _{subject}) PP PRT _{topic} VP]	10		
C.3	Topic PP: with a null-subject or complex sentence after PP	[PP null-subject sentence or complex sentence]	6		
D	Right-dislocated PP	VP (PRT) # PP	0	0	0.00
			Total	96	100

Table 3. Percentage of occurrences of templates A to D in HKCAC

Template no.	Template description	No. of instances	Percentage
A	[PP V]	182	39.91%
B	[V PP]	72	15.79%
C	Topic PP	197	43.20%
D	Right-dislocated PP	5	1.10%
	Total	456	100%

A number of observations can be made based on these frequency counts:

- 1) The results of the two corpora correspond quite closely to each other. The [PP V] and the topic PP construction show the highest frequency of occurrence, with 53.13% of [PP V] in the CRC and 39.91% of [PP V] in the HKCAC; 38.54% topic PP in the CRC and 43.20% topic PP in the HKCAC. [V PP] occupies a low percentage, with 8.33% in the CRC and 15.79% in the HKCAC. Right-dislocated PP has the lowest frequency of occurrence, with 0% in the CRC and 1.10% in the HKCAC.
- 2) Among the two orders [PP V] and [V PP], [PP V] is dominant. The frequency of [PP V] in both corpora exceeds 39.00%.
- 3) When compared with the dominant [PP V] construction, the frequency of occurrence of the topic PP construction occupies a high percentage: 38.54% in the CRC and 43.20% in the HKCAC.
- 4) The right-dislocated PP construction occupies a negligible percentage of 0% in the CRC and 1.10% in the HKCAC.

5. PROCESSING

This section argues that the topic PP construction occurs with high frequency because it is more efficient in processing compared to the [PP V] construction, especially when the PP is long. The relatively higher processing efficiency of the topic PP construction is explained by Hawkins' (1994) processing principle, *Early Immediate Constituents* (EIC)¹² which is used to explain and predict universals of word order. The underlying principle of EIC is to let ICs (immediate constituents) be recognized or produced as soon as possible (Hawkins, 1994).

5.1 Precise Formulation of EIC

There are several key definitions provided by Hawkins (1994:58-59, 76-77):

Constituent Recognition Domain (CRD)

'The CRD for a phrasal mother node M consists of the set of terminal and non-terminal nodes that must be parsed in order to recognize M and all ICs of M, proceeding from the terminal node in the parse string that constructs the first IC on the left, to the terminal node that constructs the last IC on the right, and including all intervening terminal nodes and the non-terminal nodes that they construct.' (Hawkins, 1994:58-59)

The CRD goes from left to right for a certain phrasal mother node to be recognized.

¹² Hawkins (2004) expanded his processing principle to propose Minimize Domains (MiD). MiD is more general than EIC as it includes semantic considerations. However, EIC is still subsumed under MiD (Hawkins, 2004), and IC-to-non-IC ratio and IC-to-word ratio are still used to assess the relative processing efficiency of two alternative structures.

Early Immediate Constituents (EIC)

‘The human parser prefers linear orders that maximize the IC-to-non-IC ratios of constituent recognition domains.’

(Hawkins, 1994:77)

EIC is a principle of parsing. The processing efficiency can be measured by the IC-to-non-IC ratio or the IC-to-word ratio. That means the higher the processing efficiency, the higher the IC-to-non-IC ratio and IC-to-word ratio. It must be noted that IC-to-non-IC ratio is not an absolute value to measure the efficiency of processing a sentence, but a relative value to compare the processing efficiency of two alternative orders. The calculation of IC-to-non-IC ratio proceeds as follows:

The IC-to-non-IC ratio for a CRD is calculated by dividing the number of ICs in the domain by the total number of non-ICs (or words alone) in that domain, expressing the result as a percentage. The ratio for a whole sentence is the aggregate of the scores for all CRDs within the sentence.

(Hawkins, 1994:76-77)

I will use IC-to-word ratio to assess the processing efficiency of a construction in the following. It is simpler and more appropriate to use IC-to-word ratio than IC-to-non-IC ratio, which involves counting the number of nodes in the hierarchical tree diagrams and complications easily arise in deciding how the tree diagrams are drawn. To put it simply, the calculation of IC-to-word ratio is as follows:

$$\frac{\text{Number of ICs in a domain}}{\text{Total number of words in a domain}}$$

In the following, I will show simply how the mechanism of EIC works and explain why the [PP V] order of Chinese has relatively low processing efficiency. The efficiency of the orders (I) [V [P NP]] and (II) [[P NP] V] are compared. By the computation of EIC, order (I) has relatively higher processing efficiency than order (II).

Order (I), with the [V PP] order and a preposition inside the PP, is the word order favored by VO languages as a result of its high processing efficiency (Hawkins, 1994). The CRD of VP stretches from the word ‘played’ and ends with the word ‘with’ (see Figure 1). In the VP domain (within the two dotted lines), there are 2 ICs of the VP, namely the V and the PP, and we have to go through only 2 words ‘played’ and ‘with’ to recognize the 2 ICs of the VP. Therefore, the IC-to-word ratio in the VP domain is 2/2, equal to 100%.

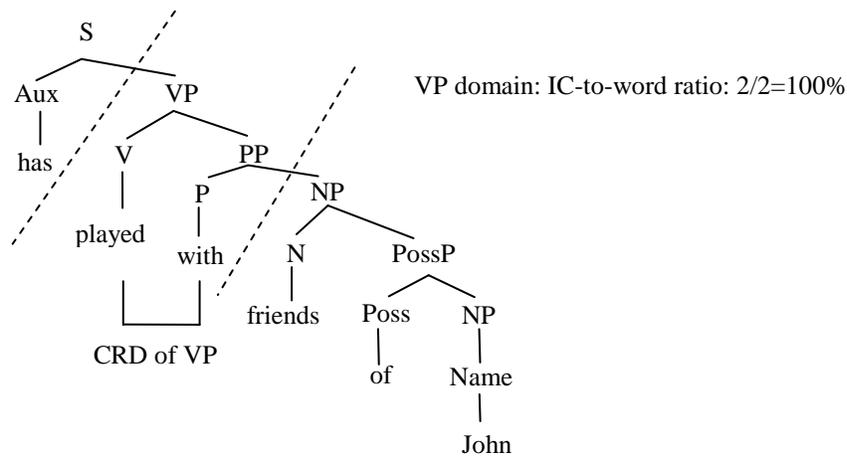


Figure 1. Computation of IC-to-word ratio of (I) [V [P NP]] (based on Hawkins, 1994:251)

Order (II), with the [PP V] order and a preposition inside the PP, is the typologically unusual order instantiated in Chinese. In order (II), the CRD of VP stretches from the word ‘with’, through ‘the’ and ‘friends’ and ends with the word ‘played’ (see Figure 2). The parser has to go through 4 words in order to recognize the 2 ICs of the VP. So, the IC-to-word ratio is 2/4, that is 50%. Order (II) is less efficient in processing when it is compared with order (I).

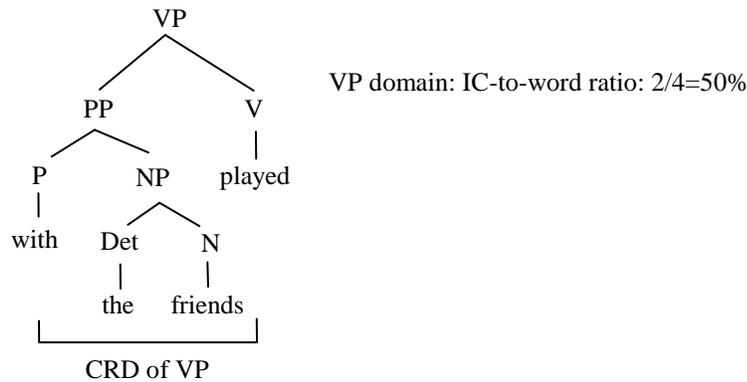


Figure 2. Computation of IC-to-word ratio of (II) [[P NP] V] (based on Hawkins, 1994:254)

5.2 The Processing of [PP V] and Topic PP in Cantonese

In the following, I will compare the relative processing efficiency of the [NP_{subject} PP V] and the topic PP construction [PP NP_{subject} VP] by the IC-to-word ratio. When counting the aggregate IC-to-word ratio, the average IC-to-word ratio of the S domain, the VP domain and the PP domain in the [NP_{subject} PP V] construction is counted; in the topic PP construction [PP NP_{subject} VP], the average IC-to-word ratio of the S1 domain, the S2 domain, the VP domain and the PP domain is counted. IC-to-word ratios are different only in these domains between the two constructions: [NP_{subject} PP V] and [PP NP_{subject} VP]. The same domains which have the same IC-to-word ratios between the two constructions are not included in the calculation of the average IC-to-word ratio, except the ratios of the PP as it is a constant for the comparison. When calculating the aggregate IC-to-word ratio, Hawkins (1994) himself only calculated the domains which have different IC-to-word ratios among the alternative constructions. Figure 3 shows an example of [NP_{subject} PP V] with a PP length of 6 words.

Note that the meaning of a preverbal PP construction and a corresponding topic PP construction (as in the two sentences illustrated in

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figures 3 and 4) are the same, since they have the same truth conditions. They differ in their structures but are truth-conditionally equivalent. Moreover, the information conveyed by the topic PP can be new or given. This freedom in the information conveyed by the topic PP is the same as that in the preverbal PP.

Processing and Iconicity of Locative PPs in Cantonese

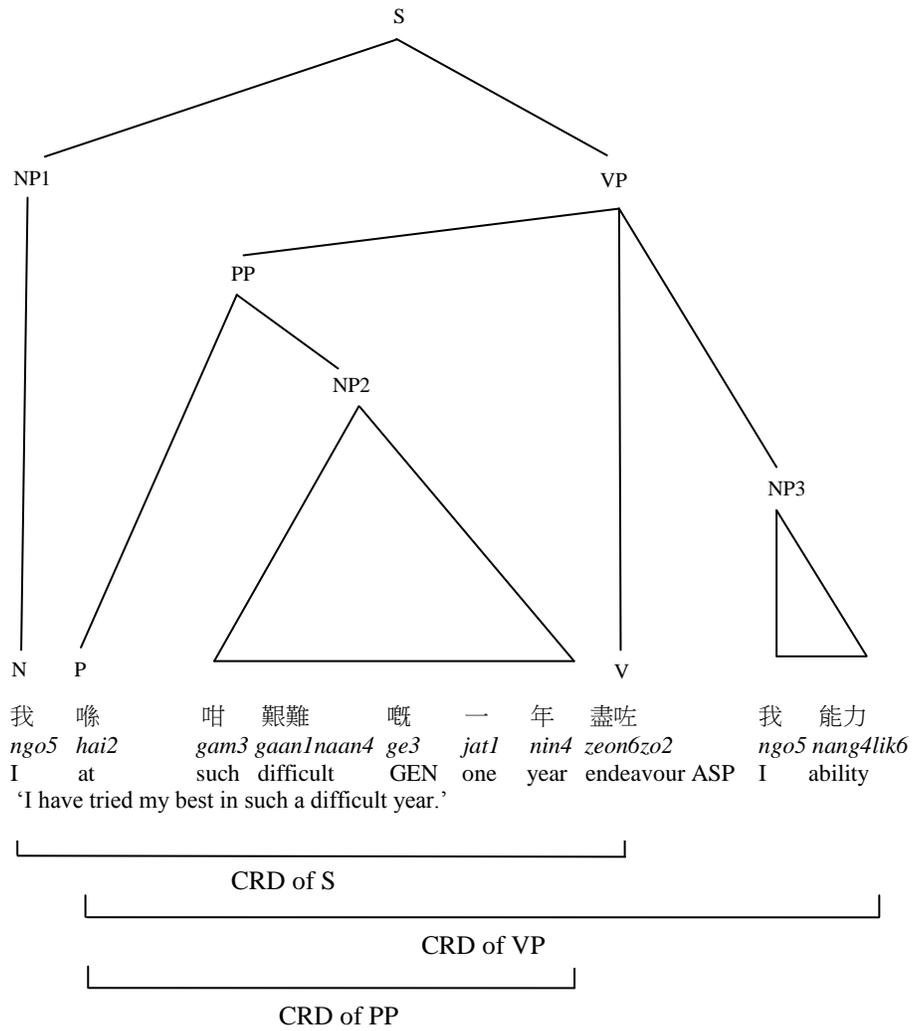


Figure 3. Tree diagram of [NP_{subject} PP V] with PP of 6 words

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Table 4. IC-to-word ratios of [NP_{subject} PP V] with PP of 6 words

Domain	ICs	No. of words	IC-to-word ratio
S domain	NP1, VP	8	$2/8 \times 100\% = 25\%$
VP domain	PP, V, NP3	9	$3/9 \times 100\% = 33.33\%$
PP domain	P, NP2	6	$2/6 \times 100\% = 33.33\%$
	aggregate IC-to-word ratio		$(25\% + 33.33\% + 33.33\%) / 3 = 30.56\%$

The following is the tree diagram of an example of the topic PP construction [PP NP_{subject} VP] with a PP length of 6 words:

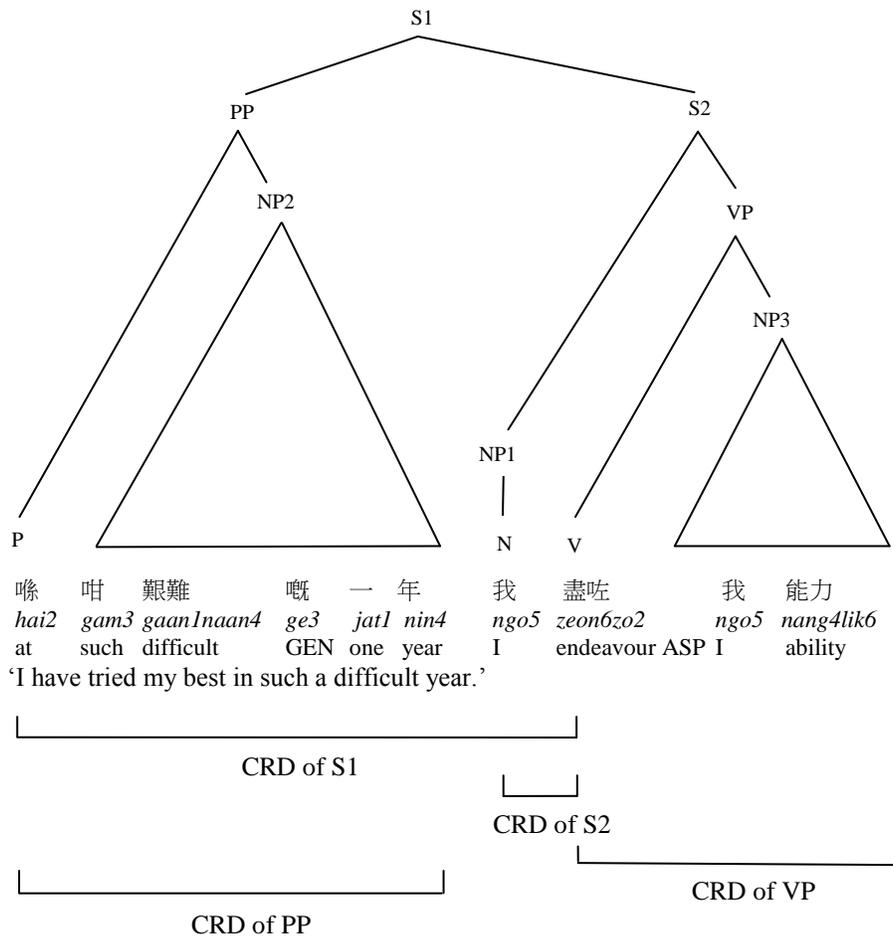


Figure 4. Tree diagram of topic PP construction [PP NP_{subject} VP] with PP of 6 words

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Table 5. IC-to-word ratios of [PP NP_{subject} VP] with PP of 6 words

Domain	ICs	No. of words	IC-to-word ratio
S1 domain	PP, S2	8	$2/8 \times 100\% = 25\%$
S2 domain	NP1, VP	2	$2/2 \times 100\% = 100\%$
VP domain	V, NP3	3	$2/3 \times 100\% = 66.67\%$
PP domain	P, NP2	6	$2/6 \times 100\% = 33.33\%$
	aggregate IC-to-word ratio		$(25\% + 100\% + 66.67\% + 33.33\%) / 4 = 56.25\%$

Table 6. IC-to-word ratios of [NP_{subject} PP V] and the topic PP construction [PP NP_{subject} VP] with PP of 2 to 7 words

No. of words of PP	IC-to-word ratios (%)									
	A: [NP _{subject} PP V]				C.1: Topic PP construction [PP NP _{subject} VP]					
	S	VP	PP	Aggregate ¹³	S1	S2	VP	PP	Aggregate ¹⁴	
2	50	60	100	70	50	100	66.67	100	79.17	
3	40	50	66.67	52.22	40	100	66.67	66.67	68.33	
4	33.33	42.86	50	42.06	33.33	100	66.67	50	62.5	
5	28.57	37.5	40	35.36	28.57	100	66.67	40	58.81	
6	25	33.33	33.33	30.56	25	100	66.67	33.33	56.25	
7	22.22	30	28.57	26.93	22.22	100	66.67	28.57	54.37	

Table 6 shows the IC-to-word ratios counted from PP of 2 words to 7 words of the two structures. EIC predicts that as the length of PP gets longer, the processing efficiency decreases. When we compare the aggregate IC-to-word ratios of the two constructions, the aggregate IC-to-word ratio of the topic PP construction [PP NP_{subject} VP] is consistently higher than that of the [NP_{subject} PP V] construction at all lengths of PP, from PP of 2 words to PP of 7 words.

¹³ The aggregate is the average IC-to-word ratio of the S, the VP and the PP domains in [NP_{subject} PP V].

¹⁴ The aggregate is the average IC-to-word ratio of the S1, the S2, the VP and the PP domains in [PP NP_{subject} VP].

The difference in the aggregate IC-to-word ratios is mainly accounted for by the difference in the VP domain of the two constructions. For a given length of PP, the IC-to-word ratio of the S domain in [NP_{subject} PP V] construction is the same as the IC-to-word ratio of the S1 domain in [PP NP_{subject} VP]. The IC-to-word ratio of the PP domain for a particular length of PP is the same in both [NP_{subject} PP V] and [PP NP_{subject} VP]. That means the S in the [NP_{subject} PP V] construction, the S1 in the [PP NP_{subject} VP] construction and the PP in both constructions do not contribute to the difference in the aggregate of the two constructions. The difference lies in the VP domain: for PPs of 2 to 7 words, the IC-to-word ratio of the VP domain in the [NP_{subject} PP V] structure declines from 60% at a PP length of 2 words to 30% at a PP length of 7 words, while the ratio remains constant at 66.67% in the VP domain of the topic PP construction [PP NP_{subject} VP]. The topic PP construction has a higher processing efficiency than the [NP_{subject} PP V] construction. This is due to the fact that the VP domain has a higher and more constant processing efficiency in the topic PP construction than in the [NP_{subject} PP V] construction. In all, the VP in the topic PP construction is lighter and therefore easier to be processed since the PP is not embedded in the VP domain. The low processing efficiency of the dominant [NP_{subject} PP V] order in Chinese is therefore circumvented due to the availability and high frequency of use of the topic PP construction.

It is also expected that as the length of PP increases, there is more motivation to employ the topic PP construction. As we can see from table 6, when the length of PP is of 2 words, the aggregate IC-to-word ratio of the two constructions is similar, with the topic PP construction [PP NP_{subject} VP] slightly higher than that of the [NP_{subject} PP V] construction. However, as the PP gets longer, the difference between the IC-to-word ratio of the topic PP construction and that of the [NP_{subject} PP V] construction becomes larger. According to the order [PP V] in Chinese, the CRD of the VP stretches from the preposition through the NP within the PP to the verb and then to the object NP if there is any (see figure 2), the lengthening of the PP will increase the length of the CRD of VP and reduce the processing efficiency of the VP. There is a motivation for the PP to be placed in the topic position so that the VP domain can be kept short even if the PP gets longer.

5.3 Length of PP and Motivation for Topic PP Construction

I will employ corpus data to study the relationship between the length of the PP and the two constructions: [PP V] and the topic PP construction. Two hypotheses are put forward in investigating the length of the PP in the two constructions: a) [PP V] and b) the topic PP construction. These two hypotheses aim at verifying that the processing motivation to employ the topic PP construction will increase when the length of the PP increases. For verifying hypotheses 1 and 2, the number of syllables of each instance of the PP in the [PP V] and the topic PP construction in the CRC and the HKCAC is counted¹⁵. The length of PP in general starts with the *hai2* character and ends with the last character of the noun phrase or localizer.

Hypothesis (1): The mean length of the PP in the topic PP construction is higher than the mean length of the PP in the [PP V] construction.

Hypothesis (2): The longer the length of the PP, the higher the percentage of occurrence of the topic PP construction.

¹⁵ Words are not counted in order to avoid problems which arise in deciding on word divisions. Words in Cantonese cannot be easily distinguished by word boundaries as they can in English. Therefore, length is measured objectively in terms of characters (corresponding to syllables). Counting syllables is not ideal, since the processing model is more directly concerned with the word and/or morpheme level. However, for Chinese, the syllable level corresponds closely (if not exactly) to the morpheme level. Also, syllables serve the purpose of length calculation here: syllables, morphemes and words are all justified means to measure the weight of a constituent, including the length of a PP. The heavier a constituent is, the larger are the numbers of syllables, morphemes and words.

Table 7. Mean length of PP of [PP V] and Topic PP in CRC and HKCAC

	CRC		HKCAC	
	[PP V]	Topic PP	[PP V]	Topic PP
Mean length of PP (syllables)	4.94	5.87	5.64	7.81
Difference of mean length of PP within each corpus	5.87-4.94 =0.93		7.81-5.64 =2.17	

In CRC, the mean length of the PPs of the topic PP construction is greater than that of the [PP V] construction by 0.93 syllables; a t-test indicates that the difference in the mean length is statistically significant ($p < 0.05$). In the HKCAC, the mean length of the PPs in the topic PP construction is 2.17 syllables greater than that of the [PP V] construction; a t-test indicates that the result is highly significant ($p < 0.001$).

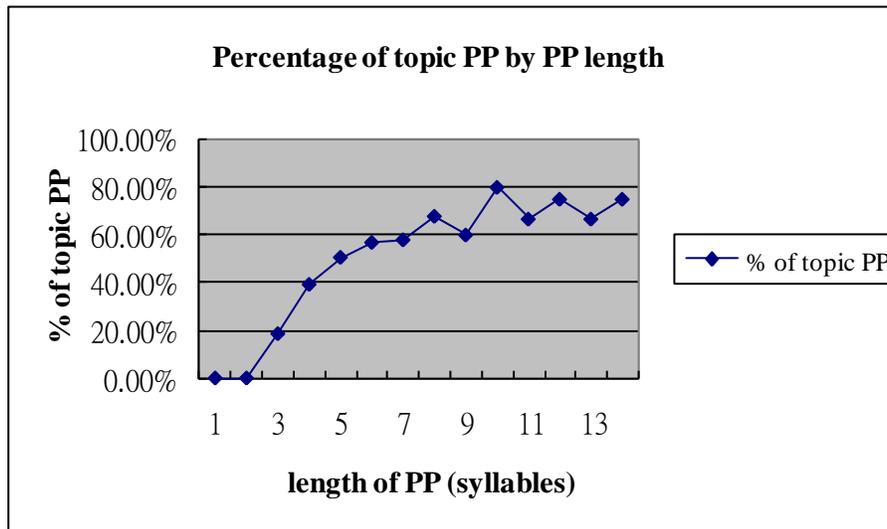


Figure 5. Percentage of topic PP by PP length

For hypothesis 2, regarding all the instances of the [PP V] and the topic PP, the percentage of the topic PP and the [PP V] by each length of PP is calculated. In figure 5, the data of the two corpora are combined for computation. Results show that the longer the PP, the larger the percentage appearing in topic position. A Pearson correlation test for the length of PPs and the percentage of topic PPs (N=12) is significant: $r=0.848$, $p<0.001$. Hypothesis 2 is therefore supported. As the length of the PP increases, the frequency of the topic PP construction increases, consistent with the greater processing motivation. In all, the topic PP construction has a higher processing efficiency since the VP of the topic PP construction is lighter by not embedding the PP. The NP inside the PP of the [[_{PP} P NP] V] construction can delay recognition of the verb. Therefore, the longer the PP, the higher the processing motivation to employ the topic PP construction¹⁶.

6. CONCLUSION

The most crucial findings of this study concern PPs in the topic position. First, the topic PP occupies a high percentage of occurrence among the four types of PPs in the corpora. The high frequency of the topic PP construction has profound implications for the analysis from the processing perspective. The dominance of the topic PP construction suggests, as I demonstrate in section 5, that there is a processing motivation for the topic PP construction. Second, the prediction that the processing motivation to employ topic PP increases when the length of PP increases is confirmed by the corpus data. This finding sheds light on the placement of the locative *hai2* PPs in Cantonese from the processing perspective. In addition to the processing factor, iconicity is shown in the placement of the PPs: [[_{PP} P NP] V] order is governed by iconicity. [[_{PP} P NP] V] order in Cantonese is tolerated due to the availability and high frequency of the topic PP construction. An insight

¹⁶ Length is demonstrated to be the factor that makes longer PPs more likely to be placed in the topic position. Examining other plausible factors that might play a role in making longer PPs more likely to be placed in the topic position is an interesting issue for further study.

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into why Cantonese is a topic-prominent language is achieved: the topic PP construction is used to enhance processing efficiency and to cope with the unusual typological word order in Cantonese. Matthews and Yeung (2001) also demonstrated that the topicalization of the relative clause and its head noun in Cantonese gives relatively higher processing efficiency than the canonical [_{VP} V [_{NP} [REL Clause] N]] structure.

Both [V [_{PP} P NP]] and [[_{PP} P NP] V] orders satisfy iconicity. While [V [_{PP} P NP]] order conforms to EIC (Hawkins, 1994) in having comparatively high processing efficiency, [[_{PP} P NP] V] order seems to be in conflict with EIC. [[_{PP} P NP] V] order is shown to exhibit iconicity, but in terms of EIC, [[_{PP} P NP] V] order has relatively lower processing efficiency and is rare among languages in the world. The topic PP construction which is shown to have higher processing efficiency than [[_{PP} P NP] V] satisfies the processing principle EIC. The topic PP construction also satisfies the iconicity principle, since a topic PP has a scene-setting function and is placed before the verb. The topic PP construction is therefore a solution allowing both functional principles, EIC and iconicity to be compatible with each other. The language structure adjusts to accommodate the two functional principles. When the length of PP is short, the [[_{PP} P NP] V] construction may be tolerated by EIC. The degree of incompatibility of iconicity and processing increases as the length of PP increases. As the length of PP increases, the processing efficiency of [[_{PP} P NP] V] decreases accordingly and the motivation for the topic PP to be employed increases. The topic PP as an alternative structure to [[_{PP} P NP] V] shows that both seemingly competing functional motivations can be reconciled. Newmeyer (1998:139) mentioned that when there are competing motivations, there are three different results:

‘Motivations in conflict are said to have three different outcomes: one motivation might win out over the other; each motivation might have its own grammatical consequence (i.e. multiple structural possibilities); and there might be a compromise, in which the resultant structure or structural subsystem fails to reflect any one motivation.’ (Newmeyer, 1998:139)

The case of topic PP shows an additional outcome apart from the three mentioned by Newmeyer: a “win-win” situation emerges. The topic PP satisfies both principles, EIC and iconicity, allowing the two competing motivations to be compatible and co-exist with each other.

Functionalism and formalism are compatible in that external motivations can help shape grammar. Iconicity and processing are factors that govern the occurrence of [PP V], [V PP] and the topic PP construction. Newmeyer (1998) discussed the seeming conflicts between the two general orientations in the field of linguistics: formalism and functionalism. There seems to be a conflict between these two general orientations in linguistics, with formalism resorting to internal factors within the grammatical system for explanations and functionalism resorting to external factors for explanations. However, they can both take part in motivating grammatical structure. As Newmeyer argued, the two mainstreams in linguistics, formalism and functionalism are compatible with each other: grammatical structure has its own autonomous system, and at the same time can be motivated externally. I have demonstrated that in the case of locative PP in Cantonese, functional forces motivate the formation of grammatical structure.

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Processing and Iconicity of Locative PPs in Cantonese

粵語處所介詞短語的位置：語句處理和象似性

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粵語作為一個 VO 語言有着[PP V]而不是[V PP]作為主要語序是不尋常的。Dryer (1992) 發現 VO 語序跟[V PP]語序有着很強的相關性。Hawkins (1994) 提出一個解釋，就是 VO 語言跟[V [PP P NP]] 語序有着最理想的處理效率。本篇文章研究為何儘管[PP V] 有着較低的處理效率，粵語仍然使用[PP V]語序。粵語中的[[PP P NP] V]語序符合象似性原則，但有着較低的處理效率。根據 Hawkins (1994) Early Immediate Constituents (EIC) 的量度方法，話題介詞短語結構(topic PP construction)比[[PP P NP] V] 有更高的處理效率，話題介詞短語結構能作避免低處理效率的[[PP P NP] V] 的一個途徑。語料庫的資料顯示，當介詞短語越長，它出現在話題位置的百分比就越高。本文論證話題介詞短語結構皆符合象似性原則和處理效率的原則，話題介詞短語結構顯示兩個似乎是處於競爭狀態的功能動因(象似性原則和處理效率的原則)能夠彼此相容。

關鍵字：粵語，介詞短語，語序，話題，象似性，處理效率