

中文連接詞之研究：以「和」為例

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摘 要

此篇論文主要探討中文連接詞「和」在做名詞組連接時，在句法與語意上的表現。前人的文獻對於「和」連接名詞組這方面並無太深入的研究，主要是探討對動詞組及形容詞組所得到的觀察。(請參閱 趙元任(1968)，呂叔湘(1980)，蔡慧瑾(2006))。因此，本論文將著重於「和」用來連接名詞組的這方面來作深入研究。

首先，本論文觀察到當一個數量詞出現於整個「和」所連接的名詞之前，我們將會得到兩種不同的語意解讀：異指解(distributive reading)和累指解(cumulative reading)。而這兩種語意解釋都是可能的解讀。

接著，本論文從語意解釋的角度下手，論證數量詞本身便帶有兩種特徵(features)：「異指特徵」(distributive feature)和「累指特徵」(cumulative feature)。當數量詞與不同的特徵結合時，便會得到不同的語意解釋。若从句法解釋的角度來看，我們認為在句法結構上可能存在一個算子(operator)。當其出現或消失在句法結構上時，便會導致不同的語意解釋。

最後，在本論文中，提出語意與句法上兩種分析來解釋異指解和累指解，除了可以套用在中文「和」的名詞連接之分析上，亦可套用於英文‘and’之上。

A Case Study of Chinese Coordinator *He*

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Abstract

This thesis deals with the semantic and syntactic representation in noun phrase conjunction. Previous studies have focused on verb phrase conjunction and adjective conjunction, but have not focused on the noun phrase conjunction in Chinese. (cf. Chao (1968), Lu (1980), Tsai (2006)). Therefore, this study aims to discuss noun phrase conjunction in Chinese.

First, this study shows that when noun phrase conjunction occurs with a number expression, it leads to two possible readings.

Second, the study proposes a semantic solution for the two different readings in noun phrase conjunction. Specifically, there are two possible features in the number expression. One is a distributive feature and the other is a cumulative feature. In other words, when the number expression is combined with different features, different readings will be derived.

Third, this study also proposes a syntactic analysis of the different readings. It is proposed that there may be an operator in syntax, and the different readings result from the presence or absence of this operator.

Finally, this study aims to propose a semantic solution and a syntactic solution for distributive and cumulative reading. This can apply to both Chinese *he* and English *and* in noun phrase conjunction.

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Chapter 1

Introduction

In this thesis, I present some phenomena that have been ignored in the analyses of *he* ‘and’, which is one of the coordinate conjunctions in Chinese. Since there are many conjunctions to express the notion of conjunction in Chinese, I will limit the scope of the research to *he*.

1.1 Preliminary: The Analysis of English *And*

Compared with English *and*, the distribution of *he* is quite limited. However, these two linguistic elements still share some properties. Therefore, I will introduce the analysis of English *and* first.

There are two usages of *and*: Boolean conjunction and non-Boolean conjunction. Boole (1854), Gazdar (1980), Partee and Rooth (1983), and Keenan and Faltz (1985) treat *and* as Boolean conjunction as (1) illustrates. They consider that Boolean conjunction follows the three laws of Boolean algebra as (2) shows.

(1) John walks and talks.

(2) a. associativity: John (walks and talks) and drinks ↔ John talks and (walks and drinks)

b. commutativity: John walks and talks ↔ John talks and walks

c. idempotency: John talks and talks ↔ John talks

However, their analysis is not compatible with example (3). If we apply the three laws to analyze (3), it will fail as (4) shows.

(3) John and Mary met.

(4) a. associativity: (John and Bill) and Mary met \leftrightarrow John and (Bill and Mary) met.

b. commutativity: John and Mary met. \leftrightarrow Mary and John met.

c. idempotency: *John and John met \leftrightarrow *John met.

When the law of associativity applies, the sentences are grammatical ones. Meanwhile, the law of commutativity will cause 'John' and 'Mary' to exchange their positions in syntax as (4b) shows. Although the nouns are switched, this does not alter the original semantic meaning. However, when the law of idempotency applies, since the source is an ungrammatical sentence, it also leads to an ungrammatical sentence.

Massey (1976), Link (1983), Hoeksema (1983, 1988), and Krifka (1990) observed that there is another usage of *and*, called 'non-Boolean *and*'. They claim that the conjunction in (3) is different from that in (1).

1.2 Noun Phrase Conjunction in Chinese

Chinese conjunction *he* behaves like *and* in English. It can also have two usages: Boolean conjunction and non-Boolean conjunction as (5) and (6) show. The example in (5) follows the three laws of Boolean algebra, as (7) shows.

(5) Lisi mai-le shu he qianbi

Lisi buy-Asp book and pencil

‘Lisi bought some books and pencils.’

(6) Lisi he Mali shi tongxue

Lisi and Mary be classmate

‘Lisi and Mary are classmates.’

(7) a. associativity: Lisi mai-le shu he qianbi

Lisi buy-Asp book and pencil

‘Lisi bought some books and pencils.’

b. commutativity: Lisi mai-le qianbi he shu

Lisi buy-Asp pencil and book

‘Lisi bought some pencils and books.’

c. idempotency: Lisi mai-le shu

Lisi buy-Asp book

‘Lisi bought some books.’

As for example (6), it does not follow the law of idempotency, as (8) shows. This is the same as the analysis of non-Boolean conjunction in English.

(8) a. associativity: Lisi he Mali shi tongxue

Lisi and Mary be classmate

‘Lisi and Mary are classmates.’

- b. commutativity: Mali he Lisi shi tongxue
 Mary and Lisi be classmate
 ‘Mary and Lisi are classmates.’
- c. idempotency: *Lisi shi tongxue
 Lisi be classmate
 ‘Lisi is classmate.’

Several scholars have discussed the complexity of the coordinate structure in Chinese. Wang (1979), Zhu (1982), Liu(2003) and Liu(2005) claim that *he* can be used to connect verbs, nouns, adjectives and so on. Some scholars, on the other hand, suggest that *he* is free to connect nominal phrases, but is restricted when used to connect other categories (cf. Chao (1968), Lu (1980), Huang, Li, and Li (2005), Tsai (2006)).

The previous studies, however, fail to explain the following phenomenon. We find out that most number expressions before the noun phrase conjunctions denote the cumulative reading as example (9a) shows while (9b) denotes distributive reading.

- (9) a. You wu-zhi gou he mao zhong-du le
 have five-Cl dog and cat poison Asp
 ‘Five dogs and cats got poisoned.’
- b. Ta-de liang-zhi shou he jiao dou duan-le
 his two-Cl hand and leg all broke-Asp
 ‘Two of his hands and two of his legs were broken.’

This phenomenon is very interesting. I will further discuss (9a) in Chapter 3 and treat the conjunction as non-Boolean conjunction. I will then deal with (9b) in Chapter 4.

In addition, I observe that Hoeksema's stipulations for proper names, definite noun phrases, and indefinite noun phrases are too strong for Chinese conjunction. In his point of view, conjunctions of proper names, definite noun phrases, and indefinite noun phrases function as non-Boolean conjunction. If we follow Hoeksema's ideas, we will then predict that a number expression before the conjunction of definite noun phrases and before the conjunction of indefinite noun phrases will always denote cumulative reading. However, there are some exceptions. In some circumstances, we do derive the distributive reading. In fact, both readings are possible.

Heycock and Zamparelli (2005) propose an interesting analysis for cumulative reading. Nevertheless, their analysis cannot explain the distributive reading, either. Therefore, I propose that the number expression is ambiguous. Specifically, it carries two features deriving two readings: the cumulative reading and the distributive reading.

It is also possible that the two readings result from different syntactic structures. Muadz (1991) proposes that the coordinate structure is three-dimensional. Following his idea, we can derive the distributive reading. However, he too is unable to explain the cumulative reading. In order to deal with this issue, we propose that there is a distributive operator in syntax. The distributive operator has been discussed in a considerable number of studies (Dowty and Brodie (1984), Link (1987), Heim, Lasnik, and May (1991), Lin(1998)). I will follow their idea and claim that the two readings result from the question of whether the

distributor is present or absent in syntactic structure.

The thesis is organized as follows: Chapter 1 is a brief introduction. Chapter 2 presents previous studies of *he* and their problems. Chapters 3 and 4 provide an explanation for cumulative reading and distributive reading in noun phrase conjunction, respectively. The possible syntactic structures are discussed in Chapter 5. Finally, Chapter 6 presents the conclusions of the study.



Chapter 2

Literature Review

In this chapter, I will first introduce previous studies on Chinese conjunction *he* and illustrate potential problems. Then, I will introduce the analysis of English conjunction *and*, examining its compatibility with the phenomena in Chinese.

2.1 Different Limitations of Chinese Conjunction *He*

There are a number of scholars who have paid attention to the limitations of Chinese conjunction *he*. To begin with, Chao (1968) claims that nouns are the only category in which *he* can function as a coordinator. Furthermore, Wang (1979), Zhu (1982), Zhou (1987), and Liao (1992)¹ discuss the coordinate structure. For example, Wang introduces the inner structure of coordinate structure, which can be single-layered (*dan ceng*) or multi-layered (*duo ceng*)². The position of the conjunction determines whether the structure is single-layered or multi-layered. In this paper, we will only discuss the single-layered structure.

In addition, Liu(2003) also discusses the conjunctions which he called ‘relators’ in Chinese. Liu (2005) then followed this idea and claimed that there are three basic term units

¹ These two authors focus on the order of the two conjuncts in coordinate structure. For further studies, please refer to these papers.

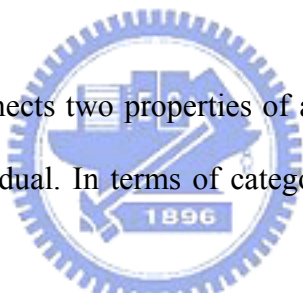
² The multilayer structure is as (i) shows.

(i) gang 、 tie 、 meitan he liang 、 mian 、 shutsai , dou qude-le jiaohao de chengji
steel iron coal and grain cotton vegetable all gain-Asp better DE result
'Steel, iron, coal and grain, cotton, vegetables all gain better results.'

Wang (1979: 261)

(ji ben ci wei): *he*, *huo*, and *shenzhi*, corresponding to *and*, *or*, and *even* in English. Among the three term units, *he* is the basic term unit, and therefore is more flexible in linking the three main categories; nouns, verbs, and adjectives. However, the phenomenon that Liu observed in verb phrase conjunction may be nominalization. It is possible that what the conjunction conjoins are not genuine verbs, but rather, nominalized verbs.

In addition, there are some researchers who hold different viewpoints on Chinese conjunction. Aoun and Li (2003) and Huang, Li, and Li (2005) state that Chinese has a rich set of conjunctions, which are used to connect different categories. They also describe the function of conjunctions, as follows.

- 
- a. The connector *jian* connects two properties of a single individual or two activities performed by one individual. In terms of categories, *jian* can connect NPs or VPs³.
 - b. The connector *he/gen* connect two individual-denoting expressions, i.e. two DPs, which can be proper names, pronouns, expressions containing demonstratives or expressions containing number and classifier expressions.
 - c. The connector *erqie* connects two non-nominal categories, including clauses, adjective phrases and VPs not expressing dual properties/activities of one individual.
 - d. These connectors are not interchangeable.

Huang, Li, and Li (2005: 35)

³ NPs refer to “noun phrases” and VPs refer to “verb phrases”.

As is mentioned before, Liu (2005) suggests that *he* is the basic term unit, and therefore it can connect nouns, verbs and adjectives. However, what Liu states is in contrast to what Huang, Li, and Li claim. In their viewpoint, *he* can only occur in noun phrase conjunction. Similarly, Chao(1968) also suggests that *he* is limited to this position and can only be used to connect two nouns. Indeed, the following examples (10) to (12) show the illegitimacy of using *he* to connect verbs, adjectives, and adverbs.⁴

(10) *Lisi jie-le-hun he sheng-le-haizi

Lisi marry-Asp and have-Asp-kid

‘Lisi got married and had kid(s).’

(11) *Lisi yingjun he youqian

Lisi handsome and rich

‘Lisi is handsome and rich’

(12) *Lisi ku-de hen dasheng he hen jilie.

Lisi cry very loudly and very impetuously

‘Lisi cried very loudly and very impetuously.’

However, Lu (1980) and Tsai⁵ (2006) have different observations on *he*. Their proposals are very insightful and they present some requirements for the conjunction of verbs

⁴ In example (10) to (12), if we replace '*he*' with '*erqie*' or '*ye*', the sentences become acceptable.

⁵ In Tsai's thesis, she discussed the additive adverb and two coordinators: *erqie* and *he*. She argues that *ye* behaves as an adverb in coordinated construction. She also argues that the interpretation of 'furthermore' denoted by *erqie* are derived from the semantic nature of *erqie*. As for *he*, she claims that it conjoins arguments of either first-order predicate or higher order predicate. As the purpose of this paper is concerned, I will concentrate on her analysis in *he*.

and adjectives. To begin with, Lu claimed that *he* can connect two verbs and adjectives as sentences (13) to (15) show.

(13) Shiqing hai yao jinyibu diaocha he liaojie
thing still need further investigate and apprehend
‘Things need to be further investigated and apprehended.’

(14) Huiyi taolun he tongguo-le mingnian de caiwu yusuan
meeting discuss and pass-Asp next year DE finance budget
‘At the meeting, the financial budget of next year was discussed and passed.’

(15) Taishan de jingse shifen zhuangli he xiongwei
Taishan DE scenery very grand and majestic
‘The scenery of Taishan is very grand and majestic.’



Lu (1980: 266)

Lu states that there are two requirements in verb phrase conjunction. As long as these requirements are fulfilled, *he* can be used to connect other categories in addition to nouns. The two requirements are presented in (16). However, there are also exceptions to the first requirement, as (17) and (18) show.

(16) a. The verbs have to be bi-syllabic.

b. A conjoint additive component or related component must appear before or after the verbs.

(17) Lisi sangshi-le pao he tiao de nengli
Lisi lose-Asp run and jump Rel ability
'Lisi lost the ability to run and jump.'

(18) Lisi changchang da laopo he ma xiaohai
Lisi often hit wife and scold child
'Lisi often hits his wife and scolds his children.'

The two verbs in example (17) are both mono-syllabic, while those in (18) are tri-syllabic. If Lu's first requirement were correct, then we would predict that examples (17) and (18) be ungrammatical sentences. However, they are grammatical sentences.

Tsai (2006) also acknowledges the constraints in verb phrase conjunctions. First, she claims that what conjunction conjoins is either first-order predicate or higher-order predicate. Second, she argues that the verbs and adjectives must be in the argument position.

Adopting Tsai's analysis, we can easily explain the legality of the sentences that are proposed by Lu. In (13), the verbs can be the arguments of the modal *yao*. In (14), the verbs are nominalized. In (15), Tsai claims that the adverb *shifen* 'very' is higher-order predicate and obligatory. It quantifies the entire conjoined phrase. According to Tsai's analysis, we can predict that sentences (19) to (21) are grammatical, which is in fact true.

(19) Ta xihuan guangjie he kan-dianying
he like go-shopping and watch-movie

‘He likes to go shopping and watch movies.’

(20) Duiyu guangjie he kan-dianying, Lisi bu gan-xingqu

about go-shopping and watch-movie, Lisi not interested

‘About going shopping and watching movies, Lisi is not interested.’

(21) Guangjie he kan-dianying shi Lisi de xingqu

go-shopping and watch-movie be Lisi DE interest

‘Going shopping and watching movies are Lisi’s interests.’

Tsai claimed that being in the argument position helps the conjunction of two verbs become acceptable. Indeed, the conjunct phrases in the above sentences are all in the argument position. In (19), the object position is an argument position. In (20), the conjunct phrase is the complement of the preposition and consequently, the conjunct phrase is also in the argument position. In (21), the subject position is also an argument position.

In addition, her theory also predicts the illegitimacy of the following sentences. When the conjoint phrase functions as a predicate, the sentence becomes ungrammatical, as (22) shows.

(22) * Lisi guangjie he kan-dianying

Lisi go-shopping and watch-movie

‘Lisi goes shopping and watches movies.’

Tsai’s proposal is a great breakthrough in the analyses of Chinese coordinators. Previous works, however, have all neglected the phenomenon of number expression in noun phrase

conjunction. I will focus on this in the following section.

2.2 *He* in Noun Phrase Conjunction

Previous works have claimed that *he* can be used to connect noun phrases. However, (23) shows the illegitimacy of noun phrase conjunction. Similarly, the English counterpart is also ungrammatical as (24) shows. In addition, most of the number expressions before the conjoined phrase refer to the total number, as (25) shows.

(23) * Zhe-zhi gou he mao dou zhong-du le
this-Cl dog and cat all poison Asp

‘This dog and this cat got poisoned.’

(24) *This dog and cat got poisoned.

(25) You wu-zhi gou he mao zhong-du le
have five-Cl dog and cat poison Asp

‘Five dogs and cats got poisoned.’

In (25), the reading of five poisoned animals, which are dogs and cats, is derived. There is no exact number for the poisoned dogs and poisoned cats. This phenomenon is very interesting. Previous studies cannot explain how we derive this reading. The analysis of this phenomenon will be presented in Chapter 3.

2.3 Analysis of English *And*

A large number of scholars have paid attention to English *and*. Boole (1854), Gazdar (1980), Partee and Rooth (1983), and Keenan and Faltz (1985) all treat *and* as Boolean conjunction. They observed that when we conjoin two categories, the expression will distribute to the argument or the predicate, as (26) and (27) show.

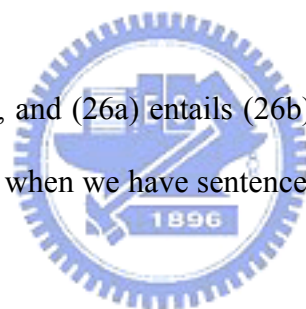
(26) a. John and Mary left.

b. John left and Mary left.

(27) a. John sings and dances.

b. John sings and John dances.

In (26a), *and* conjoins two nouns, and (26a) entails (26b). In (27a), *and* connects two verbs, and (27a) entails (27b). However, when we have sentences such as (28), the entailment is not applicable.



(28) a. John and Mary met.

b.*John met and Mary met.

Massey (1976), Link (1983), and Hoeksema (1983, 1988) observed that there is another use of *and*: non-Boolean *and*. Massey points out that the entailment does not exist in some circumstances, and Link proposes an operator \oplus , claiming that $a \oplus b$ is different from $a + b$. The following is an excerpt from Link's paper. Link also gives (29) to show the denotation of two singular countable nouns in conjunction.

Now, let a and b denote two atoms in A . Then there are two more individuals to be called below $a + b$ and $a \oplus b$. $a + b$ is still a singular object in A , the *material fusion of a and b* ; $a \oplus b$ is the *individual sum or plural object* of a and b .

Link (1983: 307)

(29) $(\zeta \text{ and } \eta) \cup \lambda z \exists x \exists y [\zeta'(x) \wedge \eta'(y) \wedge z = x \oplus y]$

Link (1983: 319)

Hoeksema observed the contrast between singular nouns and certain singular quantifiers: the conjoined phrase composed of two singular nouns usually works as a plural noun, and when composed of certain singular quantifiers works as a singular noun. This is illustrated in (30) and (31), respectively.

(30) A man and a woman {were/*was} arrested.

(31) Every day and every night was spent in bed.

Hoeksema (1988: 20)

In addition, conjoined phrases composed of proper names, definite descriptions and existential quantifiers also behave like (30). Hoeksema uses examples (30) and (31) to show that there are two usages of conjunction. Since the Boolean operations do not change the

category⁶ of their arguments, the conjunction in (31) is a Boolean operation. In (30), the conjunction conjoins two singular noun phrases and becomes a plural term. The category has been changed, so the conjunction in (30) is a non-Boolean conjunction.

Hoeksema also suggests that the conjunction of the singular quantifier is symmetric. Therefore, (32a) is equal to (32b). Besides, (32a) entails (32c) and (32d). However, if the conjuncts are proper names, we cannot derive the entailment, as shown in (33).

(32) a. Every man and every woman solved the crossword puzzle.

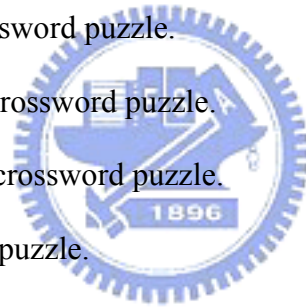
b. Every woman and every man solved the crossword puzzle.

c. Every man solved the crossword puzzle.

d. Every woman solved the crossword puzzle.

(33) a. Tim and Grace solved the crossword puzzle.

b. Tim solved the crossword puzzle.



The contrast between (32) and (33) is also due to the distinct usages of conjunction: one is Boolean conjunction and the other is non-Boolean conjunction. In (33), *Tim and Grace* is viewed as a group, which is defined as a set with two or more members.

In addition, Krifka (1990) proposes more generalized rules for Boolean conjunction and non-Boolean conjunction. Krifka tries to propose a rule to cover every category in conjunction and generalizes a conjunction and an inclusion relation at the same time.

⁶ The term “category” does not refer to “syntactic category”. Rather, it refers to “the category of being singular or plural”.

Schwarzchild (1991) examines the analyses of conjunction both in set theory and union theory while Heycock and Zamparelli (2005) provide an analysis for the noun phrase conjunctions with cardinal numerals.

2.4 Asymmetry between *He* and *And*

Chinese conjunction *he* does not behave exactly the same as English *and* in noun phrase conjunction. According to Hoeksema (1988), conjunctions of proper names, definite nouns, and indefinite nouns all behave collectively.

On the contrary, Chinese has the following contrast. In (34a), the number expression denotes the total number, but in (34b), the number expression is distributive.

(34) a. You wu-zhi gou he mao zhong-du le
 have five-Cl dog and cat poison Asp
 ‘Five dogs and cats got poisoned.’

b. Ta-de liang-zhi shou he jiao dou duan-le
 his two-Cl hand and leg all broke-Asp
 ‘Two of his hands and two of his legs were broken.’

Hoeksema’s theory predicts that the number expressions in (34a) and (34b) denote the total number of members in the set. However, there are two different readings in (34a) and (34b). In addition, Heycock and Zamparelli’s analysis only discusses the first reading. Therefore, we have to propose an analysis that can account for the phenomenon in (34). I will discuss the

first reading in Chapter 3 and the other reading in Chapter 4.



Chapter 3

Noun Phrase Conjunction

In Chapter 3, we will introduce the analysis of cross-linguistic variation in conjunction proposed by Heycock and Zamparelli (2005) and examine if their analysis is suitable for Chinese.

3.1 Preliminary

3.1.1 Cross-linguistic Variation in Conjunction

According to Heycock and Zamparelli (2005), English, Dutch and Finnish allow *singular split reading*.⁷ This reading allows a singular determiner to precede the whole conjunction as (35) to (37) show. A language that behaves like this is called an ‘English-type language’.

(35) That soldier and sailor are always in agreement.

(36) Dese man en vrouw zijn gescheiden *Dutch*

this man and woman are divorced

‘This man and woman are divorced.’

⁷ Heycock and Zamparelli introduce two readings of conjunction. One is split reading and the other is joint reading, as (i) and (ii) show respectively.

(i) This man and woman are in love.

(ii) That liar and cheat is not to be trusted.

In (i), the conjoined phrase refers to two individuals. In (ii), the conjoined phrase refers to one individual. As the purpose of this paper is concerned, I limit the discussion to the split reading.

(37) Tämä mies ja nainen tässä laulavat kuorossa *Finnish*
 this-SG man and woman here sing-PL in a choir

Heycock and Zamparelli (2005: 208-209)

According to Heycock and Zamparelli, although the conjoined phrases in (35) to (37) are not *potentially lexicalized pairs* such as *bread and butter*, the sentences are still grammatical.

However, for a number of languages, including Italian, Spanish, French, and German, *singular split reading* is not allowed. Examples of these are given in (38) to (41). This type of language is called ‘Italian-type language’.

(38) *Un uomo e bambino mangiano *Italian*
 a man and child are eating
 ‘A man and a child are eating.’



(39) *El soldado y pescador estaban luchando *Spanish*
 the soldier and sailor were fighting
 ‘The soldier and the sailor were fighting.’

(40) *Ce soldat et marin étaient d'accord *French*
 this soldier and sailor were in agreement

(41) *Der Stuhl und Tisch, den/die sie gerade *German*
 the chair and table which[sing/plur] she just
 angestrichen hatte, waren noch feucht
 painted had were still wet

‘The chair and table that she had just painted were still wet.’

Heycock and Zamparelli (2005: 210)

However, *spilt reading* is allowed in these languages in the case of plural nouns, as (42) to (45) show.

(42) Gli amici e nemici di Ginni si trovano *Italian*

the friend and enemies of Ginni were in

d'accordo su un solo punto

agreement on a single point

‘Ginni’s friends and enemies were in agreement on a single point.’

(43) Les neveux et petit-neveux de Jean sont venus aux *French*

the nephews and great-nephews of Jean are come to the

funérailles

funeral

‘Jean’s nephews and great-nephews came to the funeral.’

(44) Los hermanos y hermanas de Juan se dividieron *Spanish*

the brothers and sisters of Juan REFL divided

la herencia

the inheritance

‘Juan’s brothers and sisters split the inheritance.’

(45) Die Bücherborde und Fenster, die sie gerade *German*

the bookcases and windows which she just

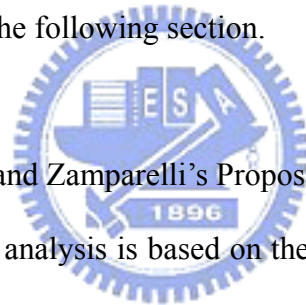
angestrichen hatte, waren noch feucht

painted had were still wet

‘The bookcases and windows that she had just painted were still wet.’

Heycock and Zamparelli (2005: 214-215)

In order to explain this phenomenon, Heycock and Zamparelli propose that English-type languages do not contain an unvalued LATT feature in Num while Italian-type languages do. I will introduce their proposal in the following section.



3.1.2 The Basic Idea of Heycock and Zamparelli’s Proposal

Heycock and Zamparelli’s analysis is based on the structure in (46). It is “an extended DP with multiple projections between D and the N proper, based on Abney (1987), Hudson (1989), Cinque (1994), Longobardi (1994), Ritter (1991), Siloni (1994), Zamparelli (1995, 1998), and others”.

(46) a. [_{DP} *Det* [_{NumP} *Num* [_{PIP} *Pl* [_{NP} (*Modifiers*) *Noun* (*Modifiers*)(*Compl*)]]]]

b. [_{DP} *Those* [_{NumP} *few* [_{PIP} *Pl* [_{NP} *linguistic papers*]]]]

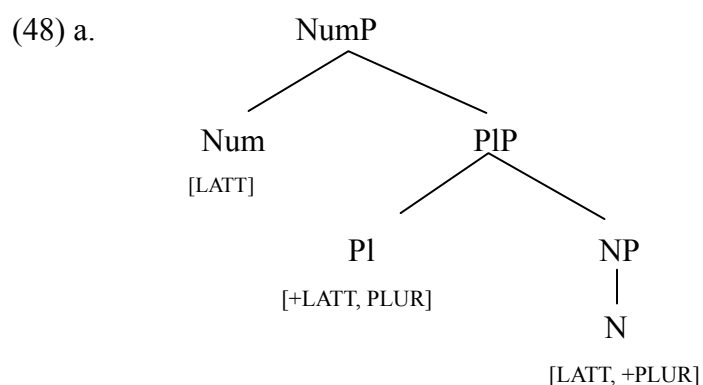
Heycock and Zamparelli (2005: 217)

The main concern of their proposal is the two features: PLUR and LATT. PLUR

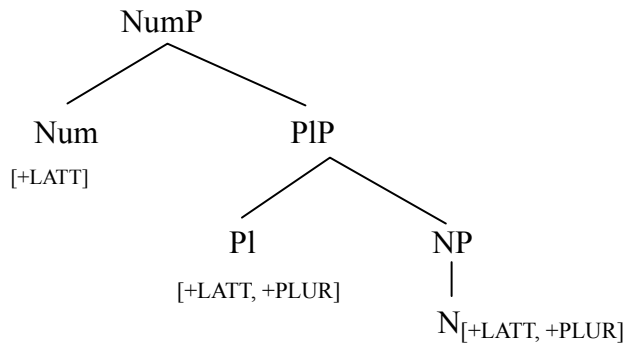
represents syntactic plurality and LATT represents semantic plurality as (47) shows.

- (47) a. +PLUR: syntactically plural
b. -PLUR: syntactically singular
c. +LATT: semantically plural
d. -LATT: semantically singular

In their theory, the semantic pluralization is performed in the functional head PI, instead of the head of NP. The head of the NP and the head of the NumP are unvalued for LATT as (48) shows. Although the head of PIP is unvalued for PLUR, it can acquire its value from the head of NP. This is because PLUR denotes syntactic feature. When the noun is plural, the head of PIP can acquire +PLUR from the plural noun. When the noun is singular, the head of PIP can acquire -PLUR from the singular noun.



b.



Heycock and Zamparelli (2005: 231)

In (48a), ‘Num’ and ‘N’ are unvalued for LATT, and ‘PL’ is valued. Heycock and Zamparelli claim that singular nouns acquire a -LATT value from an overt singular determiner while plural nouns and mass nouns acquire a +LATT from the PI. As for the Num heads, they acquire the value from PI or an overt determiner. Therefore, the unvalued features in (48a) take +LATT from the semantically active PL, and then (48b) is derived. (49) is a sample denotation given by Heycock and Zamparelli.

$$(49)a. [_{NP} N_{[+PLUR, LATT]}] = \{\{a\}, \{b\}, \{c\}\}$$

$$b. [_{PIP} PI_{[+LATT, +PLUR]} [_{NP} N_{[+LATT, +PLUR]}]] = \{\{a\}, \{b\}, \{c\}, \{a,b\}, \{a,c\}, \{a,d\}, \{a,b,c\}\}$$

$$c. [_{NumP} Num_{[+LATT]} [_{PIP} PI^*_{[+LATT, +PLUR]} [_{NP} N_{[+LATT, +PLUR]}]]] \\ = \{\{a,b\}, \{a,c\}, \{a,d\}, \{a,b,c\}\}$$

Heycock and Zamparelli (2005: 231)

⁸ Link (1983) first introduced the operator *. It refers to the set product of the elements in P, minus the empty set.

In (49a), {a}, {b}, {c} are the three members in the set. After the head of the NP takes +LATT from the head of PIP, we derive (49b), which denotes the plurality of (49a). When the head of NumP also takes +LATT from the head of PIP, we can derive (49c), which requires the number of the members to be more than one.

The above examples are used to illustrate the difference between English-type languages and Italian-type languages. The difference being that Italian-type languages do not allow *singular split reading* while English-type languages do. The contrast is shown in (50).

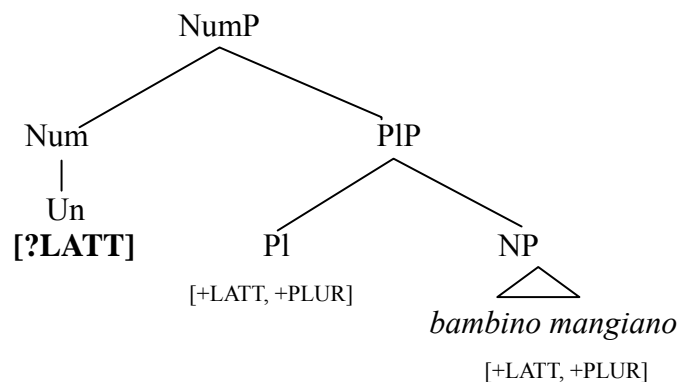
- (50) a. *Un uomo e bambino mangiano *Italian*
 a man and child are eating
 ‘A man and a child are eating.’
 b. This man and woman are in love.



Heycock and Zamparelli (2005: 210, 231)

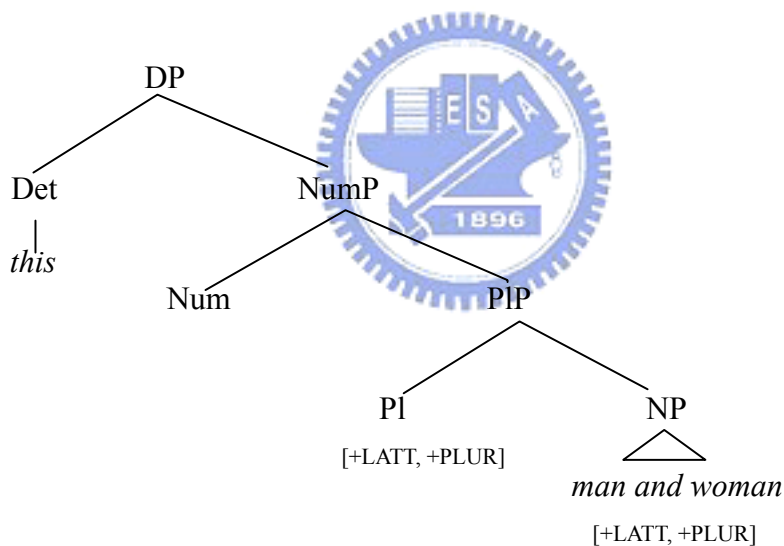
In (50a), the number expression is singular while the conjoined phrase is plural. Since the value of LATT in Num is unvalued, we have to acquire a value for it. However, the value we derive from the Pl is [+LATT], which is in conflict with the singular number expression as (51) shows. As a result, (50a) is an ungrammatical sentence.

(51)



As for (50b), it is claimed that there is no unvalued LATT feature in Num, as (52) shows, and consequently (50b) is grammatical.

(52)



In their theory, singular or plural semantic number only involves the presence or absence of the *-operator in English-type languages. When Num acquires +LATT from PI, PI is required to have the *-operator as (49c) shows. Then, we will derive plural semantic number: more than one. When Num acquires -LATT from PI, the *-operator will be absent. Then, we will derive singular semantic number.

Heycock and Zamparelli argue that Num does not carry an unvalued feature, and thus an empty NumP is inactive. Consequently, the *-operator is not triggered. Take (49b) for example, since Num does not carry an unvalued LATT feature in English, the *-operator will not be present. Therefore, the number of members does not need to be more than one. Then, the noun phrase, *man and woman*, will not be in conflict with *this*.

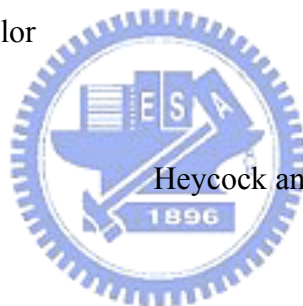
Heycock and Zamparelli also discuss the singular number expression in (53).

(53)a. *A/one soldier and sailor*

b. *Un soldato e marinaio *Italian*

a soldier and sailor

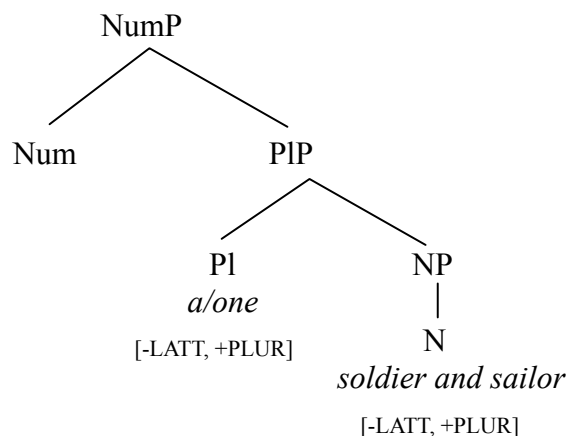
‘a soldier and a sailor’



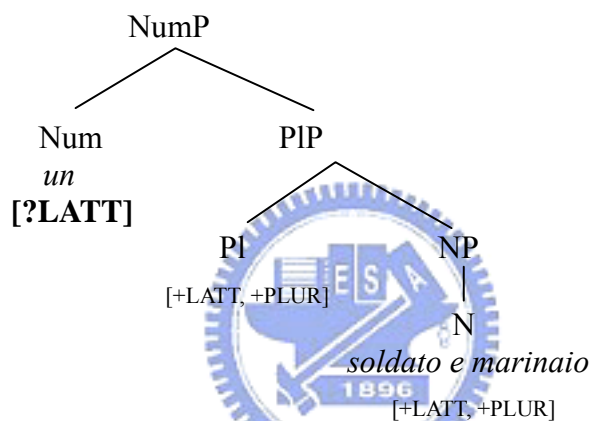
Heycock and Zamparelli (2005: 232)

They claim that *a* does not contain any semantic meaning, but is treated as a last resort to provide [-LATT] for N. They propose that in (53a), *a/one* is merged with a head of PIP as (54a) shows while in (53b), *un* ‘one’ is at NumP as (54b) shows.

(54) a.



b.



In (54a), NumP is missing because it does not carry any feature of LATT. As a result, there is no *-operator. However, in (54b), Num does carry an unvalued LATT feature. If Num acquires [+LATT] from PI, the denotation of PIP will be filtered. It will carry the *-operator and plural semantic number will be derived. Then, the number of members will need to be more than one. This will then be in conflict with the singular number expression. As a result, (54b) is an ungrammatical sentence.

3.2 The Phenomenon in Conjunction

In the previous section, we introduced the analysis of Heycock and Zamparelli in

singular split reading. In this section, we will examine if their analysis can be applied to Chinese. In Chinese, if we want to connect two singular definite nouns, determiners of both noun phrases have to appear as (55) shows. If we only have one determiner before the conjoined phrase, the sentence is ungrammatical, as (56) shows.

(55) Zhe-zhi gou he zhe-zhi mao dou zhong-du le
this-Cl dog and this-Cl cat all poison Asp
'This dog and this cat got poisoned.'

(56) *Zhe-zhi gou he mao dou zhong-du le
this-Cl dog and cat all poison Asp
'This dog and this cat got poisoned.'

It would seem that Chinese is like Italian-type languages that do not allow *singular split reading*. However, in some cases, we do allow *singular split reading* as (57) shows.

(57) Bang wo na na-zhi daozi he chazi guolai
help me carry that-Cl knife and fork come-over
'Bring me that knife and one fork, please.'

In (57), although the determiner is singular, (57) is still a grammatical sentence. This shows that we cannot adopt Heycock and Zamparelli's analysis to apply to Chinese. As a result, we propose that there are also two readings in Chinese. As Schwarzschild (1991) used

“cumulativity” to refer to the counterpart of “distributivity”, here, we qualify the number expression that distributes to the two conjuncts as “distributive reading” as (57) shows. The reading in which the number expression only denotes total number is treated as “cumulative reading”⁹, as (58) shows.

(58) You wu-zhi gou he mao zhong-du le
 have five-Cl dog and cat poison Asp
 ‘Five dogs and cats got poisoned.’

In (58), the number expression describes the total number of the poisoned animals. The structure illustrated in (58) has been discussed by Huang, Li, and Li (2005). Since Chinese does not allow an indefinite noun phrase as a subject, (59) is an ungrammatical sentence. The conjoined phrases also have this phenomenon, as (60) shows.

(59) ??San-ge xuesheng chi-le dangao
 three-Cl student eat-Asp cake
 ‘Three students ate the cake.’

Huang, Li, and Li (2005: 7)

(60) ??Wui-zhi gou he mao chi-le dangao

⁹ Scha (1981) also discusses the cumulative reading. However, what Scha mentions is different from what we discuss here. To derive Scha’s cumulative reading, we need two or more quantifiers. Scha’s example is as follows.

- (i) 600 Dutch firms have 5000 American computers.
 The cumulative reading that Scha concerns is as follows.
- (ii) The number of Dutch firms is 600 and the number of American computers is 5000.

five-Cl dog and cat eat-Asp cake

‘Five dogs and cats ate the cake.’

However, if we add *you* to (59) and (60), the sentences will become grammatical, as (61) and (62) show.

(61) You san-ge ren chi-le dangao

have three-Cl person eat-Asp cake

‘Three people ate the cake.’

(62) You wu-zhi gou he mao chi-le dangao

have five-Cl dog and cat eat-Asp cake

‘Five dogs and cats ate the cake.’



However, this still can not explain why the number expression in (58) can easily derive the reading of the total number, but not the distributive reading.

In English, we can derive the cumulative reading and distributive reading from a sentence such as (63). (64a) is the distributive reading and (64b) is the cumulative reading.

(63) Five dogs and cats got poisoned.¹⁰

¹⁰ In this sentence, we can also derive the meaning of five dogs and some cats in the subject position. However, this structure is not our present concern.

(i) [Five dogs] and cats got poisoned.

(64) a. Five dogs and five cats got poisoned.

b. Five animals which are dogs and cats got poisoned.

In addition, whether the verb is collective or distributive does not influence the reading. In (65), we can derive the cumulative reading and distributive reading, too.

(65) Five dogs and cats gathered in the park.

a. Five dogs and five cats gathered in the park.

b. Five animals which are dogs and cats gathered in the park.

From the discussion above, we can say that the type of verb phrase will not influence the reading of the number expression. In fact, Chinese is similar to English in that there are also two readings in Chinese. In the following section, we will introduce cumulative reading and leave distributive reading to Chapter 4.

3.3 Cumulative Reading

3.3.1 Preliminary

In order to derive the cumulative reading, we will follow Link's and Hoeksema's ideas for non-Boolean conjunction.

3.3.1.1 Link's Operation

Link(1983) introduces the join operation. This operation helps us derive the *individual*

sum in noun phrase conjunction. His denotation for two singular countable nouns is illustrated in (66).

$$(66) (\zeta \text{ and } \eta) \cup \lambda z \exists x \exists y [\zeta'(x) \wedge \eta'(y) \wedge z = x \oplus y]$$

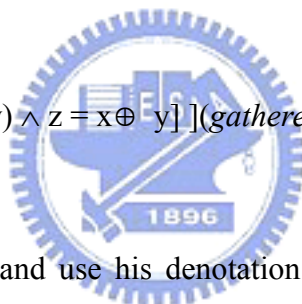
Link (1983: 319)

Therefore, we can apply the rules in (66) to (67a) and (67b) is derived.

(67) a. dog and cat gathered

b. (dog and cat) (gathered)

$$= [\lambda z \exists x \exists y [dog'(x) \wedge cat'(y) \wedge z = x \oplus y]](gathered)$$



I will follow Link's idea and use his denotation of (66) to derive the noun phrase conjunction in Chinese.

3.3.1.2 Hoeksema's Theory on Non-Boolean Conjunction

Hoeksema (1988: 24) claims that "conjunctions of plural referring terms are interpreted in exactly the same way as conjunctions of singular terms", and "a conjunction of referring terms denotes group formation of the entities referred to". According to Hoeksema, groups are defined as sets with two or more members. The denotation of the non-Boolean conjunction is as (68) shows.

(68) $\lambda P \lambda \Phi \lambda \Pi. \Phi (\lambda x. \Pi (\lambda y. P(\{x,y\})))$

Φ and Π range over denotations of type $\langle\langle e,t \rangle, t \rangle$ and P is a variable over type $\langle e, t \rangle$

Hoeksema (1988: 35)

Schwarzschild (1991)¹¹ gives an overview of Hoeksema's analysis. He presents Hoeksema's two translations for the noun phrase conjunction as (69) and (70) show.

(69) Intersective conjunction

$\text{and}_i \rightarrow \lambda \pi \lambda \Phi \lambda P [\Phi(P) \& \pi(P)]$

(70) Collective conjunction

$\text{and}_c \rightarrow \lambda \pi \lambda \Phi \lambda P [\Phi (\lambda x. \pi(\lambda y. P(x,y)))]$



Schwarzschild (1991: 31)

In (69) and (70), π and Φ are the two nouns connected by *and*. P is the predicate in the sentence. (69) is the semantic meaning of conjunctions, as (71a) shows. (70) is the semantic meaning of conjunctions, as (71b) shows. The conjunction in (71a) is a Boolean conjunction while that in (71b) is a non-Boolean conjunction.

(71) a. John and_i Mary left.

b. John and_c Mary met.

¹¹ Schwarzschild has investigated whether Hoeksema's proposal is feasible both in set theory and union theory. However, this is not our present concern and will be left for future study.

3.3.1.3 The Pragmatic Issues in Heycock and Zamparelli's Analysis

Heycock and Zamparelli (2005) discuss the phenomenon of cumulative reading as (72) shows. In (72), there are ten people who got married today in San Pietro. This phenomenon is similar to what is presented in Chapter 3, as (73)¹² shows. The number expression refers to the sum of the conjoined phrase.

(72) [Ten [men and women]] got married today in San Pietro.

Heycock and Zamparelli (2005: 206)

(73) You shi-ge nanshang he nu-shang zai jintian jiehun
have ten-Cl man and woman at today married
'Ten men and women got married today.'



In addition to the cumulative reading, Heycock and Zamparelli also observed another phenomenon as (74)¹³ shows.

(74) [My two [friends and colleagues]] wrote their paper together.

Heycock and Zamparelli (2005: 206)

¹² We can also derive another reading besides the cumulative reading in (73). This reading is called the distributive reading. If we derive the distributive reading in (73), then it will denote that there are ten men and ten women who got married today. We will discuss this reading at a later stage.

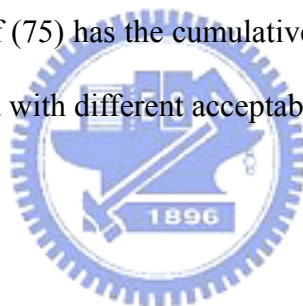
¹³ The semantic meaning in (74) is more like *jian* in Chinese as example (i) shows.

(i) Ta shi wode pengyou jian tongshi
he is my friend and colleague
'He is my friend and colleague.'

In (74), it is claimed that the most salient reading is that two people are writing their paper, and both of them have two statuses: the speaker's friend and the speaker's colleague. This is a very interesting phenomenon. In (74), the reading is not the cumulative reading. If we want to derive the cumulative reading, we have to view the conjunction as a non-Boolean conjunction, instead of an intersection. As a result, the interpretation should be (75).

(75) There are two people writing their paper. One is a friend of the speaker, and the other is a colleague of the speaker.

However, it is also claimed that if (75) has the cumulative reading, it will be an unacceptable sentence. Four examples are listed with different acceptability, as (76)¹⁴ shows.



- (76) a. twenty men and women
b. four men and women
c. three men and women
d. two men and women

Heycock and Zamparelli (2005: 246)

Heycock and Zamparelli state that (76a) and (76b) are both acceptable. (76c) is marginal while (76d) is unacceptable. They consider this variation as pragmatic issue. According to Grice's Maxim of Quantity, when there is only one member in the group, it should be more

¹⁴ The four examples in (76) are all cumulative readings in their analysis.

informative. Otherwise, it is not a grammatical sentence. Since (76c) denotes the cumulative reading, it means that there are only three members in the group. If there are two men in the group, then there is only one woman in the group. Contrarily, if there are two women in the group, then there is only one man in the group. (76c) is marginal because there is at least one conjunct which has to be more informative. In order to make it more informative, we have to specify the number expression. For example, (76c) should change to *two men and one woman* or *one man and two women*. As for (76d), both the conjuncts have to be more informative. As a result, (76d) is an unacceptable sentence. If we want to make a grammatical sentence, (76d) should be replaced by *one man and one woman*.

3.3.2 Semantic Representation of Cumulative Reading

From the section above, we conclude that the conjoined phrase forms a set. Take (77) for example; the denotation of the conjoined phrase is shown in (78). We treat the whole conjoined phrase in (77), *gou he mao* ‘dog and cat’, as a group.

(77) You wu-zhi gou he mao zhong-du le
 have five-Cl dog and cat poison Asp
 ‘The sum of the poisoned dogs and cats is five.’

(78) $\llbracket \text{gou he mao} \rrbracket = \lambda x'' \exists x \exists x' [\text{dog}(x) \wedge \text{cat}(x') \wedge x'' = x \oplus x']$

In (77), the set is composed of plural individuals. In this set, the possible members are as follows: {two dogs and three cats}, {three dogs and five cats}, {seven dogs and ten cats}...

and so on. Every member in the set is a plural individual composed of dogs and cats.

When we have the number expression *wu* ‘five’ before the conjoined phrase, we will only pick out the subset where the sum of the members is five from the set of *gou he mao* ‘dog and cat’. The denotation is illustrated in (79).

$$(79) \text{ a. } \llbracket \mathbf{wu-zhi} \rrbracket = \lambda P. \lambda Q. \exists y. P(y)=1 \wedge |y| = 5 \wedge Q(y) = 1$$

$$\text{b. } \llbracket \mathbf{wu-zhi gou he mao} \rrbracket$$

$$= \llbracket \mathbf{wu-zhi} \rrbracket (\llbracket \mathbf{gou he mao} \rrbracket)$$

$$= \llbracket \llbracket \mathbf{wu-zhi} \rrbracket ([\lambda x'' \exists x \exists x' [\mathbf{dog}(x) \wedge \mathbf{cat}(x') \wedge x''=x \oplus x']])$$

$$= [\lambda P. \lambda Q. \exists y. P(y)=1 \wedge |y| = 5 \wedge Q(y) = 1] ([\lambda x'' \exists x \exists x' [\mathbf{dog}(x) \wedge \mathbf{cat}(x') \wedge x''=x \oplus x']])$$

$$= \lambda Q. \exists y. [\lambda x'' \exists x \exists x' [\mathbf{dog}(x) \wedge \mathbf{cat}(x') \wedge x''=x \oplus x']](y)=1 \wedge |y| = 5 \wedge Q(y)=1$$

$$= \lambda Q. \exists y. [\exists x \exists x' [\mathbf{dog}(x) \wedge \mathbf{cat}(x') \wedge y = x \oplus x']]=1 \wedge |y| = 5 \wedge Q(y)=1$$

(79a) is the denotation of the number expression. In (79b), the number expression is the function while the conjoined phrase is the argument. After saturation, we will derive the reading that the total number of the group, formed by dogs and cats, is five.

In our analysis, we predict that (80) is an ungrammatical sentence. The denotation of *yi* ‘one’ is illustrated in (81).

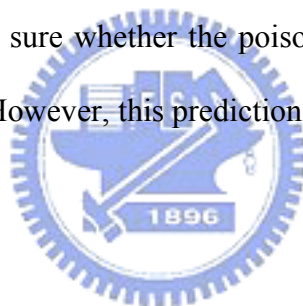
(80) *You yi-zhi gou he mao zhong-du le

have one-Cl dog and cat poison Asp

‘One dog and cat got poisoned.’

(81) $[[\text{yi-zhi}]] = \lambda P. \lambda Q. \exists y. P(y)=1 \wedge |y| = 1 \wedge Q(y) = 1$

In (81), it is shown that there is only one member in the group. If (80) were a grammatical sentence, then we would have the interpretation that one animal is poisoned, which is a dog or a cat. Since one of the conjunct does not contribute any semantic meaning, we can delete it. Then, we will predict that (80) may have the following three readings: if the poisoned one is a dog, the reading of (82a) will be derived; if the poisoned one is a cat, then the reading of (82b) will be derived and if we are not sure whether the poisoned one is a dog or a cat, then the reading of (82c) will be derived. However, this prediction is counter-intuitive. Therefore, (80) is an ungrammatical sentence.



(82) a. You yi-zhi gou zhong-du le

have one-Cl dog poison Asp

‘One dog got poisoned.’

b. You yi-zhi mao zhong-du le

have one-Cl cat poison Asp

‘One cat got poisoned.’

c. You yi-zhi gou huo mao zhong-du le

have one-Cl dog or cat poison Asp

‘One dog or cat got poisoned.’

In this chapter, we introduced the cumulative reading in conjunction. However, there is another reading in noun phrase conjunction, called distributive reading. This will be introduced in the following chapter.



Chapter 4

Distributive Reading

4.1 Preliminary

Since there are no morphological markings for plurals in Chinese, the situation of noun phrase conjunction is more complicated in this language. Specifically, in Chinese, bare nouns can be singular or plural, as (83) shows.

(83) You gou zai nali
 have dog in there
 ‘A dog/Dogs is/are there.’



In (83), the bare noun *gou* ‘dog’ can refer either to one dog or more than one dog. We can also derive the singular reading and plural reading in noun phrase conjunction as (84) shows.

(84) You gou he mao zai nali
 have dog and cat in there
 ‘A dog/Dogs and a cat/cats are there.’

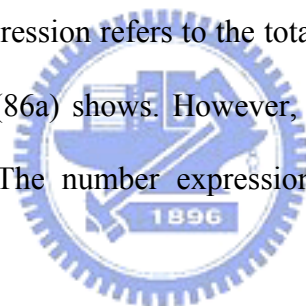
In (84), the number of dogs and the number of cats can be either singular or plural.

4.2 Number Expression *Liang* ‘two’

Chinese is similar to English in that when the number expression is *liang* ‘two’, we will only have the distributive reading, as (85) shows.

- (85) Ta-de liang-zhi shou he jiao dou duan-le
his two-Cl hand and leg all broke-Asp
‘Two of his hands and two of his legs were broken.’

Based on our analysis presented in Chapter 3, we predict that (85) is the cumulative reading, which means that the number expression refers to the total amount of the whole group that is composed of hands and legs as (86a) shows. However, this prediction is counter-intuitive, deriving the reading of (86b). The number expression has been distributed to the two conjuncts.



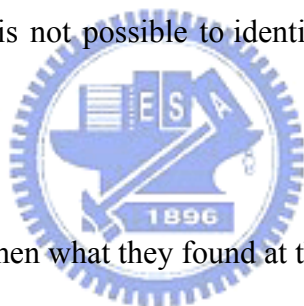
- (86) a. He broke two limbs.
b. He broke two hands and two legs.

This phenomenon in (85) is very similar to Hoeksema’s analysis for quantificational noun phrase conjunction. Hoeksema (1988:35) claims that the conjoined phrase in (87) denotes “the set of all properties of all pairs of a soldier and an officer”.

- (87) Every soldier and every officer met.

Therefore, we follow Hoeksema's idea and treat the conjoined phrase in (85) as a pair. In (85), the conjoined phrase forms a set. In the set, hands and legs are all in pairs. However, this does not mean that hands and legs are supposed to be a pair all the time. For example, we consider the following scenario:

There was an explosion in a building. The explosion was so strong that victims were torn apart. Therefore, when the firemen were collecting the severed hands and legs, they were unable to identify which hands and legs belong to which victim. It is not possible to identify which hands and legs belong to whom.



So, when reporters asked the firemen what they found at the scene, their reply was as in (88). As a result, (88) will not be a distributive reading.

(88) Xianchang zhaodao ershi-zhi shou he jiao

scene find 20-C1 hand and leg

‘Twenty hands and legs are found at the scene.’

(89) Xianchang zhaodao ershi-zhi daozi he chazi

scene find 20-C1 knife and fork

‘Twenty knives and twenty forks are found at the scene.’

The reason why example (88) does not have distributive reading is that in the scenario in question, the hands and legs are unable to form pairs. If we replace hands and legs with *daozi*, ‘knife’, and *chazi*, ‘fork’, we can easily derive the distributive reading as (89)¹⁵ shows. In (89), the number expression, *ershi* ‘twenty’ has been distributed over the conjoined phrase. Then, the distributive reading will be derived.

Normally, singular determiners are not permitted to occur with noun phrase conjunction, as (90) shows.

(90) *Bang wo bao zhe-zhi gou he mao guolai
 help I hold this-Cl dog and cat come-over
 ‘Bring me this dog and one cat, please.’



(90) is ungrammatical whether we derive cumulative reading or distributive reading. If we want to derive the cumulative reading, the singular determiner will be in conflict with the whole conjoined phrase. Since the conjoined phrase is a plural individual, it is incompatible with the singular determiner. Besides, according to Heycock and Zamparelli, Italian-type languages do not allow singular number expressions or singular determiners to occur with noun phrase conjunction. In this respect, it seems that Chinese is like Italian-type languages.

However, if the conjuncts are replaced by *daozi* ‘knife’ and *chazi* ‘fork’, the sentence becomes grammatical as (91) shows. In this case, it seems that Chinese is like English-type

¹⁵ In (89), we can also derive the cumulative reading. The larger the number expression is, the more easily we can derive the cumulative reading. However, compared with (88), (89) can derive the distributive reading more easily.

languages, which allow singular determiners to occur with noun phrase conjunction.

(91) Bang wo na zhe-zhi daozi he chazi guolai
help me carry this-Cl knife and fork come-over
'Bring me this knife and one fork, please.'

In (91), the reading we derive is the distributive reading. The cumulative reading is ruled out because the singular determiner is incompatible with the conjoined phrase.

The reason why (90) and (91) have different acceptability is due to the different conjuncts in (90) and (91). If we derive the distributive reading in (90), it would mean that there are only one dog and only one cat in the group. According to Gricean's principles, the conjuncts have to be more informative. On the one hand, both conjuncts in (90) are not informative, and thus it is an ungrammatical sentence. On the other hand, the two conjuncts in (91) are in a pair, and so are more informative than those in (90). As a result, the distributive reading is permitted in (91) but not in (90).

The English *and* also shows similar characteristics, as (92) shows.

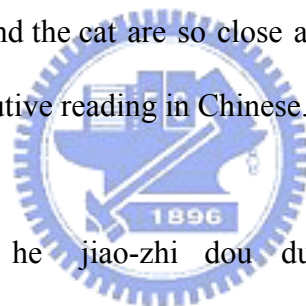
- (92) a. This husband and wife are my relatives.
b. *This dog and cat got sick.

In (92a), the two conjuncts are in a pair. Being a husband, one must have a wife. Therefore,

we can use the singular determiner to modify the conjoined phrase. As for (92b), *dogs and cats* are not in pairs, so the sentence is ungrammatical. However, in some peculiar circumstance, (92b) can also be a grammatical sentence. Here is the scenario:¹⁶

There is a dog called John and there is a cat called Mary. John and Mary never separate and always appear together. Whenever you see John, you will see Mary beside him. One day, John and Mary are both sick.

From the above scenario, we can use the sentence (92b). This shows that (92b) is grammatical only when the dog and the cat are so close as to be viewed as a pair. In (93) we provide more examples of distributive reading in Chinese.



(93) a. Ta-de san-gen shou-zhi he jiao-zhi dou duan-le

his three-Cl finger and toe all broken-Asp

‘He broke three fingers and three toes.’

b. Zhe-ge nan-ren he nu-ren bu yinggai jiehun

this-Cl man and woman not should marry

‘This man and woman should not marry each other.’

c. Bang wo na yi-shuang xiezi he wazi guolai

help me carry one-pair shoes and socks come-over

‘Bring me one pair of shoes and one pair of socks, please.’

¹⁶ This idea is give by Paul Portner in personal communication.

- d. Bang wo na yi-ge guozi he chanzi guolai
 help me carry one-Cl frying-pan and turning shovel come-over
 ‘Bring me one frying pan and one turning shovel, please.’
- e. Bang wo na yi-jian yifu he kuzi guolai
 help me carry one-Cl shirt and trousers come-over
 ‘Bring me one shirt and one pair of trousers, please.’
- f. Ta zhi chuan yi-jian neiyi he neiku jiu chu-men le
 he only wear one-Cl vest and underpants JIU go-out Asp
 ‘He went out only wearing a vest and underpants.’
- g. Mei-ge ren dou keyi huode yi-zhi yagao he yashua
 every-Cl man all can obtain one-Cl toothpaste and toothbrush
 ‘Everyone can obtain one tube of toothpaste and one toothbrush.’
- h. Ta zhi chi-le yi-wan fan he tang jiu zou-le
 he only eat-Asp one-Cl rice and soup JIU leave Asp
 ‘He only ate one bowl of rice and one bowl of soup and then he left.’

Only the distributive readings are derived in the sentences that contain singular number expression in (93). From the examples above, we can say that the distributive reading and cumulative reading are not in complementary distribution. Instead, we claim that these two readings are both possible. However, the question of which reading wins out is contextually forced. If the number is larger, then we tend to derive the cumulative reading, as (94) shows.

(94) a. Wo mai-le sanshi-ke juzi he liuding

I buy-Asp thirty-Cl tangerine and orange

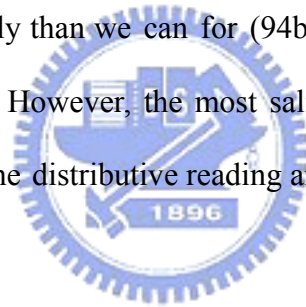
‘I bought thirty tangerines and oranges.’

b. Wo mai-le si-ke juzi he liuding

I buy-Asp four-Cl tangerine and orange

‘I bought four tangerines and oranges / I bought four tangerines and four oranges.’

Compared with (94b), the number in (94a) is much larger. Therefore, in (94a), we can derive the cumulative reading more easily than we can for (94b). It is also possible for us to derive the distributive reading in (94a). However, the most salient reading is still the cumulative reading. In (94b), we can derive the distributive reading and the cumulative reading, and both readings are salient.



If two conjuncts are in the pair relation, then we tend to derive the distributive reading, as (95) shows.

(95) a. * Wo mai-le yi-zhi gou he mao

I buy-Asp one-Cl dog and cat

‘I bought one dog and one cat.’

b. Wo mai-le yi-zhi daozi he chazi

I buy-Asp one-Cl knife and fork

‘I bought one knife and one fork.’

- c. Wo mai-le yi-zhi gou he yi-zhi mao
 I buy-Asp one-Cl dog and one-Cl cat
 ‘I bought one dog and one cat.’

In (95a), both the cumulative reading and the distributive reading are ungrammatical. If we derive the cumulative reading, it means that there is only one animal in the context and one of the conjuncts does not contribute anything in semantics. If we derive the distributive reading, it means that there is one dog and one cat in the context. According to Gricean’s principles, when there is only one member in the group, it should be more informative, as (95c) shows.

As for (95b), only the distributive reading is grammatical. If we derive the cumulative reading, we will have the same problem as in (95a). However, compared with the two conjuncts in (95a), (95b) is more informative. The two conjuncts in (95b) are in pair relation while those in (95a) are not. Therefore, (95b) will be a grammatical sentence when we derive the distributive reading.

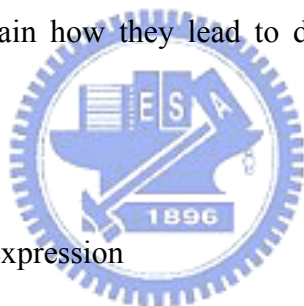
When the number expression is two, the pragmatics will rule out the cumulative reading, and thus only the distributive reading will be derived, as (96) shows.

- (96) Wo mai-le liang-zhi qianbi he yuanzibi
 I buy-Asp two-Cl pencil and pen
 ‘I bought two pencils and two pens.’

In (96), only the distributive reading is possible. If the cumulative reading is derived, it means

that there are two objects in the context. In order to make sure that both conjuncts have contribution in semantics, we will assume that there is one pencil and one pen in the context. Then, we will have the same problem as in (95a). Therefore, cumulative reading is ungrammatical. On the other hand, when we derive the distributive reading, it means that there are two pencils and two pens in the context. Since the numbers are more than one, it does not violate Gricean's principle. Therefore, distributive reading is possible.

However, distributive reading and cumulative reading do not result from different semantics of conjunction. Instead, it is the semantic representation of the number expression that leads to these two readings. In the next section, we will discuss the two denotations of the number expression, and explain how they lead to distributive reading and cumulative reading.



4.3 Two Features in the Number Expression

In the section above, we found that there are two possible readings in noun phrase conjunction, as (97) shows. (97a) expresses the distributive reading and (96b) expresses the cumulative reading.

- (97) a. Bang wo na wu-zhi daozi he chazi guolai
 help me carry five-Cl knife and fork come-over
 ‘Bring me five knives and five forks.’
- b. You wu-zhi gou he mao zhong-du le

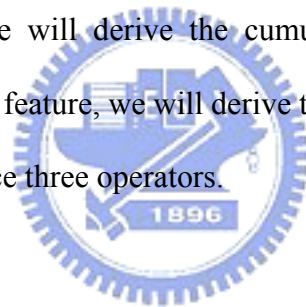
have five-Cl dog and cat poison Asp

‘The sum of the poisoned dogs and cats is five.’

In (97a), the number expression *wu* ‘five’ refers to the number of the knives and the number of forks. In (97b), the number expression *wu* ‘five’ denotes the total number of the members in the group.

We claim that the number expression carries two features: collective feature and distributive feature. The conjunctions in (97a) and (97b) are both non-Boolean. This means the conjoined phrase in each sentence is treated as a group. When the number expression carries the collective feature, we will derive the cumulative reading. When the number expression carries the distributive feature, we will derive the distributive reading.

Before we go on, we will introduce three operators.



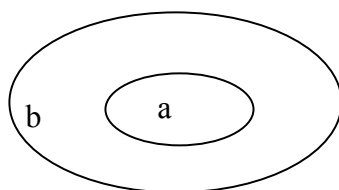
4.3.1 Three Operators in Link’s Analysis

Link (1983: 306-307) introduced three operators: $*P$, \leq_i and $\sigma_x P x$. The first operator ‘ $*P$ ’ denotes all the individual sums of members of the extension of P . P is a 1-place predicate. For example, if ‘ P ’ represents *is an apple*, ‘ $*P$ ’ represents the sum of the apples.

The second operator ‘ \leq_i ’ denotes the individual part relation as (98) shows.

(98) a. $[[\mathbf{a}]] \leq_i [[\mathbf{b}]]$ iff $[[\mathbf{a}]] \cup_i [[\mathbf{b}]] = [[\mathbf{b}]]$

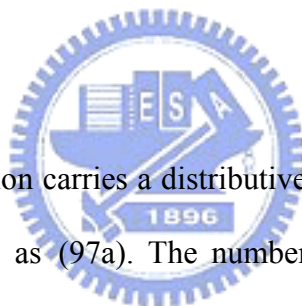
b.



In (98a), ‘ \cup ’ represents set union. It means that ‘a’ is the individual part of ‘b’ if and only if the union of ‘a’ and ‘b’ is ‘b’. The relation between ‘a’ and ‘b’ is as (98b) shows. In (98b), ‘a’ is a subset of ‘b’. Therefore, the union of ‘a’ and ‘b’ is ‘b’.

The third operator ‘ σxPx ’ represents the supremum of all objects that are $*P$. P is a 1-place predicate. For example, if ‘ P ’ represents *is an apple*, ‘ σxPx ’ represents *the maximal number of the apples*. In our continuing analysis, we need these three operators to denote the number expression carrying *distributive feature*.

4.3.2 Distributive Feature



When the number expression carries a distributive feature, we will derive distributive reading as (99), previously seen as (97a). The number expression, *wu* ‘five’, carries the distributive feature as (100) shows.

- (99) Bang wo na wu-zhi daozi he chazi guolai
 help me carry five-Cl knife and fork come-over
 ‘Bring me five knives and five forks.’

$$(100) \llbracket \text{wu-zhi}_{\text{distributive}} \rrbracket = \lambda P. \lambda Q. \exists z. [P(z)=1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma yPy = 5]]$$

In (100), w refers to the whole group that the conjoined phrase denotes, Q refers to the

predicate and y is the individual part of the group. Take (99) for example, z refers to the group that the conjoined phrase, *daozi he chazi* ‘knife and fork’ denotes. In addition, y refers to the two conjuncts, *daozi* ‘knife’ and *chazi* ‘fork’. The two conjuncts are both the individual parts of z .

If we use the argument, *daozi he chazi* ‘knife and fork’, to saturate the function in (100), we will obtain (101).

$$\begin{aligned}
 (101) \quad & \llbracket \mathbf{wu-zhi\ daozi\ he\ chazi} \rrbracket \\
 &= \llbracket \mathbf{wu-zhi}_{dis} \rrbracket (\llbracket \mathbf{daozi\ he\ chazi} \rrbracket) \\
 &= \llbracket \mathbf{wu-zhi}_{dis} \rrbracket (\lambda x'' \exists x \exists x' [\text{knife}(x) \wedge \text{fork}(x') \wedge x'' = x \oplus x']) \\
 &= [\lambda P. \lambda Q. \exists z. [P(z)=1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 5]]] (\lambda x'' \exists x \exists x' [\text{knife}(x) \wedge \text{fork}(x') \\
 &\quad \wedge x'' = x \oplus x']) \\
 &= \lambda Q. \exists z. [\lambda x'' \exists x \exists x' [\text{knife}(x) \wedge \text{fork}(x') \wedge x'' = x \oplus x'] (z) = 1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \\
 &\quad \wedge \sigma_y P y = 5]] \\
 &= \lambda Q. \exists z. [\exists x \exists x' [\text{knife}(x) \wedge \text{fork}(x') \wedge z = x \oplus x'] \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 5]]
 \end{aligned}$$

In (101), the cardinality of the individual part is five. When P denotes *daozi* ‘knife’, ‘ $\sigma_y P y$ ’ means that the cardinality of *daozi* ‘knife’ is five. When P denotes *chazi* ‘fork’, ‘ $\sigma_y P y$ ’ means that the cardinality of *chazi* ‘fork’ is five. Therefore, we will derive the distributive reading.

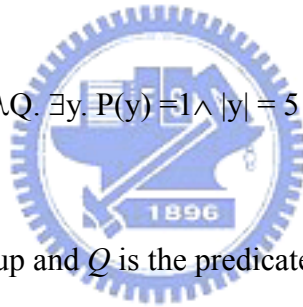
4.3.3 Collective Feature

When the number expression carries a collective feature, we will derive cumulative reading from the example in (97b), repeated here as (102).

- (102) You wu-zhi gou he mao zhong-du le
 have five-Cl dog and cat poison Asp
 ‘The sum of the poisoned dogs and cats is five.’

The number expression in (102) denotes the cardinality of the whole group. The denotation of the collective number expression is illustrated in (103).

(103) $\llbracket \mathbf{wu-zhi}_{\text{collective}} \rrbracket = \lambda P. \lambda Q. \exists y. P(y)=1 \wedge |y|=5 \wedge Q(y)=1$



In (103), y refers to the whole group and Q is the predicate.

In (103), y refers to the group formed by *gou he mao* ‘dog and cat’. If we use the argument, *gou he mao* ‘dog and cat’, to saturate the function, *wu* ‘five’ in (103), we will derive (104).

(104) $\llbracket \mathbf{wu-zhi \ gou \ he \ mao} \rrbracket$
 = $\llbracket \mathbf{wu-zhi}_{\text{col}} \rrbracket$ ($\llbracket \mathbf{gou \ he \ mao} \rrbracket$)
 = $\llbracket \mathbf{wu-zhi}_{\text{col}} \rrbracket$ ($[\lambda x'' \exists x \exists x' [\text{dog}(x) \wedge \text{cat}(x') \wedge x''=x \oplus x']]$)
 = $[\lambda P. \lambda Q. \exists y. P(y)=1 \wedge |y|=5 \wedge Q(y)=1]$ ($[\lambda x'' \exists x \exists x' [\text{dog}(x) \wedge \text{cat}(x') \wedge x''=x \oplus x']]$)

$$= \lambda Q. \exists y. [\lambda x'' \exists x \exists x' [\text{dog}(x) \wedge \text{cat}(x') \wedge x'' = x \oplus x'] (y) = 1 \wedge Q(y) = 1]$$

$$= \lambda Q. \exists y. [\exists x \exists x' [\text{dog}(x) \wedge \text{cat}(x') \wedge y = x \oplus x'] \wedge |y| = 5 \wedge Q(y) = 1]$$

In (104), we can derive the meaning in which the cardinality of the whole group is five.

Therefore, we will have cumulative reading.

These two features will only lead to two readings when they occur with conjoined phrases. When the number expression occurs with a single noun phrase instead of a conjoined phrase, it will only have one reading. Whether the number expression carries the distributive feature or the cumulative feature makes no difference. In (105), we have a number expression, *wu* ‘five’, preceding a single noun, *gou* ‘dog’. In (106), we calculate the semantic meaning when the number expression carries a distributive feature. In (107), we calculate the semantic meaning when the number expression carries a collective feature.

(105) *wu-zhi gou*

five-Cl dog

‘Five dogs’

(106) **[[wu-zhi gou]]**

$$= \llbracket \mathbf{wu-zhi}_{\text{dis}} \rrbracket (\llbracket \mathbf{gou} \rrbracket)$$

$$= \llbracket \mathbf{wu-zhi}_{\text{dis}} \rrbracket (\lambda x. x \text{ is a dog})$$

$$= [\lambda P. \lambda Q. \exists z. [P(z)=1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 5]]] (\lambda x. x \text{ is a dog})$$

$$= \lambda Q. \exists z. [\lambda x. x \text{ is a dog}](z)=1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 5]$$

$$= \lambda Q. \exists z. z \text{ is a dog} \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma y P y = 5]$$

(107) **[[wu-zhi gou]]**

$$= \llbracket \mathbf{wu-zhi}_{\text{col}} \rrbracket (\llbracket \mathbf{gou} \rrbracket)$$

$$= \llbracket \mathbf{wu-zhi}_{\text{col}} \rrbracket (\lambda x. x \text{ is a dog})$$

$$= [\lambda P. \lambda Q. \exists y. P(y)=1 \wedge |y| = 5 \wedge Q(y)=1] (\lambda x. x \text{ is a dog})$$

$$= \lambda Q. \exists y. (\lambda x. x \text{ is a dog})(y) = 1 \wedge |y| = 5 \wedge Q(y) = 1$$

$$= \lambda Q. \exists y. y \text{ is a dog} \wedge |y| = 5 \wedge Q(y) = 1$$

In (106), when P denotes *gou* ‘dog’, ‘ $\sigma y P y = 5$ ’ means that the cardinality of *gou* ‘dog’ is five.

In (107), we also derive the meaning that the sum of the dogs is five. The two features in (106) and (107) do not lead to different readings. Therefore, these two features only make a difference when they occur with noun phrase conjunction. When there is only one noun in the sentence, it is not a problem for our analysis.

4.4 The Problems with *Meiyou*¹⁷

In our analysis, we predict the following example (108) to be grammatical no matter whether it derives cumulative reading or distributive reading. However, (108) is an ungrammatical sentence.

(108) **Meiyou shizi he laohu zhong-du le*

no lion and tiger poison Asp

¹⁷ Here, we treat *meiyou* as a lexical item. It's semantic meaning is like 'no' in English.

‘No lions and tigers got poisoned.’

In our analysis, we will predict that *meiyou* ‘no’ carries two features: a distributive feature and a collective feature. When *meiyou* ‘no’ carries the distributive feature, we will derive the meaning that the cardinality of *shizi* ‘lion’ is zero and the cardinality of *laohu* ‘tiger’ is also zero. On the other hand, when *meiyou* ‘no’ carries the collective feature, we will derive the meaning that the cardinality of the whole group, *shizi he laohu* ‘lion and tiger’, is zero. Our theory will predict that both readings are grammatical. However, (108) is an ungrammatical sentence. In fact, our theory does predict the example in (108) to be grammatical. Therefore, we claim that the reason why (108) is ungrammatical is due to other factors.

(109) Meiyou shizi he laohu keyi dan chongwu le
no lion and tiger can be pet Asp
‘No lions and tigers can be pets.’

In (109), we predict that *meiyou* ‘no’ carries two features: a distributive feature and a collective feature. When *meiyou* ‘no’ carries the distributive feature, we will derive the meaning that the cardinality of *shizhi* ‘lion’ is zero and the cardinality of *laohu* ‘tiger’ is also zero. On the contrary, when *meiyou* ‘no’ carries the collective feature, we will derive the meaning that the cardinality of the whole group, *shizi he laohu* ‘lion and tiger’, is zero. Both readings convey that “there are no lions and tigers to be pets”.

The difference in acceptability between (108) and (109) also occurs when there is only one noun, instead of a conjoined phrase as (110) shows.

(110) a. *Meiyou shizi zhong-du le

no lion poison Asp

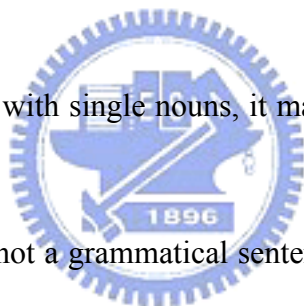
‘No lions got poisoned.’

b. Meiyou shizi keyi dan chongwu le

no lion can be pet Asp

‘No lions can be pets.’

Since this asymmetry also occurs with single nouns, it may result from other factors, instead of our theory.



The reason why (110a) is not a grammatical sentence is that there is conflict between sentential *le* and negation *meiyou* ‘no’. Previous studies (cf. Li and Thompson (1981), Lin (2003), and Wu (2005))¹⁸ show that sentential *le* involves a change of state. However, the predicate, *zhong-du* ‘poison’ in (110a) also represents a change of state as (111) shows.

(111) You shizi zhong-du le

have lion poison Asp

‘Lions got poisoned.’

¹⁸ The issue of *le* has received much attention in Chinese literature. However, this is not our current concern in this paper. As a result, we will not discuss the details in this thesis.

Normally, we are not in the state of being poisoned. As a result, when the predicate, *zhong-du* ‘poison’ occurs, there is a change of state. However, when we negate the predicate, the sentence does not convey a change of state. Then, the semantic meaning of sentential *le* is not satisfied. Therefore, (110a) is not a grammatical sentence. This is also true in conjoined phrases as (109) shows. Therefore, (109) is also an ungrammatical sentence.

If we take out the aspectual marker, *le*, the sentence becomes acceptable as (112) shows.

(112) Meiyou shizi zhong-du
 no lion poison
 ‘No lions got poisoned.’



In addition, (110a) can be acceptable if we consider the following scenario:

In the past three years, newborn lions in the zoo had gotten poisoned for no reason. One day, a man found new medicine and cured every lion. From that day on, every newborn lion stopped getting poisoned.

In this scenario, there is a change of state. In the past, newborn lions were in the state of being poisoned. Now, they have stopped getting poisoned. A change of state occurs and the semantic meaning of sentential *le* is satisfied. In this scenario, (110a) is considered as a

grammatical sentence.

As for (110b), there is no conflict between sentential *le* and the negation, *meiyou* ‘no’. In (110b), there is a presupposition that there were lions which could be pets in the past as (113) shows. Therefore, when we negate (114), we will derive (110b). The sentential *le* represents that the state has changed from ‘there are lions to be pets’ to ‘there are no lions to be pets’.

(113) You shizi keyi dan chongwu
have lion can be pet
‘There were lions to be pets.’



Therefore, noun phrase conjunction with *meiyou* ‘no’ is not an exception for our theory.

4.5 Remaining Issues: the Influence of Definiteness on NP Conjunction

In the previous sections, we argued that distributive reading and cumulative reading are both possible readings. However, there are still some problems which remain unsolved. When the number expression or determiner is singular, the representations of definite nouns and indefinite nouns are asymmetric. There are three example sentences in (114). (114a) and (114c) are both grammatical sentences while (114b) is ungrammatical.

(114) a. Wo zuotian mai-le yi-zhi ji he ya

I yesterday buy-Asp one-Cl chicken and duck

‘I bought a chicken and duck yesterday.’

b. Wo zuotian mai-le zhe-zhi ji he ya

I yesterday buy-Asp this-Cl chicken and duck

‘I bought this chicken and duck yesterday.’

c. Wo zuotian mai-le zhe-zhang zhuozi he yizi

I yesterday buy-Asp this-Cl table and chair

‘I bought this table and chair yesterday.’

In (114a), only the distributive reading can be derived while (114b) is ungrammatical, no matter whether in distributive reading or cumulative reading. It seems that definiteness influences the grammaticality. As for (114c), since *zhuozi* ‘table’ and *yizi* ‘chair’ are in pair relation, this helps us derive distributive reading even though the conjoined phrase is definite.

However, when the number expression is *liang* ‘two’, the distribution of distributive reading and cumulative reading is very interesting.

(115) a. Wo zuotian mai-le liang-zhi ji he ya

I yesterday buy-Asp two-Cl chicken and duck

‘I bought two chickens and ducks yesterday.’

b. Wo zuotian mai-le zhe-liang-zhi ji he ya

I yesterday buy-Asp this-two-Cl chicken and duck

‘I bought these two chickens and ducks yesterday.’

- c. Wo zuotian mai-le zhe-liang-jian neiyi ne neiku
 I yesterday buy-Asp this-two-Cl vest and underpants
 ‘I bought two vests and underpants’

The nouns in (115a) are indefinite and we only derive distributive reading. In (115b), the nouns are definite and we only derive cumulative reading. As for (115c), the conjuncts are in pair relation and both readings are possible. The representations of the sentences in (114) and (115) are quite different. This is very interesting. However, we have not discovered what leads to these phenomena. Further studies will be needed to account for the interesting data.

In this chapter, we have proposed that the number expression carries two features. When the number expression carries the collective feature, the cumulative reading will be derived. When the number expression carries the distributive feature, we will derive the distributive reading. However, there is another possible solution for these two readings. If the number expression does not carry the two features, it is possible that there are two syntactic structures that lead to these two readings. I will discuss this issue in the following chapter.

Chapter 5

Syntactic Representation

5.1 Three-Dimensional Structure

In the last chapter, we argued that the number expression carries two features and these different features result in different readings. It is the different semantic representations that help us to derive the cumulative reading and the distributive reading. Therefore, the syntactic representations of these two readings are the same, as (116) shows. This structure is based on the work of Abney (1987), Hudson (1989), Cinque (1994), Longobardi (1994), Ritter (1991), Siloni (1994), Zamparelli (1995, 1998), and others.

(116) [DP *Det* [_{NumP} *Num* [_{PIP} *Pl* [_{NP} (*Modifiers*) *Noun* (*Modifiers*)(*Compl*)]]]]

However, there is another possible explanation as to how we derive two different readings. If the number expression is not ambiguous, then different syntactic representations may lead to the different readings.

Muadz (1991) proposes that coordinate structures are three-dimensional in the planar model as (117) shows.

(117) [R Z₁ A -- J Z₂]

```
graph LR; A --- B1; A --- B2; A --- J; J --- Z2;
```

where R= root node

J= conjunction or disjunction

A= any node which can be coordinated

B= any sequence of nodes dominated by A

Z= any node which is not coordinated (Z_1 =left of A, Z_2 =right of A)

Muadz (1991: 21)

In (117), A with B_1 is a slice and A with B_2 is another slice. According to Muadz, we can derive the planes by selecting different slices. The conjunction, J, is treated as a function and is not part of a plane. Additionally, each node which is not dominated by a 3D-node is a shared node. Otherwise, it is an unshared node. Take (117) for example, Z_1 and Z_2 are not dominated by A. Therefore, Z_1 and Z_2 are shared information. Meanwhile, B_1 and B_2 are dominated by A. As a result, B_1 and B_2 are not shared information. Then, we will derive two planes as (118) shows.

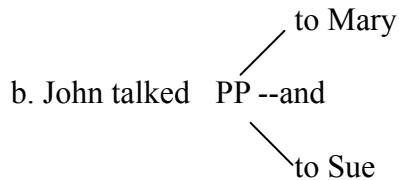
(118) Plane one: Z_1 A B_1 Z_2

Plane two: Z_1 A B_2 Z_2

Muadz has introduced three kinds of syntactic structures for conjunction: full 3D-nodes, partial 3D-nodes, and anti-3D nodes.

If node A dominates a conjunction and more than one parallel structure, then it is a full 3D-node, as (119) shows.

(119) a. John talked to Mary and to Sue

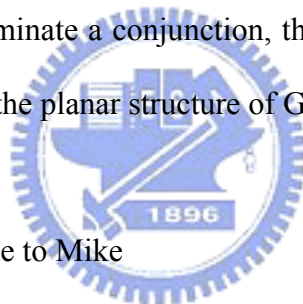


c. Plane one: [CP[C][IP[NP John][VP[V'[V talked] [PP[P to] [NP Mary]]]]]]

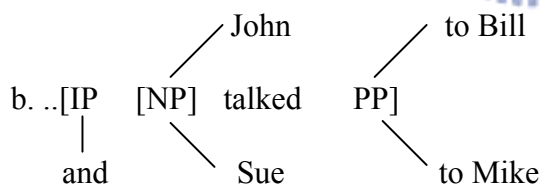
Plane two: [CP[C][IP[NP John][VP[V'[V talked] [PP[P to] [NP Sue]]]]]]

Muadz (1991: 21)

If the node A does not dominate a conjunction, then it is called a partial 3D-node, as (120) shows. It is used to explain the planar structure of Gapping.



(120) a. John talked to Bill and Sue to Mike



c. Plane one: John talked to Bill

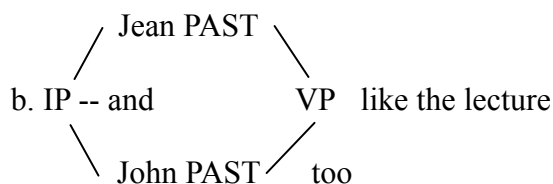
Plane two: Sue talked to Mike

Muadz (1991: 30-31)

According to Muadz, the difference between full 3D-node and partial 3D-node is the position of conjunction.

The analysis of anti-3D nodes is used to explain Verb Phrase Deletion and Right Node Raising. It is illustrated in (121).

(121) a. Jean liked the lecture, and John did, too



c. Plane one: Jean liked the lecture

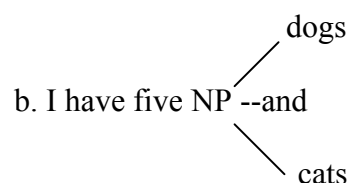
Plane two: John liked the lecture

Muadz (1991: 21-35)

(119) and (120) are 3D-nodes while (121) is an anti-3D node. Muadz claims that there are some differences between 3D-nodes and anti-3D nodes. First, an anti-3D node has multiple mothers from different slices while a 3D-node has multiple parallel daughters. Second, all nodes dominated by an anti-3D node are shared nodes. Third, an anti-3D node can only occur in the furthest right position while a 3D-node can occur in any position.

Muadz's three-dimensional tree is very interesting. If we adopt the structure of full 3D-nodes, we can derive the distributive reading in English, as (122) shows.

(122) a. I have five dogs and cats



c. Plane one: I have five dogs

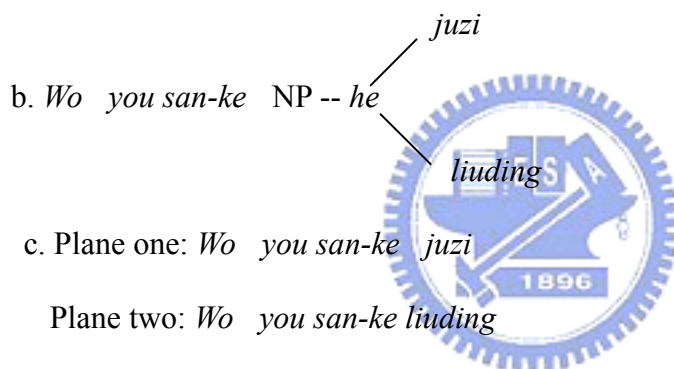
Plane two: I have five cats

In addition, it can apply to Chinese as (123) shows.

(123) a. Wo you san-ke juzi he liuding

I have three-Cl tangerine and orange

‘I have three tangerines and three oranges.’



However, we are unable to derive the cumulative reading under Muadz’s analysis. His analysis will predict that there are at least two planes while cumulative reading has only one plane. Therefore, we have to propose another syntactic structure to derive the distributive reading and the cumulative reading.

In the following section, we will introduce an operator: the *distributive operator*. When we have this operator in our structure, we will derive the distributive reading. When the operator is absent, we will derive the cumulative reading.

5.2 Previous Studies of the Distributive Operator

The distributive operator has been discussed in a considerable number of studies (Dowty and Brodie (1984), Link (1987), Heim, Lasnik, and May (1991), Lin(1998)). Dowty and Brodie take *all* as the distributive operator while Lin takes *dou* ‘all’ as the distributive operator. Heim, Lasnik, and May (1991: 75) propose that “the distributor introduces a universal quantification over the individuals, serving as the (plural) denotation of the NP”, as (124) shows.

(124) $[NP_i D_j] \Rightarrow \forall x_j (x_j \bullet \sqcap NP_i) \phi'$ Heim, Lasnik, and May (1991: 75)



In (124), \sqcap is the proper-part-of relation. For example, $\llbracket \mathbf{Heim} \rrbracket \sqcap \llbracket \mathbf{Heim \ and \ May} \rrbracket$. If we adopt the rule in (124) to analyze example (125), we will derive (126).

(125) The men each left. Heim, Lasnik, and May (1991: 75)

(126) $[\text{The men}_i \text{ each}_j] \text{ left}$
 $= \forall x_j (x_j \bullet \sqcap \text{The men}_i) \text{ left}'$

The reading of (126) will be “for all x_j , such that x_j is proper-atomic-part of *the men* and x_j left”.

Lin (1998) has proposed that Chinese *dou* is the generalized distributivity operator.

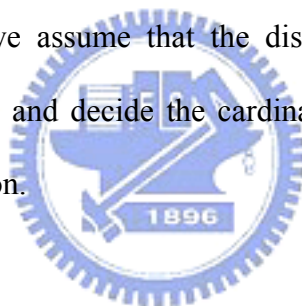
The denotation is as (127) shows.

$$(127) \text{ dou} \Rightarrow \lambda P \lambda X \forall y [y \in X \rightarrow P(y)]$$

In the following section, we will follow Lin's and Heim, Lasnik, and May's idea and present the denotation of the distributor in noun phrase conjunction.

5.3 The Translation of the Distributor

In the distributive reading, the number expression will be distributed to the material parts of the group. Therefore, we assume that the distributor will introduce a universal quantification over the individual and decide the cardinality of the material parts, as (128) shows. (129) is a sample denotation.



$$(128) [\text{Number } D] \Rightarrow \lambda P \lambda Q. \exists z. P(z) = 1 \wedge \forall y [y \preceq_i z \rightarrow Q(y) \wedge \sigma y P y = \text{Number}]$$

In (128), z refers to the whole group that the conjoined phrase denotes and y is the individual part of z . Q is the predicate while y is the individual part of z . $\sigma y P y$ is the supremum of all objects that are $*P$. P is a 1-place predicate.

$$(129) \llbracket \text{two } D \text{ dogs and cats} \rrbracket$$

$$= \llbracket \text{two } D \rrbracket (\llbracket \text{dogs and cats} \rrbracket)$$

$$= \llbracket \text{two } D \rrbracket (\lambda z_1 \exists x \exists b [dog'(x) \wedge cat'(b) \wedge z_1 = x \oplus b])$$

$$\begin{aligned}
&= [\lambda P. \lambda Q. \exists z. P(z) = 1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 2]] \wedge Q(z) = 1] (\lambda z_1 \exists x \exists b [dog' \\
&\quad (x) \wedge cat' (b) \wedge z_1 = x \oplus b]) \\
&= \lambda Q \exists z. [\lambda z_1 \exists x \exists b [dog' (x) \wedge cat' (b) \wedge z_1 = x \oplus b] (z) = 1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y \\
&\quad = 2]] \\
&= \lambda Q \exists z. \exists x \exists b [dog' (x) \wedge cat' (b) \wedge z = x \oplus b] \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 2]]
\end{aligned}$$

In (129), when P denotes *dogs*, ' $\sigma_y P y$ ' means that the cardinality of *dogs* is two. When P denotes *cats*, ' $\sigma_y P y$ ' means that the cardinality of *cats* is two. Then, we can derive the reading of two dogs and two cats.

When the distributor is present, we will derive the distributive reading. On the other hand, when the distributor is absent, we will derive the cumulative reading. Chinese also has the same interpretation. When example (130) derives the distributive reading, the denotation is as (131) illustrates.

(130) Yi-zhi daozi he chazi

one-Cl knife and fork

'one knife and one fork'

(131) \llbracket yi-zhi D daozi he chazi \rrbracket

= \llbracket yi D \rrbracket (\llbracket daozi he chazi \rrbracket)

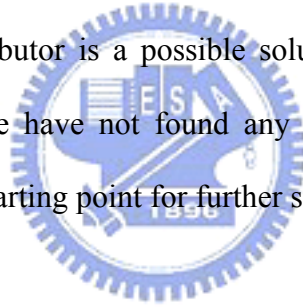
= \llbracket yi D \rrbracket ($\lambda z_1 \exists x \exists b [knife' (x) \wedge fork' (b) \wedge z_1 = x \oplus b]$)

= $[\lambda P. \lambda Q. \exists z. P(z) = 1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma_y P y = 1]]$ ($\lambda z_1 \exists x \exists b [knife' (x) \wedge fork' (b)$

$$\begin{aligned}
& \wedge z_1 = x \oplus b) \\
& = \lambda Q. \exists z. [\lambda z_1 \exists x \exists b [knife'(x) \wedge fork'(b) \wedge z_1 = x \oplus b] (z) = 1 \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma y P y \\
& = 1]] \\
& = \lambda Q. \exists z. \exists x \exists b [knife'(x) \wedge fork'(b) \wedge z = x \oplus b] \wedge \forall y [y \leq_i z \rightarrow Q(y) \wedge \sigma y P y = 1]]
\end{aligned}$$

In (131), when P denotes *daozi* ‘knife’, ‘ $\sigma y P y$ ’ means that the cardinality of *daozi* ‘knife’ is one. When P denotes *chazi* ‘fork’, ‘ $\sigma y P y$ ’ means that the cardinality of *chazi* ‘fork’ is one. Then, we can derive the reading of two knives and two forks.

The analysis of the distributor is a possible solution for the two readings in noun phrase conjunction. However, we have not found any empirical evidence to support this proposal. This would be a good starting point for further studies.



Chapter 6

Conclusions

The thesis deals with two possible readings in Chinese noun phrase conjunction: cumulative reading and distributive reading. In cumulative reading, the number expression denotes the total number of the group. In distributive reading, the number expression denotes the cardinality of each material part.

We first argue that the conjunction is non-Boolean conjunction (cf. Massey (1976), Link (1983), Hoeksema (1983, 1988), Krifka (1990) and Schwarzschild (1991)). As a result, we treat the whole conjoined phrase as a group.

Second, we argue that the number expression carries two features: collective feature and distributive feature. When the number expression carries the collective feature, we will derive the cumulative reading. When the number expression carries the distributive feature, we will derive the distributive reading.

Finally, we argue that there could be another solution for these two readings. The difference in syntactic structure may lead to these two readings. We adopt the idea of the *distributive operator* (cf. Dowty and Brodie (1984), Link (1987), Heim, Lasnik, and May (1991), Lin(1998)). When we have this operator in our structure, we will derive the distributive reading. When the operator is absent, we will derive the cumulative reading. So far, we have not found any empirical evidence for the *distributive operator*. This still calls for further study.

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