THE HONG KONG POLYTECHNIC UNIVERSITY

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Expansion and Closure: Towards a Theory of Wh-construals in Chinese

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CERTIFICATE OF ORIGINALITY

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___HE Chuansheng_____(Name of student)

Abstract

This dissertation defends a Hamblin (1973) semantics for the construals of wh-in-situ expressions in Chinese. It attempts to achieve three aims. The first aim concerns the problems facing LF movement approach and the Unselective Binding approach towards wh-construals. It is argued that though LF movement approach has difficulty in explaining island-escaping behavior of some wh-in-situ expressions and their association with *zhi* 'only', the unselective binding approach is also not successful in leaving the wh-phrase in situ, because this treatment faces equally serious problems, mostly problems of semantic misinterpretations. The conclusion we reached is that we may need to take a different approach that combines the merits of both approaches: **(1)** keeps wh-phrases in-situ (predicting association with *zhi* 'only' and no island constraints); **(2)** but interpret them in non-in-situ positions (getting semantics right).

The second aim of this dissertation is to develop a Hamblin-semantics for wh-construals in Chinese that can achieve the two merits. The working assumption made in this approach is that some wh-phrases directly denote sets of alternatives, which is supported by empirical evidence. The direct consequence from this assumption is that we need a so-called pointwise functional application, which has the effect of 'extracting' and interpreting wh-in-situ in a displaced position without resorting to covert movement. This effect is achieved by a process called expansion inherent in the definition of the pointwise functional application. It is an operation in semantics, insensitive to syntactic islands. If it is left unclosed, the expansion returns a set of propositions, that is, the denotation of questions. But this expansion may be closed by appropriate quantificational operators.

The third aim of this dissertation is to testify how this theory, namely expansion and closure, works for wh-construals in Chinese in a better way. Two wh-constructions are investigated: wh-questions and *wulun*-wh-*dou* constructions. For wh-questions, we show how the pointwise functional application rule obtains wide-scope interpretations of interrogative wh-in-situ expressions across three typical island structures under the assumption that there is no movement. It achieves this result at no additional cost: just assuming wh-in-situ expressions denotes sets of alternatives that can expand via a simple

pointwise functional application rule. It is pointed out that though LF movement can also obtain correct semantics, our theory is advantageous over LF movement in several aspects.

The investigation of the *wulun*-wh-*dou* constructions is mainly concerned with the mechanism of closure. It is proposed that the adverb *wulun* is a universal operator that universally closes the expansion of alternatives denoted or expanded by wh-phrases. If this is true, we are committed to treating *dou* (the most common matching item in the consequent clause) as a non-universal-quantificational element. Adopting the proposal of *dou* as an existential quantifier serving for skolemization (Huang 1995, 1996), we provide a detailed characterization of the interaction between *wulun* and *dou* in both the nominal and sentential *wulun-dou* constructions. Several novel ideas are proposed for *wulun-dou* structures. One is that *wulun*-XP is base-generated within *dou* VP domain, the other is that *wulun*-wh is the instantiation for distributive quantification. Some consequences of these ideas are discussed.

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Chapter 1

Tension between syntax and semantics: the case of indefinites

1. To move or not to move

Indefinites (existential quantifiers) like *a farmer* have been a persistent challenge to linguists. According to the classical view, indefinites are quantificational instead of referential (Russell 1905). This view is certainly plausible because indefinites can be non-referential in many circumstances, for example under the scope of negation. However, indefinites also demonstrate peculiar properties in comparison to universal quantifiers such as *every farmer*. One well-known peculiarity is their free scope-taking ability, as the examples below illustrate (Fodor & Sag 1981).

(1) a. This producer believes that every actor in our company is too fat to appear in public.
b. This producer believes that an actor in our company is too fat to appear in public.

(2) a. If every friend of mine dies, I will inherit a fortune.
b. If a friend of mine dies, I will inherit a fortune.

(3) a. Someone read a book which is written by every professor.
b. Someone read a book which is written by a professor.

(4) a. John overheard the rumor that each of my students had been called before the dean.
b. John overheard the rumor that a student of mine had been called before the dean

In the above examples, universal quantifiers like *every NP* or *each* NP cannot take scope out of the minimal clauses in which they occur, while indefinites can take scope out of their minimal clauses (or islands like *if*-clauses, complex NPs, etc). The contrast

between (a) and (b) above indicates that either the indefinites may obtain their scope through a mechanism other than QR[1] or one would have to stipulate that QR has different properties when it applies to universally quantified NPs and when it applies to indefinites.

Fodor and Sag (1982) argue that the apparent wide scope reading of indefinites outside an island is just an illusion. When an indefinite seemingly obtains a wide scope reading outside an island, it is not quantificational. Instead it is referential, interpreted as the individual 'the speaker has in mind'; hence there is no movement at all and no island constraints whatever. However, many authors have subsequently shown that indefinites that obtain wide scope readings outside an island can in fact be quantificational (Farkas 1981, King 1988, Neale 1990, Ludlow and Neale 1991, Ruys 1992, Abusch 1994, Cresti 1995, Kratzer 1998, Reinhart 1997, Schwarz 2004, Endriss 2009), which indicates that indefinites can be non-referential when taking wider scope and the island-escaping behavior of indefinites is real, not an illusion.

If not ambiguous, the peculiar island-escaping behavior of indefinites must be explained away in some other way. The classical QR approach was to suggest that movement of indefinites at LF is not subject to island constraints (for example Heim 1982). But this approach leaves an important question unanswered: why indefinites can outscope islands but universal quantifiers cannot. The suggestion that movement of indefinites at LF is not subject to island constraints is a restatement of facts not an explanation.

If indefinites do not exhibit island effects, maybe they do not move at all in LF. One might simply[2] suggest that indefinites might not be inherent quantifiers; instead they are best treated as variables interpreted in situ, from where they can be unselectively bound.

[1] Following most generative grammarians, we assume that scope-taking is achieved by movement. Of course, non-movement mechanisms have also been proposed within the generative grammar, which take care of scope without assuming covert movement at LF (e.g. Hornstein 1995, Beghelli and Stowell 1997).

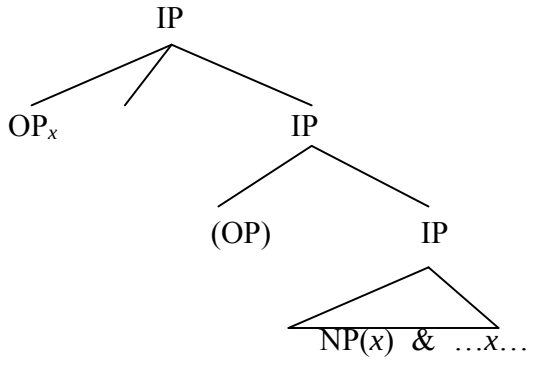
[2] The word 'simply' is used here to describe a naïve form of unselective binding approach in which the descriptive content of indefinite is left in situ. The classical version of Heim (1982) and Kamp and Reyle (1993) are not responsible for this version. However, there are indeed such proposals for indefinites and particularly for wh-in-situ (see section 3 below for more discussions).

We start from this form of unselective binding approach for English indefinites, in which there is no movement or movement-like rules. In this approach, an indefinite only introduces an open formula NP(x), which is interpreted in situ and bound by long distance operators (a default existential closure, in this case). Due to the long-distance binding, the descriptive content of the indefinite can now be evaluated in situ, thus eliminating the need to assume a costly and ill-behaved form of movement. Hence there is no movement and no island-escaping is involved in the wide scope readings of indefinites.

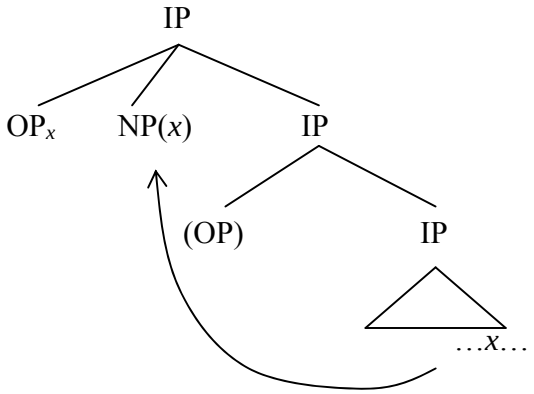
However, it is precisely the long-distance relationship between the operators and the variables as well as the in-situ evaluation of the descriptive contents that lend to various semantic misinterpretations. First, the in-situ restrictive property of an indefinite becomes a conjunct in conjunction with the main property. This is because the open predicate introduced by the indefinite is not an argument; the argument is a variable x and so the predicate has to be a conjunct in the form of NP(x), which cannot be directly used as the argument of the main predicate, as in *P(NP(x)). Second, there may be other operators (*if*-conditional, negation, attitude verbs, etc) intervening between the binder and the variable, which may change the logical properties of elements under their scope. Therefore, by unselective binding, the schema (5a) may be generated. (5b) is the more classical schema derived by QR.

(5) a. $OP_x \wedge$ (OP) [NP(x) $\wedge$ P(x)]

b. OP_x NP(x) $\wedge$ (OP) [P(x)]



(5a)



(5b)

In the next section, we will discuss various problems arising from formula (5a). We will argue that the view of treating indefinites as variables evaluated in-situ is problematic, although it has some seemingly welcome advantages.

2. Problems of treating indefinites as in-situ variables: setting the scene

In the unselective binding approach, the in-situ restrictive property becomes a conjunct in the interpretation of the phrase in which it immediately occurs. This means that any sentence that has a wide scope indefinite is forced to have an additional predicate in the form of '*x* is an NP', which has to be interpreted in situ with the main predicate via predicate modification: [P(*x*) and Q(*x*)]. In a simple sentence like (6a), the newly-added predicate does not affect the interpretation of the whole sentence because the formula (6b) is equivalent to (6c), which would be the standard logical formula for this sentence.

(6) a. John saw some girl.
b. ∃*x*[John saw *x* and *x* is a girl]
c. ∃*x*[*x* is a girl and [John saw *x*]]

However, the addition of a new predicate in situ would give rise to unwanted effects in important ways, if the sentence is made a little more complex.

2.1 Unwanted specifications in relative and complement clauses

Relative clauses and noun complement clauses are strong islands. It is well known that universal quantifiers cannot scope out of these islands, but indefinites can freely outscope them. To obtain a wide scope reading of an indefinite within complex NP islands, QR has to assume a scope-free operation while unselective binding leaves the descriptive content of the indefinite in situ, avoiding the need for long distance movement. However, the interpretation of in-situ descriptive content of the indefinite as conjunct with main predicate leads to uninterpretable representations.

First consider nouns that can take relative clauses and complement clauses, such as *theory*, *claim*, *belief*, *rumor*, *hypothesis*, and so on. Under the unselective binding approach, the following relative clause sentence (7a) is predicted to mean (7b): there is

something such that John does not like the theory that it is a professor and it has developed on indefinites. This is a very strange reading. It implies that *something is a professor* is one part of the theory itself. But this sentence does not have such a reading (though that *something is a professor* may be a theory, it is certainly not a theory in (7a)). On the other hand, QR would yield (7c), which correctly expresses the meaning of this sentence.

(7) a. John does not like the theory that some professor has developed on indefinites.

b. Unselective binding: $\exists x$[John does not like the theory that [x is a professor $\wedge$ x has developed on indefinites]]

c. QR: $\exists x$[x is a professor $\wedge$ John does not like the theory that [x has developed on indefinites]]

What's more, the conjunct *x is a professor* should be interpreted as a noun complement of the head noun *theory*. But the second conjunct is a relative clause. We cannot conjoin a complement clause and a relative clause together to the same head noun, as shown in (8).

(8) a. *The theory that some professor has developed and some indefinite can be treated as variables (RC clause + NC clause)

b. *The theory that some indefinite can be treated as variables and some professor has developed (NC clause + RC clause)

The following sentence (9) is a noun complement clause. In its wide scope reading of *some indefinite*, the QR approach extracts the existential NP out of an island. The representation (10a) gives the correct interpretation: There is an indefinite such that John does not like the theory that it can be treated as real variable. By unselective binding, formula (10b) is generated, which means that there is something such that John does not like the theory that it is an indefinite and it can be treated as real variable. It predicts that the theory itself has to include an unwanted part of content: something is an indefinite,

which is not. The theory in this example is only that *some indefinite can be treated as real variable*, but not *something is an indefinite*.

(9) John does not like the theory that some indefinite can be treated as real variable.

(10) a. QR: $\exists x$[x is an indefinite $\wedge$ John does not like the theory that [x can be treated as real variable]]

b. Unselective binding: $\exists x$[John does not like the theory that [x is an indefinite $\wedge$ x can be treated as real variable]]

In relative clauses headed by ordinary common nouns like *book*, *house*, *paper*, *professor*, etc, that cannot take noun complement clauses, unselective binding would produce uninterpretable representations. For example, the following sentence (11a) should be represented as in (11b) by unselective binding, which means that there is something such that John does not like the paper that it is a professor and it wrote on indefinites.

(11) a. John does not like the paper that some professor wrote on indefinites.

b. $\exists x$[John does not like the paper that [x is a professor and x wrote on indefinites]]

In the above formula, the second conjunct 'x wrote on indefinites' can be properly composed with the head noun *paper* by lambda abstraction and predicate modification. But the first conjunct 'x is a professor' cannot be properly interpreted with respect to the head noun *paper*. The conjunct 'x is a professor' is a complete proposition; it cannot be lambda-abstracted because there is no indexed gap within it. Even if it can be made into a predicate by some type-shifting operation, this would force the conjunct 'x is a professor' to be the complement of the head noun *paper*. However, the head noun *paper* cannot select a complement clause.

(12) *John does not like the paper that someone is a professor.

Therefore, we conclude that the unwanted specifications of head nouns discussed above cast doubt on leaving the descriptive content of an indefinite in situ. The fact is clear and the argument is independent on how relative clauses and noun complement clauses are to be semantically analyzed.

2.2 Predicate conjunction in complement clauses of belief verbs

In complement clauses embedded to matrix verbs, the addition of a new predicate in situ would give rise to unwanted content to the complement clauses selected by the matrix verbs. For instance, the following sentence (13a) would be assigned the logical representation of (13b) by unselective binding. Obviously such logical representation cannot be correct because it is not the case that John said/whispered that something is a bachelor; he only said/whispered that someone (who is a bachelor) is married. The logical representation would attribute John a saying/whispering behavior of contradictory propositions[3].

(13) a. John said/whispered that some bachelor was married.

b. $\exists x$[John said/whispered [that x is a bachelor and x is married]

2.2.1 Non-existent belief

These undesirable consequences can be more clearly illustrated in other intensional contexts. Verbs like *believe* are world-creating predicates, which allow *de re* and *de dicto* readings (specific and nonspecific) of indefinites within clauses embedded by them. In the former case, the choice of the indefinite description is the responsibility of the speaker, so the believer only holds a belief about an object, no matter how this object is described. As a result, in *de re* readings of indefinites, the descriptive contents of the NPs can be contradictory with the main predicates. In the latter case, both the object denoted by the

[3] The semantics of verbs like *say* is not directly at issue here, as long as we know that the content of the embedded clause is what has been said. If John said that something is a bachelor, he must have said *it*, whether *it* denotes a proposition, a set of worlds, or linguistic expression (see Larson and Segal 1995 for a review of the denotation of the embedded clause of *say*).

indefinite and the main predicate are within the subject's belief world, that is, the subject believes them both to be true.

Now consider (14a). The *de re* reading of *some bachelor* does not report a contradictory belief of John (in *de dicto* reading, John must be attributed such an odd belief). Assuming that people do not have contradictory thoughts, this forces the indefinite to be *de re*. But formula (14b), as might be assigned by unselective binding, would attribute John a contradictory belief. And this formula also incorrectly attributes John a non-existent belief that the entity is a bachelor. The correct formula should be (14c), which correctly capture the *de re* reading without attributing to John a contradictory belief[4]. The difference between *de dicto* and *de re* may be seen as a matter of scope ambiguity, which I adopt (Russell 1905)[5].

(14) a. John (mistakenly) believes that some bachelor is a married man.

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[4] Adopting the standard analysis for *believe*: '*x* believes that φ is true just in case all of the possible worlds compatible with *x*'s beliefs are worlds in which it is true that φ (Hintikka 1969), the more formally-articulated formulae corresponding to (14b) and (14c) should be as follows.

(i) a. $\exists x[x$ is a bachelor in w^0 & $\forall w'[w'$ is compatible with what John believes in $w^0 \rightarrow x$ is a married man in $w']]$

b. $\exists x[x$ is a thing in w^0 & $\forall w'[w'$ is compatible with what John believes in $w^0 \rightarrow x$ is a bachelor and is a married man in $w']]$

[5] Some remarks are in order as for the islandhood of embedded complement clauses. In (14a), we assume the indefinite moves to take wider scope than the attitude verb. One may argue that attitude verbs do not constitute islandhood for LF movement because universal quantifiers can also take scope over matrix attitude verbs.

(i) John (mistakenly) believes that every bachelor is a married man.

Some people consider all subordinate clauses to be scope islands though not overt movement islands, so they reject the wide scope quantifier interpretations of (i) (cf. Farkas 1981). For some people, however, this sentence allows a wide scope reading of the universal quantifier over the belief verb. Fodor and Sag (1981) consider that *every* NP in a complement clause can take scope over the matrix predicate, but the preferred interpretation is generally the one on which the quantifier has scope only within the complement clause; while an indefinite can be interpreted with wide scope over the matrix predicate as natural as the narrow scope reading. May (1977) and Reinhart (1997) consider that universal quantifiers are clause-bounded in unmarked cases.

b. ∃*x*[John believes [that *x* is a bachelor and *x* is a married man]

c. ∃*x*[*x* is a bachelor and John believes that *x* is a married man]

Further, predicate modification of the in-situ restriction and the main predicate cannot distinguish sentence (15a) below from (14a) because of the commutative law of conjunction: [P(*x*) and Q(*x*)]=[Q(*x*) and P(*x*)].

(15) a. John (mistakenly) believes that some married man is a bachelor.

b. ∃*x*[John believes [that *x* is a married man and *x* is a bachelor]]

In *de dicto* reading, sentence (15a) and (14a) indeed have the same truth condition. If John believes that there is some bachelor who is a married man, then it is also true that he believes that there is some married man who is a bachelor.

(16) a. John believes [that ∃*x*[*x* is a bachelor and *x* is a married man]]

b. John believes [that ∃*x*[*x* is a married man and *x* is a bachelor]]

The problem is more involved when the evaluation of two coordinated predicates involves world and time. Keshet (2008) proposes an Intersective Predicate Generalization to cover these cases that involve predicate modification: two predicates composed via Predicate Modification may not be evaluated at different times or worlds from one another. In typical modificational structures that need predicate conjunction, the requirement of evaluation in the same world and same time is very obvious. For example:

(17) a. Mary thinks someone in this room is outside.

b. *Mary thinks there's someone in this room outside.

(18) a. Mary thinks three professors are (still) in college.

b. *Mary thinks there are three professors (still) in college.

(19) a. Mary thinks many fugitives are in jail.

b. *Mary thinks there are many fugitives in jail.

Take (19), for instance. Example (19a) is true in a scenario where there are many real-life fugitives that Mary mistakenly believes to be safely locked up in jail; the reading that makes it true is one where *many fugitives* is *de re* and *in jail* is *de dicto*. (19b) sounds odd because it entails that Mary has a contradictory thought, namely that a number of people are both fugitives and in jail in the same world (and at the same time). This is because *many fugitives* in (19b) must be evaluated within the belief verb due to the *there*-operator (Musan 1997). The problem arising from unselective binding is that (19a) is predicted to be contradictory too because both properties are evaluated together within the belief world of Mary. Similarly, in the following example:

(20) The professors in this department are quite young. In fact,
a. John believes that many professors were in kindergarten in the ’80s.
b. *John believes that there were <u>many professors</u> in kindergarten in the ’80s.

Sentence (20b) sounds odd because the underlined NP is in existential *there*-sentence, and must be read *de dicto*. According to Keshet, it should be evaluated at the same time with its main predicate, therefore it entails that some people were both professors and in kindergarten at the same time, yielding an odd reading for the sentence. So John is attributed to a strange belief. Sentence (20a) is felicitous in *de re* reading. But leaving the indefinite restriction in situ to compose with the main predicate via predicate modification requires them to have the same index of world and time. Since the predicate *are in kindergarten in the ’80s* is evaluated in a past time in the 80s, according to the Intersective Predicate Generalization, the predicate *are professors* should also be evaluated in the same time, as in (21a). But apparently, the predicate *are professors* should be evaluated in a different time (most probably the speech time). The correct representation should be (21b), in which the property *are professors* is indexed at the speech time of the speaker.

(21) a. $\exists x$[John believes [that x are professors and x are in kindergarten in the ’80s]]

b. ∃*x*[*x* are professor & John believes [that *x* are in kindergarten in the ’80s]]

2.2.2 Substitutivity of Identicals

Another problem comes from substitutivity of co-extensive predicates in intensional contexts. As is well know, in propositional attitude contexts, substituting a coreferential term in the embedded clause may lead to a change of the truth value. Consider the following sentences:

(22) a. John believes that some politician is easily bribed.
b. John believes that some billionaire is easily bribed.

Suppose I have a particular person in mind (for example Bill Clinton), who is a politician and a billionaire too. So the two NPs are co-referential to the same individual. Further suppose that one day I met Bob, who is a billionaire. In order not to offend him (to avoid misunderstanding), sentence (22a) is uttered. The next day I met Tom, who is a politician. In order not to offend him either, sentence (22b) is uttered. I may well have a particular person in mind and reported a certain belief to John by using different descriptions, *some politician* and *some billionaire*. In both cases, the truth is preserved when the indefinite is changed.

However, if we leave the restrictive properties in-situ, these properties would be evaluated within the belief world of John. The problem now is that truth is no longer preserved. If formula (23a) below is true, formula (23b) may be false, and vice versa. The reasoning runs like this: suppose formula (23a) is true in that the variable *x* is assigned a value of Bill Clinton, whom John believes is a politician and is easily bribed (this interpretation is wrong for a different reason. But we can ignore it at this moment). Then formula (23b) may be false because John does not believe that this very value (Bill Clinton) is a politician. He believes that this very value (Bill Clinton) is a billionaire.

(23) a. ∃*x*[John believes [that *x* is a politician and *x* is easily bribed]]
b. ∃*x*[John believes [that *x* is a billionaire and *x* is easily bribed]]

2.2.3 Existential commitment

In *de re* reading, the indefinite is supposed to have existential commitment, that is, something specified in the set of the NP property exists. In *de dicto* reading on the other hand, the indefinite does not have existential commitment, that is, something specified in the set of the NP property may not exist. This distinction is truth-conditional. Given the emptiness of the set of Martians, sentence (24a) below is false in *de re* reading, but true in *de dicto* reading. Under unselective binding, this sentence may be true in *de re* reading because John may fondly believe that there are Martians.

(24) a. John believes that some Martian was caught by scientists.

b. $\exists x$[John believes that *x* is a Martian and *x* was caught by scientists]

2.3 Truth condition

In the previous subsection 2.1, we intentionally used sentences with negation. As far as the unwanted specification problem is concerned, negation does not have a bearing on the issue. However, the presence of negation plays a critical role in another interpretational problem of unselective binding: truth conditional problem. Very roughly, if there is a negation (or other monotone-decreasing operators) intervening between the binder and the variable, the unselective binding approach would generate unacceptable truth conditions. This will be the topic of this subsection, in which it will be shown that the truth conditional problems are much more serious than previously recognized in the literature, which include weak truth conditional problem (Heim 1982, Abusch 1994, Reinhart 1997, among others), wrong truth conditional problem, and strong truth conditional problem.

2.3.1 Weak and wrong truth condition

In this subsection, we mainly focus on sentences with negated belief verbs like '*not believe*'. We believe that this kind of sentences is more instructive for us to spot the various truth conditional problems[6]. Under unselective binding approach, the following

[6] The classical example is a conditional like (i).

(i) If a cat likes a friend of mine I always give it to him.

Heim (1982) points out that the in-situ interpretation of the indefinite *friend-of-mine*(x) gives rise

sentence (25a) would be assigned a logical representation (25b) for *de re* reading of the indefinite.

(25) a. John does not believe that some ghost is haunting his house.
b. $\exists x$[John does not believe [that x is a ghost and x is haunting his house]].

However, formula (25b), in which the in-situ restriction is interpreted as a conjunct with the main predicate under the scope of negation and belief verb, makes several wrong predictions in truth conditions. According to de Morgan's law on negation of conjunction: not (A and B)=not A or not B, it is conceivable that formula (25b) equals to formula (26). The whole formula is made true if either conjunct is true, or both are true. So we have three possibilities as shown in (27).

(26) $\exists x$[[John does not believe that x is a ghost] or [John does not believe x is haunting his house]].

(27) a. [John does not believe that x is a ghost]=1, [John does not believe x is haunting his house]=1
b. [John does not believe that x is a ghost]=1, [John does not believe x is haunting his house]=0
c. [John does not believe that x is a ghost]=0, [John does not believe x is haunting his house]=1

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to weak truth condition, as shown in formula (ii/a). This formula can be verified by the existence of something that is not a friend of mine, because the restrictor is within the scope of conditional, and therefore assignments not satisfying that restriction (i.e. not being members of the N-set of the indefinite NP) will be considered. To produce the correct reading, the existential quantifier and the restrictor too must have wider scope than *always,* as shown in (ii/b), hence the indefinite is moved to the level of the existential quantifier, violating an island constraint. Only friends of mine would be considered when assigning a truth value to the implication.

(ii) a. $\exists x_2 \forall x_1$ [cat(x_1) $\wedge$ f.o.m.(x_2) $\wedge$ like(x_1, x_2) $\rightarrow$ give(I, x_1, x_2)]
b. $\exists x_2$ [f.o.m.(x_2) $\wedge$ $\forall x_1$ [cat(x_1) $\wedge$ like(x_1, x_2) $\rightarrow$give(I, x_1, x_2)]]

We can test all possible readings generated by the formula (26) with respect to the three cases in (27). First consider (27a) in which both conjuncts are true. If we assign *x* a value other than a ghost, say a unicorn, this sentence is predicted to be true since it is true that John does not believe that a unicorn is a ghost (a correct belief according to common sense) and it is true that he does not believe it is haunting his house (a correct belief according to the meaning of the sentence), so the whole sentence is true. This is the problem of weak truth condition known in the literature. But the sentence does not mean that, and it also attributes the speaker a contradiction that he has a unicorn in mind instead of a ghost, which is apparently false, as witnessed in the following continuation.

(28) John does not believe that some ghost is haunting his house. *It is a unicorn, so he is right in not believing that it is a ghost (and in not believing that it is haunting his house).

On the other hand, if we assign *x* the value of a real ghost, this sentence is predicted to have a non-existent reading: there is a ghost such that John does not believe it is a ghost (this is true, albeit a non-existent belief wrongly attributed to John) and he does not believe it is haunting his house (this is true, a correct belief). Actually the sentence does not say anything about John's belief on whether it is a ghost or not, but the semantic representation gives him such a non-existent belief. The sentence only gives him the second belief that that thing is not haunting his house.

(29) John does not believe that some ghost is haunting his house. *It is a ghost, so he is right in not believing that it is a ghost (and in not believing that it is haunting his house).

Now we consider (27b) in which [John does not believe that *x* is a ghost]=1, [John does not believe *x* is haunting his house]=0. This time, the key problem is that the second conjunct requires John to believe something that he should not believe. This is a wrong prediction of course. Either we assign *x* a value of a unicorn or a real ghost, this sentence is predicted to have a non-existent reading. If *x* is assigned a value of a unicorn, the

sentence would mean: there is a unicorn such that John does not believe that it is a ghost (this is true, a correct belief) but he *does* believe it is haunting his house (this is false, a wrong belief). If *x* is assigned a value of a ghost, the sentence would mean: there is a ghost such that John does not believe that it is a ghost (this is true, albeit a non-existent belief) but he *does* believe it is haunting his house (this is false, a wrong belief). But the sentence does not have both of the readings, as witnessed in the following continuations.

(30) a. John does not believe that some ghost is haunting his house. *It is a unicorn, so he is right in not believing that it is a ghost but he is right in believing that it is haunting his house.

b. John does not believe that some ghost is haunting his house. *It is a ghost, so he is right in not believing that it is a ghost but he is right in believing that it is haunting his house.

Next we consider (27c) in which [John does not believe that *x* is a ghost]=0, [John does not believe *x* is haunting his house]=1. In this case, the first conjunct requires John to always believe something is a ghost, whether the variable is assigned a ghost or a non-ghost. This is a non-existent belief of John because the sentence does not assign any belief about the ghost itself to John. If we assign *x* a value of a unicorn, this sentence is predicted to mean: there is a unicorn such that John believes that it is a ghost (this is true, albeit a non-existent belief) and John does not believe it is haunting his house (this is true, a correct belief). If we assign *x* the value of a real ghost, this sentence is predicted to mean: there is a ghost such that John believes that it is a ghost (this is true, albeit a non-existent belief) and John does not believe it is haunting his house (this is true, a correct belief).

(31) a. John does not believe that some ghost is haunting his house. *It is a unicorn, so he is right in believing that it is a ghost and he is right in not believing that it is haunting his house.

b. John does not believe that some ghost is haunting his house. *It is a ghost, so he is right in believing that it is a ghost and he is right in not believing

that it is haunting his house.

It should be clear that it is wrong to leave the restrictor in situ as conjunct with other predicate. In other words, the following formula cannot be maintained: $\exists_x$…***NOT believe***…[NP(x) $\wedge$ Q(x)][7].

Even when no belief verb is involved, this interpretational problem exists. For example, the wide scope reading of sentence (32a) is represented in (32b) by unselective binding, and can be converted into (32c) by de Morgan's law. By (32c) three different cases are generated, as in (33).

(32) a. John did not hiss that some ghost was haunting his house.

b. $\exists x$[John did not hiss [that x is a ghost and x was haunting his house]].

c. $\exists x$[[John did not hiss that x is a ghost] or [John did not hiss x was haunting his house]].

(33) a. [John did not hiss that x is a ghost]=1, [John did not hiss x was haunting his house]=1

b. [John did not hiss that x is a ghost]=1, [John did not hiss x was haunting his house]=0

c. [John did not hiss that x is a ghost]=0, [John did not hiss x was haunting his house]=1

Taking the same procedure, we can test each of these cases. Consider the case in which both conjuncts are true. If we assign x a value other than a ghost, say a unicorn, this sentence is predicted to be true since it is possible that John did not hiss that a unicorn is a ghost and he did not hiss it was haunting his house. In this case, the whole sentence is made true, contrary to the fact. If we assign x the value of a real ghost, this sentence is predicted to have a non-existent but true reading: there is a ghost such that John did not hiss that it is a ghost and he did not hiss it was haunting his house. The same arguments can be easily extended to the other two cases. Consider (33b). Whatever value

[7] In *de dicto* reading, there is no such problem since de Morgan's Law does not apply and the variable is properly restricted:

(i) John does not believe [that $\exists x$ [x is a ghost and x is haunting his house]].

is given to the variable, the sentence is predicted to mean that John hissed that something was haunting his house. And in (33c), whatever value is given to the variable, the sentence is predicted to mean that John hissed that something is a ghost and hissed that it was not haunting his house. All these readings are not what sentence (33a) intends to mean.

The interpretational problem also extends to some basic cases. Consider (34a). If we leave the N-restrictor in situ and interpret it as a conjunct with the main predicate, various wrong and non-existent readings will be generated.

(34) a. John did not kiss some girl.
b. $\exists x$[not [John kissed $x \wedge x$ is a girl]]

By similar procedure, we can test its truth conditions in three cases: John did not kiss x=1 & x is not a girl=1, John did not kiss x =1 & x is not a girl=0, John did not kiss x=0 & x is not a girl=1. Consider the case in which both conjuncts are true. If we assign x a value of a boy, this sentence is predicted to be true since a boy is not a girl (this is true) and he did not kiss it (this is also true). In this case, the whole sentence is made true, contrary to the fact. If we assign x the value of a real girl, this sentence is predicted to be contradictory: there is a girl such that it is not a girl and John did not kiss it.

(35) a. John did not kiss some girl. *It is a boy, so it is true that it is not a girl, and John did not kiss it.
b. John did not kiss some girl. *It is a girl such that it is not a girl and John did not kiss it.

The same procedure can be extended to the other two cases. Consider the case in which x is not a girl=1 & John did not kiss x=0. Whatever value is assigned to the variable (a boy or a girl), this sentence is predicted to have a false reading: there is a boy or a girl such that it is not a girl and John kissed it. Consider the case in which x is not a girl=0 & John did not kiss x=1. If we assign x a value of a boy, this sentence is predicted to have a contradictory reading: there is a boy such that it is a girl and John did not kiss it.

If we assign *x* the value of a real girl, this sentence is predicted to be redundant: there is a girl such that it is a girl and John did not kiss it. All these readings are not available to sentence (34a).

2.3.2 Strong truth condition

In addition, unselective binding also leads to strong truth conditional problem. To illustrate, we can negate sentence (25) above into (36a) so that the indefinite takes an intermediate scope between two negation operators. Unselective binding yields (36b), equivalent to (36c) by the law of: $\neg\exists x\neg\varphi x \Leftrightarrow \forall x\varphi x$. The formula (36c) makes a strong claim that John believes everything is a ghost: Every object is such that John believes it is a ghost and it is haunting his house. This does not seem to be the case; the sentence only attributes John a certain belief of every ghost, not every object.

(36) a. It is not true that John does not believe that some ghost is haunting his house.

b. $\neg\exists x$[John does not believe [that x is a ghost $\wedge$ x is haunting his house].

c. $\forall x$[x is an object $\rightarrow$ John believes [that x is a ghost $\wedge$ x is haunting his house]].

Similarly, the following sentence in which the indefinite takes an intermediate scope between the negation operator and the *if*-conditional, unselective binding would produce (37c), which makes the claim that everything in the world is a philosopher: every object is such that it is a philosopher and we invite it and Max will not be offended.

(37) a. It is not true that if we invite some philosopher, Max will be offended.

b. $\neg\exists x$[[philosopher(x) $\wedge$ we invite x] $\rightarrow$ Max will be offended]

c. $\forall x$[x is an object $\rightarrow$ philosopher(x) $\wedge$ we invite x $\wedge$ Max will not be offended]].

On the contrary, QR yields the correct interpretation for both two sentences. The following two formulae only say something of every ghost or every philosopher. Formula

(38b) means that every ghost is such that John believes it is haunting his house, and formula (38b) means that every philosopher is such that we invite it and Max will not be offended.

(38) a. $\neg\exists x$[x is a ghost $\wedge$ [John does not believe [that x is haunting his house]]].
b. $\forall x$[x is a ghost $\rightarrow$ John believes [that x is haunting his house]].

(39) a. $\neg\exists x$[x is a philosopher $\wedge$ [we invite $x \rightarrow$ Max will be offended]].
b. $\forall x$[x is a philosopher $\rightarrow$ we invite $x \wedge$ Max will not be offended]].

This problem arises from the fact that leaving the restrictive property of an indefinite in situ would make it part of the nuclear scope instead of part of the restrictor of universal quantification when sentential negation is added. While in QR, moving the restrictive property would make it part of the restrictor and the variable is properly restricted. The two approaches yield different representations, as indicated below.

(40) a. $\forall_x$[$_{\text{restrictor}}$ x is an object] [$_{\text{nuclear scope}}$ NP(x) $\wedge$ P(x)] unselective binding
b. $\forall_x$[$_{\text{restrictor}}$ x is an NP] [$_{\text{nuclear scope}}$ P(x)] QR

2.4 Entailment relations

It is conceivable that formulae (40a) and (40b) would make different predictions in other cases. One such case is entailment relation. As is well-known, negation can reverse the direction of entailments: When a proposition is within the scope of negation, entailment relations are reversed.

(41) If A$\Rightarrow$B, then $\neg$B$\Rightarrow\neg$A

In the following pair (42), it is (42a) that entails (42b), while in the other pair it is (43b) that entails (43a). This is because [x is a Chinese ghost] is a subset of [x is a ghost], while *not* [x is a ghost] is a subset of *not* [x is a Chinese ghost].

(42) a. John found some Chinese ghost in his house.

b. John found some ghost in his house.

(43) a. It is not the case that John found some Chinese ghost in his house.

b. It is not the case that John found some ghost in his house.

According to the rule (41), the following sentence (44b) should entail sentence (44a) in the intermediate readings of the indefinites. QR account can get us the correct prediction of entailment. According to QR, both sentences are translated into (45a) and (45b), equivalent to (46a) and (46b) by the law of $\neg\exists x\neg\varphi x \Leftrightarrow \forall x\varphi x$. It is easy to verify that it is indeed (46b) entailing (46a), because the set of every ghost properly contains the set of every Chinese ghost.

(44) a. It is not true that John does not believe that some Chinese ghost is haunting his house.

b. It is not true that John does not believe that some ghost is haunting his house.

(45) a. $\neg\exists x$[x is a Chinese ghost $\wedge$ [John does not believe [that x is haunting his house]]].

b. $\neg\exists x$[x is a ghost $\wedge$ [John does not believe [that x is haunting his house]]].

(46) a. $\forall x$[x is a Chinese ghost $\rightarrow$ John believes [that x is haunting his house]].

b. $\forall x$[x is a ghost $\rightarrow$ John believes [that x is haunting his house]].

Let's see whether unselective binding can get us the correct prediction of entailment. The formulae produced by unselective binding are (47a) and (47b), paraphrased respectively as: it is not true that there is something such that John does not believe it is a Chinese ghost and it is haunting his house, and it is not true that there is something such that John does not believe it is a ghost and it is haunting his house, equivalent to (48a) and (48b).

(47) a. $\neg\exists x$[John does not believe [that x is a Chinese ghost $\wedge$ x is haunting his house]].

b. $\neg\exists x$[John does not believe [that x is a ghost $\wedge$ x is haunting his house]].

(48) a. $\forall x$[x is an object $\rightarrow$ John believes [that x is a Chinese ghost $\wedge$ x is haunting his house]].

b. $\forall x$[x is an object $\rightarrow$ John believes [that x is a ghost $\wedge$ x is haunting his house]].

Now the formulae (48a) and (48b) end up with a wrong direction of entailment: (48a) entails (48b), a wrong result. It is easy to see why this is so. If it is true that every object is such that John believes it is a Chinese ghost, it is also true that every object is such that John believes it is a ghost. It is equally easy to see that if it is true that every object is such that John believes it is a ghost, it does not follow that every object is such that John believes it is a Chinese ghost (it may be a Japanese ghost).

Similarly, according to unselective binding, the following two sentences (49a) and (49b) will be represented in (50a) and (50b), which are paraphrased as: there isn't an object such that if it is a Chinese philosopher and we invite it, Max will be offended; and there isn't an object such that if it is a philosopher and we invite it, Max will be offended, equivalent to (51a) and (51b).

(49) a. It is not true that if we invite some Chinese philosopher, Max will be offended.

b. It is not true that if we invite some philosopher, Max will be offended.

(50) a. $\neg\exists x$[[x is a Chinese philosopher $\wedge$ we invite x] $\rightarrow$ Max will be offended]

b. $\neg\exists x$[[x is a philosopher $\wedge$ we invite x] $\rightarrow$ Max will be offended]

(51) a. $\forall x$[x is an object $\rightarrow$ [x is a Chinese philosopher $\wedge$ we invite x $\wedge$ Max will not be offended]].

b. $\forall x$[x is an object $\rightarrow$ [x is a philosopher $\wedge$ we invite x $\wedge$ Max will not be offended]].

According to (41), (49b) should entail (49a). But in fact, the formulae end up with a wrong direction of entailment: (51a) entails (51b). It is easy to see that if every object is such that it is a Chinese philosopher and we invited and Max will not be offended, then every object is such that it is a philosopher and we invited and Max will not be offended.

Similarly if every object is such that it is a philosopher, it does not follow that every object is such that it is a Chinese philosopher (it may be a Japanese philosopher).

On the contrary, QR can derive the correct prediction of entailment, as indicated in (52a) and (52b) as the final representations. It is easy to verify that it is indeed (52b) that entails (52a), because the set of every philosopher properly contains the set of every Chinese philosopher.

(52) a. $\forall x$[x is a Chinese philosopher $\rightarrow$ we invite $x \wedge$ Max will not be offended]].
b. $\forall x$[x is a philosopher $\rightarrow$ we invite $x \wedge$ Max will not be offended]].

Again the failure in entailment prediction is quite general, extending to non-belief sentences as well. As long as an indefinite is required to take wide scope but with its restrictive property left in situ, the entailment relation is predicted to be in the wrong direction if we negate the whole sentence. Take the following two sentences for instance:

(53) John did not find some Chinese ghost.
a. $\exists x$[x is a Chinese ghost $\wedge$ [it is not true that John found x]].
b. $\exists x$[it is not true that [x is a Chinese ghost $\wedge$ John found x]].

(54) John did not find some ghost.
a. $\exists x$[x is a ghost $\wedge$ [it is not true that John found x]].
b. $\exists x$[it is not true that [x is a ghost $\wedge$ John found x]].

QR would produce the (a) version and unselective binding would produce the (b) version. By negating the above two sentences, we have (55) and (56) as final representations by QR and unselective binding respectively. The entailment relation is captured in (55), but not in (56).

(55) a. $\forall x$[x is a Chinese ghost $\rightarrow$ John found x]].
b. $\forall x$[x is a ghost $\rightarrow$ John found x]].

(56) a. $\forall x$[x is an object $\rightarrow$ [x is a Chinese ghost $\wedge$ John found x]].
b. $\forall x$[x is an object $\rightarrow$ [x is a ghost $\wedge$ John found x]].

Again, the problem arises from leaving the restrictive property in situ, which would make it part of the nuclear scope instead of part of the restrictor of universal quantification when sentential negation is added. While in QR, moving the restrictive property would make it part of the restrictor of universal quantification, the variable is properly restricted. Entailment relations differ in restrictor and nuclear scope because elements in restrictor and nuclear scope have different monotonicity properties. Elements in restrictor are decreasing, and elements in nuclear scope are increasing (Barwise and Cooper 1981). By unselective binding, entailment relation is not reversed; by QR, entailment relation is reversed.

3. Extending to wh-in-situ

In the previous section, we have shown that treating indefinites simply as pure variables in situ faces several semantic interpretational problems, and these problems are wider and more serious than previously thought. These problems are quite substantial because the argumentation developed so far is based on some basic laws in logic like the commutative law of conjunction, de Morgan's Law, and the law of quantifier negation.

It should, however, be noted that very few people in the unselective binding camp actually pursue this form of unselective binding for indefinites. The upshot is only to illustrate the problems facing the unselective binding approach in this form. Clearly knowing the problem of semantic misinterpretations, Heim's (1982) theory has an *NP-Prefixing* rule, which adjoins every non-pronominal NP to S (leaving behind a coindexed empty NP (trace)) and fixes the scope of quantification. It is like island-free QR. The indefinite could only be unselectively bound in a position obtained by this rule (QR) and unselective binding cannot happen across an intervening operator. Similarly in Kamp and Reyle (1993), it is postulated that all the NP-internal restrictions are entered into the box whenever the discourse variable is introduced. This amounts to saying that the descriptive content of indefinite must be along with the binder[8].

[8] If indefinites have to be 'moved', then this version of unselective binding ends up with the same representation as generated by QR. Due to this reason, we consider that this version of unselective binding is not fundamentally different from QR because movement of some sort is needed anyway,

This form of unselective binding approach has indeed been developed for wh-in-situ words, both in English and Chinese (Baker 1967, Lee 1986, Pesetsky 1987, Cheng 1991, Aoun and Li 1993, Cole and Hermon 1994, Shi 1994, Tsai 1999). In this section, we are going to show that this approach faces almost the same problems identified above for English indefinites.

3.1 Problems of LF movement approach

The unselective binding approach towards wh-construals is developed as a competing account, with good reasons, to LF movement approach. The classical analysis of LF movement stems from Chomsky (1977) and culminates in Huang (1982), who argues that a wh-in-situ expression can be treated as a quantifier, which undergoes covert raising to sentence initial position and binds a variable in its original position at a level of LF. Thus the LF representation of (57a) would be (57b)[9]:

(57) a. Zhangsan kanjian-le shei?
Zhangsan see-Asp who
'Who did Zhangsan see?'
b. [shei$_i$ [Zhangsan kanjian-le t$_i$]]?

Though the LF movement theory has been very influential and successful, it faces some problems, to be briefly discussed below.

3.1.1 No island constraints

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though the term 'movement' is not used.

[9] The following glossing symbols are used in this dissertation:

Asp	aspect marker
BA	disposal marker
BEI	passive marker
Cl	classifier
DE	NP modifier marker
Prt	particle
Q	question marker

One problem concerns the relatively free scope-taking ability of wh-phrases across various island constraints, as shown below[10].

(58) a. [taolun shenme] zui youyisi Subject Island
discuss what most interesting
'What is thing *x* such that it is the most interesting to discuss *x*?'

b. ni bijiao xihuan [shei zhu de cai]? Complex NP Island
you more like who cook DE dish
'Who is *x* such that you like dishes that *t* cooks better?'

c. Zhangsan [yinwei shei mei lai] er bu gaoxing Adjunct Island
Zhangsan because who not come then not happy
'Who is *x* such that Zhangsan is not happy because *x* did not show up?'

So something more must be said as to why covert LF movement of wh-phrases is different from overt wh-movement and more importantly from covert movement of strong quantifiers. Huang's proposal is that LF movement is immune to Subjacency though it is subject to other constraints (ECP). However, the stipulation that covert movement needs not obey island conditions is a statement of facts, not an explanation.

3.1.2 *Zhi* (only) and wh-in-situ

More serious challenge comes from the interaction of some focus words such as *zhi* 'only' and *wh*-phrases. As pointed out in the literature, *only* is associated with an element in its command domain (see, among others, Tancredi 1990). This is illustrated by the following sentences:

(59) a. He only likes Mary. (He doesn't love her.)
b. ta zhi xihuan Mali.
s/he only like Mali
'He only likes Mali.'

[10] Note that the wh-words that can escape these islands include wh-arguments like *shei* 'who', *shenme* 'what', *nage* 'which', and wh-adjuncts like *nali* 'where', *shenmeshihou* 'when', etc.

(60) a. He only likes Mary. (He doesn't like Sue.)
b. ta zhi xihuan Mali.
he only like Mali
'He only likes Mali.'

The postverbal object associated with *only* cannot undergo overt movement: it cannot be topicalized as in (61), nor can it be (*wh*-) moved to form questions or relative structures as in (62).

(61) a. *Mary$_i$, he only likes x_i.
b. *Mali$_i$, ta zhi xihuan x_i.
he only like Mali
'He only likes Mali.'

(62) a. *Who$_i$ does he only likes x_i?
b. *[ta zhi xihuan x_i de] na-ge ren$_i$.
he only like DE that-Cl person
'the person that he only likes x.'

The above facts are generalized in the Principle of Lexical Association (PLA), which encodes the restriction at work with *only* (Tancredi 1990):

(63) *Principle of Lexical Association:* An operator like *only* must be associated with a lexical constituent in its command domain.

Aoun and Li (1993), based on relevant facts regarding QP interaction and antecedent contained deletion (ACD), argue that the PLA must apply to covert movement as well. The PLA, thus, provides a test for the presence or absence of (overt and covert) movement. Interestingly, a wh-phrase can be associated with *zhi* 'only' in Chinese:

(64) ta zhi xihuan shei?
he only like who

'Who does he only like?'

If *wh*-phrases in such instances undergo movement, it is unexpected that *only* can still be associated with them, as illustrated in (64). This fact suggests that an in-situ *wh*-phrase stays in-situ even at LF. It does not undergo movement covertly. This argument poses a serious challenge to the LF movement approach, but strongly supports a non-movement approach to wh-phrases in Chinese. To my best knowledge, it has not been satisfactorily addressed by LF movement theorists (Soh 2005, cf. Yang 2008).

3.2 Wh-in-situ as variable

Perhaps if certain *wh*-phrases in situ do not exhibit island effects and can associate with *only*, it is possible that they are indeed in situ, in LF as well as in overt syntax. This is the unselective binding approach towards wh-interpretations, first proposed by Baker (1970) for English. According to this approach, a Q-morpheme, as an operator, can unselectively bind all the free variables in its c-command domain. If this approach is adopted, the LF representation for (57a) would be roughly (65):

(65) [Q_i [Zhangsan kanjian-le *shei*$_i$]]?

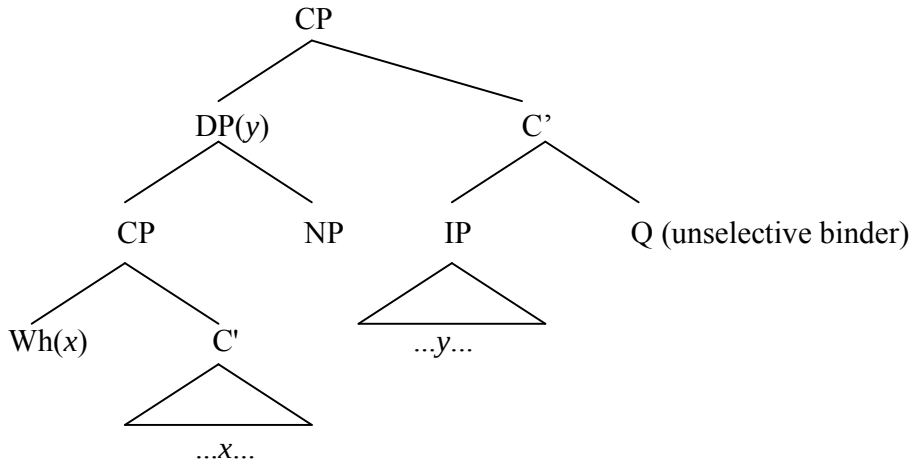
The unselective binding approach has been further developed in Nishigauchi (1990), Higginbotham and May (1981), Pesetsky (1987), Cheng (1991), Aoun and Li (1993), Cole and Hermon (1994), Shi (1994), Tsai (1999), Hua (2000), and others. In this account, w*h*-phrases, being variables, do not move in LF, hence they do not exhibit island effects. Since wh-phrases do not undergo the commonly assumed LF movement to some clause-initial position, there needs to be an alternative explanation for how these elements take scope. It is assumed that a Q-morpheme or question operator is present at the location where the *wh*-in-situ takes scope; from there, this operator can bind the variable introduced by the *wh*-phrase at an arbitrarily long distance.

These authors, though adopting the basic assumption of wh-as-variable, differ in many aspects. In Aoun and Li (1993), the wh-phrase does not move, but is co-indexed with a Qu operator which is linked to a (null) question particle (*ne*) through head-spec

agreement. What wh-questions have is operator movement from the Spec of the QP to the appropriate Spec of CP by S-Structure, which may induce island effects. The correct scope is obtained by treating Qu as quantificational and wh-phrase as variable. In Shi (1994), a Q morpheme is generated under Infl node. When the Q morpheme is raised from Infl to the head of CP, it will c-command everything dominated by the CP. The scope of a wh-expression is determined by the Q morpheme which binds it. If a wh-expression is bound by a matrix Q, it has matrix scope, i.e., a direct question interpretation. If it is bound by an embedded Q, it is interpreted as having embedded scope, i.e., an embedded indirect question reading. In Tsai (1994, 1999), wh-phrases (at least wh-arguments) are not inherently interrogative, nor do they show any evidence of any internally complete quantificational structure ('operator-variable complete'). They are just indefinites that lack inherent quantificational force, thus their quantificational force comes from other operators which merger in a higher position in the sentence, for example, the Q-operator directly base-generated in the relevant SpecCP.

In the above unselective binding approaches, wh-phrases do not undergo any movement of any kind (other elements may move). Let's call it *non-movement unselective binding approach*. On the other hand, Nishigauchi (1990)'s unselective binding approach is a *limited movement unselective binding approach*. In this theory, the idea of unselective binding is maintained: a wh-expression does not have any quantificational force; it is determined by some Q-element which bears a certain structural relation with it at LF. What differs is that wh-phrases need to move, but only within islands (like complex NP islands). This movement has the effect of making the entire complex NP identified as a *wh*-phrase (*feature percolation*). Since the entire DP is now identified as a *wh*-phrase, it can now move to Spec CP of the matrix clause (pied-piping), which is subject to island constraints. The wh-expression and the entire NP are translated as free variables, unselectively bound by the Q-element; hence both are unselectively assigned the quantificational force of the interrogative operator Q, which is ultimately analyzed as an existential quantifier. The seeming lack of subjacency at LF comes from the possibility of pied-piping an entire island. This mechanism can be illustrated in the following tree.

(66)



Let's illustrate this theory with a Chinese example. Under the pied-piping hypothesis, the LF movement of *shenme* 'what' pied-pipes the entire complex NP *mai shenme de ren* 'person that sells what' and places it in [SpecCP]. Since the *wh*-phrase *shenme* 'what' stays within the relative clause containing it, the pied-piping movement does not violate Subjacency.

(67) a. ni zui xihuan mai shenme de ren?
you most like sell what DE person
'What is the thing *x* such that you most like people who sell *x*?'
b. [$_{CP}$ Q [shenme$_j$ mai t_j de ren]$_i$ [$_{IP}$ ni zui xihuan t_i]]?

The idea that wh-expressions in Chinese are like English indefinites without inherent quantificational force is appealing. The lack of island constraints and association with *only* in wh-questions follow naturally from the simple reason that there is no movement. Since the operator-variable pair [Op$_{[Q]}$, wh] is built via unselective binding and since movement is not involved, we do not expect any island effect. LF movement, as a movement operation, should be sensitive to island boundaries, but binding is not. Similarly, since *wh*-phrases do not undergo any movement, it is expected that *only* can be associated with them. These are real advantages to the unselective binding approach, and pose serious problems to other theories that treat indefinites as inherently quantificational expressions.

3.3 Hamblin/Karttunen-semantics of wh-questions in Chinese

Nevertheless, the non-movement approach towards wh-in-situ also faces some problems of its own. It may not be the best alternative as a competing theory towards wh-construals in Chinese. Though the LF movement is in a disadvantageous position to the unselective binding approach in the above two aspects, it works better than the latter in other aspects. Before we point out the problems arising from unselective binding approach, it is necessary to elaborate on the semantics of wh-questions a little because our arguments mainly come from semantics.

Works either in the LF movement or in the unselective binding traditions usually focus on the syntactic component, while the semantic derivations under both approaches are ignored. No semantic compositional rules are given to match with the syntactic structure. Assuming that the semantic value of a question is a set of its corresponding possible answers (Hamblin 1973), the question in (68) denotes a set of propositions which are possible answers to that question[11].

(68) a. Who smiled?

b. $\lambda p \exists x[\text{person}_w(x) \& p=\lambda w'.\text{smile}_{w'}(x)]$

c. p={John smiled, Mary smiled, …}

Given the general semantics of wh-questions, below we will examine the derivations of the semantics of Chinese wh-questions according to the three major theories: LF movement, non-movement unselective binding, and limited movement unselective binding.

3.3.1 Under LF movement approach

According to this theory, the wh-phrase, being quantificational element, covertly

[11] Karttunen (1977) modifies Hamblin's proposal, and argues that denotations of questions contain only true answers. The conjunct p(w) filters out the false answers. It guarantees that only those propositions that are true in the world w are in the set.

(i) $\lambda p \exists x[p(w) \& \text{person}_w(x) \& p=\lambda w'.\text{smile}_{w'}(x)]$

moves to a SpecCP position to obtain scope. Take the following wh-question for example:

(69) a. ni xihuan shei?
you like who
'Who do you like?'
b. [$_{CP}$ shei $_{C}$ [$_{IP}$ ni xihuan t]]

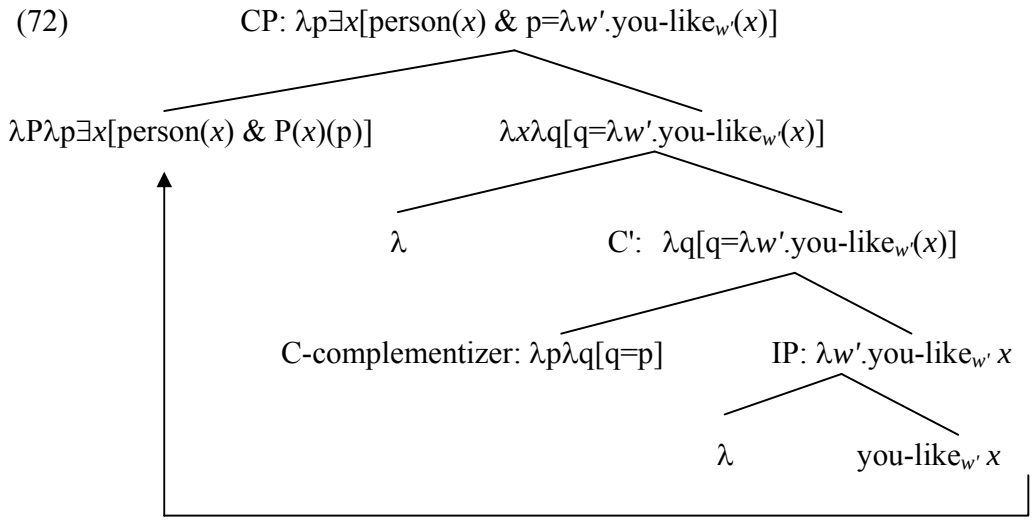
In Hamblin's theory of questions, there is no semantic need for Q-morpheme or C-complementizer since wh-phrases already denote sets of alternatives, which end up with question denotation (see chapter 2 for more details of this theory of questions). However, in (69), the wh-phrase *shei* is an existential quantifier that cannot yield a question reading itself, so in order to derive a Hamblin denotation for this question, we need the interrogative C to play a role here, which turns a proposition into a set of propositions (Karttunen 1977). The interrogative C can be thus defined as in (70a). The resulting C'-denotation is what Karttunen calls a proto-question: it has the semantic type of a full-grown question. The wh-phrase *shei* can then be translated as in (70b), the denotation of an existential quantifier (Lahiri 2002).

(70) a. ⟦C⟧=λpλq[q=p]
b. ⟦shei⟧=λPλp∃*x*[person(*x*) & P(*x*)(p)]

The function of the wh-phrase is to take a question denotation C' as argument and existentially close the free variable within it, which is the semantic value of the trace of the wh-phrase. The symbol P is a variable which corresponds to the semantic content of the CP minus the wh-phrase.

(71) [$_{CP}$ shei [$_{C'}$[$_{IP}$ ni xihuan t]]]

(72)



(73) a. IP=λw'.you-like$_{w'}$ x

b. C'=C(IP)=λpλq[q=p](λw'.you-like$_{w'}$ x)=λq[q=λw'.you-like$_{w'}$(x)]

c. λ-abstraction: λxλq[q=λw'.you-like$_{w'}$(x)]

d. CP=λPλp∃x[person(x) & P(x)(p)](λxλq[q=λw'.you-like$_{w'}$(x)])

=λp∃x[person(x) & p=λq[q=λw'.you-like$_{w'}$(x)]]

=λp∃x[person(x) & p=λw'.you-like$_{w'}$(x)]

In the formula, the part p=λw'.you-like$_{w'}$(x) embedded under the complementizer is the nucleus of the question, or more exactly the proposition to the question. So all the possible answers to the question is a set of propositions in the form of p=λw'.IP$_{w'}$(x), x is a value existentially closed and restricted by the predicate *person*(x).

3.3.2 Under the non-movement unselective binding approach

In the framework of unselective binding, we would have a different logical representation for wh-questions. The wh-phrase is translated as a variable and an open predicate like *shenme* = *thing*(x) or *shei* = *person*(x). The variable x is predicated of the main predicate in λw.IP embedded under the complementizer; the independent predicate introduced by the wh-phrases needs to occur in the part λw.IP too for restricting the variable. That is, the following semantic representation (74a) is not appropriate, because

the variable *x* is unspecified, we could not know the domain it may choose, and it may stand for anything in the universe (see section 3.5 for more discussion). The correct one should be (74b).

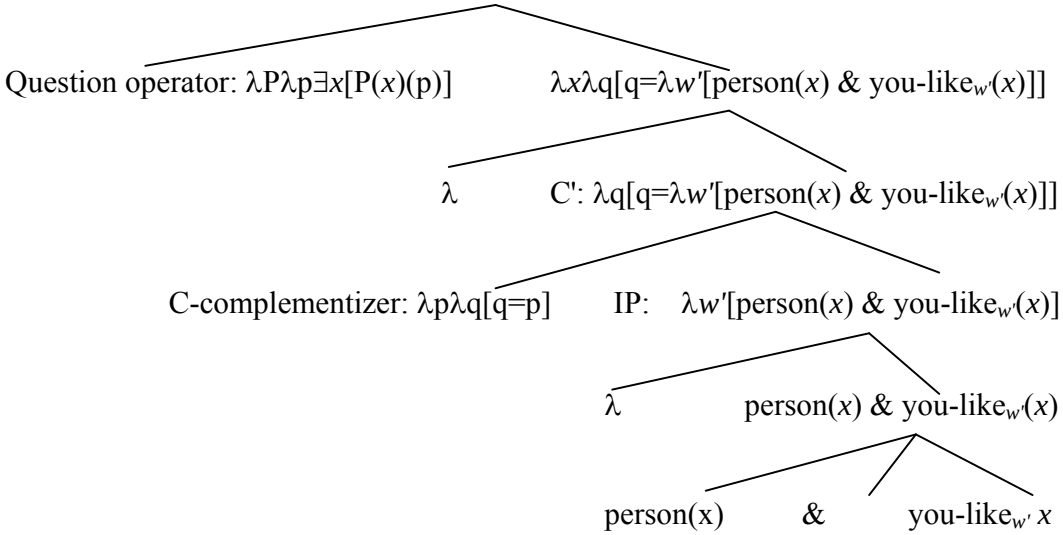
(74) a. *OP_x……[P(*x*)]

b. OP_x……[NP(*x*) & P(*x*)]

The variable *x* needs to be bound by a question operator (Q-morpheme) which can be defined as λPλp∃*x*[P(*x*)(p)]. Its function is to provide an existential operator to bind the wh-variable. The C-complementizer is again λpλq[q=p]. The wh-phrase introduces a predicate *person*(*x*), which is in situ during the derivation. Then the question (69a) is represented below:

(75) [$_{CP}$ Q [$_{C'}$[$_{IP}$ ni xihuan shei]]]

(76)



(77) a. IP=λ*w*′[person(*x*) & you-like$_{w'}$(*x*)]

b. C'=C(IP)=λpλq[q=p](λ*w*′[person(*x*) & you-like$_{w'}$(*x*)])

=λq[q=λ*w*′[person(*x*) & you-like$_{w'}$(*x*)]]

c. λ-abstraction: λ*x*λq[q=λ*w*′[person(*x*) & you-like$_{w'}$(*x*)]]

d. CP=λPλp∃*x*[P(*x*)(p)](λ*x*λq[q=λ*w*′[person(*x*) & you-like$_{w'}$(*x*)]])

$=\lambda p\exists x[\lambda x\lambda q[q=\lambda w'[\text{person}(x)\ \&\ \text{you-like}_{w'}(x)]](x)(p)]$

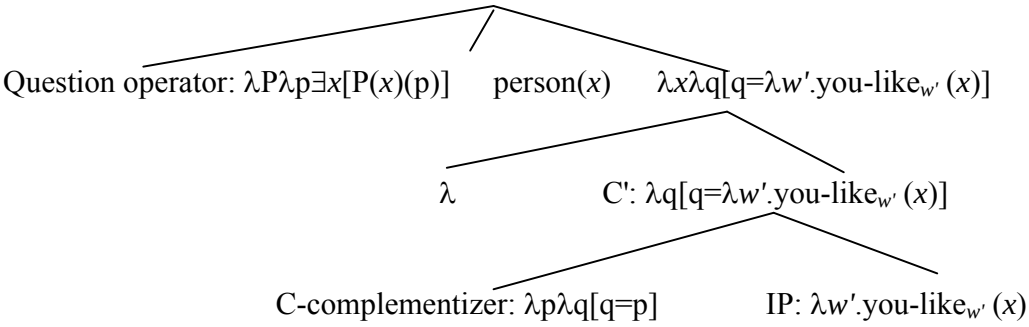
$=\lambda p\exists x[p=\lambda w'[\text{person}(x)\ \&\ \text{you-like}_{w'}(x)]]]$

3.3.3 Under the limited movement unselective binding approach

The same derivation for unselective binding outlined in the previous subsection can be extended to Nishigauchi (1990) with one difference: wh-expression (and the island it occurs in) needs to move to the specifier position of CP, from there they are assigned the existential quantificational force by a question operator, which unselectively binds the wh-expression.

(78) $[_{CP}$ Q shei $[_{C'}[_{IP}$ ni xihuan t]]]

(79) CP: $\lambda p\exists x[\text{person}(x)\ \&\ p=\lambda w'.\text{you-like}_{w'}(x)]$



(80) a. IP=$\lambda w'.\text{you-like}_{w'}(x)$

b. CP=C(IP)=$\lambda p\lambda q[q=p](\lambda w'.\text{you-like}_{w'}(x))$

$=\lambda q[q=\lambda w'.\text{you-like}_{w'}(x)]$

c. λ-abstraction: $\lambda x\lambda q[q=\lambda w'.\text{you-like}_{w'}(x)]$

d. CP: $\lambda P\lambda p\exists x[P(x)(p)](\lambda x[\text{person}(x)\ \&\ \lambda q[q=\lambda w'.\text{you-like}_{w'}(x)]])$

$=\lambda p\exists x[[\text{person}(x)\ \&\ \lambda q[q=\lambda w'.\text{you-like}_{w'}(x)]](p)]$

$=\lambda p\exists x[\text{person}(x)\ \&\ p=\lambda w'.\text{you-like}_{w'}(x)]$

3.3.4 Comparison

The above three subsections outline the compositional semantics of wh-questions in the three major syntax/semantic approaches. For a simple wh-question ‘who do you like?’ the three approaches yield the following results, respectively:

(81) a. $\lambda p \exists x[\text{person}(x) \ \& \ p=\lambda w'.\text{you-like}_{w'}(x)]$

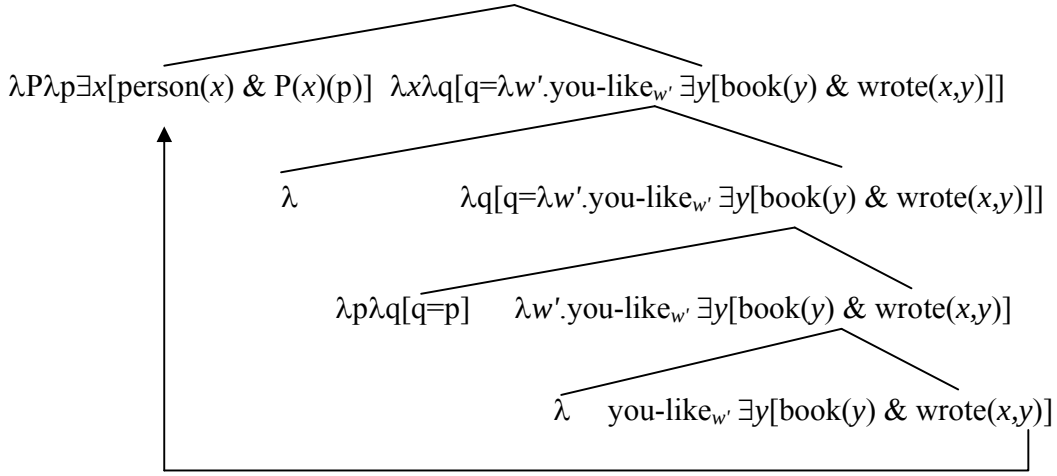
b. $\lambda p \exists x[p=\lambda w'[\text{person}(x) \ \& \ \text{you-like}_{w'}(x)]]]$

c. $\lambda p \exists x[\text{person}(x) \ \& \ p=\lambda w'.\text{you-like}_{w'}(x)]$

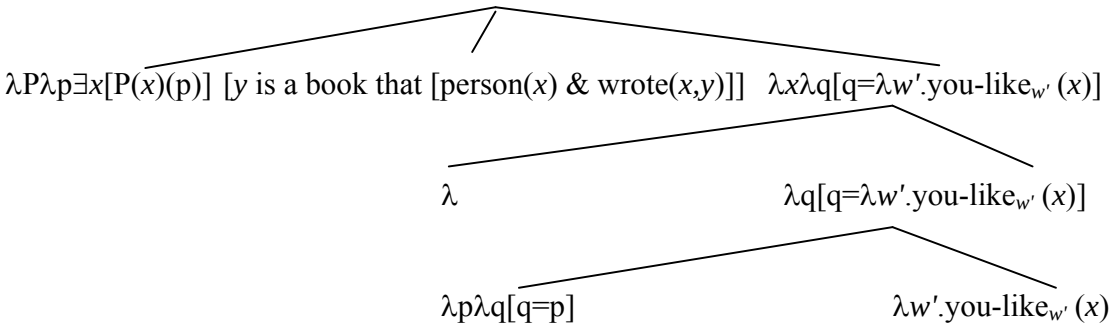
For the version of non-movement unselective binding, the result is different in that the predicate of the wh-phrase is left in-situ within the proposition *p*. The LF movement approach and limited movement unselective binding give the same result. But this is only superficial. When the wh-phrases occur within an island, such as a complex NP island, the two approaches (and the non-movement one, too) yield very different results in the semantics of wh-questions. Consider (82), for which the three syntactic theories (LF movement, limited movement unselective binding, and non-movement unselective binding) will yield (83), (84), and (85) respectively.

(82) ni xihuan shei xie de shu?
you like who write DE book
'Who is *x* such that you like books that *x* wrote?'

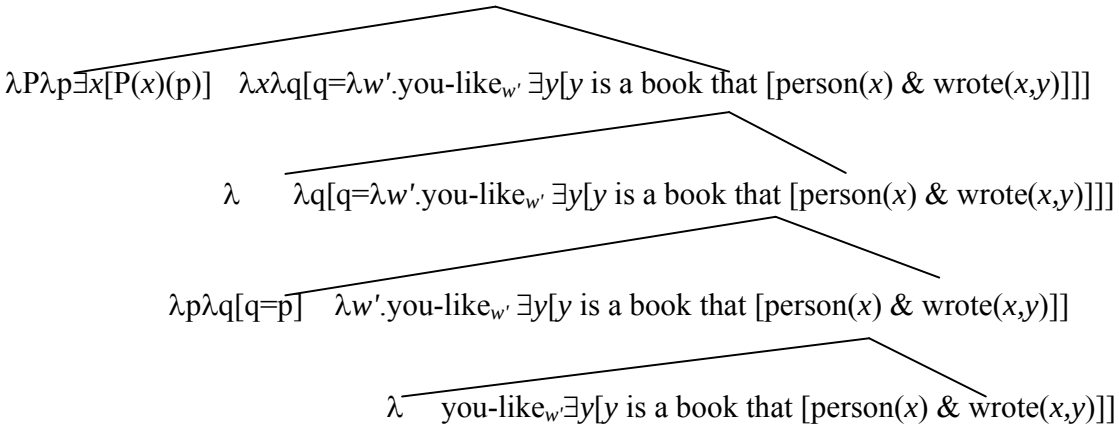
(83) CP: $\lambda p \exists x[\text{person}(x) \ \& \ p=\lambda w'.\text{you-like}_{w'} \ \exists y[\text{book}(y) \ \& \ \text{wrote}(x,y)]]$



(84) λp∃*x*∃*y*[*y* is a book that [person(*x*) & wrote(*x*,*y*)] & p=λ*w′*.you-like$_{w'}$ (*x*)]



(85) CP: λp∃*x*[p=λ*w′*.you-like$_{w'}$ ∃*y*[*y* is a book that [person(*x*) & wrote(*x*,*y*)]]]



In the following two sections, we argue that only the LF movement approach yields the correct semantics for wh-questions. The other two versions of unselective binding, as they stand, do not yield the correct semantics for interrogative wh-questions.

3.4 Problems of the non-movement version of unselective binding

This section is targeted at the version of non-movement unselective binding. The arguments are mainly those that we presented in section 2 for the case of English indefinites.

3.4.1 Unwanted specifications in relative and complement clauses

Wh-in-situ words can freely outscope relative clauses and noun complement clauses to take sentence-initial scope. In (86), the QR approach can extract *shei* out of the island.

The representation (86a) gives the correct truth condition. Unselective binding leaves the descriptive content of wh-in-situ words in situ, which will cause the same problem as it is for English indefinites discussed in section 2.1. For example, the formula (86b) is predicted to mean: what is something such that Zhangsan believes the rumor that it is a person and it has spread. In this formula, *something is a person* is one part of the rumor, which is not.

(86) Zhangsan xiangxin shei chuanbo de yaoyan?
Zhangsan believe who spread DE rumor
'Who is *x* such that Zhangsan believes the rumor that *x* has spread?'
a. QR: λp∃*x*[*x* is a person ∧ p=John believes the rumor that [*x* has spread]]
b. λp∃*x*[p=John believes the rumor that [*x* is a person and *x* has spread]]

The following sentence (87) is a noun complement clause. In its wide scope of *shei*, the QR approach can extract the existential out of an island. The representation (87a) gives the correct truth condition. By unselective binding, the formula (87b) is generated. It predicts that the rumor itself has to include an unwanted part of content: something is a person, which is not. The rumor is only that some person can be elected as president.

(87) Zhangsan xiangxin shei nenggou dangxuan zongtong de yaoyan?
Zhangsan believe who can elect president DE rumor
'Who is *x* such that Zhangsan believes the rumor that *x* can be elected president?'
a. QR: λp∃*x*[*x* is a person ∧ p=John believes the rumor that [*x* can be elected as president]]
b. Unselective binding: λp∃*x*[p=John believes the rumor that [*x* is a person and *x* can be elected as president]]

In ordinary relative clauses headed by ordinary common nouns like *xiaoshuo* 'novel', *wenzhang* 'article', etc that cannot take complement clause, unselective binding would produce uninterpretable representations. For example, the following sentence (88) should be represented as in (88b) by unselective binding, which does not make sense.

(88) Zhangsan xihuan shei xie de xiaoshuo?
Zhangsan like who write DE novel
'Who is *x* such that Zhangsan likes novels that *x* wrote?'
a. QR: λp∃*x*[*x* is a person ∧ p=John likes the novels that [*x* writes]]
b. Unselective binding: λp∃*x*[p=John likes the novels that [*x* is a person and *x* wrote]]

In order to make sensical interpretation, the descriptive content of the wh-phrase should not stay in-situ, but must be interpreted in a displaced position out of the question proposition. This is what unselective binding theorists actually do. For example, in Tsai (1999), the descriptive content of the wh-phrase is pulled out, not stays in-situ, as witnessed from the paraphrase (89c)[=(18) in Tsai) that Tsai gives us 'What is the *thing/job* x such that…' (italics added). In this representation, the descriptive content of the wh-in-situ has been assumed to undergo an implicit movement[12]. The correct one according to the unselective binding of the non movement version should be (89d), which, however, cannot be maintained.

(89) a. Akiu kan-bu-qi zuo shenme de ren?
Akiu look-not-up do what DE person
b. [$_{CP}$ Op$_x$ [Q] [$_{IP}$ Akiu kan-bu-qi [$_{DP}$ [$_{CP}$ Op$_i$ [$_{IP}$ e$_i$ zuo shenme(*x*)]] de ren$_i$]?
c. 'What is the thing/job *x* such that Akiu despises [people [who do *x*]]?'
d. 'What is *x* such that Akiu despises [people [who do *x* and *x* is a thing/job]]?'

3.4.2 Predicate conjunction

In the Hamblin/Karttunen-semantics of questions, questions denote sets of propositions which are possible or true answers to the questions. In unselective binding approach, since the wh-expressions are treated as in-situ properties which are interpreted as conjuncts with the main predicates, the propositions to questions would consist of an

[12] I guess the other unselective binding theorists should also do the same (Audrey Li, pc)

evaluation of two conjuncts. This predicts that the answer to a question may contain another conjunct: *x* is NP. But this kind of answers is redundant if not senseless, because '*x* is an NP' is not part of the proposition nucleus in the denotation set[13]. For example, the question (90a) would be represented by λp∃*x*[p=I like *x* and *x* is a person], to which (90b) would be a proper answer. Similarly, the question (91a) would be represented by λp∃*x*[p=I like *x* and *x* is a philosopher][14], to which (91b) would be a proper answer.

(90) a. ni xihuan shei?
you like who
'Who do you like?'
b. wo xihuan Zhangsan bingqie Zhangsan shi yi-ge ren.
I like Zhangsan and Zhangsan be one-Cl person
'I like Zhangsan and Zhangsan is a person.'

(91) a. ni xihuan na-ge zhexuejia?
you like which philosopher
'Which philosopher do you like?'
b. wo xihuan Chomsky bingqie Chomsky shi yi-ge zhexuejia.
I like Chomsky and Chomsky be one-Cl philosopher
'I like Chomsky and Chomsky is a philosopher.'

Because of the logical rule of conjunction (A+B=B+A), unselective binding makes no difference in the truth conditions between A(*x*)+B(*x*) and B(*x*)+A(*x*). This would make

[13] This problem is pointed out in a footnote (17) in Reinhart (1997), who commented that technically speaking, the representation (i/c) of the following sentence should allow the relevant answer to be (i/d).

(i) a. Who will be offended if we invite which philosopher?
b. $Q<_{1,2}>$ [who_2 [e_2 will be offended if we invite which $philosopher_1$]]
c. λp∃<*x*,*y*> & p= ((we invite *y* & *y* is a philosopher)→(*x* will be offended))
d. Lucie will be offended if we invite Quine and Quine is a philosopher.

[14] I treat *shei* and *na-ge ren* as semantically same, though they are different pragmatically in that the set denoted by *shei* is usually infinite but the set denoted by *na-ge ren* is finite.

absurd interpretations. Heim (1994) points out that this approach makes the following two questions synonymous, which are, however, not equivalent.

(92) a. Which toys are gifts?= $\lambda p \exists x[p=\lambda w[toy_w(x) \wedge gift_w(x)]]$

b. Which gifts are toys?= $\lambda p \exists x[p=\lambda w[gift_w(x) \wedge toy_w(x)]]$

Similarly, the following sentence (93a) is a predicational copular sentence in which a question is asked for the identity of a teacher who is a linguist. But its semantic representation in terms of unselective binding would make it truth-conditionally indistinguishable from (94a), which needs a different answer.

(93) a. nage laoshi shi yuyanxuejia?
which teacher be linguist
'Which teacher is a linguist?'

b. $\lambda p \exists x[p=x$ is a teacher and x is a linguist]

(94) a. nage yuyanxuejia shi laoshi?
which linguist be teacher
'Which linguist is a teacher?'

b. $\lambda p \exists x[p=x$ is a linguist and x is a teacher]

3.4.3 Truth conditions

Reinhart (1992, 1997) focuses on the possible weak truth conditional problem produced by leaving wh-restrictor in situ[15]. The problem is that if wh-in-situ doesn't move and unselective binding applies to it from some distant position, a crucial result of the analysis is that although their scope is identical to that of a moved wh-phrase, the N-restriction like *person(x)* or *philosopher(x)* stays in situ, rather than occurring as a restriction on the operator. The direct result is that anything that does not belong to the set denoted by the lexical restriction can be also evaluated, failing to capture the correct truth conditions. Sentence (95a) is a frequently cited illustration of this point.

[15] In Reinhart, only *which NP* is considered, but it is clear the even bare wh-words like *who* and *what* also display weak truth condition.

(95) a. Who will be offended if we invite which philosopher?

b. $Q<_{1,2}>$ [who_2 [e_2 will be offended if we invite which $philosopher_1$]]

c. $\lambda p \exists <x,y>$[p=we invite *y* & philosopher (*y*)→*x* will be offended]

d. Lucie will be offended if we invite Donald Duck and (Donald Duck is not a philosopher).

The final logical representation by unselective binding will be that in (95c). It turns out that the value for *y* can be anything in the world, since its restriction occurs in the antecedent clause of an implication. Suppose we chose Donald Duck as a value for *y* in (95c). Since he is not a philosopher, the antecedent clause is false, and the implication is true for this value. So, if (95c) was the correct representation), (95d) should have been an appropriate answer. The representation yielding the correct set of answers in such cases is that the restriction is pulled out of the implication, yielding the LF (96) which correctly allows the values for *y* to be all and only those individuals who are philosophers and for whom the implication is true.

(96) a. [which $philosopher_1$ [who_2 [e_2 will be offended if we invite e_1]]]

b. $\lambda p \exists x \exists y$[*y* is a philosopher & p=[we invite *y*→*x* will be offended]]

In addition to the above weak truth condition, unselective binding would lead to more problems (see section 2.3 above for more details). Consider the following sentence with negated belief verbs *bu xiangxin* 'not believe'. In the unselective binding framework, sentence (97a) would be assigned the logical representation of (97b), equivalent to (97c), which, however, makes several wrong predictions.

(97) a. Zhangsan bu xiangxin nage zhexuejia hui bei yaoqing?
Zhangsan not believe which philosopher will BEI invite
'Which philosopher is *x* such that Zhangsan does not believe *x* will be invited?'

b. $\lambda p \exists x$[p=Zhangsan does not believe [*x* is a philosopher and *x* will be

invited]]

c. λp∃*x*[p=Zhangsan does not believe *x* is a philosopher or Zhangsan does not believe *x* will be invited]

Suppose Zhangsan believes that Donald Duck is not a philosopher, this question can be truthfully answered by the following two contradictory answers[16]. The answer (98a) can be obtained by making 'Zhangsan does not believe *x* is a philosopher' true and 'Zhangsan does not believe *x* will be invited' true too; the answer (98b) can be obtained by making 'Zhangsan does not believe *x* is a philosopher' true but 'Zhangsan does not believe *x* will be invited' false[17].

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[16] In these answers, we ignore the part of '*x is a philosopher*' that may be included in the propositions, which we have already shown is redundant. So we only concentrate on the part of '*x will be invited*' to target the truth conditional problem.

[17] Similarly the same problems can be seen in wh-questions of English. In the following wh-question, if the wh-phrase is translated into an open formula introducing variable *philosopher(x)* in situ bound by a higher operator, it gives rise to the logical form (i/c). But according to this formula, this question can be truthfully answered by the following six answers in (ii), (iii), and (iv).

(i) a. Who does not believe which philosopher will be invited?

b. $Q<_{1,2}>$ [who_2 [e_2 does not believe which $philosopher_1$ will be invited]]

c. λp∃<*x*,*y*>[p= *x* NOT believe [*y* is a philosopher and *y* will be invited]

(ii) a. There is a linguist, John, such that Lucie does not believe that it is a philosopher and will be invited.

b. There is a philosopher, John, such that Lucie does not believe that it is a philosopher and will be invited.

(iii) a. There is a linguist, John, such that Lucie does not believe that it is a philosopher but believes it will be invited.

b. There is a philosopher, John, such that Lucie does not believe that it is a philosopher but believes it will be invited.

(iv) a. There is a linguist, John, such that Lucie believe that it is a philosopher but does not believe it will be invited.

b. There is a philosopher, John, such that Lucie believe that it is a philosopher but does not believe it will be invited.

(98) a. Zhangsan bu xiangxin Donald Duck hui bei yaoqing.
Zhangsan not believe Donald Duck will BEI invite
'Zhangsan does not believe Donald Duck will be invited.'
b. Zhangsan xiangxin Donald Duck hui bei yaoqing.
Zhangsan believe Donald Duck will BEI invite
'Zhangsan believes that Donald Duck will be invited.'

3.5 Problems of the limited movement unselective binding approach

This section is targeted at the version of unselective binding developed by Nishigauchi. Some arguments are well-known in the literature; some are new or further elaborated.

3.5.1 Scope interaction

Fiengo, Huang, Lasnik and Reinhart (1988) pointed out that Nishigauchi's (1990) unselective binding approach predicts that a wh-in-situ contained in a complex NP cannot take scope over the head of the complex NP. Consider the following sentence:

(99) mei-ge ren dou mai-le [yi-ben [shei xie de] shu]?
everybody all buy-Asp one-CL who write DE book
'Who is the person *x* such that everybody bought a book that *x* wrote?'

In this sentence, the wh-phrase *shei* 'who' is contained in a complex NP *yi-ben shei xie de shu* 'a book that who wrote', which is itself an existentially quantified NP. As indicated in the translation, the sentence has a reading according to which the wh-phrase has the widest scope, the existential NP headed by *yi-ben* has the narrowest scope, while the subject 'everybody' has an intermediate scope. This is true as the question can be answered by supplying the identity of a single author, with the resulting sentence understood in the distributive sense, i.e., each person bought a different book written by the author. The availability of this reading means that *shei* 'who' in (99) must be allowed to move out of the complex NP and beyond the subject 'everybody' to give the following LF representation, a case like 'inversely linked quantification'. But this move violates

Subjacency and destroys the original purpose of the pied-piping hypothesis.

(100) $[_{CP}$ shei$_i$ $[_{IP}$ mei-ge ren$_j$ $[_{IP}$ [yi-ben t_i xie de shu]$_k$ $[_{IP}$ t_j dou mai-le t_k]]]]
who everybody one-CL write DE book all buy-Asp

3.5.2 Proper answerhood

von Stechow (1996) discovers that the LF representations resulting from pied piping are not suitable for deriving the desired answerhood. Take the following Japanese sentence for example, (101c) is Nishigauchi's paraphrase for the question, and (101d) is an LF which corresponds piece by piece to the paraphrase.

(101) a. Kimi-wa $[_{PP}$ $[_{CP}$ dare-ga kai-ta] hon-o] yomi-masi-ta-ka
You-TOP who-NOM wrote book-ACC read Q
b. $[_{CP}$ $[_{PP}$ $[_{CP}$ dare-ga$_j$ t_j kai-ta] hon-o]$_i$, $[_{C'}$ Kimi-wa t_i yomi-masi-ta ka$_{i/j}$]
c. For which *x*,*y*, *x* a book, *y* a person that wrote *x*, did you read *x*?
d. $\lambda p \exists x \exists y[\text{book}_@(x) \,\&\, \text{person}_@(y) \,\&\, \text{write}_@(y,x) \,\&\, p=\lambda w.\text{read}_w(\text{you}, x)]$

In the nucleus $p=\lambda w.\text{read}_w(\text{you}, x)$ of this formula, we find it contains only a variable for books, but none for persons. The "person" variable *y* does not occur in the nucleus, so it has no influence on the range of possible answers. To see this, assume that the only books you read in the actual world are *The Blue Chamber Lord* and *The Children of Darkness*, both written by Wolf von Niebelschtitz. Given this scenario, Nishigauchi predicts that the true answers to (101a) are $\{\lambda w.\text{read}_w(\text{you}, \textit{The Blue Chamber Lord}),$ $\lambda w.\text{read}_w(\text{you}, \textit{The Children of Darkness})\}$ (I read *The Blue Chamber Lord*, I read *The Children of Darkness*). Clearly, this prediction is inadequate. An appropriate answer to (101a) under the circumstance depicted would be a proposition like 'I read the books which Wolf von Niebelschiitz wrote'. This answer should be represented as in (102a), where $\sum y[\ldots y \ldots]$ is the largest group *y* satisfying condition [. . . *y* . . .]. This answer can only be obtained if question (101a) has the denotation of (102b):

(102) a. $\lambda w.\text{read}_w(\text{you}, \sum y[\text{books}_w(y) \,\&\, \text{write}_w(\text{Wolf von Niebelschiitz}, y)])$

b. $\lambda p \exists x[\text{person}(x) \ \& \ p = \lambda w.\text{read}_w(\text{you}, \sum y[\text{books}_w(y) \ \& \ \text{write}_w(x,y)])]$

Formula (102b) makes an appropriate structure in which only the wh-phrase is displaced but not the entire island. In this formula, the pied-piped material 'books which *x* wrote' is located in the nucleus, so it varies over persons. This LF formula violates the Ross constraint, but it correctly represents the meaning of the question, which is a Hamblin/Karttunen formula. Nishigauchi's theory predicts that the Japanese question (101a) is synonymous with "Which book that someone wrote did you read?" But the Japanese question doesn't mean that. The question is after the identity of persons and which particular books these persons have written is not asked at all. The books need not be mentioned in the answer. This argument extends to Chinese wh-questions. The formula (103b) predicts to mean: 'For which *x*,*y*, *x* a book, *y* a person that wrote *x*, do you most like *x*?' But what we want is: 'For which person *x*, do you most like a book that *x* wrote?'

(103) ni zui xihuan shei xie de shu?
you most like who write DE book
'Who is *x* such that you most like books that *x* writes?'
a. $[_{CP}\ [\text{shei}_j\ t_j\ \text{xie de shu}]_i\ [_{IP}\ \text{ni zui xihuan}\ t_i]]$?
b. $\lambda p \exists x \exists y[\text{book}(x) \ \& \ \text{person}(y) \ \& \ \text{write}(y,x) \ \& \ p = \lambda w.\text{most-like}_w(\text{you}, x)]$

3.5.3 Unwanted specifications in relative and complement clauses

In Nishigauchi's (1990) version of unselective binding, the wh-phrase moves, therefore it can be interpreted out of some offending operators (such as negation, belief verb, etc). Consequently, it is free from *some* semantic problems that we have examined in previous sections. For example, it does not have the problem of truth conditions and the problem of predicate conjunction in complement clauses of belief verbs[18]. However, it still has the problem of unwanted specification of head nouns in relative clauses.

[18] Nishigauchi did not consider *if*-adjunct islands. Presumably the wh-word moves to a SpecCP position within the island, and the adjunct island is made +wh. Since the wh-word is still within if-conditional, the weak truth conditional problem persists.

The problem is easy to pin down as we have already discussed in several places above. In the Pied-Piping theory, the wh-phrase, though moves, is still confined within the relative clause and hence under the dominance of the head noun. This would imply that the predicate of wh-phrase like *person*(*x*) or *student*(*x*) is evaluated within the relative clause since the movement does not cross the head noun, which cannot be maintained. Hence in order to make sensical interpretation, the descriptive content of the wh-phrase must be pulled out of the complex NP structure. That is what Nishigauchi actually does just like Tsai (1999), as evidenced in the paraphrase (104c) below.

(104) a. Kimi-wa [$_{PP}$ [$_{CP}$ dare-ga kai-ta] hon-o] yomi-masi-ta-ka
You-TOP who-NOM wrote book-ACC read Q
b. [$_{CP}$ [$_{PP}$ [$_{CP}$ dare-ga$_j$ t$_j$ kai-ta] hon-o]$_i$, [$_{C'}$ Kimi-wa t$_i$ yomi-masi-ta ka$_{i/j}$]
c. For which *x*,*y*, *x* a book, *y* a person that wrote *x*, did you read *x*?
d. For which *x*,*y*, *x* is a book that *y* is a person and *y* wrote *x*, did you read *x*?

If we strictly follow the structure (104b), the predicted representation should be (104c), in which the representation '*x* is a book that *y* is a person and *y* wrote *x*' is uninterpretable at the very beginning. It cannot be compositionally derived. To make compositional derivation possible, Nishigauchi has moved (and has to move) the wh-phrase out of a relative clause, that is, his theory still belongs to the standard LF movement theory, and the problem of Subjacency is still there, contradictory to his claim that wh-movement is subject to Subjacency. This problem in Nishigauchi's theory is first pointed out by von Stechow. In a footnote (1996: 69), he makes the following remark:

> "A closer look at this analysis reveals two syntactic problems. The first is that, to my mind, it is an illusion that a transparent LF building on Nishigauchi's analysis could avoid a Subjacency violation: I take it that (21c)[=(104c) above] is Nishigauchi's "transparent LF," i.e., the paraphrase determining the interpretation. But here 'which person' has been moved out of the relative clause!"

3.5.4 Non-agreement in transparency in opaque contexts

Under the pied-piping theory, an entire island containing a wh-phrase undergoes wh-movement to Spec CP of the matrix clause. The entire NP and the wh-expression are assigned the quantificational force of the interrogative operator Q, which is ultimately analyzed as an existential quantifier. This predicts that the scope of the wh-expression and the larger NP is the same, above some operator of the main clause. However, sometimes this is not so. Consider the following sentence:

(105) a. Zhangsan xiang pinglun nage yuyanxuejia xie de shu?
Zhangsan want review which linguist write DE book
'Which linguist is *x* such that Zhangsan wants to review books that *x* wrote?'

b. λp∃*x*∃*y*[linguist(*x*) & book(*y*) & wrote(*x*,*y*) & p=Zhangsan wants to review *y*]

The above representation (105b), as would be assigned according to the pied-piping theory (as noted in section 3.5.3, here the wh-phrase has moved out of the larger NP), only give us the *de re* readings of both the wh-phrase and the whole phrase. There is no problem that the wh-phrase should be interpreted *de re* with regard to the intensional verb because wh-phrases in questions always take wide scope. The problem is that in the above representation, the larger NP is also given a *de re* reading. Intuitively, we find that in this sentence the prominent reading for the larger NP is a *de dicto* reading: Zhangsan does not have a particular book (or some particular books) in mind. The following scenario shows that it is quite natural to obtain a *de dicto* reading for the larger NP and *de re* reading for the wh-phrase.

Scenario 1: recently Zhangsan was reading the political writings written by Chomsky. Zhangsan does not know these writings are from a linguist (for example, he believes that a linguist cannot write such things). He felt that he must write something on these books, but not decided which one. Wangwu knows that the political writings are written by the famous linguist Chomsky, Lisi also knows that the political writings are written by a linguist but does not know who. They both know Zhangsan wants to review

one of these books. The following question-answer pair is felicitous on the *de re*/*de dicto* reading.

(106) Lisi: Zhangsan xiang pinglun nage yuyanxuejia xie de shu?
Zhangsan want review which linguist write DE book
'Which linguist is *x* such that Zhangsan wants to review books that *x* wrote?'
Wangwu: ta xiang pinglun Chomsky xie de shu. Dan hai meiyou jueding daodi na-yi-ben.
he want review Chomsky write DE book. But yet not decide hell which-one
'He wants to review a book written by Chomsky, but does not decide which one.'

Second, we doubt whether the larger NP can be interpreted *de re* at all, which means there is certain book (or books) that Zhangsan has in mind and wanted to review[19]. According to our intuition, the question (105a) only asks the identity of the author such that Zhangsan wanted to review some book written by him, any book will do. This intuition comes clearer from the following sentence (107) with numeral modification, which, according to my intuition, does allow a *de re* reading for the larger NP.

(107) Lisi: Zhangsan xiang pinglun yi-ben nage yuyanxuejia xie de shu?
Zhangsan want review one-Cl which linguist write DE book
'Which linguist is *x* such that Zhangsan wants to review a book that *x* wrote?'
Wangwu: ta xiang pinglun yi-ben Chomsky xie de shu, ji 911.
he want review one-Cl Chomsky write DE book. Be 911
'He does not want to review a book written by Chomsky, that is, *911*.'

[19] The bare NP cannot receive a definite or specific reading. This is the so-called Specificity Condition in wh-questions (Fiengo and Higginbotham 1981, Huang 1982).

In (107), if Zhangsan wants to review a book by Chomsky, the answer can be followed by a pronoun since there is a referent in the discourse. The *de re* readings can be made clear from the following scenario.

Scenario 2: recently Zhangsan was reading the political writings written by Chomsky. Zhangsan does not know these writings are from a linguist (for example, he believes that a linguist cannot write such things). He felt that he must write something on one of these books, and he decided to attack *911*. Lisi knows that the book is written by a linguist but does not know who. Wangwu knows that the political writings are written by the famous linguist Chomsky and he knows that Zhangsan will review *911*.

That the bare complex NP only gets a *de dicto* reading in intensional contexts follows naturally from Carlson's (1977) theory that kind terms always take narrower scope with respect to opacity-inducing predicates. It has been suggested that bare nouns in Chinese are terms referring to kinds (Chierchia 1998, Huang 2006, He & Jiang 2011). If this is correct, it is not far-fetched that a bare noun containing a wh-phrase can also be a kind referring term. We will not give an argumentation for this position here, but only provide one piece of evidence: a bare noun containing a wh-phrase can be used in kind-level predicate like *changjian* 'common'.

(108) na-ge yuyanxuejia xie de shu zui changjian?
which linguist write DE book most common
'Which linguist is *x* such that books that *x* wrote are common?'

If the assumption that a bare noun containing a wh-phrase is also a kind referring term is correct, we expect the above sentence (105) only allows a *de re*/*de dicto* reading for wh-phrase/larger NP respectively. This seems true. Under the pied-piping theory of Nishigauchi (1990), it is unclear how the larger NP can obtain a *de dicto* reading in opaque contexts because the entire island containing the wh-phrase undergoes wh-movement to SpecCP of the matrix clause, thus outscoping the opaque verb.

3.6 Presuppositional restriction of wh-pronouns

To sum up, we have investigated some problems facing unselective binding approach towards wh-in-situ expressions. Our conclusion is that some 'sort' of LF movement of the wh-in-situ seems needed anyway in order to make construals right. Unselective binding in which the descriptive content of the wh-phrase remains in situ is problematic. We also point out that even in the unselective binding theory, a careful examination reveals that the wh-phrase is actually pulled out of the relative clause island in order to give a sensical interpretation, as in Nishigauchi and Tsai. This is ironical in that these unselective binding theorists have tried to get rid of long-distance LF movement for wh-phrases, but eventually ended up with the opposite direction: pulling the wh-phrases out of islands.

Before ending our discussion, it should be noted that our arguments above are based on the assumption that wh-phrases are translated as open predicates like *person*(*x*). Wh-phrases are lexical expressions, with lexical features such as person, gender, etc. We take this as granted that wh-phrases introduce independent predicates (though very little content sometimes) which serve to restrict the variable. Otherwise we could not know the domain the unspecified variable *x* may choose. It may stand for anything in the universe. When someone utters a sentence containing *shei*, he is asking the identity of a person, not of other things. For example, if I saw an animal which I do not know, then I can ask you (109a) but not (109b) by pointing at it:

(109) a. zhe shi shenme?
this be what
'What is this?'
b. *zhe shi shei?
this be who
'Who is this?'

Therefore, we assume that wh-phrase like *shei* and *shenme* always have a hidden predicate *person* and *thing*, which must be inserted *somewhere* in the formula. And we have shown that if the predicate is interpreted in situ, various problems appear. However, one may argue that *shei* or *shenme* only introduces a variable *x*, the lexical content of

person or *thing* is presupposed to be known by speaker and hearer in the context[20]. Therefore, there is no added predicate in conjunction with the main predicate and the semantic problems can be circumvented.

This treatment is problematic for two reasons. First in questions involving *shenme*+NP or *nage*+NP, clearly there are lexical properties that must be computed in semantics, and hence must be entered somewhere in the semantic representations. We cannot simply assume that the lexical contents of NP are presupposed. If this is so, all noun phrases can be said to have presupposed lexical contents by speakers. This is a very wild assumption, though I have no good reason to refute it.

Second, according to the pragmatic view of presupposition (Keenan 1971, Stalnaker 1974, Karttunen 1973), it is the speaker, rather than the sentence he utters, has presupposition. The presupposition of a speaker are the proposition whose truth he takes for granted as part of the background of the conversation, or the *common ground* of the participants of the conversation. A sentence can be felicitously uttered only in contexts that entail all of its presuppositions. In our case, the speaker must know that there exist some entities predicated as *person* in the context in order to sincerely utter a *shei*-question. The predicate *person* is part of the speaker's presupposition. Therefore the predicate is presupposed to be known by the speaker, which will not go into semantic computation. In the following representation (110a), the variable *x* is supposed to stand for something predicated of *person*, which is presupposed by the speaker. In this question, it is fine to say that the lexical property *person* is presupposed by the speaker. If I do not know the meaning of *shei*, how can I ask (110a)?

(110) a. Zhangsan xihuan shei?
Zhangsan like who

[20] Recall the ordinary pronouns which are usually treated as variables in semantics with their lexical features presupposed. Wh-words, sometimes called wh-pronouns, reflect this tendency. However, there is fundamental difference between wh-pronouns and the ordinary pronouns in that the ordinary pronouns must have antecedents, either in contexts or in language. Wh-pronouns cannot have antecedents. Instead they introduce new discourse referents to which anaphoric items can refer back to, either in interrogative contexts or non-interrogative existential contexts.

'Who does Zhangsan like?'

$\lambda p \exists x[p=\lambda w'.\text{Zhangsan-like}_{w'}(x)]$

b. Lisi wen Zhangsan xihuan shei.

Lisi ask Zhangsan like who

'Lisi asked who Zhangsan likes?'

Lisi asked: $\lambda p \exists x[p=\lambda w'.\text{Zhangan-like}_{w'}(x)]$

However, in embedded questions like (110b), the embedding verb selects a question, so the lexical property of the wh-phrase should be interpreted within the scope of the verb. The domain presupposition is a local one belonging to the subject *Lisi*, who has such a presupposition. And according to Karttunen (1973), verbs of saying are plugs, disallowing presupposition projection. So the speaker does not have such a presupposition of lexical property. The problem is that if the speaker does not have such a presupposition on the wh-phrase, the variable *x* introduced by the wh-phrase *shei* becomes unimportant: he may ask the following question (111) instead of (110b), because the domain of *x* is unspecified to him.

(111) Lisi wen Zhangsan xihuan shenme.

Lisi ask Zhangsan like what

'Lisi asked what Zhangsan likes?'

Lisi asked: $\lambda p \exists x[p=\lambda w'.\text{Zhangan-like}_{w'}(x)]$

Another treatment would be to say that wh-phrases or wh-questions presuppose the existence of some entity satisfying the restriction (Dayal 1996, Hintikka 1978, Katz and Postal 1964, Karttunen and Peters 1976, Comorovski 1996). Therefore we need not create an additional predicate to be interpreted in situ, only variables will do, as shown in (112b).

(112) a. ni chi-le shenme?

you eat-Asp what

'What did you eat?'

b. *presupposed*: [∃*x x* is a thing]; asserted: λp∃*x*[p=you ate *x*]

Despite extensive discussions in the linguistic literature, there seems to be no consensus yet regarding the status of the existential implication that a wh-question carries. Many authors also oppose to the existence presupposition of wh-questions (Groenendijk & Stokhof 1984, Tomioka 2006). Tomioka (2006) points out that the proposition created by existentially binding a wh-variable is not a presupposition but should be considered as an epistemic bias on the part of the speaker. When the speaker asks 'What did Sue buy?', she is inclined to believe that Sue bought something. It is nonetheless uncertain that the addressee shares the same belief. Thus, the speaker should not be too shocked to find that her bias turns out to be false. On the other hand, a sentence with a real presupposition functions properly in the discourse only when all the conversation participants share the presupposition. In the following part, we will argue that existential presupposition is not available to wh-phrases or wh-questions, at least in Chinese (also see Jiang 1998).

First of all, it is well-known that presuppositional NP cannot occur in *there*-sentence. This is also true in Chinese where definite NPs (presuppositional) cannot occur in existential-construction, as shown in (113b). However, wh-phrases can perfectly occur in existential-construction, as shown in (114).

(113) a. you yi-ge ren xiang qu Beijing.
have one-Cl person want go Beijing
'A person wants to go to Beijing'
b. *you zhe-ge ren xiang qu Beijing.
have this person want go Beijing
'This person wants to go to Beijing.'

(114) a. you shei xiang qu Beijing?
have who want go Beijing
'Who wants to go to Beijing?'
b. you nage-xuesheng xiang qu Beijing?
have which student want go Beijing
'Which student wants to go to Beijing?'

Second, presupposed contents can be spelled out as indicated below in (115). This is because the presupposition is what the speaker takes for granted and is part of the context in which a sentence can be felicitously uttered. It can surely be made explicit in the linguistic context. Given this and the assumption that wh-questions invoke an existential presupposition, we expect that the presupposed proposition can be spelled out. This is not borne out, however. Sentences (116) are infelicitous.

(115) a. [There is a king of France]. The king of France is bald.
b. [I smoke]. I regret that I smoke.
c. [I smoked yesterday]. Today I smoked again.
c. [Someone smoked]. It is John who smoked.

(116) a. *[Zhangsan xihuan yi-ge ren]. Ni renwei Zhangsan xihuan shei?
Zhangsan like one-Cl person. You think Zhangsan like who
'Zhangsan likes someone. Who do you think Zhangsan likes?'
b. *[Zhangsan xihuan yi-ge xuesheng]. Ni renwei Zhangsan xihuan na-ge xuesheng?
Zhangsan like one-Cl student. You think Zhangsan like which student
'Zhangsan likes some student. Which student do you think Zhangsan likes?'

To make them felicitous, we have to say them in a different way, that of involving pseudocleft-construction. In this case, it is the pseudocleft-construction that triggers such presupposition. More exactly, it is the definite subject [Zhangsan xihuan de] that triggers the presupposition.

(117) a. [Zhangsan xihuan yi-ge ren]. Ni renwei Zhangsan xihuan de shi shei?
Zhangsan like one-Cl person. You think Zhangsan like DE be who
'Zhangsan likes someone. Who do you think it is?'

b. [Zhangsan xihuan yi-ge xuesheng]. Ni renwei Zhangsan xihuan de shi na-ge xuesheng?
Zhangsan like one-Cl student. You think Zhangsan like DE be which student
'Zhangsan likes some student. Which student do you think it is?'

In wh-questions involving other forms of wh-phrases like *when* or *where*, it is usually considered that it is the other materials except the wh-phrases that are presuppositional. In particular, it is important to note that the presupposition is completely independent of the value of the wh-phrase.

(118) Zhangsan shenmeshihou/zai nali kanjian-le Lisi?
Zhangsan what time/where see-Asp Lisi
'When/where did Zhangsan see Lisi?'
Presuppose: Zhangsan saw Lisi.

The wh-forms (e.g. *shenmeshihou* 'when' and *where* 'nali') do not presuppose anything, i.e., there is some time or some place such that Zhangsan saw Lisi. Since they do not have island constraints and can be associated with *zhi* 'only' either and they do not presuppose anything, it is not sufficient to assign these words only a variable, their lexical contents must be inserted somewhere in the formula.

4. A choice-function analysis

In the previous section, we have shown that treating wh-in-situ words simply as pure variables over individual faces several semantic interpretational problems. We also argued that resorting to presupposition of lexical property or referent of the wh-phrase is also problematic. In order to get interpretations right, the indefinites must 'move' so that their restrictive properties are interpreted along with their binders. Now we have ended up with a tension: unselective binding can well account for the well-known fact that wh-phrases appear to take scope outside of islands and are able to associate with *only*, but it encounters the interpretational problems. LF movement approach does not have the

interpretational problems, but it needs to explain why wh-phrases appear to take scope outside of islands and why they are able to associate with *only*.

A recent popular approach for accommodating the apparent scope-freedom of wh-in-situ phrases without interpretational problems is by appealing to choice functions (CFs) (Reinhart 1997, Winter 1997, Matthewson 1998, Kratzer 1998, etc). In this approach, the main idea of unselective binding is maintained, but the variable is over a different sort. Instead of introducing variables over individuals, indefinites (including wh-phrases) introduce variables over choice function, and it is the variable of choice function that is to be bound by existential operators.

(119) CF(f) iff $\forall X[X \neq \varnothing \rightarrow f(X) \in X)]$, a function f is a choice function (CH (f)) if it applies to any non-empty set and yields a member of that set.

A choice function picks an element of the (nonempty) set it applies to, so the existence of 'irrelevant' entities in the utterance world does not affect these expressions. It is the choice function that guarantees that only members of specified set are considered, hence without the weak truth conditional problem while explaining their island-free scope–taking property. Since choice function does not need movement, the issue of island-freeness of indefinites simply does not arise. For instance, the sentence (120a), involving a clause-bounded indefinite, can be paraphrased as in (120b), in which the indefinite subject of the embedded clause, *a building* takes scope over the universally quantified subject of the matrix clause. In (120c), the choice function variable, *f*, is existentially bound outside of the universal quantifier: there is a way of choosing entities such that for all entities that are firemen, those entities thought that the chosen building is unsafe.

(120) a. Every fireman thought that a building was unsafe.

b. There was a building such that every fireman thought that building was unsafe.

c. $\exists f[\mathrm{CF}(f) \wedge \forall x[\mathrm{fireman}(x) \rightarrow x \text{ thought } f(\mathrm{building}) \text{ is unsafe}]]$

In this theory, a choice function variable in the in-situ position can be closed by existential closure that may apply to any level, so an indefinite NP analyzed as a choice function can be interpreted with widest scope from an in-situ position inside an island without violating any constraint on movement (Reinhart 1997). We can apply this strategy to wh-questions straightforwardly. Sentence (121a) is given an interpretation in (121b): a set of propositions p such that there is a certain choice function *f* such that p is in the form of a particular student picked out by *f* saw Mary.

(121) a. Which student saw Mary?

b. $\lambda p \exists f[CH(f) \wedge p = saw(f(student), Mary)]$

The choice function approach can be extended to Chinese wh-questions. In the following wh-question, the wh-phrase *shei* 'who' is interpreted as a choice function variable in situ and no movement is involved. Because of the definition of choice function, though the lexical restriction is left in situ, nevertheless it is interpreted as if it is with the existential quantifier, hence no problem of island constraints because there is no movement.

(122) a. ni xihuan shei xie de shu?
you like who write DE book
'Who is *x* such that you like books that *x* wrote?'

b. $\lambda p \exists f[CH(f) \wedge p = \exists x[[book(x) \wedge wrote(f(person),x)] \wedge like(you,x)]]$

4.1 Improvements over unselective binding

Needless to say, the choice function approach improves over the pure unselective binding approach. Because the choice function is an argument to satisfy the main predicate instead of producing a coordination relation, so no additional property is added, hence there is no unwanted specification of head nouns in complement or relative clauses, as shown in (123). The choice function approach does not suffer from the problem of predicate conjunction either, and the two questions in (124) can be distinguished.

(123) Zhangsan xihuan shei xie de xiaoshuo?
Zhangsan like who write DE novel
'Who is *x* such that Zhangsan likes novels that *x* wrote?'
λp∃*f*[CH(*f*) ∧ p=[John likes the novels that *f*(person) wrote]]

(124) a. nage laoshi shi yuyanxuejia?
which teacher be linguist
'Which teacher is a linguist?'
λp∃*f*[CH(*f*) ∧ p= *f*(teacher) is a linguist]

b. nage yuyanxuejia shi laoshi?
which linguist be teacher
'Which linguist is a teacher?'
λp∃*f*[CH(*f*) ∧ p= *f*(linguist) is a teacher]

It also does not have the problem of weak wrong truth condition and various wrong truth conditions, either. Choice function "chooses" an entity from a set specified by the lexical property of indefinites, so the existence of 'irrelevant' entities in the utterance world does not affect these expressions, hence there is no weak truth conditional problem. Because in the choice function approach, no additional property is added, so there is no conjunction of predicates and therefore de Morgan's Law does not apply. For example:

(125) a. yaoshi Zhangsan yaoqing nage zhexuejia Lisi jiu hui shengqi?
if Zhangsan invites which philosopher Lisi then will angry
'Which philosopher is *x* such that if Zhangsan invites *x* then Lisi will be angry?'

b. λp∃*f*[CH(*f*) ∧ p=if Zhangsan invites *f*(philosopher) Lisi will be angry]

4.2 Problems of choice functional approach

However, choice function is not without its problems. Some of the problems are quite familiar in the literature, such as the empty set problem, specificity problem, presuppositional nature of strong indefinites, alleged wide scope reading, and so on. We will not discuss them in this dissertation since there are already plenty of discussions on

these problems (Geurts 2000, Schwarz 2001, Endriss 2002). Below, we will focus on the truth conditional problems.

Weak truth conditional problem in a different form still exists when negation is involved. Geurts (2000) points out that, in its wide scope reading, sentence (126a) intuitively entails that the speaker has a Polish friend (a Polish friend of *mine*). But the choice function does not account for this, however, since it implies that (126a) is true if the speaker does not have any Polish friends. It should state that the speaker has a Polish friend at the point at which the choice function is introduced. But that requires movement, which is precisely what choice function theorists are determined to do without. Similarly the choice function of Chinese sentence (127a) implies that it is true if the speaker does not have any student. However, this sentence must imply that the speaker have some students.

(126) a. I didn't introduce Betty to a Polish friend of mine.

b. $\exists f[\mathrm{CF}(f) \wedge \neg$[I introduced Betty to f(Polish-friend-of-speaker)]]

(127) a. ni meiyou yaoqing wo de nage xuesheng?

you not invite I DE which student

'Which student of mine is x such that you did not invite x?'

b. $\lambda p \exists f[\mathrm{CF}(f) \wedge p = \neg$[you invited f(student-of-speaker)]]

The separation of the existential quantifier and the choice function variable opens a way in which the choice function variable may be evaluated in a different world relative to the speaker's world (Geurts 2000, Yoem 1998). The following attitude sentence allows the speaker or Bob the belief to a specific witch.

(128) Bob believes that all sows were blighted by a witch.

a. $\exists f[\mathrm{CF}(f) \wedge$ Bob believes: $\forall x[\mathrm{sow}(x) \rightarrow f$(witch) blighted $x]]$

b. Bob believes: $\exists f[\mathrm{CF}(f) \wedge \forall x[\mathrm{sow}(x) \rightarrow f$(witch) blighted $x]]$

Apart from the fact that (128a) and (128b) commit the speaker and Bob, respectively, to a belief in choice functions (not in individuals), which does not seem to be right, these

representations cannot both be correct. For suppose that (128b) is correct. If this formula is true, on its intended interpretation, then it is Bob who believes that there is a witch; someone who utters (128) with this interpretation in mind does not commit himself or herself to this claim. But if this holds for (128b), then the same holds for (128a), for if the predicate *witch* is construed relative to Bob's doxastic state in one case, it should have the same construal in the other. This is not right, however: whereas (128b) should entail that Bob believes that there is at least one witch, (128a) should commit the speaker to this belief. This problem arises because the intended distinction between (128a) and (128b) demands that the indefinite *a witch* be interpreted relative to different contexts. The most natural way of accomplishing this is by moving the indefinite to the context it belongs to.

Now consider the following Chinese wh-question (129a). Suppose that the possible world w_1 is the actual world, and that w_2 is a belief world of Zhangsan's. The function *f* takes a set $[\text{person}]_{w2}$ as its argument and yields a person in w_2. Then some or even all members in $[\text{person}]_{w2}$ may not be person in w_1. The intended reading is the one in which the person must be a person in w_1 when the wh-phrase has wide scope over belief context, but the use of the function cannot yield the intended reading.

(129) a. Zhangsan xiangxin shei neng kao jige?
Zhangsan believe who can pass
'Who does Zhangsan believe can pass the exam?'
b. $\lambda p \exists f$ [CH(f) $\wedge$ p = Zhangsan believes$_{w2}$ that $f(\text{person})_{w2}$ can pass]

To summarize, the technique of choice function approach does not help much compared to the unselective binding over individuals. Its replacement of an individual variable with a choice function variable does not solve all the problems, and it commits us to an ontological entity of choice function. In order to account for a full array of data, some sort of movement is indispensable. This is the conclusion reached in Geurts (2000) and Schwarz (2001).

5. Purpose and outline of the dissertation

We have shown that treating indefinites and Chinese wh-expressions simply as pure

variables over either individual or choice function faces several syntactic and semantic problems. We can reasonably conclude that treating a wide scope wh-expression as variable to be long-distance bound and interpreting its restrictor as a conjunction together with main predicate through predicate conjunction rule are basically implausible. Even in the unselective binding theories of Nishigauchi (1990) and Tsai (1999), it was discovered that they actually have pulled the wh-phrases out of some islands though their original goal is to get rid of this kind of movement. That is to say that they still belong to the LF movement camp, and therefore the association with *only* and no island constraints are left open, too, just like the LF movement approach.

In order to get interpretations right, the restrictive properties of the wh-phrases must be interpreted along with their binders for obtaining proper restrictions. LF movement approach does this by assuming a cover movement; a Heim-style unselective binding may do this by positing a QR-like rule that has the same effect of LF movement (this amounts to saying QR is needed anyway and wh-phrases *are* quantificational at some level of derivations). Though both theories can produce the correct semantics, the two critical problems are still there: free scope-taking of wh-in-situ and association with *only*, which have not been satisfactorily addressed.

Then we are facing a tension. The LF movement approach has no problem with the semantics of wh-question, but it encounters trouble in island constraints and association with *only*. The unselective binding approach has no problem with island constraints and association with *only*, but it encounters trouble in the semantics of wh-question. It seems that this tension is irreconcilable if we adhere to either of them. Thus it seems that we need to take a different approach that combines the merits of both approaches: (1) keeps wh-phrases in-situ (predicting association with *only* and no island constraints); (2) but interpret them in non-in-situ position (getting semantics right).

In this dissertation, we will argue that the Hamblin (1973) semantics towards questions is such an approach. Similar to unselective binding, this approach also claims that wh-in-situ expressions are not quantificational. However, instead of directly introducing open predicates, these expressions denote sets of alternative individuals. The main idea is that the alternatives can expand until they meet an operator that selects them. There is no binding relation and no movement relation between a wh-in-situ expression

and 'its' operator anymore, which is only indirect and follows from the very architecture of the semantic interpretation system. Since there is no movement, island constraints do not arise and wh-phrases can be associated with *only*; and since there is no long-distance binding, it provides us with a new perspective to interpret wh-phrases in non-in-situ positions. In this dissertation, we will pursue this line of approach. It will be shown that the Hamblin semantics adopted in this work can offer a more satisfactory and simpler account to wh-construals without assuming some covert movement and without all the interpretational problems facing unselective binding.

The rest of this dissertation is organized as follows.

Chapter 2 outlines the basic assumptions and innovations of Hamblin-semantics of questions. It will be found that the key innovation of this theory lies at the pointwise functional application rule, which expands from sets of a lower type to sets of a higher type, consequently having the effect of 'extracting' wh-in-situ expressions from local proposition. The consequence is that though in syntax, the wh-in-situ is not moved, in semantics it is moved. This is a non-trivial accomplishment because as we are going to demonstrate, it overcomes all of the semantic problems faced by unselective binding approach while maintaining no LF movement generally. In this chapter, we provide empirical evidence for the plausibility of treating some wh-phrases as denoting sets of alternatives, and also show that the pointwise functional application is the direct consequence of this assumption. This rule is nothing in peculiar; it is just a generalized functional application rule with the conventional functional application rule being just a special case of it.

Chapter 3 examines how the wide-scope interpretations of wh-in-situ expressions are obtained across three typical island structures. The Hamblin analysis allows for in-situ interpretation of these expressions, and this makes a theory of LF very simple: there is no covert movement or long-distance binding of wh-in-situ expressions. Because expansion is a semantic operation, the island problem does not arise. It will be shown that this theory can straightforwardly account for a tension between proper answerhood of wh-questions and *de re*/*de dicto* readings in attitude contexts that involve complex NP structure. In this chapter, we also discuss the advantages of the current proposal compared to LF movement and/or unselective binding.

In addition to the mechanism of expansion, there is another mechanism under the current proposal, which is called closure. A closure closes the expansion of wh-phrases in derivation so that the wh-phrases no longer expand. Chapter 4 is devoted to this mechanism, more specifically closure by universal quantificational operators. It is proposed that the adverb *wulun* is a universal operator that universally closes the expansion of alternatives denoted by or expanded by wh-phrases. If this is true, we are committed to treating *dou* (the most common matching item in the consequent clause) as a non-quantificational element. Adopting the proposal of *dou* as an existential quantifier serving for skolemization (Huang 1995, 1996), we provide a detailed characterization of the interaction between *wulun* and *dou* in both the nominal and sentential *wulun-dou* constructions. Several novel ideas are proposed for *wulun-dou* structures. One is that *wulun*-NP is base-generated within *dou* VP domain, the other is that ordinary *dou*-sentences are concealed *wulun*-wh-*dou* sentences and *wulun*-wh is the instantiation for distributive quantification. The consequences of these ideas will be discussed.

Chapter 5 summarizes the main claims reached in this study and points out several remaining issues.

Chapter 2

Denotations of wh-expressions and consequence in semantics

This chapter outlines the basic mechanism of how to interpret a wh-in-situ expression in the framework of Hamblin Semantics. Section 1 introduces the working hypothesis that (at least) some wh-in-situ expressions denote sets of alternatives directly, and some evidence is provided to justify this assumption. If this assumption is plausible, then we need a pointwise functional application rule for semantic composition. Section 2 elaborates on the basic working mechanism of this rule. We discuss the main innovations of this theory: *expansion* by the pointwise functional application and *closure* by quantificational operators. By means of *expansion*, the sets denoted by wh-expressions can be *expanded* to sets of a higher type; consequently a wh-in-situ expression can be interpreted outside of a subformula while leaving only a variable in its in-situ position. Scoping is achieved simply by passing the set of alternatives upwards in the tree until the set meets an operator. Since this is done entirely in semantics, this way of scoping is not sensitive to any islands. By means of *closure*, the restriction and scope of an wh-in-situ expression will no longer expand when it encounters an operator it 'associates' with, and the quantificational operator is responsible for the quantificational force, not the wh-in-situ itself. We will also show that the pointwise functional application is a generalized functional application rule, which is needed if some linguistic expressions denote non-singleton sets, and the conventional functional application rule is just a special case of it.

1. Justifying wh-phrases as denoting sets of alternatives

Any theory of wh-construals endorses a basic assumption on the denotation of a wh-in-situ expression. Relevant to such basic assumptions, different mechanisms concerning the interpretations of wh-phrases follow. LF movement treats wh-in-situ as existential quantifiers; consequently wh-in-situ expressions are subject to logical

movement. This tradition dates back to Karttunen (1977). Unselective binding treats wh-in-situ as variables; consequently they are subject to long-distance binding from some other operators. This tradition dates back to Baker (1970). In addition to these two options, there is still one option for the denotations of wh-expressions, that is, sets of alternatives; consequently their interpretations cannot be achieved by LF movement or long-distance binding, but by some other mechanism. This tradition dates back to Hamblin (1973).

In both Karttunen tradition and Baker tradition, the question denotation of a wh-question comes from the C, not from the wh-phrases *per se*. The C-complementizer plays a critical role in deriving the question denotation, which is defined as λpλq[q=p]. In addition, within unselective binding approach, in addition to the C-complementizer (the CP projection), we need a Q-morpheme or question operator, which is just an existential quantifier defined as λPλp∃*x*[P(*x*)(p)], serving to bind the wh-variable[1]. Under Hamblin tradition, the question denotation of a wh-question comes from the wh-word itself. In this theory, all lexical items denote sets (*denotation-sets*). Most lexical items denote singleton sets containing their standard denotations: the individual-denoting DPs are mapped to singleton sets containing an individual (e.g., ⟦Zhangsan⟧={zhangsan}); verbs are mapped to singleton sets containing a property (e.g., $⟦mai⟧^{w,g}$={λ*x*λ*y*λw'.buy(*x*)(*y*)(*w'*)}). Wh-phrases like *shei*, on the other hand, denote non-singleton sets of alternatives {a, b, c,…}, which are the locus of interrogative force since the semantic value of a question is a set of alternatives. Since the set denotation can be directly derived from the wh-phrases themselves, there is no need for C-complementizer or Q-morpheme or question operator[2].

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[1] In the Karttunen tradition, a wh-phrase like *who* is treated on par with *someone*. Then the distinction between the following pair is supposed to be from the existence of a [+wh] complementizer or a [-wh] complementizer. While in the Baker tradition, *who* is treated on a par with a bound pronoun like *him*, the distinction between the following pair is supposed to be from the existence of a [+wh] complementizer or a [-wh] complementizer and the existence of a question operator or not.

(i) a. Who did John like?

b. John liked someone.

(ii) a. Whose mother does every man like?

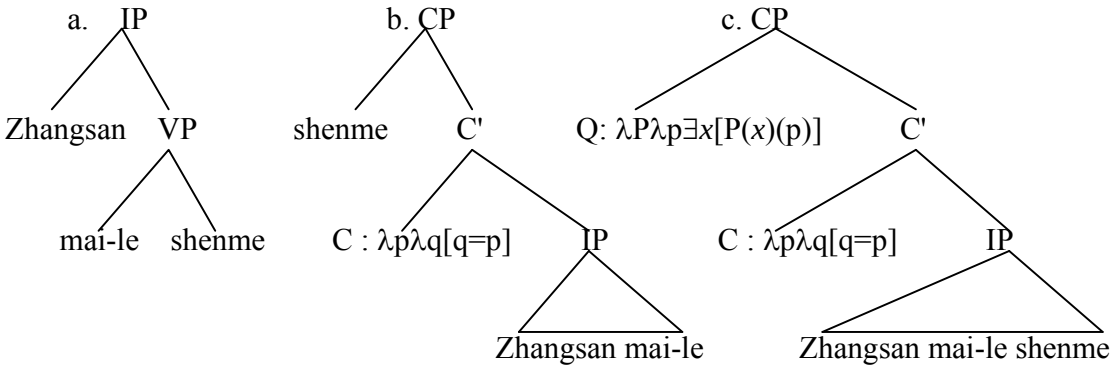
b. Every man likes his mother.

[2] In (i/a) of footnote 1, the overt movement of *who* is not semantic, instead it must be attributed to

With this brief background knowledge, the following sentence (1) would require different syntax-semantics interfaces according to the three traditions, as shown in (2a), (2b), and (2c), respectively.

(1) Zhangsan mai-le shenme?
Zhangsan buy-Asp what
'What did Zhangsan bought?'

(2)



The first two options have been fruitfully pursued with success in studies of wh-construals. The third option has recently been revived, mostly in the works of Ramchand (1997), Hagstrom (1998), Jayaseelan (2001), Shimoyama (2006), Kratzer & Shimoyama (2002), Kratzer (2006), and Tran (2009) for various languages. This proposal has been shown to be particularly promising for wh-in-situ languages like Japanese, Thai, etc. Considering that wh-phrases in Chinese share many similar properties with wh-indefinites in Japanese and Thai, treating Chinese wh-in-situ expressions as sets of alternatives may be a feasible proposal, as has already been suggested in several recent works (Lin 1996, Sugimura 2002, Hu and Pan 2003, Kim 2004, Dong 2009, Tran 2009). In this theory, a wh-phrase like *shei* denotes a set of all alternative humans and a wh-phrase like *shenme* denotes a set of all alternative things (in a properly restricted domain).

Are there any reasons to treat wh-phrases as denoting sets of alternatives? In most of

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syntactic reasons.

cases (such as a full wh-question like (1) above), there is no apparent preference among the three options of denotations of wh-phrases. No matter how we treat wh-phrases (as existential quantifier, as variable, or as set of alternatives), we can all successfully derive the denotation for a wh-question as a set of alternatives according to the theory that one adopts (see section 3.3 of chapter 1 for the derivational processes under LF movement and Unselective binding. The derivational process under the third option will be presented later in this chapter).

One can of course assume as a working hypothesis that wh-phrases denote sets of alternatives, just like others assume that wh-phrases denote existential quantifiers or variables. In this section, however, we attempt to find some cases in which it is preferable to treat wh-phrases as sets of alternatives, rather than existential quantifiers or variables. If this is successful, then we can find good reason to pursue along Hamblin-tradition at the very beginning.

1.1 Bare wh-questions

Consider the following bare wh-question asked in a situation where someone knocked on the dormitory door at midnight.

(3) Me: shei?
who

If this question is indeed bare, then it follows that the wh-phrase in the bare wh-question should be treated as denoting set of alternative directly, by assuming that a bare wh-phrase can make up a question. However, if we treat the wh-phrase *shei* as either existential quantifier or variable, we need more projections up to CP. That is to say that a bare wh-phrase cannot make up a question alone, the above bare question is actually a fuller sentence of CP, in order to obtain a question denotation.

(4) $[_{CP}\ [_{C'}[_{IP}\ [_{NP}$ shei]]]]?

Then in this account the bare question ‘shei?’ denotes a set of propositions, possibly

in the form of λp∃*x*[person(*x*) & p=…*x*…]. The proposition *p* must be filled in by context, such as 'the person is *x*' or '*x* knocked at the door', or other appropriate ones. The recovered covert elements are obviously context-dependent. In fact nothing is wrong in this practice. The real problem is: is the bare question 'shei?' really denotes a set of propositions in semantics and patterns like a CP in syntax?

Syntactically sometimes the bare wh-question 'shei?' patterns just like an NP instead of a CP. For example, it cannot be embedded under a clause-selecting verb. Consider the following question-answer pairs.

(5) Me: [same context] shi shei?
be who
'Who is it?'
Zhangsan: ni wen shenme?
you ask what
'What do you ask?'
Me: wo wen shi shei.
I ask be who
'I ask who it is.'

(6) Me: [same context] shei?
who
'Who is it?'
Zhangsan: ni wen shenme?
you ask what
'What do you ask?'
Me: *wo wen shei.
I ask be who
Intended: 'I ask who it is.'

If the bare wh-question 'shei?' is a CP, we would expect the question-answer pair (6) to be as good as (5). But it is not. This indicates that at least in bare wh-questions we should be able to yield a question denotation from the wh-phrases alone. Further consider

the following continuations. In (7a), it is fine to have an embedded question reading. However, (7b) lacks this embedded question reading; the only reading is a direct question reading, in which the verb *zhidao* 'know' is interpreted as 'to be familiar with' instead of the proposition-embedding meaning 'to hold certain knowledge'. If a bare wh-phrase can project into a larger CP clause, nothing prevents (7b) from having an embedded question reading, which is contextually favored under this situation, just like (3) does.

(7) a. Lisi: Zhangsan zhidao shi shei.
Zhangsan know be who
'Zhangsan knew who the person knocking at the door is.'
b. Lisi: *Zhangsan zhidao shei.
Zhangsan know who
Intended: 'Zhangsan knew who the person knocking at the door is.'

Note that verbs like *wen* 'ask' and *zhidao* 'know' can select an NP that has the same function as a question, as shown below.

(8) a. Zhangsan xiang wen wo de mingzi.
Zhangsan want ask I DE name
'Zhangsan wants to ask my name.'
b. Zhangsan zhidao wo de mingzi.
Zhangsan know I DE name
'Zhangsan knows my name.'

Whether the NP at issue is a CP in disguise or not, it is generally agreed that it should be a proposition-like element having the same function of a question (concealed question). If we adopt Baker's (1968) view that the noun phrase is actually a question and that the wh-phrase and the copula in the question are deleted by some process of ellipsis, (8a) should be derived from (9a), and (8b) should be derived from (9b).

(9) a. Zhangsan xiang wen wo de mingzi shi shenme.

Zhangsan want ask I DE name be what
'Zhangsan wants to ask what my name is.'

b. Zhangsan zhidao wo de mingzi shi shenme.
Zhangsan know I DE name be what
'Zhangsan knows what my name is.'

If the bare wh-phrase makes up a complete CP or if we treat the NP as a proposition-like element having the same function of a question, the following sentences (10) should be as grammatical as (8).

(10) a. *Zhangsan xiang wen shenme.
Zhangsan want ask what
'Zhangsan wants to ask what.'

b. *Zhangsan zhidao shenme.
Zhangsan know what
'Zhangsan knows what.'

Now consider *zenmeyang* 'how'. According to Li and Thompson (1981), Tsai (1994), Shao (1996), and others, *zenmeyang* has a predicate use and two adverbial uses: means and manners. The predicative *zenmeyang* can be transitive or intransitive.

(11) a. nimen zenmeyang da zhe-chang lanqiu? yi-dui-yi.
you how play this CL basketball? One-to-one
'By what means will you play this basketball game? By one-to-one approach'

b. lanqiu, nimen da-de zenmeyang? da-de hen shun.
basketball you play-DE how? Play-DE very well
'What is the manner that you played the basketball? Very well'

(12) a. Zhangsan zenmeyang le?
Zhangsan how Prt
'How is Zhangsan?'

b. Zhangsan zenmeyang ni le?
Zhangsan how you Prt
'How did Zhangsan do on you?'

The various uses of *zenmeyang* can be asked in bare form. For example, the bare question (13) can be interpreted in various ways according to the context. It can be asked when I wanted to know the means that someone is going to drive a car, the result of a dish that someone cooked, the situation of someone, or the action that someone wanted to do on me.

(13) zenmeyang?
how

If this question is indeed bare, then it follows that *zenmeyang* in this bare wh-question should be treated as denoting set of alternatives of various kinds, such as {method A, method B,…}, {result A, result B,…}, {state A, state B,…}, {action A, action B,…}. If we treat *zenmeyang* as either existential quantifier or variable, we need CP projection, as in (14).

(14) $[_{CP}\ [_{C'}[_{IP}\ [_{AP}$ zenmeyang]]]]?

However, similar to the case of 'shei?', the bare question 'zenmeyang?' cannot be embedded under a proposition-selecting verb. (15b) lacks this embedded question reading.

(15) a. Me: zenmeyang?
b. Lisi: *Zhangsan zhidao zenmeyang.
Zhangsan know how
Intended: 'Zhangsan knows how.'

Let's consider a bare question of the reason adverbial *weishenme* 'why'. Surprisingly

it can be embedded under a proposition-selecting verb. Suppose I asked Zhangsan why the sky is blue, he answered me with the following sentence.

(16) Wo ye bu zhidao weishenme.
I also not know why
'I also do not know why.'

Therefore, the above discussion shows that it is very likely that wh-phrases like *shei* and *zenmeyang* can be treated as directly denoting sets of alternatives of different natures, while *weishenme* can be treated as denoting any of the three options.

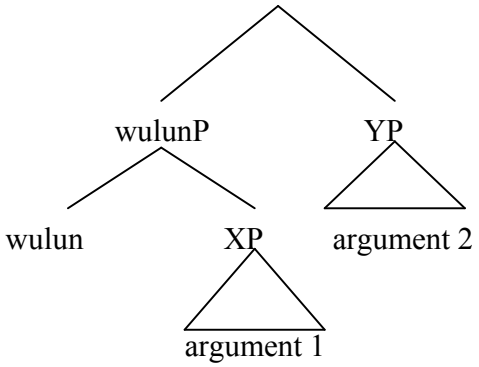
1.2 Semantic requirement on the first argument of *wulun*

In Hamblin semantics, wh-phrases are treated as sets of alternatives. What on earth does it mean for something to denote a set of alternatives? A set of alternatives is a set that contains members in a disjunctive relation. Each member in this set is eligible to be picked out for predication. Suppose there are four persons (a, b, c, d) in a model, then a set of alternatives of the four persons can be read as the union set of {a} and {b} and {c} and {d}, formalized as {a, b, c, d} or {x: person(x)(w)}. Conceived in this way, a set of alternatives is not a set of individuals in the usual sense, which eventually can be interpreted as a property, formalized as λx[person(x)(w)], or a singleton set of a property {λx[person(x)(w)]} in the semantics of Hamblin.

In set theory, union is defined in terms of a logical disjunction: $x \in A \cup B$ if and only if $(x \in A) \vee (x \in B)$. In Chinese, there is a special morpheme used to connecting alternatives: *haishi* 'or'. Noun phrases in the form of A *haishi* B intuitively denotes a set of alternatives, from which we can choose one, as shown in alternative questions which are marked by *haishi*. It is natural to consider that the only role of *haishi* is to introduce into the semantic derivation the denotation of its disjuncts as alternatives. In the expression of *Zhangsan haishi Lisi haishi Wangwu*, each disjunct denotes a singleton containing an individual: $[\![DP_1]\!]$={zhangsan}, $[\![DP_2]\!]$={lisi}, $[\![DP_3]\!]$={wangwu}. The denotation of the disjunction is the union set containing three individuals: $[\![DP]\!]=[\![DP_1]\!] \cup [\![DP_2]\!] \cup [\![DP_3]\!]$={zhangsan, lisi, wangwu}.

Further note that the adverb *wulun* 'no matter' (*buguan*, *renping*, *suibian*, etc) takes two arguments. And *wulun* seems to be free in selecting the first argument, which can be noun phrases, verb phrases, or sentences, corresponding to individuals, properties, or propositions (Lü 1980).

(17)



(18) a. wulun ni haishi wo,…
no matter you or me
b. wulun pin haishi fu,…
no matter poor or rich
c. wulun ni qu haishi wo qu,…
no matter you go or I go

The left argument must be restricted in some way. For example, in case of noun phrases, the noun phrase must be in the form of A *haishi* B (A *yehao* B *yehao*, A *yeba* B *yeba*). Other forms of NPs are not allowed to be the first argument of *wulun*.

(19) a. wulun Zhangsan haishi Lisi, wo dou xihuan.
no matter Zhangsan or Lisi I all like
'No matter Zhangsan or Lisi, I all like.'
b. wulun Zhangsan yehao Lisi yehao, wo dou xihuan.
no matter Zhangsan also-good Lisi also-good I all like
'No matter Zhangsan or Lisi, I all like.'
b. wulun Zhangsan yeba Lisi yeba, wo dou xihuan.

no matter Zhangsan also-good Lisi also-good I all like

'No matter Zhangsan or Lisi, I all like.'

(20) a. *wulun zhexie ren, wo dou xihuan.

no matter these people I all like

'No matter these people, I all like.'

b. *wulun Zhangsan he Lisi, wo dou xihuan.

no matter Zhangsan and Lisi I all like

'No matter Zhangsan and Lisi, I all like.'

c. *wulun Zhangsan huozhe Lisi, wo dou xihuan.

no matter Zhangsan or Lisi I all like

'No matter Zhangsan or Lisi, I all like.'

d. *wulun tamen, wo dou xihuan.

no matter they I all like

'No matter they, I all like.'

e. *wulun meige ren, wo dou xihuan.

no matter everybody I all like

'No matter everybody, I all like.'

f. *wulun dabufen ren, wo dou xihuan.

no matter most people I all like

'No matter most people, I all like.'

From the above facts, we can obtain a generalization on the semantic requirement of *wulun* on its first argument: the first argument of *wulun* must denote a set of alternatives. Noun phrases in the form of A *haishi* B, A *yehao* B *yehao*, A *yeba* B *yeba* are clear cases of sets of alternatives. Therefore, we conclude that the semantic requirement of its first argument of *wulun* is that it must denote a set of alternatives[3]. Given this, the

[3] Since A *haishi* B usually occurs in alternative questions, does it mean that *wulun* must select a question as its first argument. We think the logic does not hold. Undoubtedly a question is a typical form to contribute such a set (Hamblin 1973, Karttunen 1977), but a set of alternatives is not necessarily a question. This is shown in the fact that *wulun* can take the phrase of A *yehao* B *yehao* or A *yeba* B *yeba*, which do not imply questions.

ungrammaticality of sentences (20) can be easily accounted for. The first arguments of *wulun* in these sentences are all plural NPs. Though all involving more than two persons, these NPs do not denote sets of alternative members. Instead they can be considered as groups or sums or collections.

Now consider the following paradigm, in which *wulun* can take wh-phrases as the first argument. This should be sufficient to indicate that these wh-phrases also denote sets of alternatives. The reasoning is that since *wulun* must select a set of alternatives (that is, A *haishi* B *haishi* C…) as its first argument, it follows that these wh-phrases must denote sets of alternatives too[4].

(21) a. wulun shei, wo dou xihuan.
no matter who I all like
'Everyone/anyone is such that I like him.'

b. wulun shenme, wo dou xihuan.
no matter what I all like
'Everything is such that I like it.'

c. wulun na-ge ren, wo dou xihuan.
no matter which person I all like
'Every person is such that I like him.'

d. wulun nali, wo dou xiang qu.
no matter where I all want go
'Every place is such that I want to go.'

e. wulun shenmeshihou, wo dou neng lai.
no matter what time I all can come
'Every time is such that I can come.'

f. wulun duoshao, wo dou bu yao.
no matter how much I all not want

[4] Free choice *renhe* NP can also be the first argument of *wulun*, for example *wulun renhe ren* 'no matter anyone', *wulun renhe shihou* 'no matter any time', *wulun renhe didian* 'no matter any place', etc. This comes with no surprise since the free choice *renhe* NP can also be considered as denoting a set of alternatives (Menendez-Benito 2005).

'No matter how much, I do not want.'

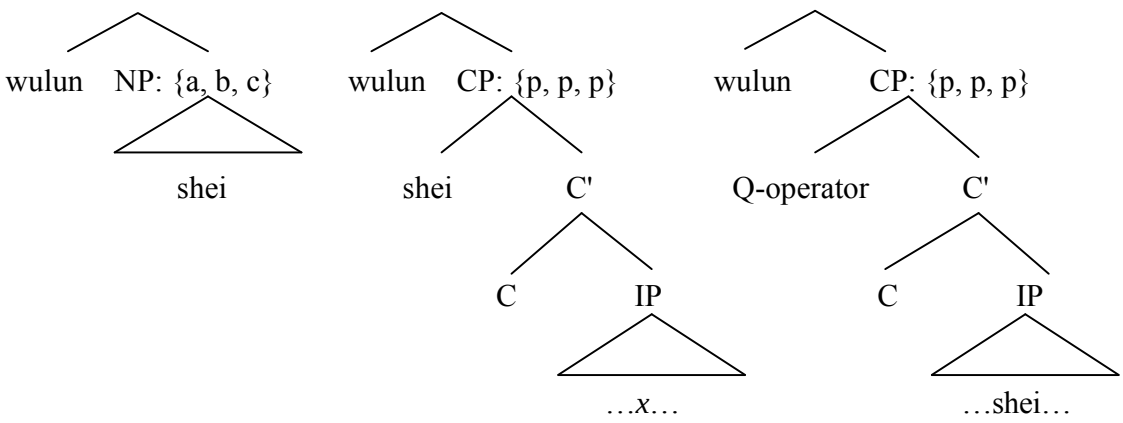
g. wulun jige, wo dou bu guan.
no matter how many I all not care
'No matter how many, I do not care.'

The pattern (21) shows that most wh-phrases (*shei*, *shenme*, *nage*, *nali*, *shenmeshihou*, *duoshao*, *ji*) in Chinese can enter the first argument slot of *wulun*. It is then natural to treat all these wh-phrases as denoting sets of alternatives, of persons, things, places, times, etc. Suppose there are two persons (Zhangsan and Lisi) in a model, then the expression *wulun shei* is equivalent to (22a). In this case, we conclude that *shei* denotes a set of alternatives of Zhangsan and Lisi. The expression (22b) shows that the wh-word *shei* can be followed by an appositive element in the form of *Zhangsan haishi Lisi* and so on, which indicates that *shei* is equivalent to *Zhangsan haishi Lisi*, both denoting a set of alternatives.

(22) a. wulun Zhangsan haishi Lisi
no matter Zhangsan or Lisi
b. wulun shei [Zhangsan haishi Lisi/Zhangsan yehao Lisi yehao]
no matter who [Zhangsan or Lisi]

In the above discussion, we have assumed that *wulun* is free to take any category as its first argument. The logic of the above argument holds only if the constituent (i.e., *shei*) under *wulun* is a nominal constituent. However, possibility exists that the constituent under *wulun* is a clausal constituent rather than a nominal constituent (Shi Dingxu pc). If they actually involve sentential projection, then treating the wh-phrases as either existential quantifiers subject to LF movement or as variables subject to unselective binding can also derive a set of alternatives to satisfy the semantic requirement of *wulun*. Then in these accounts, in order to derive a set of alternatives for *shei*, larger CP projection is needed for *shei* to move to or for a Q-operator to sit in. The following three trees (23a), (23b), and (23c) correspond to the treatments of wh-phrases as alternative sets, as existential quantifiers, and as variables, respectively.

(23) a. b. c.



Below we argue that there is no good reason that the bare *shei* is a fuller CP projection under *wulun*. On the contrary, directly assuming wh-phrases as denoting sets of alternatives and treating *wulun* as capable of selecting any category as the first argument can make the grammar much simpler.

This is also true for the expression of *Zhangsan haishi Lisi*. We treat *haishi* as an independent morpheme, just similar to the English *or*. Therefore, *haishi* is able to conjoin two nominal phrases and *haishi* is a morpheme without internal structure[5]. However, as is well known, *haishi* only occurs in alternative questions and *wulun*-construction (if we follow Cheng and Huang (1996) who claim that the clause after *wulun* is a question, we are led to the view that *haishi* only occurs in questions). Further recall that it is usually claimed that *NP haishi NP* in alternative questions should be treated as involving clausal deletion (Huang 1988, Shao 1996), as illustrated below.

[5] The word *haishi* may be historically derived from *hai* and *shi*, but it is no longer necessary to analyze it as *hai shi* 'still be'. The reason is that we can add another *shi* in the second disjunct, as shown in (i/b).

(i) a. wulun Zhangsan haishi Lisi
No matter Zhangsan or Lisi
b. wulun shi Zhangsan haishi shi Lisi
No matter be Zhangsan or be Lisi

(24) a. ni xihuan Zhangsan haishi Lisi?
you like Zhangsan or Lisi
'Do you like Zhangsan or Lisi?'
b. ni xihuan Zhangsan haishi ~~ni xihuan~~ Lisi?
you like Zhangsan or you like Lisi
'Do you like Zhangsan or do you like Lisi?'

In order to make a sound argument, we must prove that the wh-word in *wulun shei* is a genuine NP, without any clausal projection. Similarly, the NP coordination in *wulun Zhangsan haishi Lisi* is a genuine NP coordination of *haishi*, without any clausal projection[6].

There are several pieces of evidence against the clausal deletion account or CP structure account. The first evidence is that it is unclear what is deleted in the expression of *wulun Zhangsan haishi Lisi* in the following sentence, unlike (24) where we can delete the subject and the verb. We certainly cannot do so in (25). This is also true for *wulun shei*.

(25) a. wulun Zhangsan haishi Lisi, wo dou xihuan.
no matter Zhangsan or Lisi, I all like
'No matter Zhangsan or Lisi, I like.'
b. *wulun ~~wo xihuan~~ Zhangsan haishi ~~wo xihuan~~ Lisi, wo dou xihuan.
no matter I like Zhangsan or I like Lisi, I all like
'No matter I like Zhangsan or I like Lisi, I like.'

(26) a. wulun shei, wo dou xihuan.
no matter who, I all like
'No matter who, I like.'
b. *wulun ~~wo xihuan~~ shei, wo dou xihuan.
no matter I like who, I all like
'No matter I like who, I like.'

[6] In section 1.3 below, we will argue that *NP haishi NP* in alternative questions should also be treated as real nominal coordination, instead of involving clausal deletion.

Possibly, the expressions *Zhangsan haishi Lisi* and *shei* after *wulun* involve a predicative *shi*, as shown in (27). In that case, we can say that the expressions *Zhangsan haishi Lisi* and *shei* after *wulun* are not nominal phrases; instead they are predicate phrases. If this is so, *wulun* modifies two verbal phrases.

(27) a. wulun ~~shi~~ Zhangsan haishi ~~shi~~ Lisi, wo dou xihuan.
no matter be Zhangsan or be Lisi, I all like
'No matter Zhangsan or Lisi, I like.'
b. wulun ~~shi~~ shei, wo dou xihuan.
no matter be who, I all like
'No matter who, I like.'

Though semantically both (27a) and (27b) may mean the same as (25a) and (26a), they are quite different in syntactic distributions. For one thing, if the expression *shei* after *wulun* is actually a CP, we expect it is compatible with some proposition-only selecting verbs (like *yuanyi* 'hope') in the main clause. The following contrast (uttered when I heard that someone is going to jump off the building and someone asks me who it is) shows this is impossible. The same argument can be carried over to *wulun Zhangsan haishi Lisi* 'no matter Zhangsan or Lisi'.

(28) a. *wulun shei, wo dou bu yuanyi.
no matter who, I all not hope
'Everyone is such that I do not hope.'
b. wulun shi shei, wo dou bu yuanyi.
no matter be who, I all not hope
'No matter it is who, I do not hope.'
(29) a. *wulun Zhangsan haishi Lisi, wo dou bu yuanyi.
no matter Zhangsan or Lisi, I all not hope
'No matter Zhangsan or Lisi, I do not hope.'
b. wulun shi Zhangsan haishi shi Lisi, wo dou bu yuanyi.

no matter be Zhangsan or be Lisi, I all not hope
'No matter it is Zhangsan or Lisi, I do not hope.'

For another thing, if we assume there is CP projection for *shei* under *wulun*, the following sentence (30a) should be analyzed as (30b), in which a (null) pronoun should be available to satisfy the argument relation with the main verb, because *shei* is interpreted as a set of proposition, possibly in the form of λp∃*x*[person(*x*) & p=the person is *x*]. However, we find sentence (30b) is very awkward (Lin 1996). Further since there is no c-command relation between *shei* and the pronoun, the pronoun should then be interpreted as an E-type pronoun (Cheng & Huang 1996). If so, the pronoun can be replaced by a definite description, as in (30c), which sounds very bad. The same argument can be carried over to *wulun Zhangsan haishi Lisi* 'no matter Zhangsan or Lisi'.

(30) a. wulun shei dou hen congming.
no matter who all very bright
'Anyone is bright.'
b. ??wulun shei ta dou hen congming.
no matter who he all very bright
'For anyone, he is bright.'
c. *wulun shei nage-ren dou hen congming.
no matter who that-Cl person all very bright
'For anyone, that person is bright.'

(31) a. wulun Zhangsan haishi Lisi dou hen congming.
no matter Zhangsan or Lisi all very bright
'No matter it is Zhangsan or Lisi, he is bright.'
b. ??wulun Zhangsan haishi Lisi ta dou hen congming.
no matter Zhangsan or Lisi he all very bright
'No matter it is Zhangsan or Lisi, he is bright.'
c. *wulun Zhangsan haishi Lisi nage-ren dou hen congming.
no matter Zhangsan or Lisi that-Cl person all very bright
'No matter it is Zhangsan or Lisi, that person is bright.'

Further consider the following exceptional case-marking structure. Li (1990: 130-134) argues that exceptional case-marking structure in Chinese should be analyzed as control structure with the verb selecting an NP. If this is correct, the grammaticality of (32) indicates the nominal status of *wulun shei*[7].

(32) a. cong yi fangmian shuo, ni zenme keyi rang wulun shei dou renke ni
from one aspect say, you how can let no matter who all accept you
'From one aspect, how can you let anyone accept you.'

b. jiang de zuizhong rang wulun shei dou buyiweiran.
Talk DE final let no matter who all disagree
'The talk eventually let everyone disagree.'

c. you zhe rang wulun shei dou xihuan de xingge.
have prog let no matter who all like DE character
'Have a character that lets everyone like.'

d. ruci zhida de lirun kongjian rang wulun shei dou weizhi fengkuang
that big profit space let no matter who all for it crazy
'Such a big profit space lets everyone crazy.'

Now consider *zenmeyang* 'how'. All uses of *zenmeyang* can be the first argument of *wulun*, as shown in examples (33), in which we have the pre-verbal *zenmeyang* (means), the post-verbal *zenmeyang* (resultative), and the predicative *zenmeyang*. Intuitively, the wh-phrase *zenmeyang* in (33) may denote a set of alternatives indicating different things such as methods, results, states, and actions.

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[7] *Wulun-wh* construction cannot occur as argument of prepositions.

(i) *ta dui wulun shei dou bu manyi.
he to no matter who all not satisfy
'He is not satisfied with anyone.'

The ungrammaticality of (i) is left as an open issue in Lin (1996: 88). Since *wulun-shei* has been shown to be a real nominal element, it is a puzzle why (i) is ungrammatical. In section 1.2 of chapter 4, we will argue that the ungrammaticality of (i) is due to that *wulun* [XP] must c-command the main predicate *dou VP* at surface structure.

(33) a. wo bu zhidao ta zenmeyang zuo zhe-dao cai. Wulun zenmeyang,
I not know he how cook this-Cl dish no matter how
wo dou bu chi.
I all not eat
'I do not know how he cooked this dish. No matter how, I will do not eat.'

b. wo bu zhidao ta zhe-dao cai zuo de zenmeyang. Wulun zenmeyang,
I not know he this-Cl dish cook DE how no matter how
wo dou bu chi.
I all not eat
'I do not know how he cooked this dish. No matter how, I will do not eat.'

c. wo bu zhidao Zhangsan zenmeyang le. Wulun zenmeyang,
I not know Zhangsan how Prt no matter how
wo dou bu guan.
I all not care
'I do not know how Zhangsan is. No matter how, I do not care.'

d. wo bu zhidao Zhangsan zenmeyang ni le. Wulun zenmeyang,
I not know Zhangsan how Prt no matter how
wo dou bu guan.
I all not care
'I do not know how Zhangsan is. No matter how, I do not care.'

Finally, let's consider the following sentences in which the wh-phrase is the reason wh-phrase *weishenme* 'why'. Some people judged (34a) and (34b) as ungrammatical, and remarked that the best choice is to use *shenme yuanyin* 'what reason'[8]. This implicates

[8] (i) a. wo bu zhidao Zhangsan weishenme cizhi. Wulun shenme yuanyin, wo dou bu guan.
I not know Zhangsan why resign no matter what reason I all not care
'I do not know why Zhangsan resigned. No matter what reason, I do not care.'

b. wo bu zhidao tian weishenme shi lan de. Wulun shenme yuanyin, dou bu guan wo de shi.
I not know sky why be blue Prt. no matter what reason all not care I DE business
'I do not know why the sky is blue. No matter what reason, it is none of my business.'

that the reason *weishenme* cannot treated as denoting a set of alternatives itself.

(34) a. wo bu zhidao Zhangsan weishenme cizhi. ??Wulun weishenme,
I not know Zhangsan why resign No matter why
wo dou bu guan.
I all not care
'I do not know why Zhangsan resigned. No matter why, I do not care.'
b. wo bu zhidao tian weishenme shi lan de. ??Wulun weishenme,
I not know sky why be blue Prt. No matter why
dou bu guan wo de shi.
all not care I DE business
'I do not know why the sky is blue. No matter why, it is none of my business.'

Nevertheless, some people also accept (34a) and (34b)[9]. Probably, to those people the bare *weishenme* always projects a full CP. Then we can treat the reason adverbial *weishenme* as real quantifier (Huang 1982, Tsai 1994) or base-generated in CP position (Lin 1992), and we can still derive a question denotation. It is worthy to point out again that *weishenme* can occur bare within clause-taking verbs and obtains an embedded question reading. But *shei* and *zenmeyang* cannot.

(35) a. [I do not know why he resigned] Zhangsan zhidao weishenme.
Zhangsan know why
'Zhangsan knew why.'
b. [I do not know who he loves] *Zhangsan zhidao shei.
Zhangsan know who
'Zhangsan knew who.'
c. [I do not know how he passes the exam] *Zhangsan zhidao zenmeyang.

[9] For all these people, the judgement time for *wulun weishenme* is significantly longer than *wulun shei*-type. When presented with *wulun shei*, they instantly judged fine. But when presented with *wulun weishenme*, even those who accept it have to think for a while.

Zhangsan know how
'Zhangsan knew how.'

If this is true, we hope to find that a full *weishenme*-question can be modified by *wulun*. This is true, as shown in the following example, which Cheng and Huang (1996: 148) judge as grammatical.

(36) wulun ta weishenme mei lai, wo dou bu hui yuanliang ta.
no matter he why not come I all not will forgive him
'No matter why he didn't show up, I won't forgive him/her.'

To sum up, we have shown that at least in some cases (bare wh-question and the first argument of *wulun*), it is reasonable to treat *shei*-type wh-phrases as denoting sets of alternatives of various entities, but *weishenme* needs special consideration. The bare wh-question and first argument of *wulun* cannot provide us any evidence as how to treat *weishenme*. Treating it either as existential quantifier or as set of alternatives, its distribution and interpretation in the above two environments can be accounted for. However, if it denotes a set of alternatives, the ungrammaticality of (34a) and (34b) to some people is mysterious.

1.3 Substitutivity between wh-questions and alternative questions

Another supporting evidence comes from the substitutivity between wh-questions and alternative questions. As well-known, the disjunctive coordinator *haishi* expresses alternativeness, and any expression in the form of A *haishi* B denotes a set of alternatives, which must occur in questions, where it seems to invariably express an alternative question. In this kind of questions, it is the morpheme *haishi* that carries a question feature in the lexicon, which serves to type a sentence (Li and Thompson 1981). This category of questions explicitly presents the respondent with a choice of two or more possible answers.

Huang (1988) and Tang (1988) point out that wh-questions are semantically similar to alternative questions in that in the former hearers are asked to make a choice among the

extension of wh-words, which is usually contextually determined, while in the latter hearers are asked to make a choice among several alternatives explicitly set up in the question. Shao (1996: 5-6) points out that all questions can be defined on choices of alternatives, and classifies wh-questions and alternative questions into one sub-class. This clearly indicates a close affinity between wh-questions and alternative questions. Consider:

(37) a. ni qu haishi ta qu?
you go or he go
'Will you go or will he go?'
b. [nimen liang-wei], shei qu?
[you two-Cl] who go
'[You two] Who will go?'

Shao points out that the answers to the above two questions are both targeted answers (*zhendui-xing huida*). The extensions (of answers) of both questions are open in that *haishi* can conjoin an open number of choices and so is wh-question. The domains of alternatives of both questions are definite in that the domain of alternatives of *haishi*-question is explicitly expressed in the question itself, and the domain of alternatives of wh-question can be made explicit by context and discourse. In addition to semantic similarity, alternative questions and *wh*-questions share syntactic similarities (Lu 1982). For example, both have the same distribution in embedded contexts. Nearly all verbs which take indirect wh-questions as complements also take embedded alternative questions. A verb which doesn't allow embedded wh-questions in general doesn't complement with *haishi*-questions either. Both types of questions have wh-form and can be added with *ne*. And both types of questions cannot tolerate *shi*-marked focus in the same clause.

(38) a. Zhangsan wen ni xihuan shei.
Zhangsan ask you like who
'Zhangsan ask who you like'
b. Zhangsan wen ni xihuan Lisi haishi Wangwu.

Zhangsan ask you like Lisi or Wangwu

'Zhangsan ask whether you like Lisi or Wangwu'

(39) a. ni renwei Zhangsan xihuan shei?

you think Zhangsan like who

'Who do you think Zhangsan likes?'

b. ni renwei Zhangsan xihuan Lisi haishi Wangwu?

you think Zhangsan like Lisi or Wangwu

'Do you think whether Zhangsan likes Lisi or Wangwu?'

(40) a. *shi ta xihuan Zhangsan haishi Lisi?

be he like Zhangsan or Lisi

'It is him that likes Zhangsan or Lisi?'

b. *shi ta xihuan shei?

be he like who

'It is him that likes who?'

Now consider the following question (41a). This question can be paraphrased as (41b), supposing the domain contains Zhangsan, Lisi, Wangwu, etc. This means that the two questions are same in semantics, which in turn implies that both questions should be treated similarly. Then it is quite natural to paraphrase the wh-word *shei* as *Zhangsan haishi Lisi haishi Wangwu...haishi...,* that is, a set of alternative individuals.

(41) a. ni xihuan shei?

you like who

'Who do you like?'

b. ni xihuan Zhangsan haishi Lisi haishi Wangwu...haishi...?

you like Zhangsan or Lisi or Wangwu…or…

'Do you like Zhangsan or Lisi or Wangwu…or?'

To fully establish the affinity between *shei* and *Zhangsan haishi Lisi haishi Wangwu...haishi...,* we must again prove that the phrase *Zhangsan haishi Lisi* in alternative question (41b) is a genuine NP, without any clausal projection.

The syntactic nature of the connected constituents may vary from question to question, like NPs, VPs or IPs; but all such constituents within a question are of the same syntactic type. Huang (1988) and others have assumed that when *haishi* conjoins two nominal phrases, it is derived from conjunction reduction from sentential coordination. Consider (24), repeated here as (42), under the reduction account, we have to posit that (42a) is derived from (42b) by deleting the subject *ni* 'you' and the verb *xihuan* 'like'.

(42) a. ni xihuan Zhangsan haishi Lisi?
you like Zhangsan or Lisi
'Do you like Zhangsan or Lisi?'
b. ni xihuan Zhangsan haishi ~~ni xihuan~~ Lisi?
you like Zhangsan or you like Lisi
'Did you like Zhangsan or do you like Lisi?'

There are several objections towards this view. First, conjunction reduction is subject to Directionality Constraint in that left-branching terms delete forward and right-branching terms delete backward (Ross 1967). The subject, being left-branching, deletes forward (the second subject). This is attested in Chinese, as indicated in (43). But how the verb is deleted is unclear. Verb deletion (gapping) is not attested in Chinese in either direction, as shown in (44).

(43) a. Zhangsan changge, Zhangsan tiaowu=Zhangsan changge, tiaowu
Zhangsan sing, Zhangsan dance
'Zhangsan sings, Zhangsan dances.'
b. Zhangsan changge, Lisi changge=Zhangsan, Lisi changge
Zhangsan sing, Lisi sing
'Zhangsan sings, Lisi sings.'

(44) a. Zhangsan zhu fan, Lisi zhu mian.
Zhangsan cook rice, Lisi cook noodle
'Zhangsan cooks rice, Lisi cooks noodle.'
b. *Zhangsan zhu fan, Lisi ~~zhu~~ mian.

Zhangsan cook rice, Lisi cook noodle

'Zhangsan cooks rice, Lisi cooks noodle.'

c. *Zhangsan ~~zhu~~ fan, Lisi zhu mian.

Zhangsan cook rice, Lisi cook noodle

'Zhangsan cooks rice, Lisi cooks noodle.'

Second, Han and Romero (2004) propose that Korean alternative questions must involve clausal deletion. One argument is that each NP disjunct can be followed by an adverb. In Chinese, we find that such adverb placement in each NP disjunct impossible. If *haishi* conjoins two VPs or IPs, the adverb *quai* 'quick' can occur in the second disjunct.

(45) a. Chelswu-ka khophi-lul ppali animyen cha-lul ppali masi-ess-ni?

Chelswu-nom coffee-acc quickly if-not tea-acc quickly drink-past-int

Which of these two things did Chelswu drink quickly: coffee or tea?

b. *Zhangsan he kafei kuai haishi cha kuai?

Zhangsan drink coffee quick or tea quick

Which of these two things did Zhangsan drink quickly: coffee or tea?

Third, the adjective *gezi* 'each self' needs at least two individuals in the sentence. In sentence (46a) there are two individuals in the context, so the sentence is grammatical. But sentence (46b) is ruled out. This is a mystery if sentence (46a) is derived from sentence (46b) by conjunction deletion[10].

(46) a. laoshi gaosu-le Zhangsan haishi Lisi gezi de chengji?

teacher tell-Asp Zhangsan or Lisi each DE score

'Did the teacher tell Zhangsan or Lisi their score?'

b. *laoshi gaosu-le Zhangsan gezi de chengji haishi laoshi gaosu-le

teacher tell-Asp Zhangsan each DE score or teacher tell-Asp

Lisi gezi de chengji

[10] Note that this evidence also excludes the possibility of raising (leftward or rightward) instead of deletion.

Lisi each DE score

'Did the teacher tell Zhangsan his score or did the teacher tell Lisi his score?'

Fourth, alternative questions are subject to specificity condition, as indicated in the following ungrammatical sentence (47a). If alternative question involves conjunction reduction, it should be originated from (47b), which, however, is a perfect sentence.

(47) a. *ni zui xihuan Zhangsan haishi Lisi xie de na-ben shu?
you most like Zhangsan or Lisi write DE that-Cl book
'Did you most like that book that Zhangsan or Lisi writes?'

b. ni zui xihuan Zhangsan xie de na-ben shu haishi ni zui xihuan Lisi xie de na-ben shu?
you most like Zhangsan write DE that-Cl book or you most like Lisi write DE that-Cl book
'Did you most like that book that Zhangsan writes or did you most like that book that Lisi writes?'

Fifth, sometimes conjunction reduction gives rise to different meanings to the alternative question. In question (48a), one book (the same book of mine) is asked whether you give it to Zhangsan or Lisi. In question (48b) there must be two different books of mine being asked whether you give each to Zhangsan or to Lisi respectively. This is because two existentially quantified expressions cannot refer to the same thing in a sentence/discourse.

(48) a. ni ba wo xie de yi-ben shu song gei-le Zhangsan haishi Lisi?
you BA I write DE one-Cl book send-Asp Zhangsan or Lisi
'Did you send a book that I write to Zhangsan or Lisi?'

b. ni ba wo xie de yi-ben shu song gei-le Zhangsan haishi ni ba wo xie de yi-ben shu song gei-le Lisi?
you ba I write DE one-Cl book send-Asp Zhangsan or you BA wo xie de yi-ben shu song gei-le Lisi?

I write DE one-Cl book send-Asp Lisi
'Did you send a book that I write to Zhangsan or did you send a book that I write to Lisi?'

Dong (2009) provides an argument for treating the sub-sentential conjunctive *haishi* as fully sentential. In the following two sentences, only *huozhe* 'or' is compatible with the polarity question marker *–ma*, but *haishi* cannot, as shown in (49a) and (49b):

(49) a. *Zhangsan xihuan Lisi haishi Mali ma?
Zhangsan like Lisi or Mary Q
Intended reading: Does Zhangsan like someone (either Lisi or Mary)?
b. Zhangsan xihuan Lisi huozhe Mali ma?
Zhangsan like Lisi or Mary Q
Does Zhangsan like someone (either Lisi or Mary)?

The reasoning is that the incompatibility of *haishi* and *–ma* shows that the arguments of *haishi* must be IPs, because (49a) would not be ungrammatical if *haishi* can take simple DPs as arguments, just like *huozhe* in (49b). Therefore all alternative questions involve alternatives on the sentence level, even if there might be sub-sentential components. This argument does not hold for the simple reason that alternative questions cannot be further embedded with a yes/no question particle *ma*. Even in a sentential *haishi* question, the addition of *ma* is also ungrammatical as shown below in (50). Therefore we conclude that the contrast between (49) does not support the clausal deletion view.

(50) a. *Zhangsan xihuan Lisi haishi Lisi xihuan Zhangsan ma?
Zhangsan like Lisi or Lisi like Zhangsan Q
'Does Zhangsan like Lisi or does Lisi like Zhangsan?'
b. Zhangsan xihuan Lisi huozhe Lisi xihuan Zhangsan ma?
Zhangsan like Lisi or Lisi like Zhangsan Q
'Does Zhangsan like Lisi or Lisi like Zhangsan?'

Therefore, we argue that it is unnecessary to derive *haishi*-conjoined NPs from sentential reduction. *Haishi* is able to conjoin both sentences and noun phrases (and other categories). In the case of noun phrases, each alternative corresponds to one individual in the Hamblin set.

Now let's consider *zenmeyang* 'how'. The same alternation between wh-questions and alternative questions can be observed for this wh-expression. For example, *zenmeyang* questions can also be replaced by alternative questions with the same possible answers. Suppose Zhangsan has been ill for some time, and I was eager to know how he was. There are possibly only several situations that he would be: recovered, worsen, or the same. Then either I ask (51a) or (51b), I am asking for the same information. Therefore, we reach the conclusion that *zenmeyang* denotes a set of things.

(51) a. Zhangsan zenmeyang le?
Zhangsan how Prt
'How is Zhangsan?'
b. Zhangsan hao le, huai le, haishi yiyang?
Zhangsan good Prt, bad Prt, or same
'Does Zhangsan become well, bad, or the same?'

On the other hand, we have shown *weishenme* does not denote a set of alternatives. Surprisingly, the reason *weishenme* can also admit such substitutivity with alternative questions. Suppose Zhangsan resigned from his job, and I was eager to know the reason for his resignation. The reasons that I can think of may include: the salary is low, the workplace is far away, bad relation with his boss. Then I ask (52a) for information. One may substitute alternative question (52b) with it. As pointed out earlier, if we treat the reason adverbial *weishenme* as real quantifier (Huang 1982, Tsai 1994), we can still derive a question meaning that denotes a set of propositions.

(52) a. Zhangsan weishenme cizhi?
Zhangsan why resign

‘Why Zhangsan resigned?’

b. Zhangsan yinwei gongzi di cizhi, yinwei li jia yuan cizhi, haishi yinwei he laoban guanxi buhao cizhi?

Zhangsan because salary low resign, because home far resign, or because and boss relation bad resign

‘Did Zhangsan resign because the salary is low, workplace is far, or the relation with boss is bad?’

2. From ordinary functional application to pointwise functional application

What is the consequence of treating some wh-phrases as set-denoting? Recall that it is well-accepted that wh-items like *shei*, *shenme*, *nage ren*, *nali*, and *shenmeshihou* are able to take wider scope across islands. And the island-escaping property of *zenmeyang* is also well observed (Xu 1990, Tsai 1994, Hua 2000, Hu 2002). In addition, all these wh-phrases are able to associate with *zhi* ‘only’.

(53) a. ni bijiao xihuan [[ta zenmeyang zhu] de cai]?

you more like he how cook DE dish

What is the means *x* such that you like better [the dishes [which he cooks by *x*]]?

b. ni bijiao xihuan [[ta zhu-de zenmeyang] de cai]?

you more like he cook DE how DE dish

What is the result *x* such that you like better [the dishes [which he cooks into *x*]]?

(54) a. Zhangsan zhi xihuan shei?

Zhangsan only like who

‘Who is the person *x* such that Zhangsan only likes *x*?’

b. Zhangsan zhi zenmeyang kaiche?

Zhangsan only how drive-car

‘What is the manner *x* such that Zhangsan only drives a car by *x*?’

Do the denotations of these wh-phrases have any bearing to the above two properties of these wh-phrases? In the remaining part of this section, we will trace the above two properties as a consequence of the denotations of these wh-phrases[11].

2.1 Why do we need a pointwise functional application rule?

Let's see how the assumption that there are set-denoting wh-phrases influences the component of semantics. Consider the following question. If the wh-phrase denotes the usual quantifier or free variable (not a set of alternatives), we need the conventional functional application rule to compose the verb with the wh-phrase.

(55) Zhangsan mai-le shenme?
Zhangsan buy-Asp what
'What did Zhangsan buy?'

As noted earlier, in Hamblin semantics, all lexical items denote sets (*denotation-sets*). Most lexical items denote singleton sets containing their standard denotations, but the wh-phrase *shenme* denotes a set of alternative individuals {a, b, c,…}. If and there is no movement, we can no longer apply the usual functional application rule between ⟦shenme⟧^{w,g} and ⟦mai-le⟧^{w,g}, as shown in (56). This is because the predicate *mai* 'buy' takes *individuals* as its arguments, not *sets* of individuals. In other words, we have a type mismatch.

(56) Zhangsan mai-le {a, b, c,…}?
Zhangsan buy-Asp what
'What did Zhangsan buy?'

How could composition go on by composing a property and a set of alternative individuals? The answer is that we compose a property with *each* of the individuals in the set of individuals. Since there are many results of this predication (one for each of the

[11] The reason adverbial *weishenme* must abide by various island constraints and is unable to associate with *zhi* 'only'. Let's be contented with the usual treatment of *weishenme* as a quantifier.

individuals in the set of alternative individuals), we collect the results in a set too. Thus, instead of getting a property, we get a set of properties[12]. This idea was proposed by Hamblin (1973: 48):

> "This does not mean, of course, that the formula 'who walks' asserts that the set of human individuals walks: we must modify other stipulations in sympathy. We shall need to regard 'who walks' as itself denoting a set, namely, the set whose members are the propositions denoted by 'Mary walks', 'John walks', … and so on for all individuals. Pragmatically speaking a question sets up a choice-situation between a set of propositions, namely, those propositions that count as answers to it."

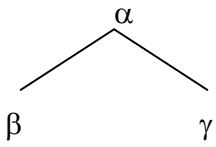
Given this idea, ⟦mai-le⟧^{w,g} and ⟦shenme⟧^{w,g} shall not be directly composed by the ordinary functional application rule; instead they shall be composed by satisfying the predicate with each of the member of the set denoted by ⟦shenme⟧^{w,g}. The result yields a set of properties in the form of {buy a, buy b, buy c,…}, suppose ⟦shenme⟧^{w,g} denotes a set of things {a, b, c,…}. Though the result is a set of properties, we still use the ordinary functional application rule, but in many times. Each time, each member in the set is applied to the predicate; as a result, the sethood is lifted from individuals to properties. A metaphor from Hagstrom and McCoy (2009) is illuminating:

> Consider a vending machine to be a function from quarters to cans of soda, and consider what the natural resolution would be of a situation in which someone approached the vending machine with a bag of quarters. Although the vending machine cannot accept things of type 'bag', each of the items *in* the bag is of the right type. Applying pointwise (flexible) functional application in this analogy, we would simply run through the quarters in the bag, collecting sodas as each iteration of the function completes.

[12] In other words, it denotes a set of sets, and it would have to take a property (a set of individuals) as an argument. This works in Hamblin semantics because every lexical element denotes a set.

This kind of functional application is called 'pointwise' functional application rule as defined below (Hamblin 1973, Rooth 1985, Beck and Rullmann 1999, Hagstrom 1998). In this formula (57), we extend the 'pointwise' operation to cover cases where predicates also denote sets of properties.

(57) If α is a branching node with daughters β and γ, and $[\![\beta]\!]^{w,g} \subseteq D_\sigma$ and $[\![\gamma]\!]^{w,g} \subseteq D_{<\sigma\tau>}$, then $[\![\alpha]\!]^{w,g} = \{a \in D_\tau: \exists b \exists c[b \in [\![\beta]\!]^{w,g} \& c \in [\![\gamma]\!]^{w,g} \& a=c(b)]\}$.



The two daughter nodes β and γ represent semantic categories, and are insensitive to syntactic categories. They may be heads, X-bars, or phrases in the syntax. The order between nodes β and γ is irrelevant too, as long as one node can be the argument of another node (type matching). This rule is the only consequence of our assumption that wh-phrases denote sets of alternatives. Later we will see that this rule can solve several puzzles concerning Chinese wh-questions.

2.2 Basic working mechanism

Now return to sentence (55). Since wh-phrases denote a set of alternatives, it must compose with its sister nodes via the pointwise functional application rule. In the above sentence, $[\![\text{shenme}]\!]^{w,g}$ denotes the set of things $\{x: \text{thing}(x)(w)\}$; $[\![\text{mai-le}]\!]^{w,g}$ denotes $\{\lambda x \lambda y \lambda w'.\text{buy}(x)(y)(w')\}$, a singleton set of a function mapping individuals to properties, as usual. By pointwise functional application rule, we have:

(58) $[\![\text{mai-le}]\!]^{w,g}([\![\text{shenme}]\!]^{w,g})$

a. $= \{a: \exists b \exists c[b \in [\![\beta_\sigma]\!]^{w,g} \& c \in [\![\gamma_{<\sigma\tau>}]\!]^{w,g} \& a=c(b)]\}$

b. $= \{a: \exists b \exists c[b \in [\![\text{shenme}]\!]^{w,g} \& c \in [\![\text{mai-le}]\!]^{w,g} \& a=c(b)]\}$

c. $= \{a: \exists b \exists c[b \in \{x: \text{thing}(x)(w)\} \& c \in \{\lambda x \lambda y \lambda w'.\text{buy}(x)(y)(w')\} \& a=c(b)]\}$

d. ={a: ∃b[b∈{x: thing(x)(w)} & a=λxλyλw'.buy(x)(y)(w')(b)]}

e. ={a: ∃x[thing(x)(w) & a=λyλw'.buy(x)(y)(w')]}

Let's suppose that when we replace a symbol with its denotation in the subformula a=c(b), the existential force of that symbol is removed. In the above derivation, replacing *c* with λxλyλw'.buy(x)(y)(w'), the existential force ∃c and the subformula c∈{λxλyλw'.buy(x)(y)(w')} can be removed from the formula, thus we obtain (58d). Replacing *b* with *x*, we obtain (58e). The final result of the VP denotes a set of properties of the form of: {λyλw'.buy(m)(y)(w'), λyλw'.buy(n)(y)(w'), ...}. Now we compose this set denoted by VP with the proper name *Zhangsan*, again by the pointwise functional application rule.

(59) ⟦zhangsan⟧(⟦mai shenme⟧^{w,g})

={a: ∃b∃c[b∈⟦β_σ⟧^{w,g} & c∈⟦$\gamma_{<\sigma\tau>}$⟧^{w,g} & a=c(b)]}

={a: ∃c∃b[c∈⟦mai shenme⟧^{w,g} & b∈⟦zhangsan⟧^{w,g} & a=c(b)]}

={a: ∃c∃b[c∈{c: ∃x[thing(x)(w) & c=λyλw'.buy(x)(y)(w')]} & b∈{zhangsan} & a=c(b)]}

={a: ∃c[c∈{c: ∃x[thing(x)(w) & c=λyλw'.buy(x)(y)(w')]} & a=c(zhangsan)]}

={a: ∃x[thing(x)(w)] & a=λw'.buy(x)(zhangsan)(w')}

Applying the law of quantifier movement: (∃x)(ψ(x)) & φ ⇔ (∃x)(ψ(x) & φ) provided that x is not free in φ, we can extract the existential quantifier over to cover both its restrictor and the proposition because the variable x in *a* is not free. Then (59) can be refined as (60)[13]:

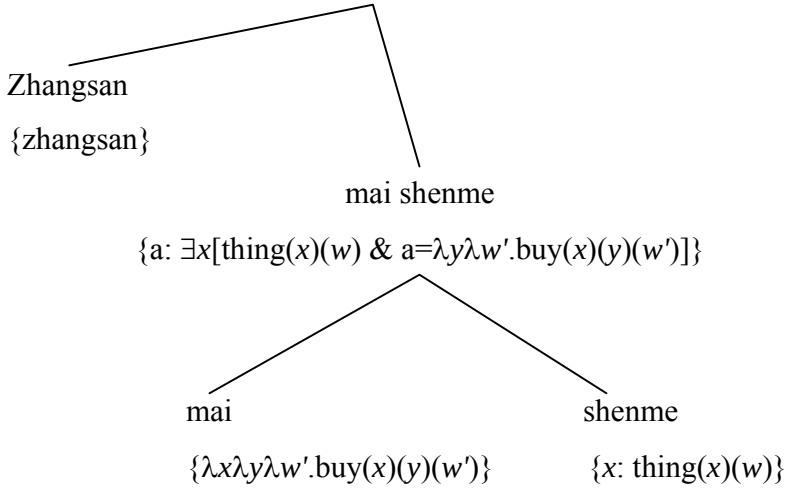
(60) {p: ∃x[thing(x)(w) & p=λw'.buy(x)(zhangsan)(w')]}

The world variable *w* associated with the wh-phrase *thing(x)(w)* is free. Since there is

[13] From now on, we use *f* as the symbol for property, *p* as the symbol for proposition, *a* as the general symbol. Superscripts will be ignored as well.

no other operator that can bind this world variable, it will be given a value of speaker's world, so the thing refers to something in the actual world. Suppose we supply constant values to the formula, we obtain a set of propositions by the pointwise functional application rule, which is a question denotation: a set of propositions, each of which states that Zhangsan bought something. On this Hamblin-style analysis, no special semantic or syntactic relation---like binding or movement---between the wh-in-situ expression and 'its' operator has to be posited.

(61) IP: {p: ∃*x*[thing(*x*)(*w*) & p=λ*w′*.buy(*x*)(zhangsan)(*w′*)]}



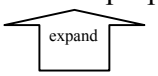
2.2.1 *Expansion* by the pointwise functional application rule

The above illustration is a rough outline of how the pointwise functional application rule works. In the process of derivation, this rule plays a critical role for obtaining the final representation. When one node denotes a set of alternatives, it must be used. Except for the assumption that wh-phrases denote sets of alternatives, which can expand to higher type, there is actually no dramatic departure from standard Montague semantics. Different from the conventional functional application[14], the pointwise functional application is able to evaluate the wh-phrase in a displaced position though it is interpreted in situ. This is achieved by the process of expansion inherent to the pointwise functional application rule, which, by definition, expands sets of individuals to sets of

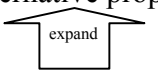
[14] In the conventional functional application rule, the argument is put to satisfy the predicate, and as a result, the argument is interpreted within the scope of the predicate within the subformula a=c(b).

properties, and from sets of properties to sets of propositions.

(62) Set of alternative propositions



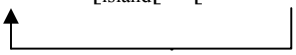
Set of alternative properties



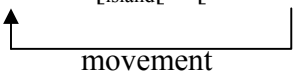
Set of alternative individuals

The consequence of this expansion process is that the restriction of the wh-phrase is located out of the subformula c(b), only leaving a variable inside: there is an element which is a member of the set of alternative individuals such that it has certain property: {a: $\exists$b[b$\in$⟦β⟧^{w,g} & a=c(b)]}. This formula is translated into a set of alternative in which the indefinite is 'extracted' from the subformula, which may be a property or a proposition. Therefore, though in syntax (surface or LF), the wh-phrase is not moved, in semantics it is moved. This mechanism provides us with a new perspective on the long-distance interpretation of wh-in-situ.

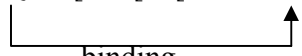
(63) a. [wh-in-situ [$_{island}$[…[…wh-in-situ…]]]]



b. [wh-in-situ [$_{island}$[…[……..t……..]]]]



c. [Q [$_{island}$[…[…wh-in-situ…]]]]



The existential force of wh-in-situ expression (though wh-phrases are not existential inherently) is produced by the interpretational mechanism of the pointwise functional application, too: *there* is an element which is a member of the set of alternative individuals such that it has certain property (similar to the treatment of DRT). The existential force $\exists$ of each member of the set is also expanded along with the set itself

until it is blocked by some operators (see chapter 4).

2.2.2 *Closure* by quantificational operators

Though in the derivation for a wh-question, the wh-phrases are expanded to the root sentence, the expansion may be closed by some suitable operators available, notably the existential operator and the universal operator. Kratzer and Shimoyama (2002) identify two paradigms of both operators: one type of quantifies over whole propositions and one type of quantifies over individuals. Each type has two quantifiers: existential and universal.

The existential propositional operator applies to a set of propositions A and yields the proposition that is true in all worlds in which some proposition in A is true. The existential generalized quantifier applies to a set of individuals and yields the property of properties that is true of any property P if some individual in A has it.

(64) For $[\![\alpha]\!]^{w,g} \subseteq D_e$ or $D_{<\sigma\tau>}$:
(i) $[\![\exists\alpha]\!]^{w,g} = \{\lambda w'.\exists p\ [p \in [\![\alpha]\!]^{w,g}\ \&\ p(w')]\}$
(ii) $[\![\exists\alpha]\!]^{w,g} = \{\lambda P\lambda w'.\exists a[a \in [\![\alpha]\!]^{w,g}\ \&\ P(a)(w')]\}$

The universal propositional operator applies to a set of propositions A and yields the proposition that is true in all worlds in which every proposition in A is true. The universal generalized quantifier applies to a set of individuals and yields the property of properties that is true of any property P if every individual in A has it.

(65) For $[\![\alpha]\!]^{w,g} \subseteq D_e$ or $D_{<\sigma\tau>}$:
(i) $[\![\forall\alpha]\!]^{w,g} = \{\lambda w'.\forall p\ [p \in [\![\alpha]\!]^{w,g} \rightarrow p(w')]\}$
(ii) $[\![\forall\alpha]\!]^{w,g} = \{\lambda P\lambda w'.\forall a[a \in [\![\alpha]\!]^{w,g} \rightarrow P(a)(w')]\}$

In the version developed by Kratzer and Shimoyama (2002), which is mainly based on Japanese data, there is also a question operator *–ka* that closes such expansion. However, the result of such closure by *ka* is just the same as its input, a set of propositions. So they considered two possibilities of the semantic contribution of the

question particle. The first possibility is that the Q is semantically vacuous. The second possibility is that the Q turns the alternative set into a partition (Groenendijk & Stokhof 1984).

(66) a. $[\![Q\alpha]\!]^{w,g} = [\![\alpha]\!]^{w,g}$

b. $[\![Q\alpha]\!]^{w,g} = \{\lambda w'.\forall p(p \in [\![\alpha]\!]^{w,g} \rightarrow (p(w)=1 \leftrightarrow p(w')=1)\}$

Under the current proposal, the wh-phrases are expanded by the pointwise functional application rule to the root sentence. The final result is a set denotation, which is the meaning of a wh-question. There is also no need for Q-morpheme or question operator or even the CP projection since wh-phrases already denote sets of alternatives, which end up with question denotation[15]. In this respect, the current proposal is closer to the traditional view on questions in Chinese[16] and is what Hamblin originally intended.

There are several reasons why we prefer to posit no question operator in Chinese. The first reason is only theory-theoretical. The current proposal features a simpler syntax-semantics interface, while in LF movement proposal, we need CP projection and the C-complementizer plays a critical role in deriving the question denotation. And in unselective binding proposal, in addition to the CP projection and the C-complementizer,

[15] Similarly, in indirect wh-questions, there is no question particle or the Q morpheme that gives rise to the question meaning. The question denotation is dependent on the nature of the embedding verb. If the embedding verb selects a question complement, the wh-phrase in the complement cannot be further expanded across the embedding verb. Otherwise the selectional restriction of the question-embedding verb cannot be met.

(1) a. Zhangsan wen shei lai le.
Zhangsan ask who come Prt
'Zhangsan asked who came.'

b. ask(zhangsan, {p: ∃*x*[person(*x*)(w) & p=come(*x*)]})

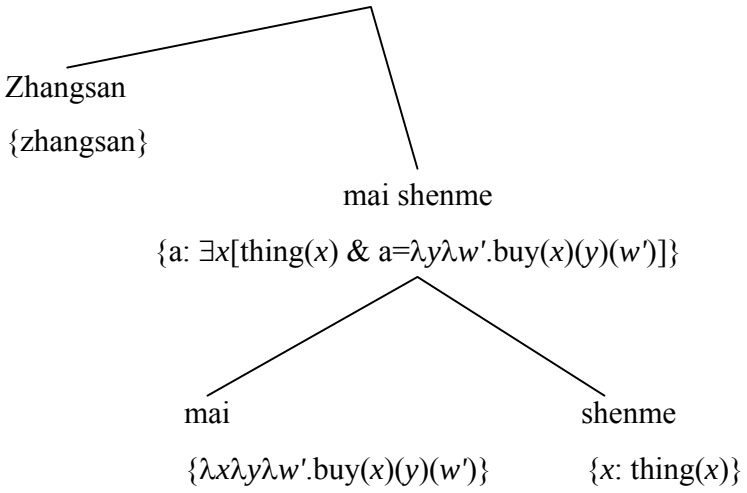
c. *{p: ∃*x*[person(*x*)(w) & p=ask(zhangsan, come(*x*)]}

[16] Traditional Chinese grammarians classify roughly four formal forms to type a question (Li and Thompson 1981, Zhu 1982, Shao 1996, among others). Each type of questions is supported by some morphological markings that signal the interrogative force of a sentence, including question particles, wh-phrases, question structures like A-not-A and A *haishi* B.

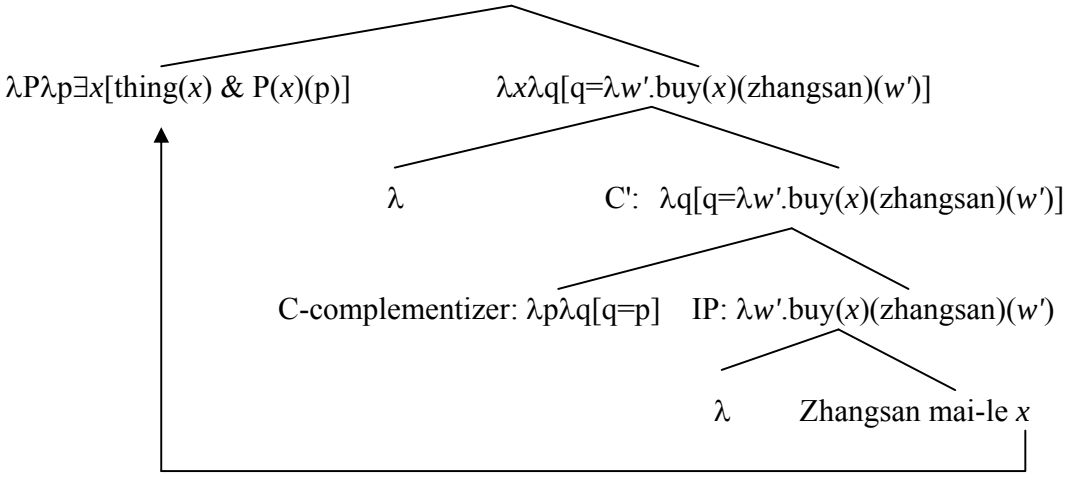
we need a Q-morpheme or question operator that binds the wh-variable. The following sentence (67), repeated from above, would be represented in (68), (69), and (70) respectively under the frameworks of the three approaches.

(67) Zhangsan mai-le shenme?
Zhangsan buy-Asp what
'What did Zhangsan buy?'

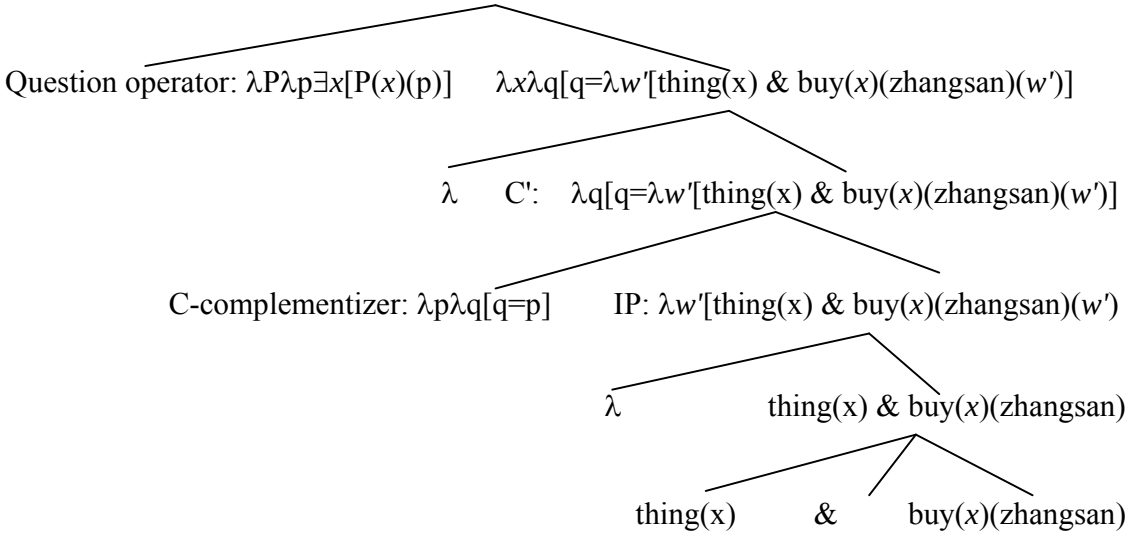
(68) IP: {p: ∃*x*[thing(*x*) & p=λ*w′*.buy(*x*)(zhangsan)(*w′*)]}



(69) CP: λp∃*x*[thing(*x*) & p=λ*w′*.buy(*x*)(zhangsan)(*w′*)]



(70) CP: λp∃*x*[p=λ*w*′[thing(*x*) & buy(*x*)(zhangsan)(*w*′)]



The second reason is empirical. In Japanese, the question operator *–ka* is obligatory in wh-questions and can be embedded. It may be reasonable to posit a question operator in that language. On the contrary, Chinese wh-questions do not need an obligatory question particle; therefore the lack of an obligatory question particle provides us with a superficial piece of evidence that there is no such wh-question operator that closes a question.

Nevertheless, many authors have proposed that *ne* in wh-questions may be a realization of the Q-morpheme or the C (Cheng 1991, Aoun & Li 1993, among others). For example, Cheng (1991) has explicitly proposed that *ne* is a Q-morpheme, which serves to type a sentence as wh-questions. When there is no *ne*, a covert one is there. If this is correct, the Q must be semantically vacuous under the Hamblin semantics adopted in this work. On the other hand, Aoun & Li (1993) proposed that *ne* is the C, signaling the existence of a question operator that carries question-seeking information or feature. In a word, *ne* in wh-questions is an element that is responsible for the interrogative force of wh-questions. Therefore it is necessary to project an interrogative CP for wh-questions.

However, the claim that *ne* is an element responsible for the interrogative force of wh-questions is not well supported. Many people have also argued that in wh-questions, *ne* does not carry any interrogative force, which is already inherent in the wh-words (Hu

1981, Lu 1982, Wen-Lian 1982, Chu 1983, Tian 1988, Shao 1996, Shi 1997). The lack of interrogative force of *ne* can be seen from its contrast with *ma*. *Ma* is usually considered as a yes/no question particle. This is shown by the fact that if a sentence has a falling intonation, it cannot be a question without *ma*. In the case of *ne*, even if the sentence has a falling intonation, it can be a question without *ne*.

(71) a. ni renshi ta ma↓?
you know him Q
'Do you know him?'
b. ni renshi ta↓.
you know him
'you know him.'

(72) a. ni renshi shei ne↓?
you know who Prt
'Who do you know?'
b. ni renshi shei↓.
you know who
'Who do you know?'

If *ne* is the wh-question operator and there is also a covert one, it implies that wh-questions with or without *ne* are the same in meaning. However, sometimes the use of *–ne* makes the question sound more like a question that the speaker asks himself/herself, and the interrogative mood is actually weakened (Wen-Lian 1982):

(73) a. shei chi le? (please tell me)
who eat Prt
'Who ate?'
b. shei chi le ne? (I just could not figure it out)
who eat Prt Prt
'Who ate?'

(74) a. ni qu haishi wo qu? (please make a decision)

you go or I go

'do you go or do I go?'

b. ni qu haishi wo qu ne? (let's have a study)

you go or I go Prt

'do you go or do I go?'

On the contrary, *ma* is to express pure interrogative force, which turns a statement into a question. If there is no *ma* but only a rising intonation, the interrogative force is weakened, on the contrary.

(75) a. ta yao zou le ma? (pure inquiry)

he will go Prt Q

'Will he go?'

b. ta yao zou le? (with a sense of doubt)

he will go Prt

'Will he go?'

Further in many occasions, it is infelicitous to add *ne*. For example, the question (76a) is natural but question (76b) is unnatural (see Li and Thompson 1981).

(76) a. ni jiao shenme mingzi?

you call what name

'What's your name?'

b. ??ni jiao shenme mingzi ne?

you call what name Prt

'What's your name?'

If *ne* is a wh-question operator, it may be introduced in a root sentence or embedded clause. However, the particle *–ne* can not be embedded under [+wh] verbs, as indicated in (77). Thus we may ask why the particle *–ne* can not take embedded scope, if it is indeed a question particle, as claimed by Cheng (1991). As for the [-wh] verbs and the [±wh]

verbs, they are compatible with *–ne* as long as a matrix scope is available.

(77) a. *Zhangsan wen wo shei mai-le shu ne?
Zhangsan ask me who buy Asp book Prt
'Zhangsan asked me who bought books.'
b. Zhangsan xiangxin shei mai-le shu ne?
Zhangsan believe who buy Asp books Prt
'Who does Zhangsan believe bought books?'
c. Zhangsan zhidao shei mai-le shu ne
Zhangsan know who buy Asp books Prt
'Who does Zhangsan know bought books?'

The above data show that the particle *–ne* is strictly speaker-oriented. Only when it is used in a root question will it be acceptable and the semantic contribution has to do with the speaker's attitude towards the question that he/she is asking[17]. Whenever the subject related to the question is not the speaker, the use of *–ne* leads to ungrammaticality, as shown in (77a). Thus this particle does not seem to be a genuine question particle (Dong 2009). Therefore we conclude that there is no necessity to posit a Q-morpheme or C-complementizer like *ne* in wh-questions that types the sentence as interrogative. Wh-words already have this function[18].

To sum up, the current proposal features two mechanisms: expansion and closure. Expansion of wh-phrases is achieved by the pointwise functional application rule. The process of expansion may be automatically blocked in the presence of some closing operators,. Thus, a wh-phrase will be trapped within a particular syntactic environment only if that environment contains an operator that prevents the alternatives from expanding further up. Consequently the scope of wh-phrases depends on the position of

[17] There are many proposals on *ne*. One proposal treats *ne* as a continuative particle, signaling a previous discourse or a common assumption (Chu 1983).

[18] Though it is not easy to prove whether a full question sentence projects a CP or an IP, we have shown in section 1.1 of this chapter that bare wh-questions like 'shei?' only projects an NP. This shows that at least sometimes it is unnecessary to posit CP projection to obtain a question denotation.

such operators. The consequence of closure is that wh-phrases are always existential (defined by the definition of the pointwise functional application rule), with their seemingly quantificational variability a product of the closing quantificational operators. To recapitulate, the main tools we need are:

(78) The assumption on the denotation of wh-phrases;

(79) The pointwise functional application rule;

(80) The mechanism of closure by quantificational operators (*quantificational closure*), if there is one.

The logic is: if we accept (78), then we must accept (79). The assumption that wh-phrases denote sets of alternatives (hence inherently interrogative), which receives some empirical support, is the most fundamental hypothesis. The mechanism of pointwise functional application rule is a consequence from it. Due to the above assumption, wh-phrases should be interpreted via the pointwise functional application rule, which has been proven to be a generalized rule for semantic composition, with the usual functional application rule just a special case of it. The process of expansion may be closed, so if we accept (79), then we are led to accept (80) too because a sentence containing a wh-phrase sometimes may not be interrogative.

2.3 The pointwise functional application rule is a generalized rule

It should be noted that this rule is not dramatically different from the ordinary functional application rule, as it might be seen at first sight. In its most generalized cases, this rule specifies how a set of alternatives composes with another set of alternatives, that is, the two daughters both denote a set of alternatives. In standard cases, the other set is usually a singleton set, the predicate $[\![\gamma]\!]^{w,g}$. Then this rule composes the singleton set with each member of the other non-singleton set of alternatives. The result is a set of entities, each of which is the entity (property or proposition) of applying each member of the non-singleton set of alternatives to the singleton set in form of a=c(b). Since the other set, the predicate $[\![\gamma]\!]^{w,g}$, is usually a singleton set, the existential force ∃c is redundant, therefore, we can reduce formula (57) to:

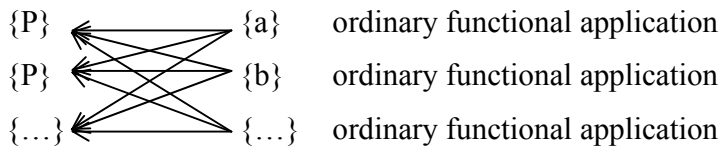
(81) If α is a branching node with daughters β and γ, and $[\![\beta]\!]^{w,g} \subseteq D_\sigma$ and $[\![\gamma]\!]^{w,g} \subseteq D_{<\sigma\tau>}$, then $[\![\alpha]\!]^{w,g} = \{a \in D\tau: \exists b[b \in [\![\beta]\!]^{w,g} \ \& \ a=c(b)]\}$.

When both nodes denote a singleton set, the pointwise functional application further reduces into the conventional functional application as defined in Heim & Kratzer (1998). So it is reasonable to say it is a special case of the pointwise functional application rule. The pointwise functional application rule is the generalized rule.

(82) If α is a branching node with daughters β and γ, and $[\![\beta]\!]^{w,g} \subseteq D_\sigma$ and $[\![\gamma]\!]^{w,g} \subseteq D_{<\sigma\tau>}$, then $[\![\alpha]\!]^{w,g} = [\![\gamma]\!]^{w,g}([\![\beta]\!]^{w,g})$.

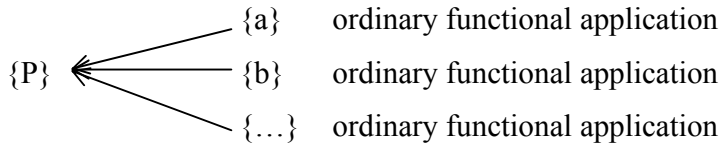
The pointwise functional application can be diagrammed in the following three graphs respectively for the three cases.

Case (1): Both sisters denote non-singleton sets



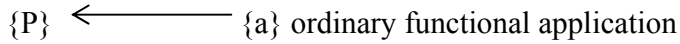
Pointwise functional application

Case (2): One denotes a singleton set, one denotes a non-singleton set



Pointwise functional application

Case (3): Both sisters denote singleton sets



Ordinary functional application

Since we have claimed that the pointwise functional application rule is a generalized rule, we hope to find applications of each schema in natural language. Below we will show that each schema of this rule is needed in Chinese, at least.

2.3.1 Both sisters denote singleton sets

Case 3 is the ordinary functional application rule, which is familiar to us.

2.3.2 One denotes a singleton set, one denotes a non-singleton set

A typical example of this case is (55), repeated here as (83), in which the argument denotes a set of alternative individuals.

(83) a. Zhangsan mai-le shenme?
Zhangsan buy-Asp what
'What did Zhangsan buy?'
b. {p: ∃*x*[thing(*x*) & p=λ*y*λ*w'*.buy(*x*)(zhangsan)(*w'*)]}

Since the pointwise functional application rule does not stipulate the syntactic categories of the two daughter nodes β and γ. The composition proceeds as long as one node can be the argument of another node (type matching). It is possible that the non-singleton set is introduced by other syntactic categories like the verb, verb phrase, or other categories. This is exactly what we find. First consider the possibility in which a set of alternatives should be introduced by the predicate (verbs or verb phrases). Consider:

(84) Zhangsan zenmeyang le?
Zhangsan how Prt
'How was Zhangsan?'

In the question (84), *zenmeyang* 'how' serves as the main predicate. The verbal "how" can be argued to contribute a set of properties. The domain restriction of the verbal *zenmeyang* is context dependent. For example in (84), the set could be a set of states like {happy, angry, …}, depending on contexts. The denotation of this verbal

zenmeyang can be defined, with the help of event semantics, as: ⟦*zenmeyang*⟧={*s*: state(*s*) & ∃*e*λ*x*[agent(*x*,*e*) & s(*e*)]}[19].

(85) ⟦zenmeyang-le⟧⟦Zhangsan⟧
={p: ∃b∃c[b∈{Zhangsan} & c∈{*s*: state(*s*) & ∃*e*λ*x*[agent(*x*,*e*) & *s*(*e*)]} & p=c(b)]}
={p: ∃c[c∈{*s*: state(*s*)} & p=∃*e*λ*x*[agent(*x*,*e*) & *s*(*e*)](Zhangsan)]}
={p: ∃*s*[state(*s*) & p= ∃*e*[agent(zhangsan,*e*) & *s*(*e*)]]}

To paraphrase the meanings of the above derivation, ⟦Zhangsan zenmeyang le⟧ denotes a set of alternative propositions such that among the propositions there is some state such that Zhangsan is the agent of an event that has the property of being in that state: {Zhangsan is happy, Zhangsan is angry, …}.

Similarly, when used as a transitive verb as in (86), the denotation of this verbal ⟦*zenmeyang*⟧ can be defined as: {*a*: action(a) & ∃eλ*x*λ*y*[thematic(*x*,*y*,*e*) & *a*(*e*)]}. Composing ⟦*zenmeyang*⟧ with ⟦Lisi⟧ produces (87), which is further composed with the proper name ⟦Zhangsan⟧, returning {p: ∃*a*[action(*a*) & p=∃*e*[thematic(lisi,zhangsan,*e*) & a(*e*)]]}. It denotes a set of alternative propositions such that among the propositions there is some action such that Zhangsan is agent and Lisi is theme in an event that has the property of being in that action: {Zhangsan hit Lisi, Zhangsan kicked Lisi, …}.

(86) Zhangsan zenmeyang ni le?
Zhangsan how you Prt
'How did Zhangsan do to you?'

(87) ⟦zenmeyang-le⟧⟦Lisi⟧=
={f: ∃b∃c[b∈{lisi} & c∈{*a*: action(*a*) & ∃*e*λ*x*λ*y*[thematic(*x*,*y*,*e*) & *a*(*e*)]} & f=c(b)]}
={f: ∃*a*[*a*∈{*a*: action(*a*)} & f=∃*e*λ*x*[thematic(*x*,lisi,*e*) & *a*(*e*)]]}
={f: ∃*a*[action(*a*) & f=∃*e*λ*x*[thematic(*x*,lisi,*e*) & *a*(*e*)]]}

[19] For sake of simplicity, world variables are ignored.

Now consider the possibility in which a set of alternatives should be introduced by adverbial phrases that have higher-order type than the predicate. Consider (88), in which *zenmeyang* is to be interpreted as manner adverbial. We assume it denotes a set of alternative manners, defined as: ⟦*zenmeyang*⟧={*m*: manner(*m*) & ∃*e*[λP[P(*e*) & *m*(*e*)]]}. Composing ⟦*zenmeyang*⟧ with ⟦kaiche⟧ produces (89), which is further composed with the proper name ⟦Zhangsan⟧, returning {p: ∃*m*[manner(*m*) & p=∃*e*[drive-car(*e*) & agent(zhangsan,*e*) & m(*e*)]}. The final result is a question denotation: a set of alternative propositions such that among the propositions there is some manner such that Zhangsan is the agent in the event of driving and this event has the property of that manner: {Zhangsan drives a car by hand, Zhangsan drives a car by foot,…}.

(88) Zhangsan zenmeyang kaiche?
Zhangsan how drive car
'How does Zhangsan drive a car?'

(89) ⟦*zenmeyang*⟧⟦*kaiche*⟧=
={f: ∃b∃c[b∈{λ*e*λ*x*[drive-car(*e*) & agent(*x*,*e*)]} & c∈{*m*: manner(*m*) & ∃*e*[λP[P(*e*) & m(*e*)]]} & f=c(b)]}
={f: ∃*m*[manner(*m*) & f=∃*e*[λ*x*[drive-car(*e*) & agent(*x*,*e*)] & m(*e*)]]}

Case 2, we suggest, may also be used to compose the semantics of other types of questions in Chinese, like yes/no question, A-not-A questions and alternative questions. These types of sentences have clear morphological markings for alternatives, such as *haishi*, A-not-A. Intuitively they all involve a set of more than two alternatives in different levels in that a felicitous and possible answer makes a choice from these alternatives. For A-not-A questions, the alternatives are formed from the A-not-A operator in the level of predicate (Huang 1988); for alternative questions, the alternatives are formed from *haishi* in different levels. This is reasonable as alternative and A-not-A questions can all be the first argument of *wulun*, indicating their denotations are similar[20].

[20] Yes/no questions are bad in *wulun*-structure, and VO+*bu* questions are less grammatical.

However, a detailed analysis will not be attempted here.

(90) a. wulun ni shi-bu-shi xihuan Lisi,...
no matter you be-not-be like Lisi
'No matter whether you like Lisi or not…'
b. wulun ni xihuan Zhangsan haishi Lisi,...
no matter you like Zhangsan or Lisi
'No matter you like Zhangsan or Lisi…'

2.3.3 Both sisters denote non-singleton sets

Now we provide sentences that should apply case 1 where both sisters denote non-singleton sets. Two apparent examples that may be composed by this case are the followings. Take sentence (91a) for example. First we compose ⟦mai-le⟧ and ⟦shenme⟧ via pointwise functional application, returning {f: ∃*x*[thing(*x*) & f=λ*y*.buy(*x*)(*y*)]}. Then we compose ⟦shei⟧ and ⟦mai-le shenme⟧ via pointwise functional application again, as in (91b). Similarly, sentence (92a) can be represented in (92b).

(91) a. shei mai-le shenme?
who buy-Asp what

(i) a. *wulun ni qu Beijing ma, wo dou buguan.
no matter you go Beijing Q I all not care
'No matter whether you go to Beijing, I do not care.'
b. ?wulun ni qu Beijing bu, wo dou buguan.
no matter you go Beijing not I all not care
'No matter whether you go to Beijing, I do not care.'

Usually answers to yes/no questions are also considered as making a choice from two alternatives. Then why (i/a) is bad remains mysterious. Perhaps it can be accounted for by pragmatics. Yes/no questions are often biased towards a positive answer whereas alternative and A-not-A questions are neutral (Chao 1968, Li and Thompson 1981). If the answers are already biased to be positive, we cannot make a choice from two alternatives. Another reason may be that *ma* cannot be embedded; it always needs to take widest scope over a sentence. Another reason may be that *wulun* does not take a direct question (Shi Dingxu, pc). Again this problem is not a task in this work.

'Who bough what?'

b. ⟦mai-le shenme⟧⟦shei⟧

$=\{p: \exists b \exists c[b \in \{y: person(y)\} \ \& \ c \in \{c: \exists x[thing(x) \ \& \ c=\lambda y.buy(x)(y)]\} \ \& \ p=c(b)]\}$

$=\{p: \exists b[b \in \{y: person(y)\} \ \& \ \exists x[thing(x)] \ \& \ p=\lambda y.buy(x)(y)(b)]\}$

$=\{p: \exists y[person(y) \ \& \ \exists x[thing(x) \ \& \ p=buy(x)(y)]]\}$

(92) a. shei zenmeyang le?

who how Prt

'How was who?'

b. ⟦zenmeyang⟧⟦shei⟧

$=\{p: \exists b \exists c[b \in \{x: person(x)\} \ \& \ c \in \{s: state(s) \ \& \ \exists e \lambda x[agent(x,e) \ \& \ s(e)]\} \ \& \ p=c(b)]\}$

$=\{p: \exists b \exists c[b \in \{x: person(y)\} \ \& \ c \in \{s: state(s)\} \ \& \ p=\exists e \lambda x[agent(x,e) \ \& \ s(e)](b)]\}$

$=\{p: \exists x[person(x) \ \& \ \exists s[state(s) \ \& \ p=\exists e[agent(x,e) \ \& \ s(e)]]]\}$

Chapter 3

Islands, scope, and opacity in wh-questions

This chapter investigates the island-escaping property of wh-in-situ expressions in interrogative uses. We will show how the pointwise functional application rule obtains wide-scope interpretations of wh-in-situ expressions across three typical island structures under the assumption that there is no movement for wh-in-situ, and get semantics right (without all the interpretational problems facing unselective binding). It achieves this at no additional cost---just assuming wh-in-situ expressions denotes set of individuals that can expand via a pointwise functional application rule.

In section 1, we illustrate how the island problem is obviated and how scope (*de re*/*de dicto*) of the larger NPs that involve complex NP structure is determined under the current proposal. Section 2 discusses the advantages of this approach over unselective binding and LF raising.

1. Three island structures

1.1 Embedded clause islands

Clause-taking verbs in Chinese can be classified into three types according to what kinds of embedded clauses they can take as complements: *xiwang*-type verbs selecting a [-wh] complement, *yanjiu*-type verbs selecting a [+wh] complement, *jide*-type verbs selecting either a [-wh] complement or a [+wh] complement. We focus only on the *xiwang*-type verbs because wh-phrases occurring within embedded clauses must be interpreted in the matrix clause[1]. The following examples show that only the reason

[1] We will not consider some [-wh] complement-taking verbs like *shuo* 'say', which, sometimes called *fawenci* (Lü 1982), 'semantically bleached verbs' (Li and Thompson 1979), or 'verbs of conjecture' (Tang 1988), have many idiosyncrasies of their own, in contrast with other *xiwang* 'hope'-type verbs (Tang 1988, Shao 1996). When these verbs seemingly select an embedded clause, we treat these verbs as independent pragmatic constituents and there is no embedding involved, following traditional Chinese linguists (Shao 1996).

adverbial *zenme* and *weishenme* cannot take scope over the matrix clause, while all other wh-phrases can take wider scope than the matrix clause to obtain a wh-question reading.

(1) a.*ni bu xiwang ta weishenme mei lai?
you not hope he why not come
'What is the reason *x* such that you do not hope he didn't come for *x*?'

b. ni bu xiwang shei hen youqian?
you not hope who very rich
'Who is *x* such that you do not hope *x* is rich?'

c. ni bu xiwang ta zenmeyang chuli nei-jian shiqing?
you not hope he how handle that-CL matter
'What is the manner *x* such that you do not hope that he (will) handle that matter by *x*?'

d. ni bu xiwang ta ke jiao de zenmeyang?
you not hope he class teach DE how
'What is the manner *x* such that you do not hope that he teach his classes by *x*?'

Our task is to explain the island-escaping property of *shei*-type wh-phrases across embedded clause and the negator. Recall that all those that can occur within verb complement while taking wide scope are those that denote sets of alternatives. Consider (1b). The embedded clause $[\![_{IP}$ shei hen youqian$]\!]$ denotes a set of alternative propositions {p: $\exists x$[person(x) & p=rich(x)]}, which then needs to compose with the embedding verb *xiwang* 'hope' via pointwise functional application. We give the standard translation for the belief verb *xiwang* as (2) below. Then the composition goes on as shown in (3).

(2) $[\![$xiwang$]\!]$={$\lambda y\lambda$p.$\forall w'$ compatible with y's desires in w: p=1 in w'}

(3) $[\![$xiwang$]\!]([\![$shei hen youqian$]\!])$
={f: $\exists$b$\exists$c[b$\in${p: $\exists x$[person(x) & p=rich(x)]} & c$\in${$\lambda y\lambda$p.$\forall w'$ compatible with y's desires in w: p=1 in w'} & f=c(b)]}
={f: $\exists$b[b$\in${p: $\exists x$[person(x)]} & f={$\lambda y\lambda$p.$\forall w'$ compatible with y's desires in

w: p=1 in w'}(rich(x))]}

={f: ∃x[person(x) & f={λy.∀w' compatible with y's desires in w: rich(x)=1 in w'}]}

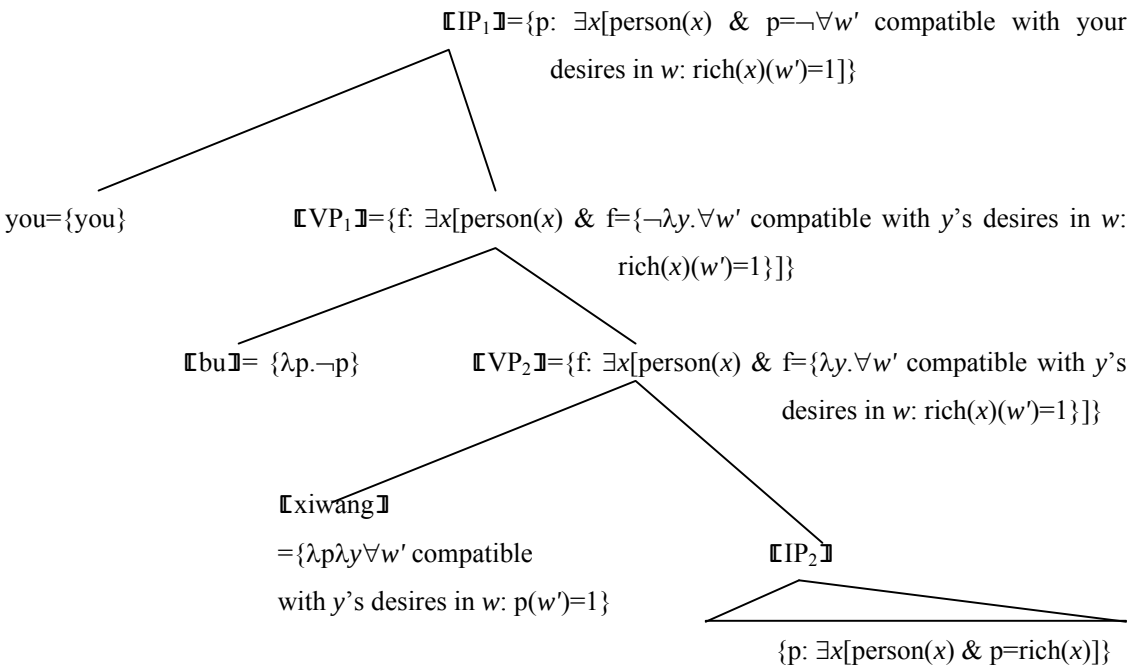
The meaning of ⟦xiwang shei hen youqian⟧ is: a set of alternative properties of being something or someone such that there is some person such that the former has certain desire of that person. Now this set goes further composition with the denotation of negation again by pointwise functional application, we obtain (4). After replacing the variable y with the pronoun (treated as a proper name here), we obtain (5).

(4) ⟦bu⟧⟦xiwang shei hen youqian⟧

={f: ∃x[person(x) & f={¬λy.∀w' compatible with y's desires in w: rich(x)=1 in w'}]}

(5) ⟦bu xiwang shei hen youqian⟧(⟦ni⟧)

={p: ∃x[person(x) & p=¬∀w' compatible with your desires in w: rich(x) =1 in w']}



The implicit world variable associated with the predicate *person* is left free, so it is

interpreted as an entity in the actual world (speaker's world). The whole sentence denotes a set of alternative propositions, which says that among the propositions that there is someone in the actual world such that it is not true that in every possible world compatible with your desires in the actual world, he is rich. The final representation is the same as that of LF movement with the wh-phrase extracted to having wide scope outside of the negation and the belief verb. But we achieve this by a single rule of pointwise functional application without assuming LF movement.

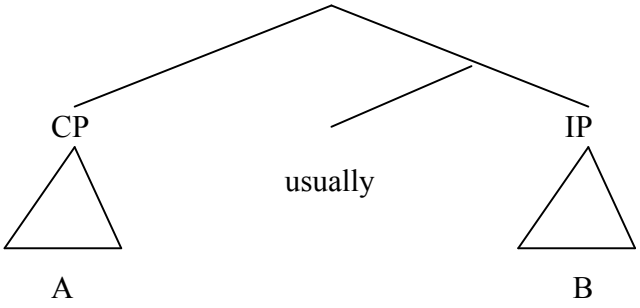
1.2 Adjunct islands

Now consider adjunct islands represented by a conditional sentence:

(6) yaoshi shei zhong-le jiang, Zhangsan jiu hen gaoxing?
If who win-Asp lottery, Zhangsan then very happy
'Who is *x* such that if *x* won the lottery Zhangsan would be happy?'

Following Lewis (1975) and Kratzer (1986), the *if*-clause serves to introduce a restriction and the consequent clause introduces the nuclear scope into a tripartite structure associated by an overt or covert modal necessity operator: ADV [ϕ][ψ]. The phonologically null universal quantifier combines with its two sentential arguments one at a time, via (pointwise) functional application.

(7)



The Q-adverbs can be assumed to quantify exclusively over something like situations or events (Berman 1987; Elbourne 2005). Then we have the following two formulae:

(8) a. ⟦always⟧= λp.λq.λs. for every minimal situation s' such that s'≤s and p(s') =1, there is a situation s'' such that s''≤s and s'' is a minimal situation such that s'≤s'' and q(s'')=1

b. ⟦always [if α]], β]^{g} =1 iff for every minimal situation s' such that ⟦α⟧$^{g\ s'\backslash s'}$=1, there is a situation s'' such that s'≤s'' and ⟦β⟧$^{g\ s'\backslash s',\ s''\backslash s''}$ =1

Return to example (6). The antecedent ⟦shei zhong-le jiang⟧ denotes a set of alternative propositions: {p: ∃*x*[person(*x*) & p=win(*x*)]} and the consequent denotes a singleton set of proposition: {Zhangsan is happy}. First we compose the consequent with the Q-adverb by ordinary functional application. Then we compose the antecedent clause with the Q-adverb satisfied with the consequent clause by pointwise functional application:

(9) ⟦always⟧(⟦Zhangsan jiu hen gaoxing⟧)

=λp.λs. for every minimal situation s' such that s'≤s and p(s')=1, there is a situation s'' such that s''≤s and s'' is a minimal situation such that s'≤s'' and Zhangsan is happy(s'')=1

(10) ⟦always Zhangsan jiu hen gaoxing⟧(⟦shei zhong-le jiang⟧)

={p: ∃*x*[person(*x*) & p=λs. for every minimal situation s' such that s'≤s and win(*x*)(s')=1, there is a situation s'' such that s''≤s and s'' is a minimal situation such that s'≤s'' and Zhangsan is happy(s'')=1)]}

The final representation (10) denotes a set of propositions each of which says that there is someone such that every minimal situation in which he wins a lottery is a situation in which Zhangsan is happy.

1.3 Relative clause islands

We will consider relative clauses with the head nouns being bare nouns. There are two types of complex NP structures formed from it: bare NPs and numeral NPs. Consider

the following sentence (11), in which the larger NP can be either *de dicto* or *de re*.

(11) Zhangsan bu xiang pinglun yi-ben shei xie de shu?
Zhangsan not want review one-Cl who write DE book
(i). 'Who is such that Zhangsan does not want to review any book that he writes?'
(ii). 'Who is such that there is a book that he writes that Zhangsan does not want to review?'

In the *de dicto* reading, Zhangsan does not have a particular book in mind. For example, suppose Zhangsan is a book critic. Whenever he read a book he likes, he usually writes a review to make a living. Recently he was reading some books written by a certain author and publicly showed his dislike of them greatly. I, being his friend, know this and his writing habit. Then I can felicitously ask this question: who is the author such that Zhangsan does not want to review any book written by him. In this reading, the question cannot be followed by another question that asks for the identity of the book.

(12) Zhangsan bu xiang pinglun yi-ben shei xie de shu? *Ni zhidao
Zhangsan not want review one-Cl who write DE book? You know
shi na-yi-ben shu?
be which book
'Who is the person such that Zhangsan does not want to review any book written by him? Do you know which book?'

In the *de re* reading, Zhangsan does have a particular book in mind. For example, Zhangsan was reading a book written by a certain author and publicly showed his dislike of it greatly. He said he would not bother to review it. Then I can felicitously ask this question: who is the author such that there is some book written by him such that Zhangsan does not want to review it. In this reading, the question can be followed by another question that asks for the identity of the book.

(13) Zhangsan bu xiang pinglun yi-ben shei xie de shu? Ni zhidao
Zhangsan not want review one-Cl who write DE book? You know be who Q
shi na-yi-ben shu ma?
be which book Q
'Who is the person such that Zhangsan does not want to review any book written by him? Do you know which book?'

Next consider the following sentence (14) with a bare NP island containing a wh-phrase inside. This sentence, on the other hand, only allows one reading: The speaker asks the identity of the author such that Zhangsan does not want to review any book that he writes. The other reading in which there is a book or some books Zhangsan does not want to review is not available.

(14) Zhangsan bu xiang pinglun shei xie de shu?
Zhangsan not want review who write DE book
'Who is such that Zhangsan does not want to review books that he writes?'

In extensional contexts, the larger numeral NP structure also allows wide scope and narrow scope readings, while the larger bare NP structure only allows narrow scope reading. First consider the following sentence with a numeral NP island containing a wh-phrase inside.

(15) Zhangsan meiyou du-guo yi-ben shei xie de shu?
Zhangsan not read-Asp one-Cl who write DE book
(i). 'Who is the person such that Zhangsan did not read any book that he wrote?'
(ii). 'Who is the person such that there is a book that he wrote such that Zhangsan did not read?'

As indicated above, sentence (15) has two readings. In one reading the larger NP is referential to a certain book in the context. The speaker asks the identity of the author

who wrote that book. For example, this question is felicitous in the following scenario: the professor requires every student to read a certain book, *LGB*. Zhangsan did not read it and was criticized by the professor. I heard of this and I can felicitously ask this question. I was not curious about the name of the book which I know is not my specialty, but was curious about the name of the author, because I think he must be an important figure, otherwise the professor would not be so angry. In this case, the larger NP should take wider scope than the negation and be specific to a concrete book in the context. This can be seen from the following example, in which another question can be asked for the identity of the book.

(16) Zhangsan meiyou du-guo yi-ben shei xie de shu?
Zhangsan not read-Asp one-Cl who write DE book?
Daodi shi na-yi-ben shu?
On earth be which book
'Who is the person such that there is a book written by him that Zhangsan did not read? Which book on earth it is?'

In another reading the larger NP is not referential; it is interpreted as a negative polarity item. This can be more easily obtained by stressing *yi-ben*. The speaker asks the identity of the author such that Zhangsan did not read any book written by him. For example, this question is felicitous in the following scenario: the professor requires every student to read at least ten books by Chomsky. Zhangsan did not read them all and was criticized by the professor.

Next consider the following sentence (17a) with a bare NP island containing a wh-phrase inside. This sentence, on the other hand, only allows one reading: The speaker asks the identity of the author such that Zhangsan did not read any book written by him. The other reading in which there is a book or some books Zhangsan did not read is not available, as indicated in the following infelicitous continuation (17b). The bare NP *shei xie de shu* may be interpreted as definite, but not in wh-questions (Specificity Condition, Fiengo and Higginbotham 1981, Huang 1982). Then in this case, the larger NP is interpreted as an indefinite and should take scope below the negation.

(17) a. Zhangsan meiyou du-guo shei xie de shu?
Zhangsan not read-Asp who write DE book
(i). 'Who is the person such that Zhangsan did not read any book that he wrote?'
b. *Daodi shi na-yi-ben shu?
On earth be which book
'Which book on earth it is?'

The following table summarizes the *de re* and *de dicto* readings of the wh-phrase and the larger NP in questions.

		De re	De dicto
Bare headed complex NP islands	Wh-phrase	√	×
	Larger NP	×	√
Numeral-headed complex NP islands	Wh-phrase	√	×
	Larger NP	√	√

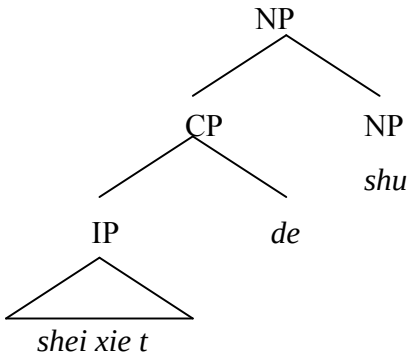
There are two issues that we would like to address under the framework adopted here. One is the island-escaping and hence the wide scope of the wh-phrases outside of complex NP islands. The other is the different scope readings of the larger NPs. Our next work is to give a compositional semantics for both types of complex noun phrases, with the aim of interpreting the wh-phrases outside of the island structure.

1.3.1 Semantic composition of two types of relative clause islands

1.3.1.1 Numeral headed relative clause islands

Both types of complex noun phrases have the common core *shei xie de shu* 'book that who wrote'. We need to start from this common core. Assuming the following structure for relative clauses as indicated below (Ning 1993):

(18)



The denotation of the embedded clause is clear: ⟦IP⟧={p: ∃*x*[person(*x*) & p =wrote(*t*)(*x*)]}. Note in this inner clause, the wh-phrase is interpreted in a displaced position, that is, it is 'moved'. And this is a question denotation. *De* functions as a lambda operator, abstracting away the constant *t*. The problem is how to lambda-abstract a set of propositions into a set of properties by *-de*. The idea is simple. We can keep the tenet of the usual Predicate Abstraction rule by applying lambda-abstraction to the subformula a=c(b), leaving the expansion of the wh-phrase intact. Then we have the rule (19).

(19) If α is a branching node whose daughters are an index i and β, where $⟦\beta⟧^{w,g} \subseteq D_\sigma$, then $⟦\alpha⟧^{w,g} = \{f_{<e,\sigma>}: \exists x[NP(x) \& f=\lambda y ⟦\beta⟧^{w,g[y/i]}]\}$.

Applying this rule to the denotation of {p: ∃*x*[person(*x*) & p=writes(*t*)(*x*)]}, we have (20), which denotes a set of properties of being something such that there is some person such that the former is written by the person.

(20) ⟦CP⟧={f: ∃*x*[person(*x*) & f =λ*y*.writes(*y*)(*x*)]}

This set of properties needs to compose with the singleton set {λ*y*.paper(*y*)} denoted by *paper*. We need to modify the Predicate Modification rule to make it apply to a subformula pointwise, as in (21).

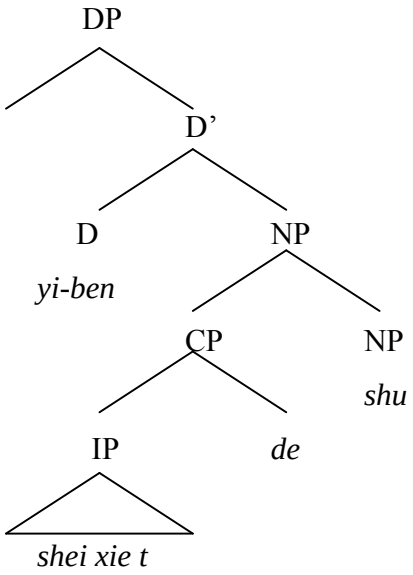
(21) If α is a branching node, {β, γ} is the set of α's daughters, and ⟦β⟧ and ⟦γ⟧ are both in $D_{<e,t>}$, then ⟦α⟧={f: ∃*x*[NP(*x*) & f=λ*y*[⟦β⟧(*y*) & ⟦γ⟧(*y*)(*x*)]]}.

By applying this modified Predicate Modification rule, we get again a set of properties of being something such that there is some person such that the former is a book and is written by that person.

(22) ⟦NP⟧={f: ∃*x*[person(*x*) & f=λ*y*[wrote(*y*)(*x*) & book(*y*)]]}

Assuming that the numeral-classifier *yi-ben* has the function of a determiner (generalized quantifier), we can compose it with NP via pointwise functional application.

(23)



(24) ⟦DP⟧

={a: ∃b∃c[b∈{λPλQ∃*y*[P(*y*) & Q(*y*)]} & c∈{f: ∃*x*[person(*x*) & f=λ*y*[wrote(*y*)(*x*) & book(*y*)]]} & a=c(b)]}

={a: ∃c[c∈{f: ∃*x*[person(*x*)]} & a={λQ∃*y*[λ*y*[wrote(*y*)(*x*) & book(*y*)](*y*) & Q(*y*)]}]}

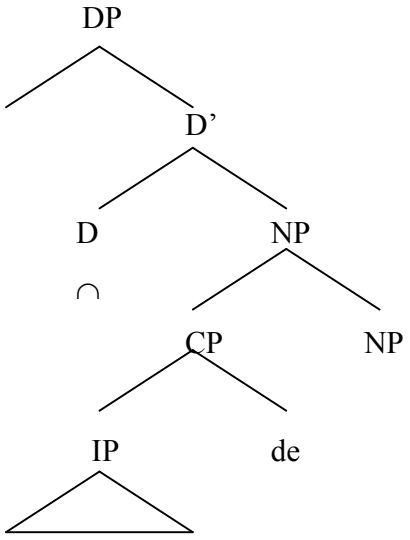
={a: ∃*x*[person(*x*) & a={λQ∃*y*[wrote(*y*)(*x*) & book(*y*) & Q(*y*)]}]}

This is the denotation of *yi-ben shei xie de shu*. Note that the wh-phrase *shei* is interpreted outside of the complex NP island. This is the result that we desire for.

1.3.1.2 Bare headed relative clause islands

What is the denotation of DP *shei xie de shu*? Earlier in section 3.5.4 of chapter 1, we have assumed that the bare noun containing a wh-phrase is a kind referring term. Suppose there is a determiner for kind terms, which works as a down operator returning a kind from a predicate, defined as follows (disregarding world): For any property P, $^{\cap}$=λPιP. So a kind can be manufactured out of a property by taking the largest member of its extension (at any given world) (Chierchia 1998).

(25)



As usual, the derivation of ⟦NP⟧ is {f: ∃*x*[person(*x*) & f=λ*y*[wrote(*y*)(*x*) & book(*y*)]]}. Composing it with the down operator via pointwise functional application rule, we get:

(26) ⟦DP⟧

=$\{a \in D_{\tau}: \exists b \exists c[b \in [\![\beta]\!] \ \& \ c \in [\![\gamma]\!] \ \& \ a = c(b)]\}$

=$\{a: \exists b \exists c[b \in \{f: \exists x[\text{person}(x) \ \& \ f=\lambda y[\text{wrote}(y)(x) \ \& \ \text{book}(y)]]\} \ \& \ c \in \lambda P \iota P \ \& \ a=c(b)]\}$

=$\{a: \exists x[\text{person}(x) \ \& \ a=\iota[\lambda y[\text{wrote}(y)(x) \ \& \ \text{book}(y)]]]\}$

This is the denotation of *shei xie de shu*. Note that the wh-phrase *shei* is interpreted outside of the complex NP island. This is the result that we desire for.

1.3.2 Scope and opacity

Given the denotations at hand, we next provide detailed derivations for the island-escaping property of the wh-phrases and the different scope readings of the larger NPs in wh-questions. First consider (11), repeated here as (27), which allows a de re/de dicto reading and a de re/de re reading.

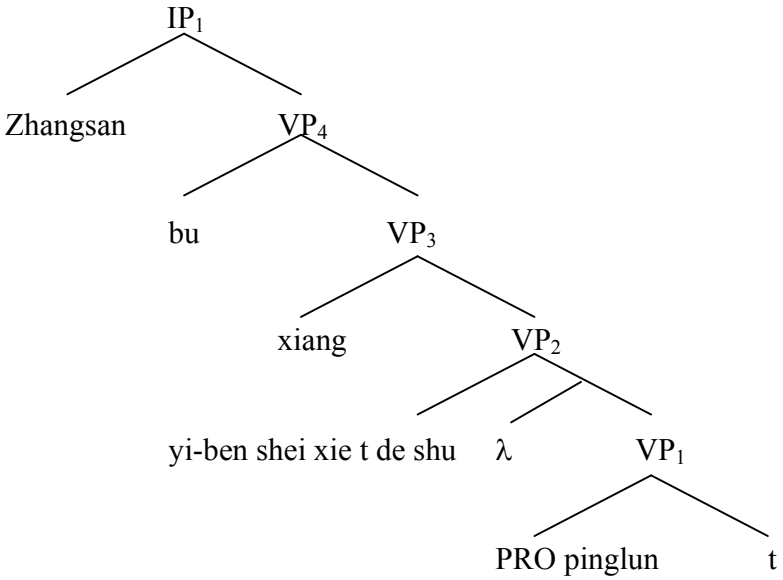
(27) Zhangsan bu xiang pinglun yi-ben shei xie de shu?
Zhangsan not want review one-Cl who write DE book
(i). 'Who is such that Zhangsan does not want to review any book that he wrote?'
(ii). 'Who is such that there is a book that he wrote that Zhangsan does not want to review?'

The wide scope reading of the wh-phrase is achieved by the pointwise functional application rule. The two readings of the larger NP, in our view, correspond to the scope positions that the larger NP can take. Assuming that numerical noun phrases can be operators subject to movement (Lee 1986: 95), and further assuming that movement of quantifiers leaves a trace, and a lambda operator is generated immediately behind the moved position, which returns a property from a proposition (Heim & Kratzer 1998). As usual, we treat *yi-ben shei xie de shu* as a generalized quantifier with denotation of: {f: ∃x[person(x) & f=λQ∃*y*[book(*y*) & writes(*y*)(x) & Q(*y*)]]}. It is subject to movement to two positions below and above the intensional verb *xiang* 'want', which is responsible for the *de re*/*de dicto* reading of the larger NP, respectively:

In (28), the generalized quantifier *yi-ben shei xie de shu* moves to a position immediately below the verb xiang 'want', so the denotation of ⟦λ PRO pinglun t⟧ is {λ*y*.review(*y*)(PRO)}, which is then composed with the denotation of the generalized quantifier, yielding VP_2. Step by step, we have the following derivational process. The final representation denotes a set of propositions each of which says that there is someone such that Zhangsan does not want to review any book written by him. The representation captures the *de dicto* reading of the larger DP: Zhangsan need not have a particular book

in mind. Any book will do.

(28)



a. ⟦VP_1⟧={λ*y*.review(*y*)(PRO)}

b. ⟦VP_2⟧={f: ∃x[person(x) & f=∃*y*[book(*y*) & wrote(*y*)(x) & review(*y*)(PRO)]]}

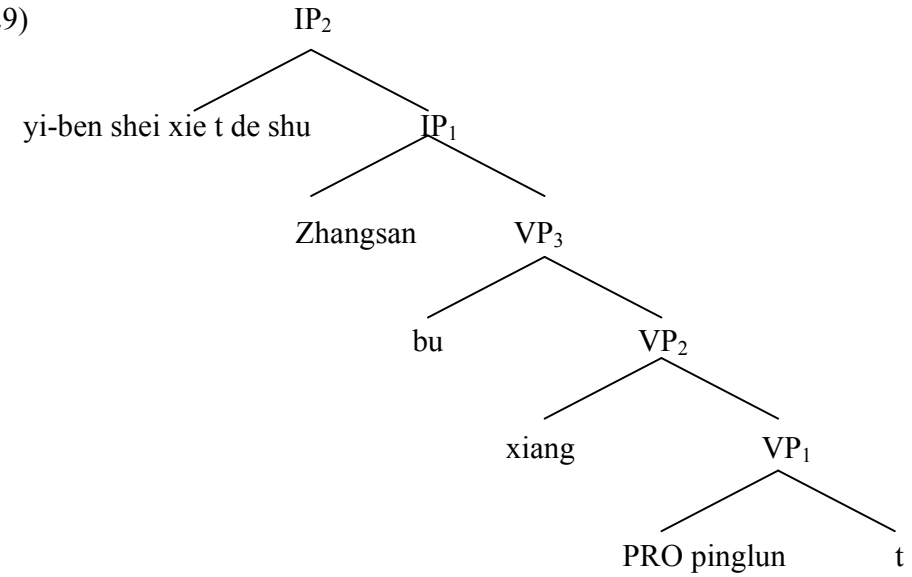
c. ⟦VP_3⟧={f: ∃x[person(x) & f=λz.want(z, ∃*y*[book(*y*) & wrote(*y*)(x) & review(*y*)(z)]]}

d. ⟦VP_4⟧={f: ∃x[person(x) & f=λz.want(z, ¬∃*y*[book(*y*) & wrote(*y*)(x) & review(*y*)(z)]]}

e. ⟦IP_1⟧={p: ∃x[person(x) & p=want(zhangsan, ¬∃*y*[book(*y*) & wrote(*y*)(x) & review(*y*)(zhangsan)]]}

In (29), the generalized quantifier *yi-ben shei xie de shu* moves to a position above the negator *bu*. Step by step, we have the following derivational process. The final representation denotes a set of propositions each of which says that there is someone such that there is some book written by him such that Zhangsan does not want to review. The representation captures the *de re* reading of the larger DP: there is a certain book that Zhangsan has in mind that he wanted to review.

(29)



a. ⟦VP$_1$⟧={λ*y*.review(*y*)(PRO)}

b. ⟦VP$_2$⟧={λz.want(z, review(t)(z))}

c. ⟦VP$_3$⟧={¬λz.want(z, review(t)(z))}

d. ⟦IP$_1$⟧={¬want(zhangsan, review(t)(zhangsan))}

e. ⟦IP$_1$⟧={¬want(zhangsan, λ*y*.review(*y*)(zhangsan))}

f. ⟦IP$_2$⟧={p: ∃x[person(x) & p=∃*y*[book(*y*) & wrote(*y*)(x) & ¬want(zhangsan, review(x)(zhangsan))]]}

In both the two representations for this sentence, the wh-phrase is interpreted with widest scope. This is required by the semantics of wh-questions. The difference lies at the fact that the larger NP is interpreted outside or within the scope of the negation and the intensional verb. It is worth noting that the semantic representations yield the correct answers to the question. Following von Stechow (1996), questions should be represented in such a way that all the materials except the wh-phrases should be properly contained in the proposition. In both (28e) and (29f), the representation for the larger NP is properly contained within the proposition. Such a question is interpreted as asking for the identity of the person in terms of the book that the person wrote.

(30) A: yi-ben Chomsky xie de shu.
One-Cl Chomsky write DE book

'a book that Chomsky wrote'

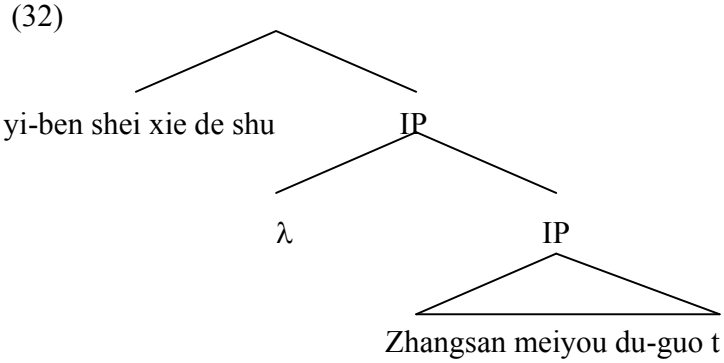
B: Chomsky xie de shu.
Chomsky write DE book
'a book that Chomsky wrote'

C: ??Chomsky.

Similarly the extensional sentence (15), repeated here as (31), can be derived on a par. The final representation (32) denotes a set of propositions each of which says that there is someone such that there is some book that he wrote such that Zhangsan did not read. The final representation (33) denotes a set of propositions each of which says that there is someone such that it is not true that there is some book that he wrote such that Zhangsan read. The former represents the wide scope of the larger NP, while the latter the narrow scope.

(31) Zhangsan meiyou du-guo yi-ben shei xie de shu?
Zhangsan not read-Asp one-Cl who write DE book
(i). 'Who is the person such that Zhangsan did not read any book that he wrote?'
(ii). 'Who is the person such that there is a book that he wrote such that Zhangsan did not read?'

(32)

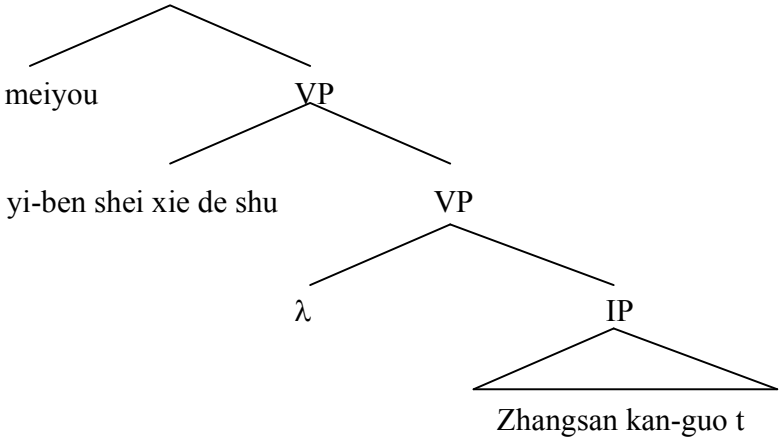


a. ⟦yi-ben shei xie de shu⟧(⟦λ Zhangsan meiyou du-guo⟧)
={p: ∃b∃c[b∈{λ*y*.¬read(*y*)(zhangsan)} & c∈{f: ∃*x*[person(*x*) &

f=λQ∃*y*[book(*y*) & wrote(*y*)(*x*) & Q(*y*)]]} & p=c(b)]}

={p: ∃*x*[person(*x*) & p=∃*y*[book(*y*) & wrote(*y*)(*x*) & ¬read(*y*)(zhangsan)]]}

(33)



a. ⟦yi-ben shei xie de shu⟧(⟦λ Zhangsan kan-guo⟧)

={f: ∃*x*[person(*x*) & f=∃*y*[book(*y*) & wrote(*y*)(*x*) & λ*y*.read(*y*)(zhangsan)]]}

b. ⟦meiyou⟧(⟦yi-ben shei xie de shu λ Zhangsan kan-guo⟧)

={p: ∃*x*[person(*x*) & p=¬∃*y*[book(*y*) & wrote(*y*)(*x*) & λ*y*.read(*y*)(zhangsan)]]}

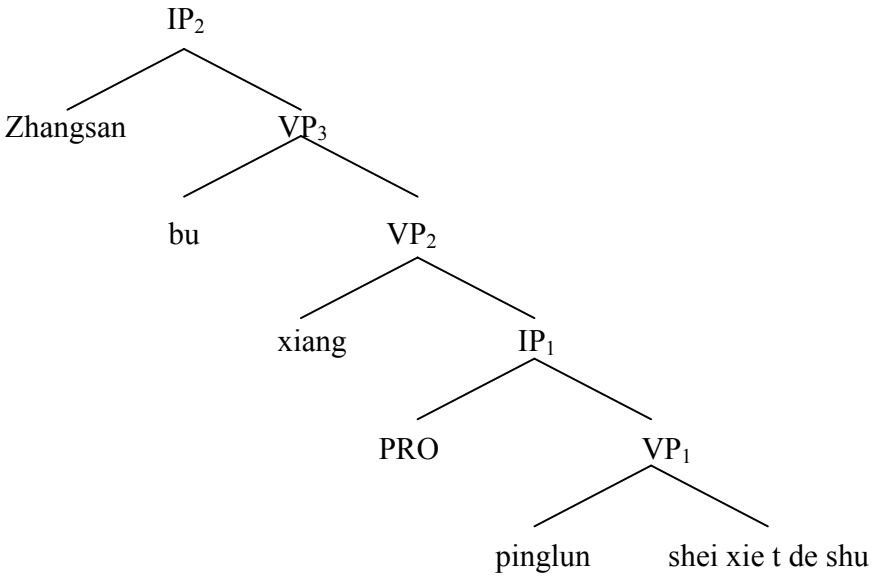
Now consider sentence (14), repeated below as (34), which allows only one reading: *de re* for wh-phrase and *de dicto* for the larger NP.

(34) Zhangsan bu xiang pinglun shei xie de shu?
Zhangsan not want review who write DE book
'Who is such that Zhangsan does not want to review any book that he wrote?'

We have given the whole DP a kind denotation of {a: ∃*x*[person(*x*) &

a=ι[λ*y*[wrote(*y*)(*x*) & book(*y*)]]]}. Unlike generalized quantifiers, it needs not move[2]. It composes directly with the main predicate *pinglun* via pointwise functional application. One thing needs attention, however. The kind 'books that who wrote' is not a proper thing that can be reviewed (a sortal mismatch), so we have to realize it as stages over which the (stage-level) predicate *pinglun* can apply, and this realization function is built into the meaning of the predicate: ⟦pinglun⟧=λ*z*λi^k∃x^s[R(x^s, i^k) ∧ review(x^s)(*z*)], in the spirit of Carlson (1977). Step by step, we have the following derivational process.

(35)



a. ⟦VP_1⟧={f: ∃*x*[person(*x*) & f=λ*z*∃x^s[R(x^s, ι[λ*y*[book(*y*) & wrote(*y*)(*x*)]]]) ∧ review(x^s)(*z*)]}

b. ⟦IP_1⟧={p: ∃*x*[person(*x*) & p=∃x^s[R(x^s, ι[λ*y*[book(*y*) & wrote(*y*)(*x*)]]]) ∧ review(x^s)(PRO)]}

c. ⟦VP_2⟧={f: ∃*x*[person(*x*) & f=λ*z*.want(*z*, ∃x^s[R(x^s, ι[λ*y*[book(*y*) & wrote(*y*)(*x*)]]]) ∧ review(x^s)(*z*)]}

d. ⟦VP_3⟧={f: ∃*x*[person(*x*) & f=¬λ*z*.want(*z*, ∃x^s[R(x^s, ι[λ*y*[book(*y*) &

[2] We can also assume that kind terms are generalized quantifiers and subject to movement. However, due to sortal mismatch, the kind term is always interpreted within the scope of the predicate, and gets the same result as the non-movement proposal. To simplify the derivation, I will simply treat kind terms as <e> individuals, and movement is unnecessary.

wrote(y)(x)]]]) ∧ review(x^s)(z)]}

e. ⟦IP_2⟧={p: ∃x[person(x) & p=¬want(zhangsan, ∃x^s[R(x^s, ι[λy[book(y) & wrote(y)(x)]]]) ∧ review(x^s)(zhangsan)]}

This representation is the denotation of a question: a set of propositions each of which states that there is someone such that Zhangsan does not want to review any realizations of the kind book that the person wrote. The formula guarantees a proper answer too. In addition, the head noun *shu* 'book' is not bound by the same binder that binds the wh-phrases; instead, it is interpreted independently as a kind term. Though the final quantificational force given to it is existential, the existential force comes from the predicate.

Now consider the extensional (17a), repeated as (36) below. Its derivational process is shown in (37): a set of propositions each of which states that there is someone such that Zhangsan did not read any realizations of the kind book that the person wrote.

(36) Zhangsan meiyou du-guo shei xie de shu?
Zhangsan not read-Asp who write DE book
'Who is the person such that Zhangsan did not read any book that he wrote?'

(37) ⟦du-guo⟧(⟦shei xie de shu⟧)
={f: ∃b∃c[b∈{a: ∃x[person(x) & a=ι[λy[book(y) & wrote(y)(x)]]} & c∈{λzλy.read(y)(z)]} & f=c(b)]}
={f: ∃x[person(x) & f=λz.read(ι[λy[book(y) & wrote(y)(x)]])(z)]}
={f: ∃x[person(x) & f=λz∃x^s[R(x^s, ι[λy[book(y) & wrote(y)(x)]]) ∧ read(x^s)(z)]]}
⟦meiyou⟧(⟦kan-guo shei xie de shu⟧)
={f: ∃x[person(x) & f=¬λz∃x^s[R(x^s, ι[λy[book(y) & wrote(y)(x)]]) ∧ read(x^s)(z)]]}
⟦zhangsan⟧(⟦meiyou kan-guo shei xie de shu⟧)
={p: ∃x[person(x) & p=¬∃x^s[R(x^s, ι[λy[book(y) & wrote(y)(x)]]) ∧ read(x^s)(zhangsan)]]}

2. Advantages

The previous section is devoted to deriving the wide scope reading of interrogative wh-phrases across three typical kinds of islands. The key lies at the pointwise functional application rule which compose the embedded clause in which the wh-in-situ expands with higher operators: attitude verbs, Q-adverbs, and generalized quantifiers. These three kinds of operators correspond to the three typical kinds of islands: embedded clauses, if-conditionals, and relative clauses. As a result, when the set composes with the higher operators, the pointwise functional application only applies to the proposition, leaving the wh-in-situ out. Consequently, the wh-in-situ expressions are 'extracted' outside of the higher operators; the island-escaping behavior does not arise.

(38) a. …embedding verb [$_{IP}$ …wh-in-situ…] by pointwise functional application

b. …Q-adverb [$_{IP}$ …wh-in-situ…] by pointwise functional application

c. ……[$_{DP}$[$_{NP}$[$_{CP}$[$_{IP}$ …wh-in-situ…] by pointwise functional application

In this account, the wh-in-situ expressions are not inherently quantificational, so needing no movement in the syntax and LF. This is similar to the unselective binding. Though the wh-in-situ expressions do not move, nevertheless they can be interpreted in a different position. In this respect, it is similar to the LF movement. It seems that the current proposal integrates some ideas of the other two approaches: the wh-in-situ expressions need no movement in the syntax and LF, and they can be interpreted in a different position. Consequently, we hope the current proposal is free of some problems facing the other two approaches. This section investigates this topic.

2.1 Advantages compared to unselective binding

2.1.1 Correct semantics

In chapter 1, we have shown that treating indefinites and Chinese wh-expressions simply as pure variables over either individual or choice function faces several syntactic

and semantic problems. In order to get interpretations right, the restrictive properties of the indefinites must be interpreted along with their binders for obtaining proper restrictions. LF movement approach does this by assuming a cover movement so that the variable is properly restricted in the formula. The current proposal does this by expanding the set denoted by wh-phrase via a generalized functional application rule so that it is able to 'move' the wh-phrase to a higher position across some truth-value changing operators. The final representation is exactly like that derived by movement, and the descriptive content of indefinite is properly restricted. Consequently, all the interpretational problems discussed in the previous chapter 1 do not arise in this theory, which can be considered as an improvement over unselective binding. For example, the following sentences repeated from above would be represented in (a) and (b) respectively by expansion and unselective binding approach. It is obvious that the (b) version cannot be maintained.

(39) ni bu xiwang shei hen youqian?
you not hope who very rich
'Who is *x* such that you do not hope *x* is rich?'
a. {p: ∃*x*[person(*x*) & p=you do not hope that rich(*x*)]}
b. {p: ∃*x*[p=you do not hope that person(*x*) & rich(*x*)]}

(40) yaoshi shei zhong-le jiang, Zhangsan jiu hen gaoxing?
If who win-Asp lottery, Zhangsan then very happy
'Who is *x* such that if *x* won the lottery Zhangsan would be happy?'
a. {p: ∃*x*[person(*x*) & p=if win(*x*), then Zhangsan will be happy]}
b. {p: ∃*x*[p=if person(*x*) & win(*x*), then Zhangsan will be happy]}

(41) Zhangsan bu xiang pinglun shei xie de shu?
Zhangsan not want review who write DE book
'Who is *x* such that Zhangsan does not want to review any book that *x* wrote?'
a. {p: ∃*x*[person(*x*) & p=Zhangsan does not want to review any book that wrote(*x*)]}
b. {p: ∃*x*[p=Zhangsan does not want to review any book that person(*x*) & wrote(*x*)]}

A possible way for the unselective binding approach to fix this problem seems to invoke some notion of presupposition. However, in the section 3.6 of chapter 1, we have argued that resorting to presupposition of lexical property or referent of the wh-phrase is also questionable because the 'presupposition' of wh-phrases, if there is indeed some kind of presupposition, does not pattern like the canonical presupposition of other linguistic items like definite descriptions. Considering this, we claim that in terms of correct semantics, the current proposal (and the LF movement) fares better than the unselective binding approach.

2.2 Advantages compared to LF movement

Because the LF movement gives us exactly the same semantic representations as Hamblin semantics, we would like to know in which aspects the current proposal is advantageous to the LF raising approach.

2.2.1 *only* (*zhi*) and wh-in-situ

As shown in section 3.1.2 of chapter 1, Aoun and Li (1993) convincingly argued that the fact of association with *only* favors a no-movement account of wh-in-situ in Chinese, otherwise it is unexpected that *only* can be associated with a trace at LF.

(42) ta zhi xihuan shei?
he only like who
'Who does he only like?'

Nevertheless, this fact poses no challenge to the current proposal. This is because under this proposal, there is no LF movement of wh-phrases, which are interpreted in situ. So the LF of (42), if there is such a level, would be (43). However, due to the set denotation of the wh-phrase, the restriction of the wh-phrase *shei* is interpreted in a displaced position. Though the final representation obtained by the current proposal is the same as that by LF movement, it is obtained by a semantic rule, not by syntactic operation.

(43) ta zhi xihuan {a, b, c,…}?

2.2.2 wh-arguments vs. wh-adjuncts

Another advantage concerns the distinction between wh-arguments and wh-adjuncts. Under the current proposal, wh-arguments (*shei*, *shenme*, *nage*) and wh-adjuncts (*nali*, *shenmeshihou, zenmeyang*) can take wide scope across islands because they all denote sets of different things, which can expand in semantics. There is no distinction between wh-arguments and wh-adjuncts. As long as they denote sets of alternatives, they can expand to higher level and higher position. It does not matter what the alternatives may stand for.

The LF raising analysis holds that LF movement is subject to proper government. As a result wh-arguments can violate island constraints because their traces left can be properly governed, but wh-adjuncts cannot. For example, the following two sentences are cited to support this view.

(44) a. *ni xihuan ta weishenme xie de shu?
you like he why write DE book
'What is the reason such that you like books that he writes for?'
b. ni xihuan ta zenmeyang xie de shu?
you like he how write DE book
'What is the manner such that you like books that he writes by?'

However, later studies have shown that at least *zenmeyang*, as manner adverbial, can freely escape islands just like wh-arguments (Xu 1990, Lin 1992, Tsai 1994, Shi 1994, Hua 2000, Hu 2002). The current proposal can predict the grammaticality of (44b) by expanding the set of manners denoted by *zenmeyang*.

Further, place and time adverbials are adjuncts, but do not show any island constraints. The LF raising account is forced to posit a null preposition that serves to properly govern the traces left by movement.

(45) a. ni du guo Lisi (zai) shenmeshihou xie de shu?
you read-ASP Lisi (in) when write DE book
'What is the time *x* such that you read the book Lisi wrote at *x*?'
b. ni du guo Lisi (zai) nali xie de shu?
you read-ASP Lisi (in) where write DE book
'What is the place *x* such that you read the book Lisi wrote in *x*?'

Huang (1982) argues that (45) are well-formed because *nali* 'where' and *shenmeshihou* 'when' appear in the categorical position of $[_{pp}$ P[NP], where the prepositions can be phonetically null. Thus, *nali* and *shenmeshihou* are complements of the Ps and are on a par with *shei* 'who' in being arguments (although the PPs containing *nali* 'where' and *shenmeshihou* 'when' are adjuncts). Their traces are head-governed by the null prepositions, satisfying the ECP. The presence of null prepositions is supposedly supported by the following fact (at least in the case of locative whs).

(46) a. Zhangsan *(zai) xuexiao yujian Lisi.
Zhangsan (at) school meet Lisi
'Zhangsan met Lisi at school.'
b. Zhangsan *(zai) nali yujian Lisi?
Zhangsan (at) where meet Lisi
'Where did Zhangsan meet Lisi?'

This idea is similar to Bresnan and Grimshaw (1978), but criticized by Larson (1985), who suggests that bare NP adverbs of time, location such as *tomorrow, now,* and *here* are inherently Case marked. Therefore there is no necessary to posit null prepositions. In addition, it is also empirically inadequate to posit a null preposition in wh-adjuncts. For example, sometimes it is very awkward to insert a preposition before *shenmeshihou*.

(47) Zhangsan *(zai) shenmeshihou lai?
Zhangsan (at) what time come
'When did Zhangsan come?'

In the following example, it is equally difficult to posit a proper preposition when the wh-adjuncts are *duojiu* 'how long', *jishi* 'what time', etc.

(48) a. Zhangsan (*zai) duojiu keyi zuowan zhejian shi?
Zhangsan (at) how long can do-finish this matter
'How long can Zhangsan finish this matter?'
b. Zhangsan (*zai/cong) jishi chufa?
Zhangsan (at/from) what hour depart
'What hour will Zhangsan depart?'

2.2.3 wh-phrases vs. wh-heads

A third advantage of the current proposal over the LF movement concerns the non-distinction between wh-phrases vs. wh-heads. An implicit assumption in the LF raising analysis is that all Chinese wh-elements are maximal projections and thus may undergo A'-movement. This is, however, not a correct generalization. Some Chinese wh-elements seem to have a status of less than XP, namely, that of X° or X'. For example:

(49) a. Zhangsan zenmeyang ni le?
Zhangsan how you Prt
'How did Zhangsan do to you?'
b. ni du-guo Zhangsan xie de shenme?
you read-Asp Zhangsan write DE what
'What do you like that Zhangsan writes?

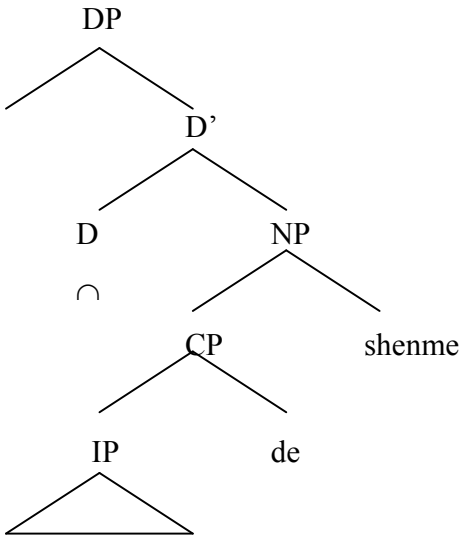
Shi (1994) pointed out the LF raising analysis needs to explain why wh-heads (like the transitive verbal *zenmeyang* 'how' and the head *shenme* in complex NP) can also undergo A'-movement, which affects only maximal projections according to the standard assumption in generative grammar and that X° items can only be involved in

head-to-head movement (cf. Chomsky 1986)[3].

Recall that in the pointwise functional application rule of the current proposal, the two daughter nodes β and γ represent semantic categories, and are insensitive to syntactic categories. They may be heads, X-bars, or phrases. Therefore the problem of wh-heads vs. wh-phrases does not arise here.

Earlier in section 2.3.2 of chapter 2, we have discussed how the verbal *zenmeyang* obtains its matrix scope via expansion. Next we turn to (49b). For bare complex NP, we follow our previous treatment by positing a covert down operator occurring in the D position, which turns the property into a kind.

(50)



[3] In fact, this might also be a problem to the unselective binding. It is unclear how unselective binding can deal with this problem too. It needs to posit that a binding operator can occur as a phrase or as a head in order to bind a phrase variable or a head variable. For example, Aoun and Li (1993) posit that an [+Qu] operator is generated in the Spec of QP that binds the wh-in-situ, and Tsai (1994, 1999) also assumes that a Q(uestion)-operator is generated in Spec position of CP, so they have to make extra mechanism to deal with wh-heads in sentences (49). In Shi (1994), a Q morpheme is generated under Infl node, which is a head. But he has to make extra mechanism to deal with wh-phrases. However, Shi points out in a footnote that if we adopt the generalized binding framework of Aoun (1986), this problem does not arise because the wh-element can be considered as an A'-anaphor that has to be bound by an A'-antecedent within a certain domain, and an A'-anaphor can be an X max, an X' or an X^0. Since this suggestion is not spelled out, I consider it as unsolved under the unselective binding approach.

Zhangsan xie t

The denotation of the embedded clause is clear: ⟦CP⟧={λ*x*[writes(*zhangsan*)(*x*)]}. The denotation of *shenme* is {*x*: thing(*x*)}, which can be type-lifted to a predicate {f: ∃*x*[thing(*x*) & f=λ*y*[*y*=*x*]]}. Composing the two nodes by the pointwise Predicate Abstraction rule, we have (51). Composing it with the down operator via pointwise functional application rule, we get (52). Further derivation with the rest of the sentence gives us the following question denotation as in (53).

(51) ⟦NP⟧=⟦CP⟧(⟦shenme⟧)
=={f: ∃*x*[NP(*x*) & f=λ*y*[⟦β⟧(*y*) & ⟦γ⟧(*y*)(*x*)]]}
=={f: ∃*x*[thing(*x*) & f=λ*y*[wrote(*zhangsan*)(*y*) & *y*=*x*]]}

(52) ⟦DP⟧
=={a∈Dτ: ∃b∃c[b∈⟦β⟧ & c∈⟦γ⟧ & a =c(b)]}
=={a: ∃b∃c[b∈{f: ∃*x*[thing(*x*) & f=λ*y*[wrote(*zhangsan*)(*y*) & *y*=*x*]]} & c∈λPιP & a=c(b)]}
=={a: ∃*x*[thing(*x*) & a=λPιP(λ*y*[wrote(*zhangsan*)(*y*) & *y*=*x*])]}
=={a: ∃*x*[thing(*x*) & a=ι[λ*y*[wrote(*zhangsan*)(*y*) & *y*=*x*]]]}

(53) ⟦ni duguo Zhangsan xie de shenme⟧
=={p: ∃*x*[thing(*x*) & p=∃x^s[R(x^s, ι[λ*y*[writes(*zhangsan*)(*y*) & *y*=*x*]]) ∧ read(x^s)(you)]]}

Shi points another problem with LF raising. Apart from the obvious problem of accounting for how a zero level wh-element is raised at LF, the existence of wh-heads poses another problem. A wh-head can take another wh-element as its complement or specifier. This type of complex wh-phrase can sometimes have split scope. Consider the sentence in (54a). It allows two direct question readings, with either *shenme* 'what' or *shei* 'whose' having the matrix reading, and takes either (54b) or (54c) as an appropriate answer.

(54) a. ni xiang-zhidao ta xihuan shei de shenme?
you wonder he like whose what
i. What is the thing *x* such that you wonder whose *x* he likes?
ii. Who is the person *y* such that you wonder what of *y*'s he likes?
b. wo xiang-zhidao ta xihuan shei de xiaoshuo.
I wonder he like whose novel
I wonder whose novel he likes.
c. wo xiang-zhidao ta xihuan Cao Yu de shenme.
I wonder he like Cao Yu DE what
I wonder what of Cao Yu's he likes.

Under the LF raising analysis, the interpretation (54a/i) means that at LF the head of the embedded object NP is raised to the Spec of the matrix CP while its specifier is raised to the Spec of the embedded CP. The reading (54a/ii) entails an LF configuration in which the specifier of the embedded object NP is raised to the Spec of the matrix CP and the head is raised to the Spec of the embedded CP.

The analysis of the following question in (55a) is similar: either the head of the embedded VP or its complement can have matrix scope.

(55) a. ta wen ni Lisi ba shei zenme le?
he ask you Lisi BA who how Asp
i. What is the action *x* such that he asked you to who Lisi did *x*?
ii. Who is the person *y* such that he asked you what Lisi did to *y*?
b. ta wen wo Lisi ba shei shale.
he ask me Lisi BA who kill Asp
He asked me who Lisi killed.
c. ta wen wo Lisi ba Zhangsan zenme le.
he ask me Lisi BA Zhangsan how Asp
He asked me what Lisi did to Zhangsan.

It is not too hard to design a possible derivation for the LF representation of (54a/ii)

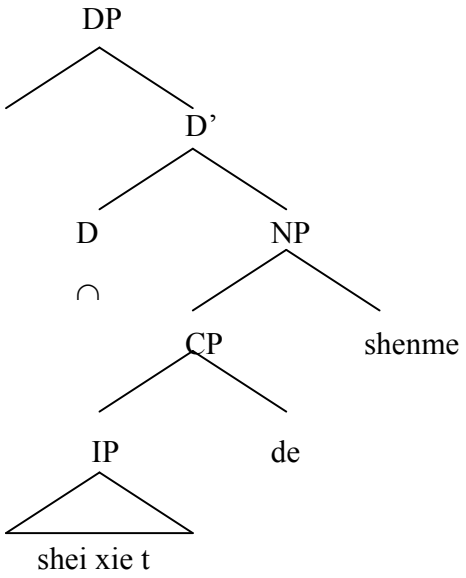
or (54a/ii), in which the specifier of NP or the complement of the VP has matrix scope. For example, it is possible to raise the entire embedded (WH) object NP in (54a) to the Spec of the embedded CP first, and then raise its specifier to the Spec of the matrix CP. Each step involves only one maximal projection and no barrier is crossed in either movement. What is problematic is the LF representation of (54a/i) or (55a/i), where the head of an NP or VP has matrix scope. Within the current theoretical framework, it is not possible for an X° element to undergo A'-movement to a position for an X max, given the Head Movement Constraint. A derivation in which the entire embedded (WH) object NP of (54a) is raised to the Spec of the embedded CP and then the wh-head is raised to the Spec of the matrix CP is therefore illicit. The same constraint also prohibits any attempt to raise the head and the specifier of the embedded (WH) object NP separately. The ECP requirement that every trace be properly governed renders impossible a derivation in which the entire embedded object is raised to the Spec of the matrix CP first and the specifier is then lowered to the Spec of the embedded CP. There seems to be no legitimate way to derive the representation for (54a/i), nor for (55a/i), under the LF raising analysis.

Let's consider how the two readings are achieved in our account. Take the following sentence (56) as an example.

(56) a. ni xiang-zhidao ta duguo shei xie de shenme?
you wonder he read-Asp who write DE what
(i). What is the thing *x* such that you wonder he reads *x* that who wrote?
(ii). Who is the person *y* such that you wonder he reads what that y wrote?

As usual, the derivation $[\![CP]\!]=\{f: \exists x[person(x) \ \& \ f=\lambda y.writes(y)(x)]\}$. The type-lifted denotation of *shenme* is $\{f: \exists y[thing(y) \ \& \ f=\lambda z[z=y]]\}$. Composing the two nodes by the pointwise Predicate Abstraction rule, we have (58). Further composing the result with the down operator, we obtain (59).

(57)



(58) ⟦she xie de⟧⟦shenme⟧

$=\{f: \exists y[NP(y) \& f=\lambda z[⟦\beta⟧(z) \& ⟦\gamma⟧(y)(z)]]\}$

$=\{f: \exists y[thing(y) \& f=\lambda z[\{f: \exists x[person(x) \& f=\lambda y.writes(y)(x)]\}(z)(y) \& \lambda z[z=y](z)]]\}$.

$=\{f: \exists y[thing(y) \& \exists x[person(x) \& f=\lambda z[wrote(z)(x) \& z=y]]]\}$.

(59) ⟦DP⟧

$=\{a \in D\tau: \exists b \exists c[b \in ⟦\beta⟧ \& c \in ⟦\gamma⟧ \& a=c(b)]\}$

$=\{a: \exists b \exists c[b \in \{f: \exists y[thing(y) \& \exists x[person(x) \& f=\lambda z[wrote(z)(x) \& z=y]]]\} \& c \in \lambda P \iota P \& a=c(b)]\}$

$=\{a: \exists y \exists x[thing(y) \& person(x) \& a=\iota[\lambda z[wrote(z)(x) \& z=y]]]\}$

This is the denotation of *shei xie de shenme*. Note that the wh-phrases *shei* and *shenme* are interpreted outside of the complex NP island. Further derivation with the rest of the sentence gives us the following question denotation.

(60) ⟦ta duguo shei xie de shenme⟧

$=\{p: \exists y[thing(y) \& \exists x[person(x) \& p=\exists y^s[R(y^s, \iota[\lambda z[writes(z)(x) \& z=y]] \& read(y^s)(he)]]\}$

Putting in the context of matrix verb *xiang-zhidao* 'wonder', which is a [+wh] embedding verb needing a question complement, we have three possibilities, as shown below.

(61) ni xiang-zhidao ta duguo shei xie de shenme?
you wonder he read-Asp who write DE what
(i). What is the thing *y* such that you wonder he reads *y* that who wrote?
(ii). Who is the person *x* such that you wonder he reads what that *x* wrote?
(iii). You wonder who is the person *x* and what is the thing *y* such that he reads *y* that *x* wrote?

In possibility (i), the wh-phrase *shenme* 'what' is further expanded while the other wh-phrase *shei* 'who' does not expand.

(62) ⟦xiang-zhidao⟧(⟦ta duguo shei xie de shenme⟧)
$=\{f: \exists b \exists c[b \in \{p: \exists y[thing(y) \ \& \ \exists x[person(x) \ \& \ p=\exists y^s[R(y^s, \iota[\lambda z[wrote(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\} \ \& \ c \in \lambda u \lambda p.wonder(u,p) \ \& \ f=c(b)]\}$
$=\{f: \exists y[thing(y) \ \& \ p=\lambda u.wonder(u, \{p: \exists x[person(x) \ \& \ p=\exists y^s[R(y^s, \iota[\lambda z[wrote(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\})]\}$
$=\{p: \exists y[thing(y) \ \& \ p=wonder(you, \{p: \exists x[person(x) \ \& \ p=\exists y^s[R(y^s, \iota[\lambda z[wrote(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\})]\}$

In possibility (ii), the wh-phrase *shei* 'who' is further expanded while the other wh-phrase *shenme* 'what' does not expand.

(63) ⟦xiang-zhidao⟧⟦ta duguo shei xie de shenme⟧
$=\{f: \exists b \exists c[b \in \{p: \exists x[person(x) \ \& \ \exists y[thing(y) \ \& \ p=\exists y^s[R(y^s, \iota[\lambda z[wrote(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\} \ \& \ c \in \lambda u \lambda p.wonder(u,p) \ \& \ f=c(b)]\}$
$=\{f: \exists x[person(x) \ \& \ p=\lambda u.wonder(u, \{p: \exists y[thing(y) \ \& \ p=\exists y^s[R(y^s, \iota[\lambda z[wrote(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\})]\}$

$=\{p: \exists x[person(x) \ \& \ p=wonder(you, \ \{p: \ \exists y[thing(y) \ \& \ p=\exists y^s[R(y^s, \ \iota[\lambda z[wrote(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\})]\}$

In possibility (iii), both wh-phrases take embedded scope. This reading can be achieved just by composing the embedded question with *wonder* by the usual functional application rule.

(64) ⟦ni xiang-zhidao ta duguo shei xie de shenme⟧

$=wonder(you, \ \{p: \ \exists y[thing(y) \ \& \ \exists x[person(x) \ \& \ p=\exists y^s[R(y^s, \ \iota[\lambda z[writes(z)(x) \ \& \ z=y]] \ \& \ read(y^s)(he)]]\})$

Chapter 4

Closure by *wulun*

In the previous chapter, we focused on the mechanism of expansion. This mechanism is a direct consequence of the set denotation of wh-phrases. If we accept the assumption that wh-phrases denote sets of alternatives, then we must accept the mechanism of expansion, which is achieved by pointwise functional application rule. We have tried to show that the mechanism of expansion works well in wh-questions, able to integrating the merits of both LF movement and unselective binding while circumventing their respective shortcomings.

In addition to the mechanism of expansion, there is another mechanism under the current proposal, which is called closure. A closure closes the expansion of wh-phrases in derivation so that the wh-phrases no longer expand. In section 2.2 of chapter 2, we hesitatingly say that if we accept the mechanism of expansion, then we are led to accept the mechanism of closure because a sentence containing a wh-phrase sometimes may not be interrogative. This chapter will confirm this logic: the process of expansion must be closed by some suitable quantificational operators, if there is one. Therefore this chapter will be focusing on closure. The goal is only limited to closure by universal quantificational operators, and we will propose that *wulun* is such an operator.

The structure of this chapter is organized as follows. Section 1 proposes that *wulun* serves as a universal operator triggering universal quantification, which closes the expansion of alternatives denoted or expanded by wh-phrases. If this is true, we are committed to treating *dou* (the most common matching item in the consequent clause) as a non-universal-quantificational element. In section 2, adopting the proposal of *dou* as an existential quantifier over events serving for skolemization (Huang 1995, 1996), we provide a detailed characterization of the interaction between *wulun* and *dou*. Section 3 examines some consequences of treating *dou* as an existential quantifier in ordinary *dou*-sentences. It is suggested that ordinary *dou*-sentences are concealed *wulun*-wh-*dou*

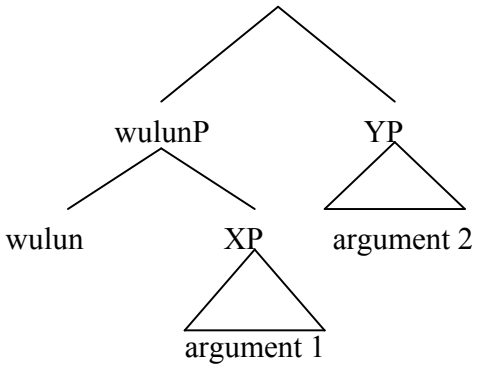
sentences and *wulun*-wh is the linking element for associating *dou* and a plural NP (for distributive quantification). Some consequences will be discussed.

1. Semantics of *wulun*

1.1 Generalized union operator or quantificational operator?

The adverb *wulun* 'no matter' (*buguan*, *bulun*, *renping*, *suibian*, etc) takes two arguments. The first argument must denote a set of at least two alternatives, while the second argument needs the occurrence of a matching item, usually *dou*.

(1)



In this *wulun-dou* construction, the semantics of *wulun* did not receive much attention compared to *dou*. Currently there are mainly two different views towards *wulun*: as a generalized union operator (Lin 1996) and as a universal operator (Huang 1996, Cheng and Giannakidou 2006). In the first account, the function of *wulun* is to form a set of individuals {a, b, c,……} from a set of sets of individuals {{a}, {b}, {c}…}. For example, in the expression *wulun shei*, the wh-phrase *shei* contributes a set of singleton sets of individuals {{a}, {b}, {c}…}, where {a}, {b}, {c}, etc are individuals in the universe, *wulun* form a union from them, thus ⟦wulun shei⟧ denotes a set of {a, b, c,…}.

There are several reasons why we do not endorse this view. First of all, the set of {a, b, c,……} is equivalent to the set of {{a}, {b}, {c}…} if we adopt Quine's Innovation. Second, as we have shown in section 1.2 of chapter 2, *wulun* can take *A haishi B* as its first argument, which is a union set of alternatives. That is to say, what *wulun* takes is already a union set of alternatives. Similarly, in *wulun shei*, we have shown that it is

preferable to treat *shei* as a set of alternatives {a, b, c,…}, it is then questionable that *wulun* yields a union set one more time. Third, if *wulun* is a generalized union operator, its sole function is to form a union set. Then it is difficult to explain why *wulun* must take two arguments and the second argument must have a matching item like *dou*. In Lin's work, the generalized union is considered as a plural entity, therefore, there are no reasons why *wulun* needs the obligatory presence of *dou*, since a plural entity can enter a derivation without distributive interpretation.

On the other hand, Huang (1996) suggested that *wulun* is an inherently distributive quantifier modeled after EVERY, and Cheng and Giannakidou (2006) further pointed out that *wulun shei* is morphologically related to *ren*[*he ren*] in that *wulun* corresponds to *ren* 'regardless' and *he* is a wh-phrase '*which*' in classical Chinese. In *Babaici* (Lü 1980: 465), *renhe* 'any' is paraphrased as *bulun shenme* 'no matter what'. This comes without surprise because *wulun shei* patterns with *renhe ren* in important ways. For example, both are incompatible with collective or symmetric predicates, and both need an obligatory *dou/ye*.

(2) a. *renhe ren dou shi tongxue.
Any person dou be classmate
'Anyone is classmate.'
b. *wulun shei dou shi tongxue.
no matter who dou be classmate
'Anyone is classmate.'

(3) a. *renhe ren xiang lai.
Any person want come
'Anyone wants to come.'
b. *wulun shei xiang lai.
no matter who want come
'Anyone wants to come.'

1.2 *Wulun* as a universal operator closing the expansion of alternatives

We have known that in Hamblin semantics, wh-expressions contribute a set of

alternatives, which keeps expanding in the derivation. If it expands to the root of sentence, then by default a question meaning is derived. The expansion may be closed by some closing operators. Given this mechanism of closure, we may need to find these operators that close the expansion. We propose that *wulun* is just one of these operators, more exactly the universal operator.

One piece of evidence comes from the blocking effect of *wulun*. A wh-phrase can expand until it meets a closing operator. After being closed by the closing operator, the wh-phrase no longer expands further up in the derivation; hence the scope of the wh-phrase is blocked within the closing operator and the question denotation is no longer available. *Wulun* fits with this pattern. Any wh-phrase within its scope must be interpreted as non-interrogative. For example, the following two sentences (4a) and (4b) can obtain wh-question readings in which the wh-phrases *can* be interpreted interrogatively as long as there are preceding plural elements satisfying *dou*. On the other hand, in sentences (5a) and (5b), the wh-arguments must be interpreted as non-interrogative and get a universal interpretation. Obviously it is the presence of *wulun* that triggers the closure. Wh-arguments can escape the scope of *dou*; but in the presence of *wulun*, they must take scope within *wulun*. This indicates the essential role of *wulun*.

(4) a. naxie shu, shei dou bixu kan?
these book, who all must read
'As for these books, who must read them all?'
b. Zhangsan yaoqing shei, women dou hui tongyi?
Zhangsan invite who, we all will agree
'Who is *x* such that if Zhangsan invites *x* then we all agree?'

(5) a. naxie shu, wulun shei dou bixu kan.
these book, no matter who all must read
'As for these books, anyone must read.'
b. wulun Zhangsan yaoqing shei, women dou hui tongyi.
no matter Zhangsan invite who, we all will agree
'No matter who Zhangsan invites, we will agree.'

Therefore, we conclude that *wulun* should be treated as the Kratzer-Shimoyama style universal operator, which applies to a set of alternatives and yields the property of properties that is true of any property P if every alternative in A has it.

(6) $[\![\text{wulun}]\!]=\{\lambda P \forall a[a \in [\![\alpha]\!]^{w,g} \rightarrow P(a)=1]\}$

Next we have to make clear the domain of the *wulun*-quantification, that is, the nature of the set of alternatives. The domain of *wulun*-quantification in nominal *wulun*-wh-*dou* construction seems pretty apparent: quantifying over individuals denoted or expanded by the wh-phrases. For example, if the argument of *wulun* is a bare wh-phrase, $[\![\alpha]\!]^{w,g}$ denotes a set of alternative individuals, as shown in (7a). If the argument of *wulun* is a complex NP containing a wh-phrase, $[\![\alpha]\!]^{w,g}$ denotes a set of alternative things expanded by the wh-phrase, as shown in (7b).

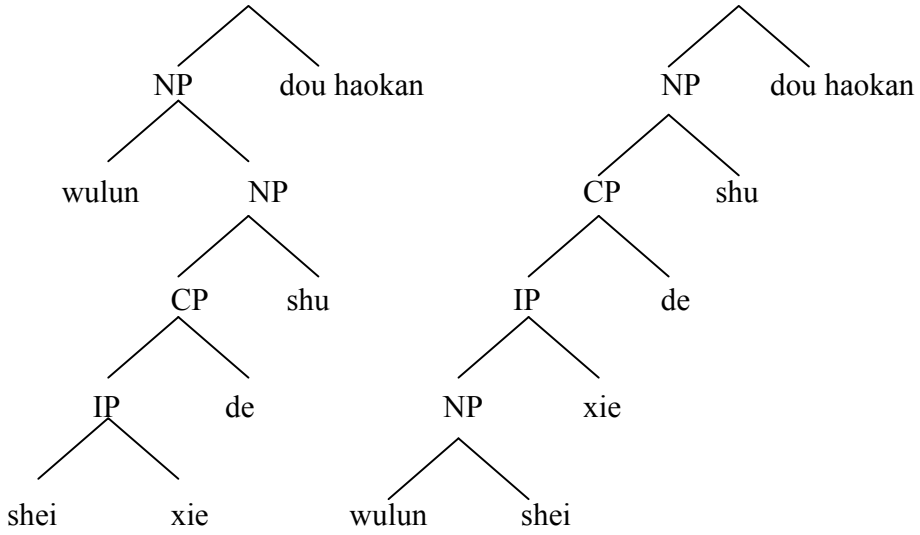
(7) a. $[\![\text{wulun shei}]\!]=\{\lambda P \lambda w'.\forall a[a \in \{a: \text{person}(a)\} \rightarrow P(a)(w')=1]\}$

b. $[\![\text{wulun ta songgei shei de shu}]\!]=\{\lambda P \lambda w'.\forall a[a \in \{a: \exists x[\text{person}(x) \,\&\, a=\iota[\lambda y[\text{book}(y) \,\&\, \text{give}(y)(x)(\text{he})]]\} \rightarrow P(a)(w')=1]\}$

However, if the first argument of *wulun* is a complex NP like *wulun shei xie de shu* 'books no matter who wrote', there are two possibilities for the arguments that *wulun* ranges over: a set of alternative things expanded by the wh-phrase or a set of alternative things denoted by the wh-phrase only, corresponding to two internal structures of the complex NP, as indicated below.

(8) a. [wulun [shei xie de shu]] dou haokan.
no matter who write DE book all good-read
'Anyone is such that his books are good to read.'

b. [[wulun shei] xie de shu] dou haokan.
no matter who write DE book all good-read
'Anyone is such that his books are good to read.'



We argue that the only option is (8a), in which *wulun* modifies the whole NP, not the wh-phrase within it, or in other words, *wulun* quantifies over a set of alternative things expanded by the wh-phrase but not directly denoted by the wh-phrase.

(9) ⟦wulun shei xie de shu⟧={λPλ*w′*.∀a[a∈{a: ∃*x*[person(*x*) & a=ι[λ*y*[book(*y*) & write(*y*)(*x*)]]}→P(a)(*w′*)=1]}

The position of *wulun* is very low in the tree (8b). If we can establish that *wulun* [XP] must c-command the main predicate *dou* VP at surface structure, then we are left with the first option only. Since it is impossible to do this in the above examples (8) because we can always interpret this sentence in either case, we need to find other cases where it is clear what *wulun* modifies. As we have known that the canonical environment for *wulun* to modify is a set of disjunction (*A haishi B*). The set of disjunction can also be provided by wh-phrases, that is, *wulun shei* can be restated as *wulun* A *haishi* B. Suppose there are only three people in the model, we have the following paradigm. Sentence (10b), modeled after the supposed constituency of [[wulun shei] xie de shu], becomes ungrammatical. Sentence (11b), modeled after the supposed constituency of [wulun [shei xie de shu]], remains grammatical.

(10) a. [[wulun shei] xie de shu] dou haokan.
no matter who write DE book all good-read
'Anyone is such that his books are good to read.'

b. *[[wulun [Zhangsan, Lisi, haishi Wangwu]] xie de shu] dou haokan.
no matter Zhangsan, Lisi, or Wangwu write DE book all good-read
'Books written by no matter Zhangsan, Lisi, or Wangwu are good to read.'

(11) a. [wulun [shei xie de shu]] dou haokan.
no matter who write DE book all good-read
'Anyone is such that his books are good to read.'

b. [wulun [Zhangsan xie de shu, Lisi xie de shu, haishi Wangwu
no matter Zhangsan write DE book Lisi write DE book or Wangwu
xie de shu]] dou haokan.
write DE book all good-read
'Books written by anyone, no matter Zhangsan, Lisi, or Wangwu, are good to read.'

Similarly in sentential *wulun*-wh-*dou* sentences, there are two options: quantification over individuals (wh-phrase) or quantification over propositions. According to the former view, the universal quantification is over individuals denoted by the wh-phrases. In sentence (12a) below, the wh-phrase *shei* contributes a set of people {*x*: person(*x*)}, which serves as the restrictor for the universal quantification. The other elements are all mapped to the nuclear scope. Then the formula (12b) means: for every *x* such that *x* is a member of the set of persons, then there exists a proposition such that you invite *x* and I agree.

(12) a. wulun ni yaoqing shei wo dou tongyi.
no matter you invite who, I all agree
'No matter who you invite, I agree.'

b. $\forall x[x \in \{x: \text{person}(x)\}] \rightarrow [\exists p[p=\text{you invite } x \ \& \ \text{I agree}]]$

There are several problems with this treatment. First of all, *wulun* can quantify over propositions. In the following sentence, there are two different events involved, instead of two different individuals (there is no individual).

(13) wulun tian xiayu haishi di guafeng, wo dou bu pa.
no matter sky rain or ground blow, I all not fear
'No matter it rains or it blows, I am not afraid.'

When the wh-clause is embedded within an *ask*-type verb, the universal quantification cannot be over individuals; it must be over propositions. The reason is as follows. The wh-phrase cannot move to the position immediately below *wulun* because of the blocking of the verb *wen* 'ask'.

(14) wulun ni wen wo xihuan shei, wo dou bu gaosu ni.
no matter you ask I like who, I dou not tell you
'No matter you ask who I like, I will not tell you.'

Thus in sentential wh-*dou* sentences, *wulun* does not range over the wh-phrases directly, instead it ranges over the propositions expressed by the question in which wh-phrases occur. This conclusion is further supported by the following sentences.

(15) a. [zhe ji-ge ren] wulun shei lai, wo dou bu pa.
this several-Cl person no matter who come, I all not fear
'These people, no matter who comes, I do not fear.'
b. *[zhe ji-ge ren] wulun shei yiqi lai, wo dou bu pa.
this several-Cl person no matter who together come, I all not fear
'These people, no matter who come together, I do not fear.'

The contrast lies at the collective adverb *yiqi* 'together', which cannot occur in the *wulun*-clause. In (15a) *wulun* ranges over a set of propositions {Zhangsan lai, Lisi lai, Wangwu lai,…}. In (15b) *wulun* is supposed to range over a set of individuals {Zhangsan,

Lisi, Wangwu,…}[1], not a set of propositions because there is forced to be only one proposition {tamen yiqi lai}. The problem is that if *wulun* quantifies over wh-phrases, the above sentence (15b) should be fine because *wulun* ranges over this set and the semantic requirement of it is met, as shown in the following representation.

(16) $\forall x[x \in \{x: \text{person}(x)\}][\exists p[p=X \text{ together come } \& \text{ I do not fear}]]$

It is then mysterious why (15b) cannot allow a collective adverb *yiqi*. Note that *shei* is compatible with collective predicates.

(17) shei yiqi lai?
who together come
'Who will come together?'

In the second view, the domain of *wulun*-quantification in sentential wh-*dou* construction is over propositions. The antecedent clause is interpreted as an embedded question, which, according to standard Hamblin semantics, denotes a set of propositions (Cheng & Huang 1996, Lin 1996). One piece of evidence is the occurrence of adverbs like *jiujing* 'on earth' and *daodi* 'on earth' in the *wulun*-clause, as evidenced in (18). It has been a well-known fact that these adverbs only occur in wh-questions and other non-polarity questions (cf. Lü 1980, Ma 2004: 24). Given this fact, the clause behind *wulun* must be a question sentence.

(18) a. wulun ni jiujing shi zenyang xiang de,
no matter you on earth be how think Prt

[1] The following sentence is fine, in which *yiqi* is compatible with *na jige* 'which several persons'. The sentence says that no matter these several persons come together, or those several persons come together, I do not fear (example due to Pan Haihua).

(i) wulun na ji-gen ren yiqi lai, wo dou bu pa.
no matter which several person together come, I all not fear
'No matter which several people come together, I do not fear.'

'No matter how on earth you think,'

b. wulun ni jiujing shi ge shenmeyang de ren,
no matter you on earth be what kind DE person
'No matter what kinds of person you are,'

c. wulun ni jiujing dao nali qu le, zai zuo shenme,
no matter you on earth go where go Prt, Prog do what
'No matter where on earth you go, what you do,'

d. wulun ni jiujing wei zhaiqu renmin zuo le doshao shiqing,
no matter you on earth for disaster people do Asp how much thing
'No matter what on earth you do for the disaster people,'

e. wulun ni jiujing you shenme nengnai,
no matter you on earth have what ability
'No matter what ability on earth you have,'

f. wulun ni jiujing shi shei, ni zhineng shi wo de qizi.
no matter you on earth be who, you only be I DE wife
'No matter who on earth you are, you can only be my wife'

g. wulun ni jiujing zuo le shenme,
no matter you on earth do Asp what
'No matter what on earth you do,'

Therefore, we conclude that the domain of *wulun*-quantification in sentential wh-*dou* construction is over propositions contributed by the embedded wh-question sentence, and *wulun* does not range over the wh-phrases alone. The wh-phrases must be interpreted in the derivation for wh-questions, having nothing to do with *wulun*.

2. Interaction between *wulun* and *dou*

This section is devoted to the interaction between *wulun* and *dou*, including their respective semantic contributions to sentences. A compositional semantics will be provided for two types of *wulun*-wh-*dou* constructions: nominal and sentential. To start with, we should ascertain the role of *dou* in this structure.

If *wulun* should be treated as a universal operator triggering universal quantification

over a set of alternatives, we are committed to treating *dou* as a non-universal-quantificational element, that is, *dou* is not the source for the universal quantification in *wulun*-wh-*dou* constructions. The problem is how to treat *dou* under the current proposal. Several strategies are available. One is that we can treat *dou* as a dummy universal quantifier which matches with *wulun* to achieve 'universal concord' (Kratzer 2006, Dong 2009). Another one is to treat *dou* as a sum operator and *wulun* is a skolemized universal quantifier. *Dou*, being a sum operator, is basically a union functor. The set it collects then is ready for the pointwise operation for the one-on-one pairing/matching between the *x* variable and *y* variable (Huang Shizhe, pc). Still another one is to treat *dou* as an existential quantifier over an event variable and again *wulun* is a skolemized universal quantifier (Huang 1995, 1996). *Dou* makes event variable available for the skolemized universal quantifier *wulun*. In this strategy, the set of events for the one-on-one pairing/matching between the *x* variable and *y* variable shall be guaranteed by another mechansim. I believe all these options can be pursued to fit with our purpose and the current proposal on *wulun*. Below I will choose the existential quantifier account of Huang plus her skolemization account of universal quantification, because it is easier to present both ideas in compositional semantics and this account is actually interchangeable with the sum operator account.

2.1 *Dou* as an existential quantifier (sum operator of events)

The following is a brief summary of Huang's proposal. The main idea is that *dou* is an existential quantifier over an event variable introduced by a plural predicate. Though Huang later abandoned this account, she emphasized that the empirical observations remain: when an inherently universal quantifier EVERY is used, there must be a paired reading in its scope such that there is an event variable (or some other variable) mapped by each choice of the value to the universal quantifier. To capture formally the pairing imposed by EVERY, the two arguments can be related by a skolem function, which links two variables by making the choice of a value for one variable depend on the choice of a value for the other.

(19) EVERY (P, f(P)) is true iff P is a subset of f(P), where f(P) is constructed

from P by an appropriate total skolem function f.

Pairing is an integral part of the meaning of EVERY, skolemization should always be used in the formal translation of sentences in which EVERY appears. *Dou* is an overt form that can license such variables and hence makes it available for skolemization.

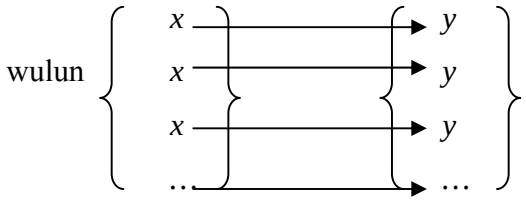
The plurality (sum) of events associated with *dou* VP can be derived by adopting one well-justified assumption. According to the principle of *uniqueness of participants* (Carlson 1984), a singular event is one that has only one individual (atomic individual or group) as argument that plays a thematic role in this event, and it should not be the case that one and the same event has different participants. If we assign different values to the individual variable *x*, we obtain different event variables. If a same value is assigned to the individual variable in different value assignments, we obtain the same event variable. Since a choice of a different participant is sufficient to establish distinctions of events, every time when the individual variable *x* is assigned a different value, a different event is obtained. As a result, *dou* VP implicates the existence of a plural event consisting of these minimal events ($<e_1 \oplus e_2 \oplus \ldots>$). Therefore being an existential quantifier, the principle of *uniqueness of participants* garuantees the plurality of events and entails the treatment of *dou* as a sum operator of events.

Huang proposes that *dou* in *wulun-dou* structure should also be treated in that way, and its presence is guaranteed by *wulun*, which is an inherently distributive universal quantifier. *Wulun* should be modeled after EVERY, which can be manifested in a number of ways in Chinese, including *mei* and *wulun*[2]. *Wulun* is defined in such a way that each member in the set denoted by its first argument has to match with a member in the set denoted by the second argument. *Dou* is not a universal quantifier, instead it is analyzed as an existential quantifier that takes event variable as its argument, hence making it

[2] Though *mei* and *wulun* are both modeled after EVERY, there may be distinctions between them. One of the distinctions may be that the variable in the second argument of *mei* is unselective, it may be individual variable or event variable. On the other hand, we assume that the variable in the second argument of *wulun* is selective, it can only be event variable. We hope this distinction can account for why *wulun* must have *dou* to match, but *mei* allows *dou*, indefinites, and reflexives to introduce variables (Huang 1996).

available for skolemization of *wulun*[3].

(20)



2.2 Compositional semantics of two *wulun*-wh-*dou* constructions

2.2.1 Nominal *wulun*-wh-*dou* sentences

With the functions of *wulun* and *dou* adopted, let's consider the following nominal *wulun*-wh-*dou* sentence:

(21) a. wulun shei dou congming.
no matter who all smart
'Everyone is smart.'
b. $\forall x[x \in \{x: \text{person}(x)\} \rightarrow \exists e[\text{smart}(e) \,\&\, \text{agent}(x, e)]]$

The first argument is the usual $\{x: \text{person}(x)\}$, the second argument *dou* VP is translated as $\exists e[\text{smart}(e) \,\&\, \text{agent}(x, e)]$. The verb phrase has an event argument *e*, which is a minimal event compatible with the semantics of the predicate indicated in *smart*(*e*). The subformula *agent*(*x*, *e*) is to assure that the individual is the agent in the event *e* and it is the minimal argument of the event *e* (note that the Agent relation may be replaced by other thematic relations).

Now consider the following example (22) involving complex NP islands. From a pre-theoretic point of view, what it intuitively expresses is the following: the book that Zhangsan wrote is popular, the book that Lisi wrote is popular, the book that Wangwu wrote is popular, etc. Our task is to capture this intuition under the current proposal that wh-phrases denote sets of alternatives and can expand until it is closed by *wulun*.

[3] We leave the possibility open that other elements may also be used to serve the purpose of skolemization of *wulun*.

(22) wulun shei xie de shu dou hen liuxing.
no matter who write DE book all very popular
'The book that anyone wrote is popular.'

According to our earlier discussion on the syntax of *wulun*-construction, the complex NP structure should be analyzed as [wulun [shei xie de shu]]. Recall that the representation we have given to the complex NP island structure of ⟦shei xie de shu⟧ is {a: ∃*x*[person(*x*) & a=ι[λ*y*[book(*y*) & write(*y*)(*x*)]]}, which is a set of kinds of books that someone wrote (see section 1.3.1.2 of chapter 3). *Wulun* universally closes the whole complex NP (not the wh-phrase), which denotes a set of individuals expanded by the wh-phrase *shei*. Then we have (23) as the representation of (22).

(23) ∀z[z∈{a: ∃*x*[person(*x*) & a=ι[λ*y*[book(*y*) & wrote(*y*)(*x*)]]}→∃*e*[popular(*e*) & agent(z, *e*)]]

The final representation says that for every *z* such that it is a member of the set of the book kinds that someone or other wrote there is a paired event such that the event is true of being popular and *z* is the unique participant of that event. Suppose there are three people (Zhangsan, Lisi, and Wangwu) in the model, then the sentence intuitively means:

(24) a. The book kind that Zhangsan wrote is popular.
b. The book kind that Lisi wrote is popular.
c. The book kind that Wangwu wrote is popular.

Consider another sentence in which we choose an individual-level predicate. Following Carlson's (1977) treatment of individual-level predicate, we add a generalized operator to promote the predicate *youqu* 'interesting' to apply to a kind.

(25) a. zhejia shudian, wulun shei xie de shu dou youqu.
this bookstore no matter who write DE book all interesting

'In these bookstores, books that anyone wrote are interesting.'

b. $\forall z[z \in \{a: \exists x[\text{person}(x) \ \& \ a=\iota[\lambda y[\text{book}(y) \ \& \ \text{wrote}(y)(x)]]\} \rightarrow \exists e[\text{Gn}(\text{interesting})(e) \ \& \ \text{agent}(z, e)]]$

The final representation says that for every *z* such that it is a member of the set of the book kinds that someone or other wrote there is a paired event such that the event is true of being interesting and *z* is the unique participant of that event. Given the same model as above, the sentence intuitively means:

(26) a. The book kind that Zhangsan wrote is interesting.
b. The book kind that Lisi wrote is interesting.
c. The book kind that Wangwu wrote is interesting.

Consider sentence (27a) in which we choose a stage-level predicate. Following Carlson's treatment of stage-level predicate, we realize the kind as stages as usual so that the predicate can apply to a kind indirectly.

(27) a. zhejia shudian, wulun shei xie de shu dou you ren mai-guo.
this bookstore no matter who write DE book all have person buy-Asp
'In these bookstores, books that anyone wrote were bought.'

b. $\forall z[z \in \{a: \exists x[\text{person}(x) \ \& \ a=\iota[\lambda y.[\text{book}(y) \ \& \ \text{write}(y)(x)]]\} \rightarrow \exists e[\text{bought}(e) \ \& \ \text{agent}(\exists z^s(R(z^s, z)), e)]]$

The final representation says that for every *z* such that it is a member of the set of the book kinds that someone or other wrote there is a paired event such that the event is true of being available and there is some z^s realizing *z*, which is the unique participant of that event. The formula (27b) intuitively means:

(28) a. some copies of the book kind that Zhangsan wrote are available.
b. some copies of the book kind that Lisi wrote are available.
c. some copies of the book kind that Wangwu wrote are available.

This treatment has two advantages over some earlier proposals (Lee 1986, Nishigauchi 1990). The first advantage is that the wh-phrase is interpreted outside of the complex NP island, hence it does not have the problem of unwanted specification to the head noun *shu* 'book'. Another advantage is that this treatment can yield the correct interpretation. Ohno (1991) considers the following Korean example (29a), represented in (29b) according to Nishigauchi.

(29) a. I kake-nun [[onu nala eso culphantoenun] caek ina] panta
this store [[which country in is published] book ever] sells
'This store sells books published in every country.'
b. [[which country$_y$ in is published] book$_x$ every$_{xy}$] this store *x* sells
'For every *x*,*y*, *y* a country, *x* a book published in *y*, this store sells *x*:

Ohno comments that universal quantification over the domain of countries and the domain of books would give rise to ridiculous reading: this store sells every book published in one country or another. The bookstore in question needs not be so well-stocked. To make this sentence true, every country must be represented in the store, but a few books from each country would be good enough.

In our account for sentence (27a) which is similar to the Korean sentence (29a), we do not produce a reading that this store sells every book written by one author or another. In our account the whole complex NP is interpreted as a kind. It is true that every book kind is predicated, however due to the realization function, we eventually arrive at an existential reading of the realizations of the book kinds.

2.2.2 Sentential *wulun*-wh-*dou* sentences: Double quantification

Now we consider sentential *wulun*-wh-*dou* sentences. We assume in such sentences, there is always a Q-adverb, either overtly or covertly. This is natural since *wulun*-sentences can be considered as conditionals (Lin 1996). The difference lies in that the antecedent of *wulun*-conditional denotes a set of propositions while the antecedent of *ruguo*-conditional denotes a single proposition. Consider:

(30) a. wulun Zhangsan yaoqing shei, tongchang qingkuang xia wo dou tongyi.
no matter Zhangsan invite who, usual situation Loc I all agree
'No matter who Zhangsan invites, usually I agree.'

b. wulun Zhangsan yaoqing shei, duoshu qingkuang xia wo dou tongyi.
no matter Zhangsan invite who, most situation Loc I all agree
'No matter who Zhangsan invites, mostly I agree.'

c. wulun Zhangsan yaoqing shei, shaoshu qingkuang xia wo dou tongyi.
no matter Zhangsan invite who, few situation Loc I all agree
'No matter who Zhangsan invites, rarely I agree.'

Intuitively, these sentences say that in all/most/few cases in which whoever you invite are cases in which I will agree. Suppose there are three boys: John, Tom, and Bob, who are the best friends of Zhangsan. Zhangsan and I share a room. He always invites them to party in the room, which sometimes makes me unhappy. Though unhappy, I still agree on his inviting of them all of the times/most of the times/few of the times, as schematized below:

(31)

a	b	c
Party 1: {John, Tom, Bob}	Party 1: {John, Tom, Bob}	Party 1: {John, Tom, Bob}
Party 2: {John, Tom, Bob}	Party 2: {John, Tom, Bob}	Party 2: {John, Tom, Bob}
Party 3: {John, Tom, Bob}	Party 3: {John, Tom, Bob}	Party 3: {~~John~~, Tom, Bob}
Party 4: {John, Tom, Bob}	Party 4: {John, Tom, Bob}	Party 4: {John, ~~Tom, Bob~~}
Party 5: {John, Tom, Bob}	Party 5: {~~John~~, Tom, Bob}	Party 5: {John, ~~Tom~~, Bob}
Party 6: {John, Tom, Bob}	Party 6: {John, ~~Tom, Bob~~}	Party 6: {John, Tom, ~~Bob~~}

For sentence (30a) to be true, in all the 6 invitings, I have to agree all the three boys can be invited in each time. For sentence (30b) to be true, in all the 6 invitings, I have to agree all the three boys can be invited in more than 3 cases, while in the other two cases I may not agree on some or all boys being invited. For sentence (30c) to be true, in all the 6 invitings, I have to agree all the three boys can be invited in less than 3 times, while in the

other cases I may not agree on some or all boys being invited.

Clearly in the above sentences, there are double quantifications involved, one by the Q-adverb, and one by *wulun*. According to the standard view that Q-adverbs quantify exclusively over something like situations or events, the Q-adverb quantifies over situations while *wulun* quantifies over the set of propositions denoted by the antecedent clause. Assuming this is correct, we can examine how to account for the double quantification phenomenon. First consider a simpler sentence:

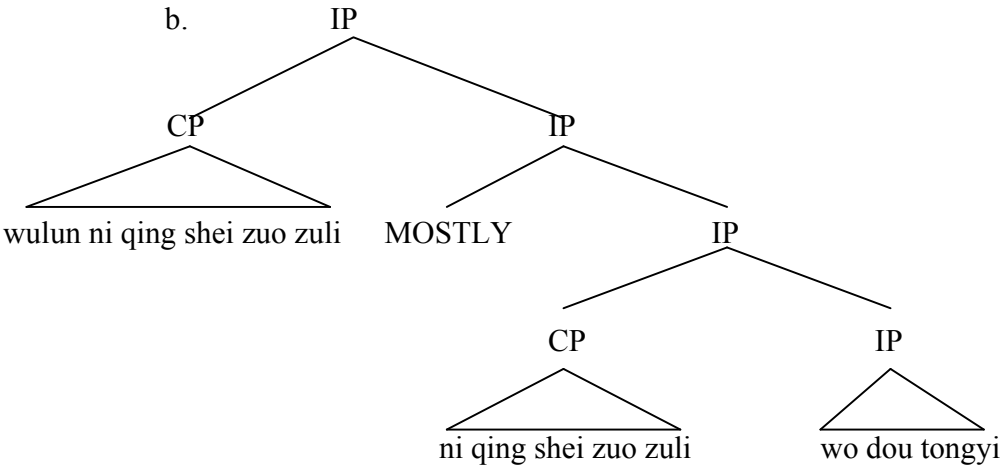
(32) wulun ni qing shei zuo zuli, duoshu qingkuang xia wo dou tongyi.
no matter you invite who as assistant, most situation Loc I all agree
'No matter who you invite as the assistant, in most cases I agree.'

The problem to ask is the domain of the Q-adverb and the order between the two quantifiers. A possible tripartite structure may be the following (33a), in which the Q-adverb takes two sentential arguments. But this structure cannot be interpreted because the universal quantification triggered by *wulun* would be blocked by the universal quantification triggered by MOST. *Wulun*-dou already makes a tripartite structure of universal quantification. Then it is unclear what tripartite structure of universal quantification is introduced by the Q-adverb.

(33) a. MOST [wulun ni qing shei zuo zuli] [wo dou tongyi].
b. MOST [$\forall$p[p$\in${p: $\exists x$[person(x) & p=you invite x as assistant}$\rightarrow\exists e$[agree(e) & agent(I, e)](p)]]

The problem is that we need a domain for the Q-adverb. Let's consider a first attempt. We can make the Q-adverb *duoshu qingkuang xia* 'mostly' ranging over situations of the antecedent, which is copied from the antecedent. This copying process is quite common in semantics literature because of the conservativity rule of quantifiers.

(34) a. [wulun ni qing shei zuo zuli] [MOST [ni qing shei zuo zuli] wo dou tongyi].



Note that the scope of *wulun* is larger than the scope of MOSTLY. Let's examine whether it tells us the true meaning of this sentence. Consider the following situation (35): Every month, professor Li in our department will invite one student among 3 PhD students (John, Tom, Bob) as assistant. In a total of 12 times of inviting, the dean agrees on more than 6 times (say 10 times) in which anyone of the three students can be invited. The remaining two times, the dean may not agree on a particular student being invited. For example in one time the dean does not agree that Tom is invited; on another time the dean does not agree that Bob is invited, though in all times he agrees that John is invited because John is *his* student. Under this scenario, the statement (32) is true. Note that in each time, one student John is permitted.

(35)	J	J	J	J	J	J	J	J	J	J	J	J
	T	T	T	T	T	T	T	T	T	T	~~T~~	T
	B	B	B	B	B	B	B	B	B	B	B	~~B~~

Therefore the sentence (32) can be true if one student is invited all the times, as long as in few times the dean does not agree on some others. However, if we let *wulun* to scope over the Q-adverb, we obtain the following formula (36), in which the invitation of John in all cases is not captured because the formula only says that for each student, if he is agreed in most situations, then the sentence is true. This means the formula is too weak.

(36) [∀p[p∈{p: ∃*x*[person(*x*) & p=you invite *x*]}→MOST [∃*x*[person(*x*) & you invite *x*] [∃*e*[agree(*e*) & agent(I, *e*)](p)]]

(37) a. if you invite John as assistant then most situation in which you invite him is a situation I agree.

b. if you invite Tom as assistant then most situation in which you invite him is a situation I agree.

c. if you invite Bob as assistant then most situation in which you invite him is a situation I agree.

Worse, the formula sometimes makes a statement true that cannot be true. Consider the following scenario (38), in which each student is agreed to be invited by the dean in most of the cases (8 times out of 12 times for each student). Therefore, the formula is true under this situation. However, this situation turns to be false in that in each case, the dean does not agree on all the students being invited; in each case, there is one student being rejected[4].

(38)

~~J~~	~~J~~	~~J~~	~~J~~	J	J	J	J	J	J	J	J
T	T	T	T	~~T~~	~~T~~	~~T~~	~~T~~	T	T	T	T
B	B	B	B	B	B	B	B	~~B~~	~~B~~	~~B~~	~~B~~

Now consider a more complicated example, in which all boys should be invited in each inviting.

(39) wulun ni yaoqing shei, duoshu qingkuang xia wo dou tongyi.
no matter you invite who, most situation Loc I all agree
'No matter who you invite, in most cases I agree.'

[4] This scenario is only true of the following statement (i), in which the negation *buhui* 'not will' takes wider scope than *wulun*. It means that it is not true that for everyone you invite, I will agree.

(i) wulun ni qing shei zuo zuli, wo bu hui dou tongyi.
no matter you invite who as assistant, I not will all agree
'It is not true that no matter who you invite as the assistant, I agree.'

Intuitively this sentence can be true in the following scenario (40): In a total of 10 invitings, all the three boys can be invited more than 5 times (say 7 times), while in the remaining cases, I may not agree on one or two or all boys being invited.

(40) Party 1: {John, Tom, Bob}
Party 2: {John, Tom, Bob}
Party 3: {John, Tom, Bob}
Party 4: {John, Tom, Bob}
Party 5: {John, Tom, Bob}
Party 6: {John, Tom, Bob}
Party 7: {John, Tom, Bob}
Party 8: {John, Tom}
Party 9: {John, Bob}
Party 10: {John}

However, if we let *wulun* to scope over the Q-adverb, we obtain the following formula (41), in which the invitation of John in all cases is not captured because the formula only says that for each student, if he is agreed in most situations, then the sentence is true.

(41) [$\forall$p[p$\in${p: $\exists x$[person(x) & p=you invite x]}$\rightarrow$MOST [$\exists x$[person(x) & you invite x] [$\exists e$[agree(e) & agent(I, e)](p)]]

(42) a. if you invite John then most situation in which you invite him is a situation I agree.
b. if you invite Tom then most situation in which you invite him is a situation I agree.
c. if you invite Bob then most situation in which you invite him is a situation I agree.

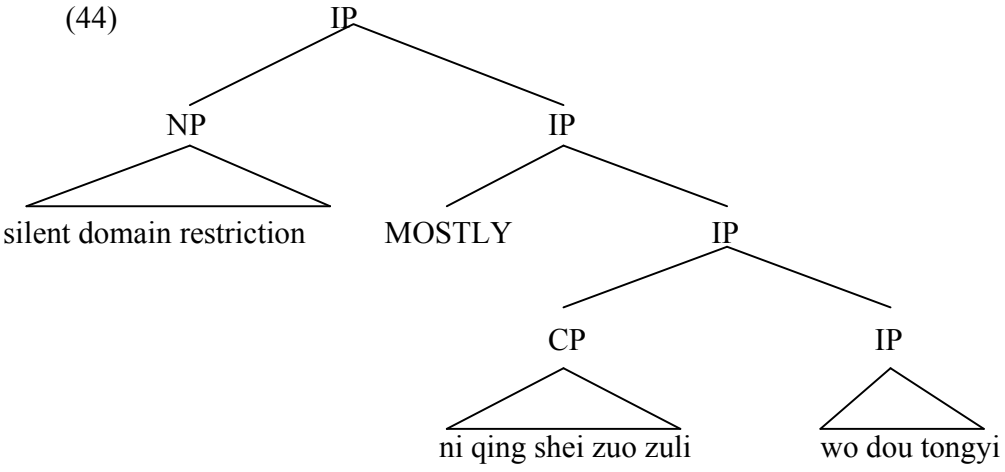
This formula also makes a statement true that cannot be true. Consider the following

scenario (43), in which out of ten times of inviting, I agreed for John in 6 times, Tom in 6 times, and Bob in 6 times, this sentence is predicted to be true because the number of situations for each person is independent of each other as long as the number is larger than half of the total number of invitings.

(43) Party 1: {John, Tom}
Party 2: {John, Tom}
Party 3: {John, Bob}
Party 4: {John, Bob}
Party 5: {Tom, Bob}
Party 6: {Tom, Bob}
Party 7: {John, Tom}
Party 8: {John, Tom}
Party 9: {Tom, Bob}
Party 10: {Tom, Bob}

Therefore, we conclude that the copying approach does not work. Let's make another attempt. Assuming that there is always a silent or specified domain for the wh-phrases in sentential wh-*dou* construction, the Q-adverb ranges over this silent domain, which serves as the restrictor, and the whole sentence is mapped into the nuclear scope, as schematized in (44). Then we can define the truth of sentential wh-*dou* construction in (45).

(44)



(45) [[wulun α] Q-adverb [dou-β]] is true iff the following holds: Q-many situations in which there is a domain of individuals is a situation in which it is true that [wulun α dou-β].

Given this new treatment, let's examine whether the new formula (45) can capture the true meaning of sentential *wulun*-sentences. Sentence (32), repeated below as (46a) with a silent domain restriction, would receive a semantic representation of (46b), paraphrased as in (46c).

(46) a. [zhexie xuesheng] wulun ni qing shei zuo zuli, duoshu qingkuang xia wo dou tongyi.

[these student] no matter you invite who as assistant, most situation Loc I all agree

'[These students] no matter who you invite as assistant, in most cases I agree.'

b. MOSTs [silent domain][$\exists s'[s \leq s'$ & $\forall p[p \in \{p: \exists x[\text{person}(x)$ & p=you invite $x]\} \rightarrow \exists e[\text{agree}(e)$ & $\text{agent}(I, e)](p)]]$

c. Most situations in which there is a domain of individuals is a situation in which $\forall p[p \in \{p: \exists x[\text{person}(x)$ & p=you invite $x]\} \rightarrow \exists e[\text{agree}(e)$ & $\text{agent}(I, e)](p)]$

In this representation, the scope of IN MOST CASES is larger than the scope of *wulun*. It correctly predicts sentence (46a) to be true under the scenario described in (35), in which one student can be invited all the times, as long as in few times the dean does not agree on some others. It also correctly predicts this sentence to be false under the scenario described in (38), in which there is one student being rejected in each case. Similarly sentence (39), repeated below as (47a), would receive a semantic representation of (47b), paraphrased as in (47c).

(47) a. [zhexie ren] wulun ni yaoqing shei, duoshu qingkuang xia wo dou tongyi.

[these people] no matter you invite who most situation Loc I all agree

'[These people] no matter who you invite, in most cases I agree.'

b. MOSTs [silent domain][$\exists s'[s \leq s'$ & $\forall p[p \in \{p: \exists x[\text{person}(x)$ & p=you invite $x]\} \rightarrow \exists e[\text{agree}(e)$ & $\text{agent}(\text{I}, e)](p)]]$

c. Most situations in which there is a domain of individuals is a situation in which $\forall p[p \in \{p: \exists x[\text{person}(x)$ & p=you invite $x]\} \rightarrow \exists e[\text{agree}(e)$ & $\text{agent}(\text{I}, e)](p)]$

The new formula (46) correctly predicts sentence (47a) to be true under the scenario described in (40), in which one student can be invited all the times, as long as in few times the dean does not agree on some others. It also correctly predicts sentence (47a) to be false under the scenario described in (43), in which there is one student being rejected in each case.

3. *Wulun*-wh as the instantiation for distributive quantification

Under the current proposal, it is *wulun* that gives rise to universal quantification and *dou* is an existential quantifier serving to license an event variable for skolemization. It seems that we have changed the functions of the two morphemes among each other; especially Huang's proposal that *dou* is an existential quantifier looks very atypical. This is because *dou* is usually considered as responsible for universal quantification by most researchers (Lee 1986, Cheng 1994, Jiang 1998, Pan 2006, among many others). One may bring the following sentence (48) to argue against this view. Intuitively sentence (48) tells us that each member of the group of people is smart, a clear case of distributive (universal) quantification. Since *dou* is not responsible for the triggering of universal quantification, then where the universal quantification comes from, because in this sentence we could not find any other item that is associated with universal quantification.

(48) zhexie ren dou hen congming.
these people all very smart
'These people are all smart.'

This section attempts to answer this question. The idea is very simple. Earlier, in order to derive the correct semantics of sentential *wulun-dou* construction, we have assumed that there is a silent NP specifying a domain for the set denoted by wh-phrase. In order to accommodate the ordinary plural subject *dou*-sentences after the proposal that *dou* is needed to license event variable for skolemization, we assume that in ordinary *dou*-sentences, there is always a silent subject that denotes a set of alternative individuals. The silent set can be covert or overt, in the form of *wulun*-wh-phrases. The domain of the set denoted by the wh-phrase is determined by the preceding plural NP, which can be thought as a plural individual ($<x_1 \oplus x_2 \oplus \ldots>$). The universal quantification comes from *wulun-wh*, which serves to distribute over the *sum* denotation of the plural NP, thus allowing us to talk each member of the plural subject denotation. That is, the distributivity between $<x_1 \oplus x_2 \oplus \ldots>$ and $<e_1 \oplus e_2 \oplus \ldots>$ is established through *wulun-wh*, which assures the distributive correspondence between sums of events and sums of individuals. This distributivity interpretation, though a semantic operation, happens to have overt realization in syntax in Chinese: *wulun-shei*.

We can further assume that the plural NP is the topic while the [*wulun shei*]+*dou* VP is the comment. Due to this silent *wulun-wh*, the universal quantification and plurality of events are assured. In each minimal event, there must be a separate individual (every member in the set denoted by the wh-phrase) taking part in. There need to be different individuals participating in each minimal event, and each individual participating in each minimal event are lumped together to have the meaning of a plural NP, which provides the domain for the set to refer to.

(49) a. zhexie ren [wulun shei] dou hen congming.
these people [no matter who] all very smart
'These people (no matter who) are all smart.'

b. ⟦these people⟧ $\forall x[x \in$ ⟦shei⟧ $\rightarrow \exists e[\text{smart}(e) \,\&\, \text{agent}(x, e)]$

3.1 Empirical support

The empirical support of this view mainly comes from the closer relation between *wulun*-wh and *dou* VP than between plural NP and *dou* VP. Many pieces of evidence

show that *wulun shei* and *tamen* occur in different positions in the tree. For example, all plural NP *dou*-sentences can be inserted with wh-phrases between the plural NP and *dou* VP. The reverse ordering is illicit.

(50) a. Zhangsan he Lisi/tamen/zhexie ren/zheli de meigeren
Zhangsan and Lisi/they/these people/here DE everyone
[wulun shei] dou hen congming.
no matter who all very smart
'Zhangsan and Lisi/they/these people/everyone here, everyone is smart.'

b. *[wulun shei] Zhangsan he Lisi/tamen/zhexie ren/zheli de meigeren
no matter who Zhangsan and Lisi/they/these people/here DE everyone
dou hen congming.
all very smart
'Everyone, Zhangsan and Lisi/they/these people/everyone here, is smart.'

Second, it is well-known that auxiliary verbs mark the boundary of VP in a sentence, which usually must be adjacent to VPs. *wulun*-NPs cannot occur preceding auxiliary verbs, but ordinary plural subjects can, as indicated below in (51a) and (51b). This shows that *wulun*-NP is closer than *tamen* 'they' in the tree.

(51) a. *[wulun shei] bixu/yinggai/keyi dou lai.
no matter who must/should/can all come
'Anyone must/should/can come.'

b. tamen bixu/yinggai/keyi dou lai.
they must/should/can all come
'They must/should/can all come.'

Third, the placement of adverbs provides us with a good diagnostic to distinguish the different positions of *wulun*-NP and ordinary plural NPs in a *dou*-sentence. Some adverbs that cannot precede subjects in the ordinary sense can precede *wulun*-wh instead. Examples include *yiding* 'definitely', *changchang* 'always', *wangwang* 'usually', *yizhi*

'often', *bingbu* 'and not', *jihu* 'almost', and so on.

(52) a. zhexie ren, yiding wulun shei dou hen congming.
these people, definitely no matter who all very smart
'These people, definitely everyone is smart.'
b. *zhexie ren, yiding tamen dou hen congming.
these people, definitely they all very smart
'These people, definitely they are smart.'

(53) a. zhexie rizi, wangwang wulun shei dou xiang lai.
these day, usually no matter who all want come
'These days, usually everyone wanted to come.'
b. *zhexie rizi, wangwang tamen dou xiang lai.
these day, usually they all want come
'These days, usually they wanted to come.'

(54) a. zhexie rizi, yizhi wulun shei dou xiang lai.
these day, often no matter who all want come
'These days, it is often the case that everyone wanted to come.'
b. *zhexie rizi, yizhi tamen dou xiang lai.
these day, often they all want come
'These days, it is often the case that they wanted to come.'

(55) a. zhexie ren, bingbu wulun shei dou hen congming.
these people, and-not no matter who all very smart
'These people, it is not the case that everyone is smart.'
b. *zhexie ren, bingbu tamen dou hen congming.
these people, and-not they all very smart
'These people, it is not the case that they are all smart.'

(56) a. zhexie ren, jihu wulun shei dou hen congming.
these people, almost no mater who all very smart
'These people, almost everyone is smart.'
b. *zhexie ren, jihu tamen dou hen congming.
these people, almost they all very smart

'These people, almost they are smart.'

Furthermore, mono-syllabic adverbs like *jiu* 'then', *que* 'but', *you* 'again', and *hai* 'still' can only appear between subjects and verb phrases. These linking adverbs cannot occur before subjects. Sugimura (2002) observes that these adverbs can, surprisingly, modify *wulun*-wh constituents, though they cannot appear before ordinary subjects.

(57) a. *ni you cuowu, gai-le jiu hao, zai fan lao maobing
you have mistake, correct-Asp then good, again commit old mistake
jiu Wang zhuren dou jiu bu liao ni le.
then Wang director all help not you Prt
'You have mistakes, it is good to correct them; if you commit old mistakes again, then director Wang cannot help you out.'

b. ni you cuowu, gai-le jiu hao, zai fan lao maobing jiu
you have mistake, correct-Asp then good, again commit old mistake then
shei dou jiu bu liao ni le.
who all help not you Prt
'You have mistakes, it is good to correct them; if you commit old mistakes again, then whoever cannot help you out.'

(58) a. *ren, yaoshi you zhezhong zixin, na jiu zhezhong shi
man, if have this-kind confidence, then this-kind matter
dou bu pa le.
all not afraid Prt
'A man, if having this kind of self-confidence, is not afraid of this kind of matters.'

b. ren, yaoshi you zhe-zhong zixin, na jiu shenme dou bu pa le.
man, if have this-kind confidence, then what all not afraid Prt
'A man, if having this kind of self-confidence, is not afraid of anything.'

Another piece of evidence concerns the topichood of plural NPs in *dou*-sentences. It is observed that not all plural NPs can be associated with *dou* (Huang 1995, Wu 1999).

Compare the following contrasts:

(59) a. zhexie xuesheng dou hen congming.
these student all very smart
'These students are smart.'
b. *yixie xuesheng dou hen congming.
some student all very smart
'Some students are smart.'

(60) a. henduo xuesheng dou hen congming.
many student all very smart
'Many students are smart.'
b. *henshao xuesheng dou hen congming.
few student all very smart
'Few students are smart.'

(61) a. mei-ge xuesheng dou hen congming.
every student all very smart
'Every student is smart.'
b. *meiyou xuesheng dou hen congming.
not student all very smart
'No student are smart.'

(62) a. na yiwan-ge xuesheng dou hen congming.
that 10,000-Cl student all very smart
'These 10,000 students are smart.'
b. *zuiduo yiwan-ge xuesheng dou hen congming.
at most 10,000 student all very smart
'At most 10,000 students are smart.'

This phenomenon can be explained by our proposal that a *dou*-sentence always involves a silent *wulun*-wh item, while the plural NP may be a topic used to introduce a domain of old referents in the context. Noun phrases like *zhexie xuesheng* 'these students', *henduo xuesheng* 'many students', *mei-ge xuesheng* 'every student', *na yiwan-ge*

xuesheng ‘these 10,000 students’, etc are canonical terms of introducing old referents in the context, while noun phrases like *yixie xuesheng* ‘some students’, *henshao xuesheng* ‘few students’, *meiyou xuesheng* ‘no student’, *zuiduo yiwan-ge xuesheng* ‘at most 10,000 students’, etc are canonical terms of introducing new referents in the context. Thus the latter cannot be topic that *wulun*-wh refers to and hence cannot occur in *dou*-sentences.

(63) a. zhexie xuesheng, wo renwei tamen hen congming.
these student I think they very smart
‘These students, I think they are smart.’
b. *yixie xuesheng, wo renwei tamen hen congming.
some student I think they very smart
‘Some students, I think they are smart.’

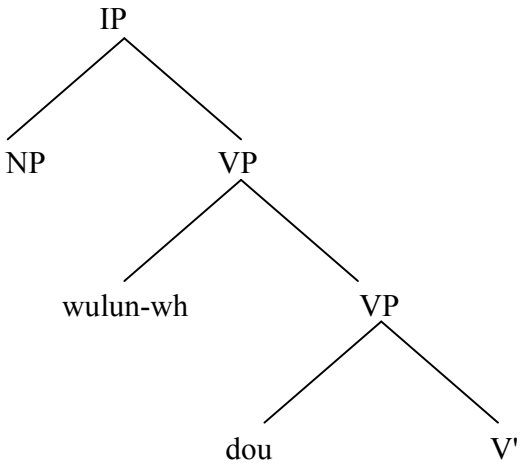
(64) a. henduo xuesheng, wo renwei tamen hen congming.
many student I think they very smart
‘Many students, I think they are smart.’
b. *henshao xuesheng, wo renwei tamen hen congming.
few student I think they very smart
‘Few students, I think they are smart.’

(65) a. mei-ge xuesheng, wo renwei tamen hen congming.
every student I think they very smart
‘Every student, I think they are smart.’
b. *meiyou xuesheng, wo renwei tamen hen congming.
not student I think they very smart
‘No students, I think they are smart.’

(66) a. na yiwan-ge xuesheng, wo renwei tamen hen congming.
that 10,000-Cl student I think they very smart
‘These 10,000 students, I think they are smart.’
b. *zuiduo yiwan-ge xuesheng, wo renwei tamen hen congming.
at most 10,000 student I think they very smart
‘At most 10,000 students, I think they are smart.’

Therefore, it seems correct that the position of *wulun*-NP is closer to VP. More specifically, we argue that *wulun*-NP is situated as an adjunct to *dou* VP within the VP domain, while *tamen* may occur in a topic position.

(67)



3.2 Some consequences

The assumption that plural NP *dou*-sentences are concealed *wulun*-wh-*dou* sentences raises many important questions. We will address two of them by pointing out possible treatments.

3.2.1 Cover readings

Lin (1996, 1998) proposes that *dou* is a generalized distributor, distributing property over every member of covers formed from a plural NP, because there are cases in which *dou* distributes a property not over every atom but a combination of atoms of the plural referent. Consider (68).

(68) naxie ren dou shi fuqi.
those people all be husband-and-wife
'Those people are all husbands and wives (couples).'

In the above sentence, what is distributed over by *dou* must be pairs of people. It does not make sense to distribute the property of being a couple to an individual and to all

the people; therefore it is neither distributive nor collective, but something in between (intermediate reading). To account for this, Lin adopts the notion of cover and proposes that *dou* can be treated as a generalized D-Operator distributing a property to a plurality cover formed from a set denoted by the plural NP, which may include individuals or pairs of individuals or other combinations (Gillon 1987, Schwarzschild 1996).

(69) a. C is a plurality cover of A iff C covers A and no proper subset of C covers A.

b. C covers A if:

C is a set of subsets of A.

Every member of A belongs to some set in C.

Ø is not in C.

A cover is context-dependent and pragmatically determined. Suppose we have a set {a, b, c, d} as set A. We can form different kinds of plurality covers of set A: {{a}, {b}, {d}, {c}}, {{a, b, d}, {c}}, {{a, b}, {c, d}}. All of these covers satisfy the conditions set forth in (68). Take {{a, b, d}, {c}} for example. This set is a set of subsets of set A (both {a, b, d} and {c} are subsets of {a, b, c, d}), and every member of set A belongs to some set in it, and there is no null set in this set. Therefore this set satisfies all the conditions of (69), accordingly we may say this set covers set A.

The generalized D-operator *dou* distributes over every member of a plurality cover C formed of the plural NP such that VP is true for every element in C. The members of *Cov* are sets (excluding null sets), and the universal quantification introduced by *dou* quantifies over every member of *Cov* that are subsets of the plurality. Since the generalized distributive operator quantifies over sets, it can distribute over sub-pluralities (i.e., when the members of *Cov* are sets with more than one member), resulting in intermediate readings. The ∀ symbol in the formalism of *dou* guarantees that the number of individuals involved must be larger than one since universal quantification presupposes plurality; otherwise it is meaningless to say 'every'.

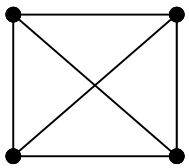
(70) $[\![dou]\!] = \lambda P \lambda X \forall y[y \in \mathrm{Cov} \ \& \ y \subseteq X \ \rightarrow \ P(y)]$

By varying the structure of covers, we can obtain different kinds of distributivity in a given context. When the cover contains sets of only atomic individuals, it yields distributive reading. When the cover contains sets of multiple individuals, it yields intermediate reading. Given this new definition over covers, sentence (68) can receive a natural account. The cover is {{a, b}, {c, d}, {e, f}} and the predicate *shi fuqi* 'be husband-and-wife' is then predicated of the multi cell of this plurality cover and cannot be distributed further into members of the set.

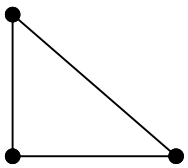
Real inherently collective predicates provide support to it. Let's make a real inherently collective predicate like *zucheng sanjiaoxing* 'form a rectangle' and further define that exactly three people can form a shape of rectangle by standing in the three corners of it. The following two sentences are judged to be true and false under the situations depicted in graph 1 and graph 2, respectively.

(71) a. tamen si-ge ren dou zucheng-le sanjiaoxing.
they four-Cl people all form-Asp rectangle
'Those four people all form a rectangle.'
$\forall y[y \in \{\{a, b, c\}, \{b, c, d\}, \{c, d, a\}, \{d, a, b\}\} \ \& \ y \subseteq \text{tamen} \rightarrow \text{form a rectangle}(y)]$)

b. *tamen san-ge ren dou zucheng-le sanjiaoxing.
they three-Cl people all form-Asp rectangle
'Those three people all form a rectangle.'
$\forall y[y \in \{\{a, b, c\}\} \ \& \ y \subseteq \text{tamen} \rightarrow \text{form a rectangle}(y)]$)



Graph 1



Graph 2

This contrast follows from the cover-based analysis. In the case of sentence (71a), let

the cover={{a, b, c}, {b, c, d}, {c, d, a}, {d, a, b}}, *dou* distributes over each member of the cover with the property 'form rectangle'. Thus the grammaticality is accounted for. The ungrammaticality of sentence (71b) is ruled out naturally, because the only cover compatible with the verb is {{a, b, c}}, which is a singleton. And according to the definition of cover, we cannot form a cover of {{a, b, c}, {b, c, a}, {c, a, b}} from the set of {a, b, c} because there are proper subsets of the cover that covers the set.

This analysis seems very attractive to account for the various cover readings[5]. The

[5] As far as we know, there are two problems with the cover-based analysis of *dou*. Lasersohn (1995: 139) points out that this analysis gives wrong truth conditions for a certain range of examples (also see Pan 2000). For example, the following sentence (i) only allows a distributive reading. But the cover-based analysis would give an intermediate reading, because pragmatically nothing prevents us from distributing a property of *losing 10 dollars* to each member of {{a, b}, {b, c}, {a, c}}. Then according to the cover-analysis, there is a possibility that Zhangsan and Lisi collectively lost ten dollars and Zhangsan and Wangwu collectively lost ten dollars.

(i) Zhangsan, Lisi, Wangwu dou diu-le shi-kuai qian.
Zhangsan Lisi Wangwu all lose-Asp ten-CL money
'Zhangsan, Lisi, Wangwu all lost ten dollars.'

The cover-based analysis does not fully explain some kinds of collective predicates. Consider the following sentence (ii/a). It says that all these people look alike, thus a true collective reading. *Dou* should distribute the property of looking alike to a one-cell cover {{a, b, c}}. However this violates the definition of *dou* in that one-cell cover is illicit in this account, as evidenced in (ii/b).

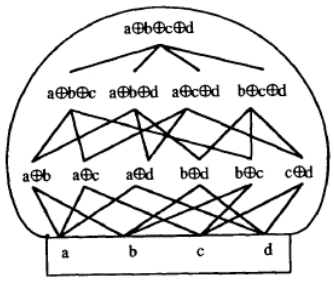
(ii) a. Zhangsan, Lisi he Wangwu dou zhang de hen xiang.
Zhangsan Lisi and Wangwu all look DE very alike
'Zhangsan, Lisi and Wangwu all look alike.'
b. *Zhangsan he Lisi dou zhang de hen xiang.
Zhangsan and Lisi all look DE very alike
'Zhangsan and Lisi all look alike.'

The cover-based analysis can resort to some reduction of a one-cell cover to multi-cell cover in order to derive a collective reading of (ii/a), thus satisfying the requirement for universal quantification. This idea is implicit in Lin and made explicit in Xiang (2006). Instead of {{a, b, c}}, we can have {{a, b}, {b, c}, {a, c}}. When the predicate *zhang de hen xiang* is applied to these three covers, we get the interpretation that a and b look alike, a and c look alike, and b and c look alike, and therefore all three people look alike. However, this reasoning does not follow. *look alike*(a, b, c) cannot be reduced to *look alike*(a, b) & *look alike*(a, c) & *look alike*(b, c) since for example, if a and b

problem is how we derive these cover readings under the current proposal that *dou* is an existential quantifier and *wulun*-wh serves as the overt syntactic instantiation for distributivity.

Under the current proposal, *dou* VP denotes a sum of events ($\{<e_1 \oplus e_2 \oplus \ldots>\}$). The subject NP must be also a plural individual denoting a sum of individuals in order to satisfy the argument structure of the *dou* VP. If the verb is inherently distributive, then the individual variable *x* stands for a single individual; if the verb is inherently symmetric, then *x* stands for a pair of two individuals; if the verb is inherently collective, then *x* stands for a pair of n-tuple individuals. All *dou* VP have the same denotation of distributive predicates $=\{e_1 \oplus e_2 \oplus \ldots>\}$, the difference is that the participant variable *x* should stand for different types of individuals.

According to Link (1983), the denotation of plural NP can be considered as a semi-lattice structure with many members formed from it. For example, the plural noun phrase *tamen si-ge* 'they four' can have a sum structure as depicted in graph 3 below (taken from Krifka 1991).



Graph 3

This semi-lattice structure provides us with a variety of ways to interpret the denotation of the NP *tamen si-ge*. The exact reading depends on how the sum of events is interpreted. Since a plural predicate is interpreted as denoting a sum, which has a part-of structure, the sum can be interpreted in various ways and consequently the sum of individuals is interpreted in same way. Consider:

---

look alike in having red hair, a and c look alike in having big eyes, and b and c look alike in having round face, sentence (ii/a) is predicted to be true. But it is false.

(72) a. tamen si-ge ren dou hen congming.
they four-Cl people all very smart
'Those four people are all smart.'
b. tamen si-ge ren dou zhang de hen xiang.
they four-Cl people all look-alike
'Those four people all look alike.'

In the case of *dou hen congming* 'all smart', the bottom level in graph 3 is counted because each one (single-one) is the agent of the minimal events of being smart. In case of the symmetric verb phrase *dou zhang de hen xiang* 'all look alike', the individual variable *x* has to be a group individual consisting of two individuals *x*={a, b} in order to satisfy the semantics of the verb. The second line in graph 3 is counted. Each node can be considered as a different group individual, which is a special kind of atomic individuals to model the behavior of predicates with a collective interpretation (Landman 2000). So we have ↑(a⊕b), ↑(a⊕c), ↑(a⊕d), ↑(b⊕d), ↑(b⊕c), and ↑(c⊕d). Consequently we have (↑(a⊕b))⊕(↑(a⊕c))⊕(↑(a⊕d))⊕(↑(b⊕d))⊕(↑(b⊕c))⊕(↑(c⊕d))∈⟦dou zhang de hen xiang⟧. This also explains why the plural NP must have at least three members. Two members only produce one two-membered group individual. The reduction problem of *looking alike* does not appear in this account. Suppose there are four people, we can have {{a, b}, {a, c}, {a, d}, {b, c}, {b, d}, {c, d}}. Each of them is a thematic player in a minimal event *e*, and this minimal event should be compatible with the meaning of *look-alike*, which means that the property holds in the event *e*. This has the effect of guaranteeing that the property of *looking alike* is the same. This is because the event variable *e* is restricted by the verb meaning and the individual variable is restricted by the event variable. The value of the event variable *e* depends on the meaning of the verb. If the verb *look-alike* implies (from the context) that people look alike in having round face, then all minimal events should also mean that all people look alike in having round face.

In the case of a collective predicate *dou zucheng le sanjiaoxing* 'all form a rectangle', the third line in graph 3 is counted. Each node can be considered as a different group of ↑(a⊕b⊕c), ↑(b⊕c⊕d), ↑(a⊕b⊕c), and ↑(b⊕c⊕d). These group individuals have accomplished four events of forming a rectangle. Thus in this account, sentences (71a)

and (71b), repeated here as (73a) and (73b), are also predicted to be true and false against the graphs 1 and 2, because the two graphs depict a multi and a single event of forming a rectangle, respectively.

(73) a. tamen si-ge ren dou zucheng-le sanjiaoxing.
they four-Cl people all form-Asp rectangle
'Those four people all form a rectangle.'
b. *tamen san-ge ren dou zucheng-le sanjiaoxing.
they three-Cl people all form-Asp rectangle
'Those three people all form a rectangle.'

Therefore, all the cover readings are derived. This shows that the current proposal is at least as good as the generalized distributor account. Given that we can derive the cover readings involving group individuals, one may wonder how group individuals are reflected in *wulun*-wh structure, that is, what kind of *wulun*-wh structure shall be used to link the plural NP and *dou* VP. One possible way that occurs to us is the following paradigm, in which the *wulun*-wh structures are expressed in atom individuals.

(74) a. tamen si-ge ren [wulun shei] dou hen congming.
they four-Cl people [no matter who] all very smart
'Those four people, everyone is smart.'
b. tamen si-ge ren [wulun na liang-ge] dou zhang de hen xiang.
they four-Cl people [no matter which two-Cl] all look alike
'Those four people, every two look alike.'
c. tamen si-ge ren [wulun na san-ge] dou zucheng-le sanjiaoxing.
they four-Cl people [no matter which three-Cl] form-Asp rectangle
'Those four people, every three form a rectangle.'

If this treatment is correct, then we would expect every *dou*-sentence is truth-conditionally equivalent to every *dou*-sentence with *wulun*-wh inserted. This is true when the distributive quantification is over atom individuals. The following sentence (75)

is truth-conditionally equivalent to (74a) in that both require every member of the four people is smart.

(75) tamen si-ge ren dou hen congming.
they four-Cl people all very smart
'Those four people are smart.'

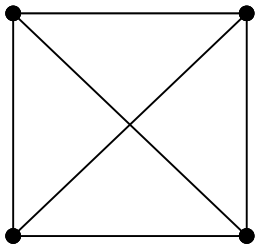
When the verb is a symmetric predicate like *jianmian* 'meet' or *zhang de hen xiang* 'look alike', equivalence in truth-condition is also found. The following sentence (76) is truth-conditionally equivalent to (74b). Both sentences require that every tuple of any two persons look alike, that is, a and b look alike, a and c look alike, a and d look alike, b and d look alike, b and c look alike, and c and d look alike.

(76) tamen si-ge ren dou zhang de hen xiang.
they four-Cl people all look DE very alike
'Those four people all look alike.'

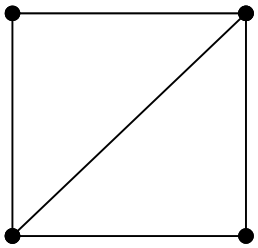
However, in other cases, *dou*-sentences with or without *wulun*-wh structure may be truth-conditionally non-equivalent. Consider the following two sentences. Under the situations described in the three graphs 4, 5, and 6, sentence (77a) is judged to be true in all these situations by all people that I consulted. However, (77b) is judged to be true only in graph 4, but not in graph 5 and graph 6. Graph 4 describes a situation in which every tuple of any three persons makes up a rectangle. This conforms to our intuition of *wulun na-san-ge* 'no matter which three', which seems to require the exhaustive four group individuals of ↑(a⊕b⊕c), ↑(b⊕c⊕d), ↑(a⊕b⊕c), and ↑(b⊕c⊕d). Graph 5 and 6 describe a situation in which not every tuple of any three persons makes up a rectangle, only two group individuals are involved in forming a rectangle (as depicted in the linking lines).

(77) a. tamen si-ge ren dou zucheng-le sanjiaoxing.
they four-Cl people all form-Asp rectangle
'Those four people all form a rectangle.'

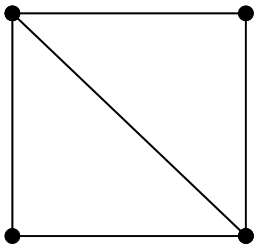
b. tamen si-ge ren [wulun na-san-ge] dou zucheng-le sanjiaoxing.
they four-Cl people [no matter which three-Cl] all form-Asp rectangle
'Those four people, every three form a rectangle.'



Graph 4



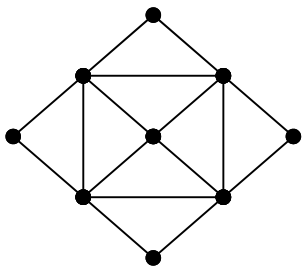
Graph 5



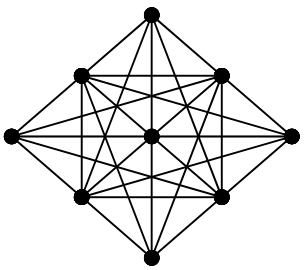
Graph 6

Let's consider a more complex structure. To all those people, sentence (78a) is true under the situation described in graph 7, but sentence (78b) is false in the same situation because there are many other triple-membered group individuals that do not form a rectangle. Sentence (78b) can only be true in graph 8.

(78) a. tamen jiu-ge ren dou zucheng-le sanjiaoxing.
they nine-Cl people all form-Asp rectangle
'Those nine people all form a rectangle.'
b. tamen jiu-ge ren [wulun na-san-ge] dou zucheng-le sanjiaoxing.
they nine-Cl people [no matter which three-Cl] all form-Asp rectangle
'Those nine people, every three form a rectangle.'



Graph 7



Graph 8

Further consider the following sentence (79a), which can be paraphrased as (79b) in our proposal. Pragmatically sentence (79a) can only be true in a situation of two couples shown in the set of {{a, b}, {c, d}}. However, sentence (79b) can only be true in a situation of six couples shown in the set of {{a, b}, {a, c}, {a, d}, {b, c}, {b, d}, {c, d}}, which is pragmatically odd.

(79) a. tamen si-ge ren dou shi fuqi.
they four-Cl people all be husband-and-wife
'Those four people are all husbands and wives (couples).'
b. tamen si-ge ren [wulun na-liang-ge] dou shi fuqi.
they four-Cl people [no matter which two-Cl] all be husband-and-wife
'Those four people, every two are husbands and wives (couples).'

Therefore, it is problematic that we use wh-phrases for atom individuals to express group individuals, because this treatment gives rise to strong interpretations. Instead we should use wh-phrases for group individuals to express group individuals, like *na-yi-dui* 'which couple', or *na-yi-zu* 'which group'. Besides, the denotations of the wh-phrases for group individuals should be flexible enough to accommodate the various predicates with different pragmatic requirements. For example, predicates like *zhang de hen xiang* require every member in a set to form a power set of any two members; while predicates like *shi fuqi* require every member in a set to form a disjoint set of any two members.

Now the above examples should be restated as follows, in which *na-yi-dui* 'which couple' and *na-yi-zu* 'which group' are flexible enough to accommodate the various predicates with different pragmatic requirements. It is easy to verify that these sentences are true in the situations described above. Our counting is over groups but not atoms; some atom may not form a group with other members as long as each is involved in at least one group formation[6].

(80) a. tamen si-ge ren [wulun na-yi-dui] dou shi fuqi.

[6] I leave here the pragmatics of group formation from a plural NP as an open issue, which involves many factors such as the nature of predicates and world knowledge etc.

they four-Cl people [no matter which one-Cl] all be husband-and-wife
'Those four people, every pair is husband and wife (couple).'

b. tamen si-ge ren [wulun na yi-dui] dou zhang de hen xiang.
they four-Cl people [no matter which one-Cl] all look DE very alike
'Those four people, every pair looks alike.'

c. tamen si-ge ren [wulun na yi-zu] dou zucheng-le sanjiaoxing.
they four-Cl people [no matter which one-Cl] all form-Asp rectangle
'Those four people, every group forms a rectangle.'

3.2.2 Coordinated predicates

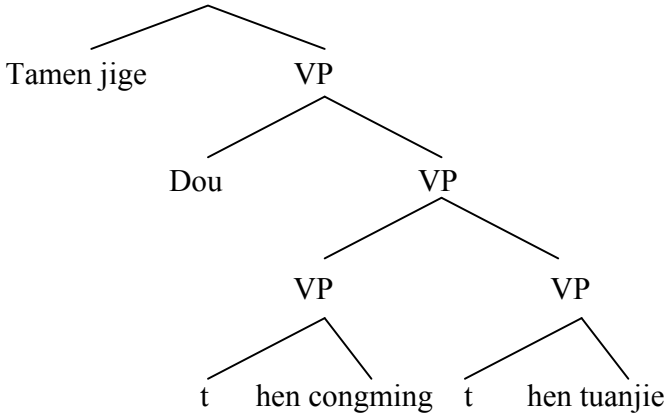
Consider the following sentence, in which there are coordinated predicates. The potential difficulty for our analysis is that the first predicate is true of only atomic individuals, but the second predicate is true of only two-membered group individuals.

(81) tamen jige dou hen congming erqie hen tuanjie.
they several-Cl all very smart and very consolidated
'They are smart and consolidated.'

The problem is a general one, also encountered by the distributor analysis. For the distributor analysis, the coordinated predicate, whose intersection actually returns an empty set, has to be distributed over to every member of the covers. However, any member that satisfied one predicate cannot satisfy the other at the same time. For example, we need a cover of {{a, b}, {b, c}, {a, c}} to be the argument of *hen tuanjie*, but we need a cover of {{a}, {b}, {c}} to be the argument of *hen congming*. In either case, or in a combination of the two covers, we are unable to give the correct representation.

One possible solution of distributor analysis may look like this. Given the VP-internal subject hypothesis (Huang 1993), we can assume that the subject originates from a position below *dou*. By this analysis, we may assume there are two subject traces, each for one predicate.

(82)



Now we can revise the definition of *dou* as in (83) and the representation for sentence (81) is shown in (84).

(83) $dou = \lambda P \lambda Q \lambda X \forall x \forall y\ [x \in \text{Cov} \ \& \ x \subseteq X \ \& \ y \in \text{Cov} \ \& \ y \subseteq X \ \rightarrow \ P(x) \ \& \ Q(y)]$

(84) $\forall x \forall y\ [x \in \{\{a\}, \{b\}, \{c\}\} \ \& \ x \subseteq [\![\text{they several}]\!] \ \& \ y \in \{\{a, b\}, \{b, c\}, \{a, c\}\} \ \& \ y \subseteq [\![\text{they several}]\!] \rightarrow \text{smart}(x) \ \& \ \text{consolidated}(y)]$

This may be a possible approach even though it complicates the definition of *dou* (in that the formula will iterate endlessly if there are different types of predicates) and the problematic assumption that the two traces left by the same subject have different denotation (no evidence shows this is possible).

Our account is not helpless with sentence (81). It is well known that inherently distributive predicates can be predicated of singular individuals and collective individuals. In the latter case, the inherent distributivity may be derived from some meaning postulate or just by implicature. Whatever reason it may be, it is clear that when an inherently distributive predicate is predicated of plural individual, the predicate can go down to the atomic elements of the plural individual by some mechanism.

(85) a. ta hen congming.

he very smart

'He is smart.'

b. tamen hen congming.

they very smart

'They are smart.'

Given this observation, we can give a simple account to the problem. The covert wh-phrase should be the one that is compatible with the collective predicate. Then we have (86b), in which the silent wh-phrase takes on the form of *na-yi-dui* 'which pair'[7]. It is the argument of both the distributive and collective predicates, via the mediation of agent(x, e).

(86) a. tamen jige [wulun na-yi-dui] dou hen congming erqie hen tuanjie.

they several-Cl [no matter which one-Cl]all very smart and very consolidated

'These several people, every pair is smart and consolidated.'

b. $\forall x[x \in [\![\text{which pair}]\!] \rightarrow \exists e[\text{smart}(e) \,\&\, \text{consolidated}(e) \,\&\, \text{agent}(x, e)]]$

[7] When the argument of *tuanjie* involves more than two people, we can reduce the event into sub-events of consolidated that involves two people. For example if Zhangsan, Lisi, and Wangwu are consolidated, it follows that Zhangsan and Lisi are consolidated, Zhangsan and Wangwu are consolidated, Lisi and Wangwu are consolidated.

Chapter 5

Summary and remaining issues

1. Summary

This dissertation is organized in three parts. The first part, namely chapter 1, explores the problems facing LF movement approach and the Unselective Binding approach towards wh-construals. It is argued that though LF movement approach has difficulty in explaining island-escaping behavior of wh-in-situ and association with *only*, the unselective binding approach is also not successful in leaving the wh-phrase in situ, because this treatment faces equally serious problems, mostly the semantic misinterpretations. The conclusion we reached is that we may need to take a different approach that combines the merits of both approaches: (1) keeps wh-phrases in-situ; (2) but interpret them in non-in-situ position.

Considering the tension between syntax and semantics, a third approach looks necessary. The second part of this dissertation, chapter 2, develops such a theory for wh-in-situ interpretations under the general framework of Hamblin semantics. This key assumption postulated in this chapter is that wh-phrases denote sets of alternatives, which is supported by empirical evidence. The direct consequence from this assumption is that we need a so-called pointwise functional application, which has the effect of 'extracting' and interpreting wh-in-situ expressions in displaced positions without resorting to covert movement. This effect is achieved by a process called expansion inherent in the definition of the pointwise functional application. It is an operation in semantics, insensitive to syntactic islands. If unclosed, the expansion returns a set of propositions, that is, the denotation of a question. But this expansion may be closed by quantificational operators.

The remaining part of this dissertation testifies how this theory, namely expansion and closure, works for wh-construals in Chinese. This part composes of two chapters. Chapter 3 examines how the wide-scope interpretations of interrogative wh-in-situ

expressions are obtained across three typical island structures by means of expansion, while giving correct semantics, which we have shown pose a big problem to unselective binding. Though LF movement can also obtain correct semantics, this chapter discusses several aspects in which our theory is advantageous. Chapter 4 deals with closure, closure by universal operator. This chapter proposes that the adverb *wulun* is a universal closing operator. In this chapter, several novel ideas are proposed for *wulun-dou* structures. One is that *wulun*-XP is base-generated within *dou* VP domain, the other is that ordinary *dou*-sentences are concealed *wulun*-wh-*dou* sentences and *wulun*-wh is the linking element for associating *dou* and a plural NP (for distributive quantification).

2. Remaining issues

In this dissertation, we mainly focused on wh-phrases in wh-questions and in *wulun-dou* constructions. The conclusion we reached is that wh-phrases in these two environments uniformly denote sets of alternatives, which expand in the derivational process. If it expands to the root of the sentence, then by default it derives a question meaning. If it encounters *wulun*, the process of expansion is closed, yielding a universal reading.

We did not discuss other construals of wh-phrases occurring in other environments, for example, the polarity existential construal of wh-phrases in downward-entailing environments such as negation, if-clauses, and epistemic modality (*xuzhi* 'vague reference' in the terminology of traditional Chinese grammar). This phenomenon has been fruitfully described and studied in various important works, both within descriptive grammar (Yu 1965, Lü 1980, Zhu 1982, Hu and Wang 1989, Shao and Zhao 1989, Zhang 2005, among many others) and within generative grammar (Huang 1982, Lee 1986, Cheng 1991, Li 1992, Lin 1996, among others). For consideration of uniformity, it is preferable to treat the existential polarity wh-phrases as denoting sets of alternatives too, and the existential quantification is from somewhere else. Below we will show this might be a right way to approach existential polarity construal of wh-phrases, though some problems, unclear to me, exist.

First, it should be noted that the existential polarity wh-phrases can also be interpreted in displaced positions outside island constraints. For example in the following

sentences, the existential wh-indefinites can take an intermediate scope as long as they meet the licensing condition, that is, within the scope of a licensor (Lin 2004).

(1) a. haoxiang Zhangsan bu xiwang shei hen youqian de yangzi.
seem Zhangsan not hope who very rich seem
'It seems that there is someone such that Zhangsan does not hope he is rich'

b. haoxiang yaoshi shei zhong-le jiang, Zhangsan jiu hen gaoxing.
seem if who win-Asp lottery, Zhangsan then very happy
'It seems that there is someone such that if he won the lottery Zhangsan would be happy.'

c. haoxiang Zhangsan meiyou kan-guo shei xie de shu yiyang.
seem Zhangsan not read-Asp who write DE book seem
'It seems that there is someone such that Zhangsan does not read any book written by him.'

It is relatively easy to see that treating the non-interrogative wh-phrases as in-situ variable does not work for the same reasons that we have discussed in chapter 1. For example, if we leave the lexical restrictions in situ, the above sentences will have representations of (2a), (2b), and (2c) respectively, which will give rise to various problems.

(2) a. SEEM: $\exists x$[Zhangsan does not hope that [person(x) & rich(x)]]

b. SEEM: $\exists x$[[person(x) & win(x)]→Zhangsan is happy]

c. SEEM: $\exists x$[Zhangsan did not read books that [person(x) & write(x)]]

Resorting to presupposition is not possible since there is no existential presupposition either in the wh-phrases or in the whole sentences. These non-interrogative uses of wh-phrases are mainly licensed in non-veridical environments. According to Lin (1996), the felicity condition for such wh-phrases is "nonexistence".

(3) The use of an EPW is felicitous iff the proposition in which the EPW appears does not entail existence of a referent satisfying the description of the EPW.

Having existential presupposition is roughly equivalent to saying that the existential quantifier associated with it has wide scope and introduces a discourse referent. In EPW uses, there is apparently no such existential presupposition of a referent that satisfying the description of the EPW. For example, when we ask people whether or not they met someone, apparently we are not presupposing the existence of someone who they met (see (4a)).

(4) a. ni jian guo shei ma?
you see Asp who Q
'Did you see someone?'
b. haoxiang ta jian-guo shei.
seem he see-Asp who
'It seems that he saw someone.'
c. yaoshi ni jian-guo shei,...
if you see-Asp who
'If you saw someone…'

Choice function does not help either. Consider the following sentences (5a) and (6a), in which the wh-indefinites take an intermediate scope between two negation operators. Choice function yields (5b) and (6b) respectively, paraphrased as: every choice function is such that Zhangsan hopes the person it chooses passed the exam, and, every choice function is such that we invite the person it chooses and Zhangsan will not be offended. Both formulae seem odd in that every choice function only chooses a person. This is the problem of strong truth condition.

(5) a. bushi shuo Zhangsan bu xiwang shei neng kao jige.
not-be say Zhangsan not hope who can pass exam

'It is not true that there is someone such that Zhangsan does not hope he can pass the exam.'

b. $\forall f$[CH(f) → Zhangsan hopes [that f(person) passed exam]].

(6) a. bushi shuo yaoshi women yaoqing-le shei Zhangsan hui bu gaoxing.
not-be say if we invite-Asp who Zhangsan will not happy
'It is not true that there is someone such that if we invited him Zhangsan will be unhappy.'

b. $\forall f$[CH(f) → we invited f(person) ∧ Zhangsan will not be offended]].

The direction of entailment relation is not correct either. In the following two sentences (7a) and (8a), the wh-phrases (*nage nanxuesheng* 'which male student' and *nage xuesheng* 'which student') take intermediate scope between the two negation operators. Now the formulae (7b) and (8b) end up with a wrong direction of entailment: (7b) entails (8b). It is easy to see why this is so. If it is true that every choice function is such that Zhangsan believes it chooses a male student, it is also true that every choice function is such that Zhangsan believes it chooses a student. It is equally easy to see that if it is true that every choice function is such that Zhangsan believes it chooses a student, it does not follow that every choice function is such that Zhangsan believes it chooses a male student (it may choose a female student).

(7) a. bushi shuo Zhangsan bu xiwang nage nanxuesheng neng kao jige.
not-be say Zhangsan not hope which boy student can pass exam
'it is not true that Zhangsan does not hope some boy student can pass the exam.'

b. $\forall f$[CH(f) → Zhangsan hopes [that f(male student) passed exam]].

(8) a. bushi shuo Zhangsan bu xiwang nage xuesheng neng kao jige.
not-be say Zhangsan not hope which student can pass exam
'it is not true that Zhangsan does not hope some student can pass the exam.'

b. $\forall f$[CH(f) → Zhangsan hopes [that f(student) passed exam]].

Now let's see how the current proposal derives the intermediate scope of existential wh-indefinites in displaced positions outside island constraints. Following Cheng (1991), Dong (2009), and others, we assume that modals can trigger an Existential Closure operator under its immediate scope. This Existential Closure operator is an instantiation of the existential propositional operator defined in Kratzer and Shimoyama (2002). Like *wulun* that universally closes the expansion, its function is to existentially close the expansion, by applying to a set of propositions A and yielding the proposition that is true in all worlds in which some proposition in A is true.

(9) a. $[\![\exists\alpha]\!]^{w,g} = \{\lambda w'.\exists p[p \in [\![\alpha]\!]^{w,g} \,\&\, p(w')]\}$

b. Modality licensor [$\exists_{\text{Closure}}$ [wh-phrase$_{\text{Expansion}}$… [… […wh-phrase…]]]]

Consider (1a). The licensor *haoxiang* 'seem' introduces a sentential existential operator, which closes the denotation of the subsequent clause, which, we have shown, is a question denotation: {p: $\exists x$[person(x) & p=$\neg\forall w'$ compatible with Zhangsan's desires in w: rich(x)(w')]}. The existential propositional operator applies to this question denotation, returning a singleton proposition set, as shown in (10).

(10) SEEM: $\exists x$[person(x) & $\neg\forall w'$ compatible with Zhangsan's desires in w: rich(x)(w')]

Assuming the semantics of *haoxiang* as (11) below, we get the final representation as shown in (12).

(11) $[\![\text{haoxiang}]\!]^{w,g} = \lambda p_{<s,t>}.\exists w'$ compatible with the evidence in w: p(w') = 1.

(12) $\exists w'$ compatible with the evidence in w: $\exists x$[person(x) & $\neg\forall w''$ compatible with Zhangsan's desires in w: rich(x)(w'')](w')=1

The wh-phrase takes intermediate scope between the licensor *haoxiang* and negation, the variable associated with *person* (which is not indicated in the formula) is evaluated within the scope of the possible world w', so the final representation means: There is an

epistemically accessible world w' from the actual world w such that it is true in this possible world w' that there is some person such that in every possible world compatible with Zhangsan beliefs in the actual world, he is not rich. This proposition is only evaluated in the epistemically accessible world w', the world variable associated with the wh-phrase is above the world variable associated with the belief verb but within the world variable associated with the modal adverb.

By similar strategy, we can derive the semantic representations for the other sentences (1b) and (1c), as shown below:

(13) a. $\exists w'$ compatible with the evidence in w: $\exists x$[person(x) & λs. for every minimal situation s' such that $s' \leq s$ and $\lambda w'$.win(x)(s'), there is a situation s'' such that s" $\leq s$ and s'' is a minimal situation such that $s' \leq s''$ and Zhangsan is happy(s'')](w')= 1.

b. $\exists w'$ compatible with the evidence in w: $\exists x$[person(x) & $\neg\exists x^s$[R(x^s, ι[λy[book(y) & write(y)(x)]]) $\wedge$ read(x^s)(zhangsan)]](w')=1

In this view, non-interrogative existential readings are derived from closing the sets of propositions (which are interrogative readings) by existential closure introduced by the modal licensors. Without an existential operator, the clause ends up being construed as a wh-question. If there is existential operator available, the set of propositions is closed by it, which takes the set of propositions as its argument and returns a singleton set of proposition.

Though this account seems plausible, there are two issues needing further investigations. The first issue is that environments that license existential polarity wh-items are more widespread than previously recognized. It can appear in affirmative contexts, in A-not-A, in wh-sentences, in factual verbs, etc. The following sentences are from Yu (1965), Zhu (1982), Hu and Wang (1989), Hua (2000), Zhang (2005). As a result, we need to know what the licensors in these sentences are, which trigger the existential propositional operator.

(14) a. ta jiao shenme ban-le yi jiao.

he let what cripple-Asp one cripple
'He was crippled by something.'

b. zheli que-le shenme.
here lack-Asp what
'Something is lacking here.'

c. Lisi you shenme babing zai Zhangsan shou li.
Lisi have what error in Zhangsan hand Loc
'Lisi has some error in the hand of Zhangsan.'

d. laoshi, shei nazou-le wo de cidian.
teacher, who take-away-Asp I DE dictionary
'Teacher, someone has taken away my dictionary.'

e. kan, shenme dongxi zai chao women fei lai.
look, what thing prog towards we fly come
'Look, something is flying towards us.'

f. ta yiding yincang-le shenme mimi.
he sure hide-Asp what secret
'He must be hiding some secret.'

g. wo natian qu zhao ni.
I which day go look you
'I will go for you some day.'

h. shei shi-bu-shi chuqu kan yixia?
who be-not-be go out see a little
'Would someone go out to have a look?'

A more serious problem concerns the existential polarity reading of manner adverbial *zenmeyang*. We have shown in chapter 2 that *zenmeyang* also denotes sets of alternatives, just like the ordinary wh-arguments. Then it is expected that *zenmeyang* can obtain existential reading just like *shei* or *shenme* according to our proposal: As long as wh-phrases that denote sets of alternatives are within the scope of modal elements, these wh-phrases can be interpreted as existential. But this is incorrect, as shown in (15)

below[1].

(15) a. *yaoshi Zhangsan zenmeyang kai-che, wo jiu hen gaoxing.
if Zhangsan how drive-car I then very happy
'If Zhangsan drives a car in some manner, I am happy.'
b. *Zhangsan shi-bu-shi zenmeyang kai-che?
Zhangsan be-not-be how drive-car
'Does Zhangsan drive a car in some manner?'
c. ??Zhangsan meiyou zenmeyang kai-che.
Zhangsan not how drive-car
'Zhangsan does not drive a car in some manner.'

In addition to the issue of existential polarity wh-phrases, this dissertation does not address another wh-construction that exhibits universal quantification over the wh-phrases: bare conditionals (Cheng & Huang 1996, Lin 1996, Pan and Jiang xxxx).

(16) shei xian lai, shei xian chi.
who first come, who first eat
'The person who comes first is the person who eats first.'

Cheng & Huang (1996) considers bare conditionals as a prime case for unselective binding in that the two wh-phrases introduce free variables together bound by a covert

[1] When *zenmeyang* is interpreted as verbal *how*, the judgment improves, as shown below.
(i) a. yaoshi Zhangsan zenmeyang le, wo jiu dui ni bu keqi.
if Zhangsan how Prt I then to you not graceful
'If Zhangsan becomes in some condition, I will be bad with you.'
b. ?Zhangsan shi-bu-shi zenmeyang le?
Zhangsan be-not-be how Prt
'Does Zhangsan become in some condition?'
c. ?Zhangsan meiyou zenmeyang.
Zhangsan not how
'Zhangsan does not become in some condition.'

necessity operator, a case like English donkey sentences. If this is true, our assumption under the Hamblin semantics framework is weakened, because we have to assume that wh-phrases are ambiguous under different environments. This is an undesirable result. Though we do not make an attempt here as to how wh-phrases work in bare conditional under the current proposal, some remarks are in order, which show that bare conditional is a complicated phenomenon, still poorly-understood.

In Chinese bare conditionals, the wh-expressions in antecedent clause can refer back to old referents, a feature not shared by English donkey sentences.

(17) a. Zhangsan he Lisi. Shei youqian, wo jiu jia gei shei.
Zhangsan and Lisi. Who rich, I then marry to who
'Zhangsan and Lisi. Whoever is rich can marry me.'
b. * John and Bill. If a man is rich, I will marry him.

Second, the logical representations produced by unselective binding approach also face some interpretational semantic problems that we have discussed in previous chapters. For example:

(18) a. ni xihuan shei xie de xiaoshuo, wo jiu xihuan shei xie de sanwen.
you like who write DE novel, I then like who write DE prose.
'The person who you like the novel he wrote is the person who I like the prose he wrote.'
b. $\forall x$ [you like novels that [person(x) and write(x)] → I like proses that [person(x) and write(x)]]

(19) a. ni bu xiangxin shei neng jige, shei jiu bu hui jige.
you not believe who can pass, who then not will pass.
'The person who you do not believe can pass the exam is the person who will not pass.'
b. $\forall x$ [you ***NOT*** [***believe*** [person(x) and pass(x)]] → x will not pass]

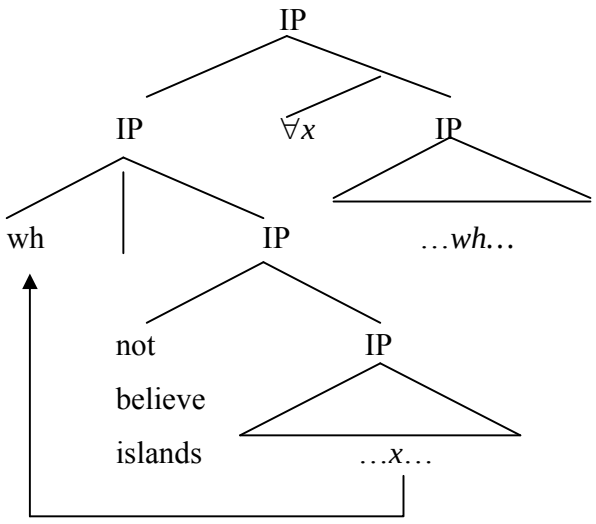
Therefore, it seems clear that the wh-phrases should also be interpreted outside of

some operators in order to obtain correct meaning. Furthermore, in bare conditionals there is clearly no existential presupposition. Consider the following sentence, which is likely a warning in a restricted area. This sentence does not presuppose someone will enter (and it is intended to prevent trespassing in a restricted area).

(20) shei jinlai, jiu zhua shei.
who enter, then catch who
'The one who enters will be prosecuted.'

Therefore, we conclude that wh-phrases in Chinese donkey sentences should also not be treated as variables interpreted in situ for the same kind of interpretational problems. In order to get interpretations right, the indefinite should be considered as undergoing some sort of 'movement' (in syntax or in semantics) crossing possible island structures if necessary, just like the wh-phrases in other cases, as illustrated below.

(21)



Is it possible to treat wh-phrases in bare conditionals as also denoting sets of alternatives? According to the basic assumptions of Hamblin semantics, the two wh-phrases in a bare conditional introduce two sets of alternative individuals that expand to form question denotations in each conjunct. Suppose there is a covert ∀ operator that

closes the expansion, then roughly we have:

(22) a. shei xian lai, shei xian chi.
who first come, who first eat
'The person who comes first is the person who eats first.'
b. $\forall p[p \in \{p: \exists x[\text{person}(x) \ \& \ p=\text{come-first}(x)]\} \rightarrow \exists q[q \in \{q: \exists x[\text{person}(x) \ \& \ q=\text{eat-first}(x)]\}]$

This is a bad result because in each situation (proposition) two individuals are involved. In (22b), the universal quantifier ranges over proposition situation variable, and there are two independent existentially quantified individuals. There is no guarantee in this representation that the second *shei* refers to the same entity as the first one. And it is well recognized that two independently existentially quantified indefinites cannot refer to the same thing. For example, in the following bare conditional, the wh-indefinites are marked with *you* 'have', which supposedly marks the existential reading of them. It is obvious that the two *you*-marked wh-indefinites cannot refer to the same person.

(23) zai gupiao shichang shang, you shei facai, jiu you shei kuiben.
in stock market Loc, have who make money, then have who lose money
'In stock markets, if someone makes money, then someone loses money.'

The crucial problem is how to ensure the same identity of the referents of the two wh-phrases. Several strategies are in mind. We may adopt Huang (1996)'s proposal that the skolem function $\forall$ in bare conditional is an identity function. The value assignment to the variable of the wh-phrase (after expansion in the current proposal) in the second conjunct is determined by the variable of the wh-phrase (after expansion too) in the first conjunct according to the identity function. Therefore the two sets of individuals are identical. Another strategy is to treat the second wh-phrase as an E-type pronoun as suggested in Pan and Jiang (xxxx). I will not pursue these issues here and must leave them to future investigations.

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