ASSOCIATION BETWEEN FOCUS PARTICLES AND INTERROGATIVE WH-PHRASES*

Haoze Li
The Chinese University of Hong Kong

1. Introduction

Aoun & Li (1993) discuss an interesting phenomenon—the association between focus particles and interrogative wh-phrases (F-WH association, henceforth) in Mandarin. Specifically, it refers to the phenomenon that in a wh-question, a focus particle must be associated with a wh-phrase, as in (1a-c). In these sentences, the wh-phrases occupy positions with which the focus particles are able to associate (details to be discussed in section 2) (in this paper, a focus particle and its focused associate are set in boldface and underlined, respectively).

(1) a. Libai zhi zai nali du shu?
Libai only in where read book
‘What is the place x such that Libai reads books only in x?’
b. Libai zhiyou shenme cai cai gei nv’er zuo?
Libai only what dish just for daughter cook
‘Which is the dish x such that Libai only cook x for his daughter?’
c. Shi shei zuotian qu-le Guangzhou?
SHI who yesterday go-Asp Guangzhou
‘Who was the person x such that it is x who went to Guangzhou yesterday?’

Although F-WH association has been also noted in other studies (Shi 1994, Zhu 1997, Li 2011, Yang 2012), its importance to the theory of grammar has not been properly explored. This study takes up the theoretical consequences of F-WH association, showing that it not only challenges Beck’s (2006) General Minimality Effects (GME, henceforth), but also poses problems for three major approaches to wh-in-situ questions, namely the LF movement approach (Huang 1982), the unselective binding approach (Tsai 1994, 1999) and the choice function approach (Reinhart 1997, 2006). This study then proceeds to propose that wh-questions are best analysed along the lines of Hamblin’s (1973) classic compositional system, which makes it possible to reduce F-WH association to the phenomenon widely known as “Association with Focus” (AwF, henceforth) (Jackendoff 1972, Rooth 1985, 1992).

The paper is organized as follows. Section 2 describes the distributional and interpretive properties of F-WH association, highlighting the similarities between F-WH association and AwF. Sections 3 and 4 illustrate how F-WH association raises questions for Beck’s (2006) GME and previous approaches to wh-in-situ questions, respectively. I offer my proposal based on Hamblin (1973) in section 5 and conclude the paper in section 6.

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2. Similarities between F-WH Association and AwF

The current paper only includes the focus particles *shi, zhi* ‘only’ and *zhiyou* ‘only’, the focus marking function of which has been well studied. According to Aoun & Li (1993), Cheung (2008), Tsai (2004), Xu (2002, 2004), Zhang (1997, 2000) and Zhu (1997), these focus particles occur only in preverbal positions and must be associated with preverbal focused phrases they immediately c-command, as in (2)-(3).

(2) a. Libai *zhi/ zhiyou* [Xi’an]_{F} qu nian [VP qu-guo liang ci].
   
   Libai only only Xi’an last year go-Asp two Cl
   
   ‘Libai visited only Xi’an twice last year.’

   b. *Libai zhi/ zhiyou* Xi’an [qu nian]_{F} [VP qu-guo liang ci].
   
   Libai only only Xi’an last year go-Asp two Cl
   
   ‘Libai visited Xi’an only twice last year.’

(3) a. Shi [Libai]_{F} zuotian [VP tan-le gangqin].
   
   SHI Libai yesterday play-Asp piano
   
   ‘It is Libai who played the piano yesterday.’

   b. *Shi Libai [zuotian]_{F} [VP tan-le gangqin].
   
   SHI Libai yesterday play-Asp piano
   
   ‘It is yesterday that Libai played the piano.’

In addition, a postverbal object can be associated with a preverbal focus particle and be marked as a contrastive focus, as in (4a-b).

(4) a. Libai *zhi* [VP song-le [shu]_{F} gei Wangwei].
   
   Libai only send-Asp book to Wangwei
   
   ‘Libai sent only books to Wangwei.’

   b. Libai *shi* [VP song-le shu [gei Wangwei]_{F} ].
   
   SHI Libai send-Asp book to Wangwei
   
   ‘It was Wangwei who Libai sent books to.’

If a focused constituent is outside the c-command domain of a focus particle, no AwF can take place, as shown in (5a-b).

(5) a. *[Libai]_{F} zhiyou/ zhi* zai wangshang cai tan gangqin.
   
   Libai only only in evening just play piano
   
   ‘Only Libai played the piano at evening.’

   b. *[Zhe ben shu]_{F}, shi Libai mai-le.
   
   this Cl book SHI Libai buy-Asp
   
   ‘It is this book that Libai bought.’

For F-WH association, *wh*-associates share the identical distributional properties of non-*wh* associates: (a) a focus particle must immediately c-command a preverbal *wh*-phrase, as in (6)-(7); (b) association can take place between a focus particle and a post-verbal *wh*-associate, as in (8a-b); (c) association cannot take place when a focus particle does not c-command a *wh*-phrase, as in (7a-b).
(6) a. Libai zhi/ zhiyou na ge difang qu nian [VP qu-guo liang ci]? Libai only only which CI place last year go-Asp two CI ‘Which place is the x such that Libai visited only x in the last year?’ *Libai zhi/ zhiyou Xi’an shenme shihou [VP qu-guo liang ci]? Libai only only Xi’an what time go-Asp two CI ‘What is the time x such that Libai visited Xi’an twice only in x?’

(7) a. Shi shei zuotian [VP tan-le gangqin]? SHI who yesterday play-Asp piano ‘Who is the person x such that it is x who played the piano yesterday?’ *Shi Libai shenme shihou [VP tan-le gangqin]? SHI Libai what time play-Asp piano ‘What is the time x such that it is in x that Libai played the piano?’

(8) a. Libai zhi [VP song-le shenme gei Wangwei]? Libai only send-Asp what to Wangwei ‘What is the x such that Libai only sent x to Wangwei?’ b. Libai shi [VP song-le shu gei shei]? Libai SHI send-Asp book to who ‘What is the person x such that Libai sent books to x?’

(9) a. *Shei zhiyou/ zhi zai wangshang cai tan gangqin? who only only at evening just play piano ‘Who is the person x such that only x plays the piano in evening?’ *Shenme shu, Libai shi mai-le? what book Libai SHI buy-Asp ‘What is the book x such that it is x that Libai bought?’

According to Xu (2002), Tsai (2004) and Li (2011), focused phrases associated with shi, zhi and zhiyou are treated as contrastive focus, expressing exhaustivity, i.e. it specifies an exhaustive set of discourse entities for which a given proposition holds true and excludes other possibilities. Following É. Kiss (1998), they devise denial tests as diagnostics for exhaustivity. The conversations in (10) illustrate a denial test.

(10) Context: Libai visited Xi’an and Beijing.
Speaker A: Libai qu-guo [ Xi’an ]F. Libai go-Asp Xi’an ‘Libai visited Xi’an.’
Speaker B: (#Bu dui,) ta hai qu-guo Beijing. (#No,) he also go-Asp Beijing ‘(#No,) he also visited Beijing.’

Speaker A’: Libai zhi qu-guo [ Xi’an ]F. Libai only go-Asp Xi’an ‘Libai only visited Xi’an.’
Speaker B’: Bu dui, ta hai qu-guo Beijing. No right he also go-Asp Beijing ‘No, he also visited Beijing.’

In the context, Libai visited both Xi’an and Beijing. The focused phrases in Speaker A’s
utterance is not associated with a focus particle, hence does not express exhaustivity. In other words, this utterance does not indicate that Libai only visited Xi’an, excluding Beijing. This utterance cannot be judged as false in the given context. Hence, the denial in Speaker B’s utterance is inappropriate. In contrast, the focused phrase in Speaker A’’s utterance is associated with the focus particle *zhi*, hence expresses exhaustivity. It means that the set of cities Libai visited only includes Xi’an and excludes Beijing. The utterance is false in the context. Therefore, the denial in Speaker B’’s utterance is inappropriate.

If association can take place between focus particles and *wh*-phrases, we should expect to attest exhaustivity in the *wh*-phrases associated with focus particles. Generally, if a *wh*-phrase bears exhaustivity, it requires its answer to share the same property (see Horvath 1986). The conversations in (11) illustrate how to diagnose exhaustivity in *wh*-phrases using the denial test.

(11) Context: Libai wants to drink wine and beer.

Speaker A: Libai xiang he shenme? Libai want drink what ‘What does Libai want to drink?’

Speaker B: Hongjiu. wine ‘Wine.’

Speaker C: (#Bu dui,) ta hai yao he pijiu. no right he also want drink beer ‘(#No,) he also wants to drink beer.’

Speaker A’: Libai shi xiang he shenme? Libai SHI want drink what ‘What is the thing x such that it is x that Libai want to drink?’

Speaker B’: Hongjiu. wine ‘Wine.’

Speaker C’: Bu dui, ta hai yao he pijiu. no right he also want drink beer ‘No, he also wants to drink beer.’

In the first conversation, the *wh*-question posed by Speaker A does not require a semantically exhaustive answer. Speaker B’s answer says that Libai wants to drink wine, and indeed he does. Since Speaker B’s answer is only incomplete, but not false, Speaker C cannot deny Speaker B’s answer. In contrast, in the second conversation, Speaker C’ can deny Speaker B’’s answer. In Speaker A’’s question, the *wh*-phrase associated with the focus particle *shi* semantically requires an answer with exhaustivity. Consequently, Speaker B’’s answer describes a situation in which it is wine that Libai wants to drink, and he wants to drink nothing else. Obviously, it is false according to the context. Therefore, Speaker C’’s response is appropriate in this situation.

In addition, we can use the partial truth diagnostics to test semantic exhaustivity in *wh*-questions with or without F-WH association. Consider the conversations in (12).

(12) Context: Libai wants to drink wine and beer.

Speaker A: Libai yao he shenme? Libai want drink what ‘What does Libai want to drink?’

Speaker B: Hongjiu. wine ‘Wine.’

Speaker C: Shi de, buguo ta ye yao he pijiu. yes DE but he also want drink beer ‘Yes, but he also wants to drink beer.’
Speaker A': Libai zhi yao he shenme? Speaker B': Hongjiu.
Libai only want drink what wine
‘What is the thing x such that it is x that Libai want to drink?’ ‘Wine.’
Speaker C': Shi de, buguo ta ye yao he pijiu.
yes DE but he also want drink beer
‘Yes, but he also wants to drink beer.’

For example, in the first conversation in (1 2), Speaker C can credit Speaker B by affirming that his answer is partially correct. This is because although speaker B’s answer is incomplete, it is still true in this context. In contrast, in the second conversation, what Speaker A’ produces is a wh-question with F-WH association. It requires a semantically exhaustive answer. By answering “wine”, Speaker B’ really means that Libai only wants to drink wine and nothing else. Clearly, his answer is not only incomplete but also false. So, Speaker C’ cannot affirm that Speaker B’’s answer is partially true.

In sum, I have demonstrated that F-WH association shares distributional and interpretive properties with AwF. I take these similarities as evidence that F-WH association is a subtype of AwF. The possibility of F-WH association should not be surprising, given the vast amount of literature advocating that wh-phrases are focus (Horvath 1986, Rochemont 1986, Shen 1990, Zubizarreta 1998, Liu & Xu 2005). If a wh-phrase must function as the focus of a wh-question, it is expected that it can be associated with a focus particle. In section 6.2, I show that the compositional system of AwF is also applicable to F-WH association.

3. GME

Based on intervention effects in wh-questions, Beck (2006) proposes GME, the statement and the configuration of which are given in (13a) and (13b), respectively.

(13)

\[
\begin{align*}
\text{(13)a.} & \quad \text{The evaluation of alternatives introduced by an XP cannot skip an intervening focus interpretation operator, } \sim \text{ Op;} \\
\text{b.} & \quad \text{*[Op}_1 \ldots [\sim \text{Op} [ \ldots \text{XP}_1 \ldots ]]} \\
\end{align*}
\]

Beck adopts the modified alternative semantics (Kratzer 1991, Wold 1996) to interpret AwF. In addition, she argues that a wh-phrase has a focus semantic value, denoting a set of alternatives, but its ordinary semantic value is undefined. In her analysis, the question operator (Q-Op, henceforth) in the CP layer is a kind of focus sensitive operator. It can evaluate a wh-phrase and define the ordinary semantic value of a wh-question.

Let me take one of Beck’s examples and concretely show how GME works. The example (14a) comes from Korean. In this sentence, the focused subject associated with the focus particle –man can introduce the ~Op into the LF representation, as in (14b).

(14)

\[
\begin{align*}
\text{(14)a.} & \quad \text{*[Minsu-man]F nuku-lůl po-ass-ni?} \\
& \quad \text{Minsu-only who-Acc see-Past-Q} \\
& \quad \text{‘Who did only Minsu see?’} \\
\text{(Beck 2006: 1)} \\
\text{b.} & \quad \text{*[CP Q-Op [ip}_1 \sim \text{Op [ip}_2 \text{ [Minsu-man]F nuku-lůl po-ass-ni]]]} \\
\end{align*}
\]

Crucially, since wh-phrase has undefined ordinary semantic value, the ordinary semantic value of IP2 is also undefined. According to Rooth (1992), the ~Op must make use of both the ordinary semantic value and the focus semantic value. Due to the undefined ordinary semantic value of IP2, the composition between the ~Op and IP2 fails. As a result, IP1 is undefined. Furthermore, since the ~Op intervenes between the Q-Op and the wh-phrase,
GME prevents the Q-Op from evaluating the *wh*-phrase, leaving the ordinary semantic value of whole sentence undefined. According to Beck, the undefined ordinary semantic value leads to the ungrammaticality of the LF representation.

Beck’s original work has been well noted in the literature and has influenced some recent studies, such as Kim (2006), Beck & Kim (2006), Cable (2010) and Erlewine (to appear). Nevertheless, like many other general principles, GME runs into problem when a wider array of crosslinguistic data is taken into consideration. Specifically, I will show that in Mandarin a *wh*-question is perfect even if there is an intervening focus particle. Consider (15a) with the LF representation (15b).

(15) a. Libai *zhi* [VP hui du shenme shu]?
Libai only will read what book
‘What is the book x such that Libai will read only x?’

b. [CP Q-Op [IP ... *zhi* [~Op [VP ... *wh*-phrase]]]]

Obviously, (15b) is similar to the typical GME configuration in (13b), but it represents a fully grammatical sentence.

Moreover, Beck’s analysis leads to the prediction that a focus particle cannot be associated with a *wh*-phrase. Following Rooth (1985, 1992), I propose that the semantic interpretation of the focus particle *zhi* ‘only’ in (15a) is (16).

(16) $\lambda x \forall p [p \in C & \text{true}(p) \rightarrow p = \text{VP}'(x)]$

If the ordinary semantic value of the *wh*-phrase were undefined, as claimed by Beck (2006), the ordinary semantic value of the VP would be undefined. As a result, the expression after “$\rightarrow$” would also be undefined, i.e. without a truth value. Accordingly, (16) would be ill-formed. This means that F-WH association should be totally disallowed in natural languages. However, the fact that F-WH association is allowed in Mandarin, as shown in section 2, challenges this conclusion.

4. Challenges for Previous Approaches to *Wh*-questions

We have seen that F-WH association poses problems for Beck’s GME. In this section, I further show that F-WH association challenges three approaches to *wh*-questions in Mandarin, namely the LF movement approach, the unselective binding approach, and the choice function approach.

4.1 LF Movement

The classic analysis of LF movement originates from Chomsky (1977) and is developed by Huang (1982), who argues that an in-situ *wh*-phrase is a quantifier and undergoes covert movement to Spec-CP. According to this view, the LF representation of (17a) is (17b).

(17) a. Libai kanjian-le na ge ren?
Libai see-Asp which Cl person
‘Which person did Libai see?’

b. [CP [na ge ren]_i [IP Libai kanjian-le t_i]] (LF representation)

Although the LF movement approach has been influential, it faces some nontrivial problems, among which is F-WH association. As pointed out by Aoun & Li (1993), in (18a)
the LF movement of the in-situ *wh*-phrase results in the failure of F-WH association, as visualized in (18b).

(18)a. Libai **zhi** kanjian-le na ge ren?
   Libai only see-Asp which CI person
   ‘Who is the person x such that Libai saw only x?’

   b. [CP [na ge ren]1 [IP Libai zhi du t1]]

In order for AwF to take place, the focus particle must c-command its associate (see section 2). Aoun & Li (1993), based on quantifier scope interactions and Antecedent Contained Deletion, argue that the c-command requirement must apply to the LF representation as well. In (18b), since *zhi* does not c-command the *wh*-phrase, F-WH association should not be possible, contrary to fact.

There is a possible solution to this problem. Since the focus particle is associated with the *wh*-phrase in (18a), the latter may be assumed to undergo covert movement to a position adjacent to the former, as in (19a). They may be combined together through reanalysis, and move further to Spec-CP, as in (19b). In this way, the *wh*-phrase moves to Spec-CP and the focus particle can still be associated with it.

(19)a. [CP [IP Libai zhi [na ge ren]1 [VP kanjian-le t1]]]

   b. [CP [zhi [na ge ren]1]2 [IP Libai t2 [VP kanjian-le t1]]]

However, this solution leads to new problems. If there were indeed covert movement of the *wh*-phrase, it should be constrained by island conditions. However, the sentences in (20) - (21) show that focus particles can be associated with *wh*-phrases inside islands.

(20)a. Libai shi [zai sheme ren likai zihou] ye likai-le?
   Libai SHI at what person leave after also leave-Asp
   ‘Who is the person x such that it is after x left that Libai also left?’

   b. [CP [shi sheme ren]12 [IP Libai t2 [zai t1 likai zihou] ye likai-le]]

(21)a. Libai tingshuo-le [Wangwei zhi xihuan shei de xiaoxi]?
   Libai hear-Asp Wangwei only like who DE message
   ‘Who is the person x such that Libai heard the news that Wangwei only liked x?’

   b. [CP [zhi [shei]12]2 [IP Libai tingshuo-le [Wangwei t2 xihuan t1 de xiaoxi] ]]

Even though the island insensitivity can be handled by Fiengo *et al.* (1988), their solution leads to another problem on scope interactions. Consider the sentences in (22a-b).

(22)a. Libai keyi **zhi** he shei tiaowu?
   Libai can only with who dance
   ‘Who is the person x such that it is allowed that Libai dances only with x?’

   b. Libai **zhi** keyi he shei tiaowu?
   Libai can only with who dance
   ‘Who is the person x such that Libai is only allowed to dance with x?’

In (22a), the modal verb *keyi* ‘can’ scopes over the focus particle *zhi*, and the answer to the *wh*-phrase is a person such that Libai is allowed to only dance with this person. Under this interpretation, Libai is allowed to dance with others. In (22b), *zhi* scopes over *keyi*, and the answer to the *wh*-phrase is a person who is the only one partner Libai can dance with. Under this interpretation, Libai is not allowed to dance with anyone else.
According to the derivations in (19a-b), (22a) should have an LF representation in which the focus particle *zhi* ‘only’ should have a wider scope than the modal verb *keyi* ‘can’, as in (23), since the *wh*-phrase could covertly move to the adjacent position to *zhi* and the *zhi*-wh-phrase complex could undergo further LF movement to Spec-CP.

\[(23) [\text{CP} \ [\text{zhi} \ [\text{he shei}]_1]_2 \ \text{[IP} \ \text{Libai} \ \text{keyi} \ t_2 \ t_1 \ \text{tiaowu}] \]

Obviously, *zhi* should scope over the modal verb *keyi* in (23). This means that (22a) should have the same interpretation as (22b), contrary to fact.

### 4.2 Unselective Binding

In order to resolve the problem of F-WH association, Aoun & Li (1993) proposes an in-situ binding approach, i.e., an in-situ *wh*-phrase does not undergo any movement and is bound by a Q-Op. This approach is developed by Tsai (1994, 1999), who makes use of Heim’s (1982) mechanism for interpreting indefinites. According to this approach, a Q-Op in Spec-CP can unselectively bind all the free variables in its scope. According to this approach, the LF representation for (24a) is roughly (24b).

\[(24) a. \text{Libai} \ \text{shenme} \ \text{difang} \ \text{qu-guo} \ \text{liangci?} \\
\text{Libai} \ \text{what} \ \text{place} \ \text{go-Asp} \ \text{twice} \\
‘Which place did Libai visit twice?’
\]

\[b. [\text{CP} \ \text{Q-Op}_1 \ \text{[IP} \ \text{Libai} \ \text{[shenme difang]}_1 \ \text{qu-guo liangci}] \]

Working under the unselective binding approach, Shi (1994) uses the operator binding mechanism to explain F-WH association: a *wh*-phrase is treated as an emphatic variable, which can be bound by emphatic operators. This is evidenced by the fact that the focus of a *wh*-question is the *wh*-phrase (see section 2). Both focus particles and the Q-Op are emphatic operators. In his account, one emphatic variable can be bound by two emphatic operators simultaneously. Thus, the LF representation of (25a) is (25b).

\[(25) a. \text{Libai} \ \text{shi} \ \text{shenme} \ \text{difang} \ \text{qu-guo} \ \text{liangci?} \\
\text{Libai} \ \text{SHI} \ \text{what} \ \text{place} \ \text{go-Asp} \ \text{twice} \\
‘What is the place x such that it is x that Libai visited twice?’
\]

\[b. [\text{CP} \ \text{Q-Op}_1 \ \text{[IP} \ \text{Libai} \ \text{shi}_2 \ \text{[shenme difang]}_{1/2} \ \text{qu-guo liangci}] \]

It is clear that F-WH association is reduced to operator-variable binding. However, (25b) violates the locality condition of binding. In the logical representation, the focus particle, as an emphatic operator, is closer to the *wh*-phrase than the Q-Op. Hence, when the focus particle binds the *wh*-phrase, it is impossible for the Q-Op to bind the same *wh*-phrase.

Exploring the literature, the locality condition on operator binding might be made amenable to Lee’s (1986) modified Bijection Principle (I), which allows a variable to be bound by two quantifiers of the same type. Therefore, the *wh*-phrase in (25) can be bound by both the Q-Op and the focus particle, since the two binders are both emphatic operators. Nevertheless, this solution faces empirical problems. In Mandarin, one focused phrase cannot be associated with two focus particles simultaneously, as shown in (26a-b).

\[(26) a. *\text{Zhiyou}_1 \ \text{shi}_2 \ \text{Libai}_{1/2} \ \text{qu-guo Xi’an}. \\
\text{only SHI Libai go-Asp Xi’an}
\]

\[b. *\text{Libai} \ \text{zhiyou}_1 \ \text{zhi}_2 \ \text{zhe ben shu}_{1/2} \ \text{du-guo}. \\
\text{Libai only only this Cl book read-Asp} \]
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According to Shi (1994), the focus particles are emphatic operators. If the modified Bijection Principle (I) could adequately account for F-WH association, it should license (26a-b), in which two emphatic operators bind one emphatic variable. Unfortunately (26a-b) are outright unacceptable.

Besides violating the locality condition on operator binding, analysing F-WH association under the unselective binding approach also raises a problem on semantic implication. As pointed out by Reinhart (2006), an unselectively bound in-situ wh-phrase is translated into a free variable with its N-restriction. For example, shei ‘who’ is translated into “person(x)”. Note that the N-restriction stays in situ, rather than occurring as a restriction on the operator. As a result, anything that does not belong to the set denoted by the N-restriction can be regarded as a felicitous answer to the wh-question. Sentence (27a) illustrates this point.

(27)a. Ruguo ta zhi qing na ge gangqingjia, Libai jiu hui hen shengqi?  
   if he only invite which CI pianist Libai just will very angry
   ‘What is the pianist x such that if he only invites x, Libai will be very angry?’
   b. {p: \exists x [p = (he only reads x & pianist(x)) \rightarrow (Libai will be very angry)]}

The logical representation of (27a) is (27b). It turns out that the value for x can be anything in the world, since its N-restriction occurs in the antecedent clause of an implication. Suppose Russell, a non-pianist, is chosen, the antecedent clause is false, and the implication must be true. So, an appropriate answer to this question would be ‘if he only invites Russell, Libai will be very angry’. However, (27a) cannot be answered in this way.

The representation yielding the set of felicitous answers should be one where the N-restriction is pulled out of the implication, as in (28). This representation correctly allows the values for x to be all and only pianists.

(28){p: \exists x [pianist(x) & p = he only invites x \rightarrow Libai will be angry]}

However, this goes against the spirit of the unselective binding approach. Since the wh-phrase na ge gangqingjia ‘which pianist’, as shown in (28), must be extracted out of the implication clause, the focus particle can no longer associate with it.

4.3 Choice Function

To resolve the implication problem mentioned in section 4.2, Reinhart (1997, 2006) proposes the choice function approach, which has been developed by Winter (1997) and Kratzer (1998). In this approach, the main idea of unselective binding is maintained, but the variable is of a different sort. In wh-in-situ questions, wh-phrases introduce variables over choice functions, instead of variables over individuals, and the Q-Op in Spec-CP, as an existential quantifier, binds the choice function variable.

According to Reinhart, a function is a choice function if it applies to any nonempty set and yields a member of that set.  
1 As a result, the choice function can guarantee that only members of a specified set are considered. According to this approach, the logical representation of (27a) is (29).

(29){p: \exists f [CH(f) & p = he only invites f(pianist) \rightarrow Libai will be very angry]}

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1 Although Winter (1997) and Kratzer (1998) revise Reinhart’s original choice function approach, they share the definition of the choice function with Reinhart.
(29) says that a function exists, such that if he invites the pianist selected by this function, Libai will be very angry. Here, the function cannot pick a member from sets other than the set of pianists.

However, the choice function approach cannot solve Beck’s (2006) problem. In (27a), the focus particle is associated with the *wh*-phrase. Under the choice function approach, the *wh*-phrase is translated as “$f(\text{pianist})$” in the logical representation (29). Since $f$ is a variable, $f(\text{pianist})$ also has an undefined ordinary semantic value. Consequently, the semantic composition does not allow association between the *wh*-phrase and the focus particle, wrongly ruling out F-WH association.

Furthermore, the choice function approach also raises a problem with the belief context. Consider the example in (30a-b).

(30)a. Libai xiangxin Wangwei zhì kànjiān-le shéi?
Libai believe Wangwei only see-Asp who
 ‘Who is the person x such that Libai believes that Wangwei only saw x?’

b. \{p: \exists f [\text{CH}(f) \& p = \text{Libai believe}_w_2 \text{Wangwei only saw } f(\text{person})_w_2 ]\}

In (30a), the focus particle is associated with the *wh*-phrase, and the association prevents the *wh*-phrase from being extracted out of the embedded clause. According to the logical representation (30b), since the *wh*-phrase must be scoped over by the verb “believe”, it should yield a person in Libai’s belief world rather than in the actual world. Consequently, this logical representation wrongly predicts that *wh*-phrases cannot have the *de re* reading.

5 Proposal

So far, we have seen that F-WH association causes problems for Beck’s (2006) GME as well as three well-known approaches to *wh*-questions. Drawing insights from Hamblin’s (1973) classic semantics of *wh*-questions, I propose that F-WH association can be accounted for by the same compositional system handling AwF.

5.1 Hamblin’s Semantics for *Wh*-questions

Since Hamblin (1973), the semantics of *wh*-questions has been standardly assumed to denote sets of propositions. Although this has been implemented in various ways by its successors (see Karttunen 1977, Hagstrom 1998, Reinhart 1997, 2006), I adopt Hamblin’s (1973) original work. Under his framework, a question simply characterizes a set of propositions, which serve as possible answers to the question. In other words, knowing the meaning of a question is equivalent to knowing what can be counted as answers. Given this, the answer set for (31a) would be the set in (31b).

(31)a. Libai pìngpì shéi?
Libai criticize who
 ‘Who does Libai criticize?’

b. \{Libai criticizes Bach, Libai criticizes Mozart, …\}

According to Hamblin (1973), a *wh*-phrase like *shéi* ‘who’ in (31a) denotes a set of alternative individuals, made up of the possible candidates for substituting the *wh*-phrase in the answer, as in (32a). In addition, a verb like *píngpì* ‘criticize’ in (31a) denotes a singleton set whose only member is its ordinary denotation, i.e., a function, as in (32b).
The composition of the verb and the *wh*-phrase is facilitated by the pointwise functional application rule, as stated in (33):

\[(33)\text{Pointwise functional application rule (Kratzer & Shimoyama’s (2002) version)\}
\]

If \( \alpha \) is a branching node with daughters \( \beta \) and \( \gamma \), and \( [[\beta]]^w_g \subseteq D_{<\alpha,\gamma>} \) and \( [[\gamma]]^w_g \subseteq D_{<\alpha,\gamma>} \), then \( [[\alpha]]^w_g = \{ a \in D_{\gamma} : \exists b \exists c [b \in [[\beta]]^w_g \land c \in [[\gamma]]^w_g \land a = c(b)] \}\]

Simply speaking, applying the function in (32b) to each member in (32a) results in a set of properties in (34):

\[(34) [[\text{piping shei}]]^w_g = \{ a : \exists x [\text{person}(x)(w) \land a = \lambda y \lambda w' [\text{criticize}(x)(y)(w')]] \}
= \{ \lambda y \lambda w' [\text{criticize}(\text{Bach})(y)(w')], \ldots \}\]

Now we compose the set denoted by the VP *piping shei* with the proper name *Libai*, again by the pointwise functional application rule, and thus form a set of propositions in (35):

\[(35) [[\text{Libai piping shei}]]^w_g = \{ a : \exists b \exists c [b \in [[\text{Libai}]]^w_g \land c \in [[\text{piping shei}]]^w_g \land a = c(b)] \}
= \{ a : \exists x [\text{person}(x)(w) \land a = \lambda w' [\text{criticize}(x)(\text{Libai})(w')]] \}
= \{ \lambda w' [\text{criticize}(\text{Bach})(\text{Libai})(w')], \lambda w' [\text{criticize}(\text{Mozart})(\text{Libai})(w')], \ldots \}\]

Finally, according to Kratzer & Shimoyama (2002), a Q-Op is applied to the set of propositions in (35). The Q-Op leaves the set intact, producing a question meaning, as in (36):

\[(36) [[\text{Q-Op}]]^w_g ([[\text{Libai piping shei}]]^w_g) = [[\text{Libai piping shei}]]^w_g\]

The above illustration is a sketchy description of how the interpretation of a *wh*-question is derived. In the process of the derivation, the pointwise functional application rule plays a critical role for obtaining the final representation. Note that the pointwise functional application rule is able to evaluate a *wh*-phrase in a displaced position though the *wh*-phrase is interpreted in situ (see Eckardt 2007, He 2011). This is achieved by the process of expansion inherent to the pointwise functional application rule, i.e., expanding sets of individuals to sets of properties, and from sets of properties to sets of propositions, as visualized in (37).

\[(37) \]

\[
\begin{array}{c}
\text{Q-Op} \\
[[\text{IP}]]^w_g = [[\text{IP}]]^w_g \\
[[\text{Libai}]]^w_g \\
[[\text{VP}]]^w_g = \{ a : \exists x [\text{person}(x)(w) \land a = \lambda y \lambda w' [\text{criticize}(x)(y)(w')]] \}
= \{ \lambda x \lambda y \lambda w' [\text{criticize}(x)(y)(w')] \}
= \{ x : \text{person}(x)(w) \}\end{array}
\]
Section 5.3 will show that the expansion mechanism can help us resolve the island problems faced by the LF movement approach and the interpretative problems faced by the unselective binding approach.

5.2 Semantic Composition for F-WH Association

Based on Hamblin’s semantics of wh-questions, I illustrate how to interpret F-WH association. Consider the wh-question in (38). As presented in section 5.2, the VP piping shei ‘criticize who’ denotes a set of properties in (39).

(38) Libai zhi piping shei?

Libai only criticize who

‘Who is the person x such that Libai only criticizes x?’

(39) \[ [[\text{piping shei}]] = \{a: \exists x \ [\text{person}(x)(w) \& a = \lambda y \lambda w'[\text{criticize}(x)(y)(w')]] \}
\]

= \{\lambda y \lambda w'[\text{criticize}(\text{Bach})(y)(w')], \lambda y \lambda w'[\text{criticize}(\text{Mozart})(y)(w')], \ldots \}

Now, we apply the focus particle zhi to the set of properties through the pointwise functional application rule, i.e., zhi is applied to each member of the set. As a result, we get a set in (40).

(40) \[ [[\text{zhi}}]]=^{w,g}([[\text{piping shei}}])]^{w,g} \]

= \{[[\text{zhi}}]]=^{w,g}(\lambda y \lambda w'[\text{criticize}(\text{Bach})(y)(w')]),
[[\text{zhi}}]]=^{w,g}(\lambda y \lambda w'[\text{criticize}(\text{Mozart})(y)(w')]), \ldots \}

Each member of the set in (40) provides an ordinary semantic value for zhi; and other members, as alternatives, provide a focus semantic value for zhi. This effectively solves the problem of undefined ordinary semantic value. Based on the denotation of zhi (see also Rooth 1985, 1992), we can rewrite (40) as (41).

(41) \[ [[\text{zhi}}]]=^{w,g}(\lambda y \lambda w'[\text{criticize}(\text{Bach})(y)(w')]) \]

= \lambda y \lambda w \forall p \ [p \in \{\lambda w'[\text{criticize}(\text{Bach})(y)(w')], \lambda w'[\text{criticize}(\text{Mozart})(y)(w')], \ldots \} \& \]

p(w) = 1 \Rightarrow p = \lambda w''\text{criticize}(\text{Bach})(y)(w'') \}

[[\text{zhi}}]]=^{w,g}(\lambda y \lambda w'[\text{criticize}(\text{Mozart})(y)(w')]) \]

= \lambda y \lambda w \forall p \ [p \in \{\lambda w'[\text{criticize}(\text{Bach})(y)(w')], \lambda w'[\text{criticize}(\text{Mozart})(y)(w')], \ldots \} \& \]

p(w) = 1 \Rightarrow p = \lambda w''\text{criticize}(\text{Bach})(y)(w'') \}

\ldots \]

Apparently, the ordinary semantic value of the expression after “\(\Rightarrow\)” in each member of the set is defined. Therefore, against the expectation of Beck’s (2006) analysis, F-WH association is possible.

Then, the subject Libai is composed with the set in (41), resulting in a set of propositions, as shown in (42).

(42) \[ [[\text{Libai zhi piping shei}}]]=^{w,g} \]

= \lambda w \forall p \ [p \in \{\lambda w'[\text{criticize}(\text{Bach})(\text{Libai})(w')], \lambda w'[\text{criticize}(\text{Mozart})(\text{Libai})(w')], \ldots \} \& \]

p(w) = 1 \Rightarrow p = \lambda w''\text{criticize}(\text{Bach})(\text{Libai})(w'') \}

\lambda w \forall p \ [p \in \{\lambda w'[\text{criticize}(\text{Bach})(\text{Libai})(w')], \lambda w'[\text{criticize}(\text{Mozart})(\text{Libai})(w')], \ldots \} \& \]

p(w) = 1 \Rightarrow p = \lambda w''\text{criticize}(\text{Bach})(\text{Libai})(w'') \}

\ldots \]
= \{ \textit{Libai only} criticizes \textit{Bach}, (not \textit{Mozart}, …),
\textit{Libai only} criticizes \textit{Mozart}, (not \textit{Bach}, …) \}

The Q-Op is applied to the set and the set is the meaning of the \textit{wh}-question in (38). According to Hamblin’s system, each of propositions contained in the set is a possible answer to the \textit{wh}-question. Suppose that the answer is “\textit{Libai only} criticize \textit{Bach}”. Since the focus particle is associated with \textit{Bach}, the answer claims that the person \textit{Libai} criticizes is \textit{Bach} and only \textit{Bach}, not \textit{Mozart} and others. The exhaustivity (see section 2) are correctly encoded.

5.3 Advantages

In this section, I examine whether our proposal can account for F-WH association adequately, i.e., accounting for F-WH association without getting trapped in the problems reviewed in section 4.

Crucially, in our proposal, F-WH association is reduced to association between focus particles and members of a set expanded from a \textit{wh}-phrase, as shown in (40)-(41). As a result, F-WH association can be treated as a set of AwFs. Since AwF is allowed in natural languages, F-WH association is certainly allowed in languages.

Moreover, as shown in section 2, F-WH association has similar distributive and interpretative properties as AwF. According to our proposal, F-WH association can be reduced to AwF. Therefore, the similarity is expected.

Furthermore, since F-WH association is reduced to AwF, it is reasonable that F-WH association is interpreted by the same mechanism that interprets AwF. Hence, it is unnecessary to assume additional rules or principles but only make use of the basic concepts and mechanisms defined in Hamblin’s semantics and Rooth’s alternative semantics to interpret F-WH association.

In addition, I do not argue that a \textit{wh}-phrase is inherently quantificational, so LF movement of \textit{wh}-phrases is not needed. As a result, the c-command requirement of F-WH association is trivially satisfied in overt syntax and LF. Moreover, since there is no movement, the island insensitivity problem faced by the LF movement approach is resolved directly. The scope problem is also resolved, given that there is neither movement of a focus particle nor a \textit{wh}-phrase out of the scope bearing modal verb, as shown in (22)-(23).

The current proposal is also free from the binding problems faced by the unselective binding approach. Unlike Shi’s (1994) analysis, F-WH association in our compositional system does not block the function of the Q-Op. The Q-Op takes as its argument the set of propositions expanded from a \textit{wh}-phrase, whereas a focus particle is associated with each member of a set expanded from a \textit{wh}-phrase, leaving the expansion intact, as shown in section 5.2. Consequently, F-WH association does not close the expansion so the Q-Op can still be applied to a set of propositions.

Although a \textit{wh}-phrase stays in situ at LF, it must be interpreted in a different position at the interpretive level. As shown in (37), the \textit{wh}-phrase, which denotes a set, undergoes proliferation and takes a wide scope. In other words, the \textit{wh}-phrase must be semantically extracted from the formula. Note that the extraction does not result from syntactic movement but rather from the pointwise functional application rule. In this respect, the extraction is purely semantic, instead of syntactic. For F-WH association, according to our proposal, a focus particle does not close the expansion of a \textit{wh}-phrase, i.e., the set denoted by the \textit{wh}-phrase also undergoes proliferation. Therefore, the bottom-up composition of (38) looks as follows:
Based on this, our proposal can avoid the implication problem discussed in section 4.2 and the problem with the belief context discussed in section 4.3. Let’s consider the sentence (27), repeated as (44a), in which F-WH association is embedded in the antecedent clause of the implication. By the pointwise functional application rule, the set denoted by the wh-phrase undergoes proliferation and is extracted out of the implication, as in (44b) (see also He 2011). Apparently, this logical representation does not trigger the implication problem.

(44) a. Ruguo ta zhi qing na ge pianist, Libai jiu hui hen shengqi? if he only invite which Cl pianist Libai just will very angry
‘What is the pianist x such that if he only invites x, Libai will be very angry?’

b. {p: \( \exists x [\text{pianist}(x) \land p = (\text{he only invites } x) \rightarrow (\text{Libai will be very angry})] \)}

Then, consider the sentence (30), repeated as (45a). In this sentence, F-WH association is contained in the clausal argument of the intensional verb \textit{xianxin} ‘believe’. According to the pointwise functional application rule, the set denoted by the \textit{wh}-phrase is extracted and takes a scope wider than the intensional verb \textit{xianxin} ‘believe’, as shown in (45b) (see also He 2011). The logical representation correctly allows the \textit{de re} reading of the \textit{wh}-phrase.

(45) a. Libai xianxin Wangwei zhi xihuan shei?
Libai believe Wangwei only like who
‘What is the person x such that Libai believes that Wangwei only like x?’

b. {p: \( \exists x [\text{person}(x)(w) \land p = \text{Libai believe}_w \cdot \text{Wangwei only like x in } w'] \)}

6 Conclusion

This paper studies F-WH association in Mandarin, which is pointed out by Aoun & Li (1993). Empirically, I find that it shares the distributional and interpretive properties of AwF in Mandarin. Theoretically, based on Hamblin’s semantics of \textit{wh}-questions, I propose that F-WH association can be reduced to AwF. The current study may shed light on the interpretive mechanism of in-situ \textit{wh}-questions. Our proposal accounts for the availability of F-WH association in natural languages, a phenomenon wrongly excluded by Beck’s (2006) GME, and avoids many interpretive problems faced by previous approaches to \textit{wh}-questions. If this study is on the right track, then Hamblin’s semantics may be the best tool for interpreting in-situ \textit{wh}-questions.

References


