

## “Wh-on-earth” in Chinese Speakers’ L2 English: Evidence of Dormant Features

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### **Abstract**

Adopting a decompositional approach to items in the lexicon, this article reports on an empirical study investigating Chinese speakers’ second language (L2) acquisition of English *wh-on-earth* questions (i.e. questions with phrases like *what on earth* or *who on earth*). An acceptability judgment task, a discourse-completion task and an interpretation task were used in the study, and the results indicate that in Chinese speakers’ L2 English, the form of *wh-on-earth* can be learned and stored in a native-like manner, but without being endowed with fully elaborated features. A distinction between active features and dormant features in L2 lexicon is made in the analysis, and it is argued that features transferred from learners’ L1 to their L2 are likely to lose their vigour and vitality in their L2 lexicon and become dormant if there is no evidence in the target language input to confirm or disconfirm them. A typical consequence of a dormant feature is random behaviours of a related structure in L2 learners’ production and interpretation. The results of the study show that semantic features, discourse features as well as morphosyntactic features can become dormant in L2 lexicon.

### **I Introduction**

In the 1980’s and 1990’s, most studies in generative approaches to second language (L2) acquisition focused on L2 acquisition of syntactic structures, influenced by Chomsky’s (1981) classic Government-Binding Theory, a syntactic theory that predates accounts of linguistic variation in terms of the lexicon. However, in the Minimalist Program (Chomsky, 1993 *et seq.*), all morphosyntactic variation (both within and across languages) is considered to be encoded in the lexicon. In recent years, features and properties attached to items in L2 lexicon have also become a focus of many L2 studies (e.g. Hawkins, 2009; Hawkins and Hattori, 2006; Juffs,

2009; Lardiere, 2008, 2009; Tsimpli and Dimitrakopoulou, 2007; among many others). According to Jackendoff (2002a,b), the lexicon – the store of memorized elements – contains not only words, their affixes and stems, but also phrasal units such as idioms and set phrases, and an item in the lexicon is a bundle of phonological, syntactic, and semantic features. In this article, we adopt the decompositional approach and report on an empirical study investigating how features attached to the English set-phrase *wh-on-earth* is acquired by Chinese-speaking learners. It is found in the study that some of the features transferred from learners' L1 to the target language (TL) become dormant due to the absence of either confirming or disconfirming evidence in the TL input.

English phrases such as *what on earth* and *who on earth* are considered to belong to the same category as phrases like *what the hell* and *who the dickens* (cf. Dikken and Giannakidou, 2002; Huang and Ochi, 2004; Huang, 2010; Chou, 2012; Yuan 2013).<sup>1</sup> They share the same syntactic behaviours and are subject to semantic and discourse constraints. Dikken and Giannakidou (2002) identify *wh-on-earth* as a Polarity Item (PI), like *any* in English. It is generally agreed that a PI must be licensed and that the licensing must be achieved under c-command (e.g. Progovac, 1994). PIs like *any* have to be licensed in a question, as in (1a), a negative sentence, as in (1b), the complement of a non-veridical verb like *wonder*, as in (1c); it cannot occur in a sentence without a licenser, as in (1d).

- (1) a. Does he know anyone?  
b. He doesn't know anyone.  
c. I wonder whether he knows anyone.  
d. \*He knows anyone.

It has been proposed by Dikken and Giannakidou (2002) that, in much the same way as with *any*, *wh-on-earth* in English can also be licensed by the question feature [+Q], as in (2a), the negation feature [+neg], as in (2b), non-veridical verbs like *wonder*, as

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<sup>1</sup> In most of the literature, this type of wh-questions is called *wh-the-hell* questions. However, we focus on *wh-on-earth* in our L2 empirical study because it is observed that L2 English learners are more frequently exposed to this phrase in their input data than *wh-the-hell* or *wh-the-dickens*.

in (2c), and it is not grammatical for *wh-on-earth* to occur in a sentence without a licenser, as in (2d).

- (2) a. Who on earth would buy that car?
- b. I don't know who on earth would buy that car.
- c. I wonder who on earth would buy that car.
- d. \*I know who on earth would buy that car.

## II Behaviours of *wh-on-earth* phases in English

It is pointed out in Dikken and Giannakidou (2002) that *on-earth* by itself is not a PI, but the whole *wh-on-earth* phrase is. Based on Pesetsky's (1987) work on wh-movement, Huang and Ochi (2004) argue that the English *wh-on-earth* is a continuous and synthetic constituent, as shown in the contrast between (3a) and (3b), and that this constituent is required to move to the Specifier of CP, as shown in the contrast between (3a) and (3c). The ungrammaticality of (3d) indicates that the phrase *on earth* cannot occur in a sentence without a wh-word and that it cannot occur in a yes-no question. *Wh-on-earth* in English is a synthesized lexical item and cannot be separated.

- (3) a. **What on earth** would he buy?
- b. \***What** would he buy **on earth**?
- c. \*Would he buy **what on earth**?
- d. \*Would John **on earth** buy that house?

It is generally assumed (going back at least to Katz and Postal, 1964; Baker, 1970; Bresnan, 1972; Pesetsky 1987; among many others) that all wh-questions universally feature a projection of C harbouring an abstract question feature [+Q] even though different languages vary with respect to whether the wh-phrase moves and where it moves to if it does. It is argued in Dikken and Giannakidou (2002) that the question feature [+Q] should semantically be treated as a type-shifter taking a proposition as its input and yielding a question as its output. The [+Q] feature is responsible for the interrogative semantics of the question, which is non-veridical in nature. It is assumed in this article that the [+Q] feature is base-generated in C in a question, and it can

function covertly as in English or be morphologically realized in languages like Chinese.<sup>2</sup> This assumption leads to a desirable consequence that the [+Q] feature in C in an English *wh*-question c-commands the trace of the moved *wh*-phrase, as shown in (4).<sup>3</sup>

- (4) a. [<sub>CP</sub> [Who on earth]<sub>i</sub> [<sub>C</sub> would<sub>j[+Q]</sub> [<sub>IP</sub> t<sub>i</sub> t<sub>j</sub> help her?]]]]  
 b. [<sub>CP</sub> [What on earth]<sub>i</sub> [<sub>C</sub> would<sub>j[+Q]</sub> [<sub>IP</sub> he t<sub>j</sub> buy t<sub>i</sub> ?]]]]

The required existence of the [+Q] feature as a licenser in English *wh-on-earth* questions is further illustrated in the contrast between (5) and (6), which shows that the distribution of *wh-on-earth* matches that of a PI. That is, it can occur in the complement of an interrogative verb like *wonder* as in (5b), but not that of factive verbs like *know*, as in (6b). This is because interrogative verbs like *wonder* are non-veridical but factive verbs like *know* are veridical. The former c-selects an interrogative and s-selects a question as its complement, while the latter c-selects a declarative and s-selects a proposition. The former, but not the latter, has the [+Q] feature in C in the embedded clause. We can label veridical verbs like *know* with a feature [V<sub>veri</sub>] and non-veridical verbs like *wonder* [V<sub>non-veri</sub>]. No veridicality is required when the regular *wh*-phrase occurs by itself as shown by the comparison between (5a) and (6a), which are different in the use of veridical and non-veridical verbs respectively.

- (5) a. I wonder who would trust him.  
 b. I wonder who on earth would trust him.
- (6) a. I know who would trust him.  
 b. \*I know who on earth would trust him.
- (7) I don't know who on earth would trust him.

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<sup>2</sup> For example, Chinese uses *-ma* and *-ne* to morphologically mark yes-no and *wh*-questions in C respectively. For more details, see Cheng's (1991) Clause Typing Hypothesis and Yuan (2007a,b, 2010).

<sup>3</sup> It is assumed here that the [+Q] feature in C c-commands the trace of the moved *wh*-phrase, which forms a chain with the moved *wh*-phrase.

Interestingly, negating the matrix verb in (6b) yields a well-formed sentence in (7), which suggests that negation feature [+neg] can function as a licenser for *wh-on-earth* in English embedded questions. This is because, like the case with the PI *any*, the insertion of the [+neg] feature provides the required non-veridical c-commanding element that *wh-on-earth* depends upon for grammaticality.

Dikken and Giannakidou (2002) point out that phrases like *wh-on-earth* in English carry a unique lexical property of a negative attitude, which is illustrated by sentences with modals as in (8). Unlike the question in (8a), where the regular wh-phrase *who* is used, the question with *who on earth* in (8b) cannot be interpreted as a genuine information question; rather, its informative reading is suppressed and it can only be read as requiring an answer with a negative attitude, compatible with the negative rhetorical answer like *Nobody would buy that house*.<sup>4</sup> If we take *attitude* as a pragmatic factor and *information seeking* as a discourse factor, we can assume that *wh-on-earth* in English has the pragmatic and discourse features [+negative rhetorical] and [-information seeking] attached to it. As Dikken and Giannakidou argue, crucial to the licensing of the [+negative rhetorical] feature is the presence of a modal *would* in (8b), which intensifies the negative reading and converts the question into a negative rhetorical question. With a simple past tense, as in (9), there is no rhetorical reading in it although the question still has a negative connotation.

- (8) a. Who would buy that house?  
b. Who on earth would buy that house?

- (9) Who on earth bought that house?

Another lexical property of *wh-on-earth* that Dikken and Giannakidou find is that regular wh-phrases are always presuppositional and are linked to discourse-familiar values, but *wh-on-earth* differs in this respect; it cannot be presuppositional and cannot be veridical or existential. This can be seen in (10b), where *who on earth* cannot be linked to *Someone* in the previous sentence, in spite of the fact that a context is created that forces an interpretation of *who on earth* to be anaphoric to a

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<sup>4</sup> Dikken and Giannakidou (2002) note that the sentence in (8a) can also arguably have a negative rhetorical reading although less saliently.

previously introduced discourse referent, i.e. *Someone*. This is consistent with the aggressively non-D(iscourse)-Linked characterization of *wh-on-earth*, as proposed by Pesetsky (1987). That is, the domain of *wh-on-earth* is an open set, which includes familiar and novel values. In this sense, the domain of quantification for *who on earth* in (10b) is the domain of the entire universe including all persons in the universe, and cannot be a presupposed subset of it and cannot be bound by a default existential referent at the text level or in the discourse. On the other hand, *who* in (10a) can be linked to the discourse-familiar *Someone*. Here, the use of *who* presupposes that a specific person exists and is yet to be identified. Based on the contrast between (10a) and (10b), we can assume that regular wh-phrases *who* and *what* have a discourse feature [+D-link] but the *wh-on-earth* must have the [-D-link] feature because it cannot be linked to an entity in the discourse.

- (10) a. Someone<sub>i</sub> bought that house. John knows who<sub>i</sub>  
 b. Someone<sub>i</sub> bought that house. \*John knows who<sub>i</sub> on earth.

### III *Daodi...wh*-questions in Chinese

*Daodi...wh* and *jiujing...wh* in Mandarin Chinese (hereafter, Chinese) have been considered approximate counterparts of *wh-on-earth* and *wh-the-hell* in English (see Huang and Ochi, 2004; Huang, 2010; Chou, 2012; Yuan 2013; Concise English-Chinese Chinese-English Dictionary 1992; A Chinese-English Dictionary 1997; Oxford Chinese Beginner's Dictionary 2001).<sup>5</sup> As *daodi* and *jiujing* behave the same in Chinese wh-questions, we will use *daodi...wh* as a representative of the two in this article.<sup>6</sup> The English *wh-on-earth* and Chinese *daodi...wh* share some properties, but

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<sup>5</sup> A question might be asked about the appropriateness of comparing *daodi* with *on earth*, because the former is an adverb and the latter a PP. However, the categorical difference should not prevent them from having similar functions. For example, *the hell* has the same function as *on earth* in English wh-questions even though they are categorically different, with the former being a DP and the latter a PP. It might also be argued that *daodi* and *on earth* are different semantically because *daodi* has additional meanings of “finally” and “after all” (see Note 6). This is certainly true, but *the hell* and *the dickens* also have meanings different from those of *on earth*. Being a homonym does not necessarily mean that it cannot have functions similar to other elements even though its other meanings are not shared by the other elements.

<sup>6</sup> Apart from being approximate counterparts of the English *the hell* and *on earth*, the Chinese *daodi* and *jiujing* also have other meanings. *Daodi* can also mean “finally” and “after all”, and *jiujing* can mean “after all” and “in the final analysis”. However, *daodi* or *jiujing* cannot be used in wh-questions in any of these readings (cf. Lü, 1981).

they are different from each other semantically and pragmatically as well as morphosyntactically.

Unlike *wh-on-earth* in English, the Chinese *daodi* and its *wh*-associate do not form a synthetic constituent; they are discontinuous with *daodi* in a preverbal position and the *wh*-phrase staying *in situ*, as shown in (11a) and (11b).

- (11) a. Ta **daodi** yao mai **shenme**?  
He daodi will buy what  
“What on earth will he buy?”  
b. \*Ta yao mai **daodi shenme**?  
He will buy daodi what

Huang and Ochi (2004) further point out that like the *wh-on-earth* expression, *daodi* in Chinese must occur in a *wh*-question, as in (12). As we can see, *daodi* is not allowed in (12a) because there is no *wh*-phrase in the sentence although it is a question. In contrast, the sentence in (12b) is grammatical because it is a *wh*-question. The *wh*-phrase in (12b) is c-commanded by *daodi*, which, in turn, is licensed by the *wh*-particle *ne* in C which has both [+Q] and [+wh] features.<sup>7</sup>

- (12) a. \*Zhangsan **daodi** yao mai shu ma?  
Zhangsan daodi will buy book Q  
\*“Will Zhangsan the hell buy books?”  
b. [<sub>CP</sub> [<sub>IP</sub> Zhangsan **daodi** yao mai shenme] *ne*<sub>[+Q, +wh]?]</sub>  
Zhangsan daodi will buy what Q  
“What on earth will Zhangsan buy?”

Recall that in English, the use of modals intensifies the negative reading of the *wh-on-earth* question and converts the question into a negative rhetorical question. The question in (8b), repeated below, is not naturally read as a genuine information question, and as Dikken and Giannakidou argue, it can only be answered felicitously by a negative rhetorical reply like *Nobody would buy that house*. However, the

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<sup>7</sup> In Chinese, the *wh*-particle *ne* does not have to be morphologically or phonetically realized, and as a result, it can be omitted, as in (13a,b).

Chinese *daodi...wh* questions with modals can be naturally interpreted as genuine information questions and can be felicitously answered by providing genuine information, as shown in (13). Given that the Chinese *daodi...wh*-question is an information-seeking question and is naturally answered with genuine information, we can assume that unlike *wh-on-earth* in English, the Chinese *daodi...wh* has [-negative rhetorical] and [+information seeking] features attached to it.

(8) b. Who on earth would buy that house?

(13) a. Q: Ta daodi hui xihuan shei?

She daodi will like who

“Who on earth would she like?”

A: Zhangsan.

b. Q: Daodi shei hui bangzhu ta?

Daodi who will help him

“Who on earth would help him?”

A: Lisi kending hui.

“Lisi definitely will.”

Also different from *wh-on-earth* in English is that *daodi...wh* in Chinese does not have the property of non-presupposition. In contrast with the impossible co-indexing between “who” and “Someone” in the unacceptable English sentence in (10b), repeated below, the Chinese counterpart is completely acceptable as in (14a), where *shei* “who” can be felicitously linked to *Youren* (=Someone). A similar example is given in (14b). In both of the two Chinese examples, *daodi* and its associate *shei* (=who) is linked to a discourse-familiar referent, i.e. *youren* (=someone) in (14a) and *ren* (=a person) in (14b), which demonstrate that the Chinese *wh*-word associated with *daodi* has a [+D-link] feature, because it can be presuppositional and anaphoric to a referent previously mentioned in the discourse.

(10) b. Someone<sub>i</sub> bought that book. \*John knows who<sub>i</sub> on earth.

(14) a. Youren<sub>i</sub> mai-le naben shu. Zhangsan zhidao daodi shi shei<sub>i</sub>.



Someone buy-PERF that book Zhangsan know daodi is who.

\*“Someone bought that book. Zhangsan knows who on earth that person is.”

- b. Women xuexiaode shitai jisuanji bei ren<sub>i</sub> touzou le, keshi jingcha  
our school’s ten computers by person steal Part but police  
yijing zhidao daodi shi shei<sub>i</sub> tou de.  
already know daodi is who steal Part

\*“Ten computers in our school were stolen by someone, and the police  
already know who on earth did that.”

The possession of the presuppositional property by *daodi...wh* should enable it to occur in complement clauses of veridical verbs like *zhidao* (=know), and this is confirmed by sentences in (15a), where *daodi...wh* occurs in the complement clause of the affirmative form of the veridical verb *zhidao*, which is in contrast with the sentence in (5b) and the English translation of (15a), where it is shown that *wh-on-earth* is not allowed in the complement of the veridical verb in English. However, similar to *wh-on-earth* in English, *daodi...wh* in Chinese can appear in the complement clause of negative forms of veridical verbs, as in (15b) as well as the complement of non-veridical verbs, as in (15c). In Chinese, *daodi...wh* can freely occur in the complement clause of a verb with either a [V<sub>veri</sub>] feature or a [V<sub>non-veri</sub>] feature, as shown in (15).

- (15) a. Zhangsan zhidao daodi shei hui mai na ben shu.  
Zhangsan know daodi who will buy that CL book  
\*“John knew who on earth would buy that book.”
- b. Zhangsan bu zhidao daodi shei hui mai na ben shu.  
Zhangsan not know daodi who will buy that CL book  
“John doesn’t know who on earth would buy that book.”
- c. Zhangsan xiang zhidao daodi shei hui mai na ben shu.  
Zhangsan want know daodi who will buy that CL book  
“John wonders who on earth would buy that book.”

It should be pointed out that although the complement clauses of the three sentences in (15) are all *wh*-clauses, they are different semantically. We follow Groenendijk and Stokhof (1982), Berman (1991), Lahiri (1991) and Adger and Quer (2001), and make

a semantic distinction between a *wh*-complement as a proposition, as in (15a), and a *wh*-complement as a question, as in (15b,c), with the former having a [*wh*<sub>Prop</sub>] feature and the latter a [*wh*<sub>Q</sub>] feature. Based on this line of analysis, we argue that *daodi...wh* in Chinese is not subject to such a distinction, as shown in (15), where it is grammatical for *daodi...wh* to be in any of the three complement clauses whether it has a [*wh*<sub>Prop</sub>] feature or a [*wh*<sub>Q</sub>] feature. In contrast, *wh-on-earth* in English is strictly subject to this distinction; only the *wh-on-earth* with a [*wh*<sub>Q</sub>] feature is legitimate but not the one with a [*wh*<sub>Prop</sub>] feature, as shown by the contrast in the English translation of the three sentences in (15) and the sentences in (5-7).

Table 1: A summary of features attached to *wh-on-earth* and *daodi...wh*

	<i>wh-on-earth</i>	<i>daodi...wh</i>
synthesized	+	-
licensed by [Q]	+	+
licensed by [neg]	+	+
licensed by [ <i>V</i> <sub>non-veri</sub> ]	+	+
licensed by [ <i>V</i> <sub>veri</sub> ]	-	+
[ <i>wh</i> <sub>Q</sub> ] feature	+	+
[ <i>wh</i> <sub>Prop</sub> ] feature	-	+
[negative rhetorical] feature	+	-
[information seeking] feature	-	+
[D-link] feature	-	+

It is proposed in the Minimalist Program (Chomsky, 1993, 1995) that all morphosyntactic and semantic features are located in the lexicon, and in this sense, we can assume that *wh-on-earth* in English and *daodi..wh* in Chinese are endowed with different sets of morphosyntactic, semantic, pragmatic and discourse features that distinguish them from each other. Table 1 provides a summary of the features attached to *wh-on-earth* and *daodi...wh* respectively, which provides us with evidence that *wh-on-earh* in English shares many properties with the PI *any* in English. In this article, we follow Huang and Ochi (2004) in assuming that *daodi* in Chinese is an adverb and that the Chinese *daodi* and its *wh*-associate do not form a synthetic

constituent and must be discontinuous with *daodi* in a preverbal position and a *wh*-phrase staying *in situ*.<sup>8</sup>

#### IV Features in L2 lexicon

It is proposed in Jackendoff (2002a,b) that the lexicon is central to the whole grammar because it encodes a combination of phonological, morphosyntactic, and semantic information that is vital in establishing meaning contrasts. In this sense, the lexicon is a unifying part of the grammar, and cross-linguistic variation can be accounted for on the basis of features and properties attached to items in the lexicon. This can help to open up a new frontier in L2 acquisition research, in which L2 grammars are examined and analyzed with regard to comparisons and contrasts of features between the L1 and the target language and whether features that are absent or different in the L1 lexicon can be acquired in the L2 language lexicon.

An influential model of L2 acquisition is Schwartz and Sprouse's (1994, 1996) Full Transfer/Full Access (FT/FA) Hypothesis, which assumes that the final state of L1 acquisition is the initial state of L2 and that the L1 grammar in its entirety, including features, is transferred and constitutes the initial L2 state. According to this model, L2 development is failure-driven. Initially the learner uses a representation based entirely on the L1 grammar to account for the input of the target language. However, when the L1 grammar is unable to assign appropriate structures to the target language input, restructuring occurs to the L2 grammar in order to arrive at an analysis more appropriate to the target language input. In this way, L2 learners can revise their L2 grammars to make them more target-like. On the basis of the FT/FA, Sprouse (2006) proposes a Full Lexicon Transfer (FLT) Model of L2 acquisition, in which he follows the Minimalist Program (Chomsky, 1993, 1995) and assumes that all features for

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<sup>8</sup> One may ask whether *wh...daodi* in Chinese should be considered a PI since its behaviours are different from those of *wh-on-earth* in English. Here, we follow Zwarts (1998) by assuming a distinction between weak, strong and superstrong PIs. Giannakidou (1999) uses the sentence in (i) as an example to show that the Greek PI *ook maar iets* (=anything) is much weaker than its counterpart in English. Given the degrees of strength of PIs cross-linguistically, it seems reasonable to assume that *wh...daodi* in Chinese is close to the weak end of the strength continuum for PIs while *wh-on-earth* is a strong PI on the continuum.

(i) De kinderen vertrokken zodra zij ook maar iets ontdekten.  
the children left.3pl as soon as they anything discovered.3spl  
\*“The children left as soon as they discovered anything.”

linguistic variation are encoded in the lexicon. This entails that full transfer takes place at the level of lexicon in L2 acquisition, and that all L1 lexical features are transferred to the initial state of the L2 lexicon. The development of the L2 lexicon is driven by learners' inability to use features transferred from an item in their L1 lexicon to accommodate properties of corresponding items in the target lexicon, and this motivates revision and modification of features attached to the relevant item in their L2 lexicon to make it more target-like.

Another influential model that attaches importance to features in L2 acquisition is Lardiere's (2008, 2009) Feature Reassembly (FR) Hypothesis, which postulates that divergence from the target language grammar is mainly due to L2 learners' failure to reconfigure formal features for the target language which are not instantiated in their L1. According to Lardiere, successful L2 acquisition of TL features depends on (a) whether specific features selected by both languages exhibit exactly the same configuration, and if so, feature reassembly is not necessary; (b) whether L2 learners are able to reassemble features into the TL configurations when the relevant features in both languages are configured in different ways and necessitate reassembly in learners' L2 grammars. Lardiere assumes that L2 learners are able to reassemble features into the TL configuration with the availability of positive evidence in the TL input

All the three models above, the FT/FA, the FLT and the FR, recognize that there may not always be positive evidence available in the target language input to trigger the necessary revision and modification in the L2 lexicon or feature reconfiguration, because features of the L1 lexicon or L1 configuration may prevent the learner from noticing relevant features in the TL, and that the absence of informative evidence in the target language input can lead to the L2 lexicon or L2 configuration permanently divergent from that in the target language. However, all these models seem to fall short of describing and explaining how those features or feature configurations behave which are transferred from the L1 to the L2 but are neither confirmed nor disconfirmed by any target language input. What happens to this type of features? Are they still as alive and active as they are in L1 throughout the L2 development? We hypothesize here that these features will gradually lose their vigour and vitality and

become dormant because of the absence of either confirming or disconfirming evidence in the input.

## V Empirical Study

### 1 Research questions

Given the differences between English and Chinese with respect to *wh-on-earth* and *wh...daodi* questions, an empirical study was conducted, which asked the following research questions:

- (a) Will Chinese speakers be able to acquire the synthetic form of *wh-on-earth* and reject the L1-based discontinuous form *wh...on-earth* in their L2 English syntax?
- (b) Will their L2 English morphosyntax allow *on-earth* to occur only in *wh*-questions, but not in yes-no questions?
- (c) Will *wh-on-earth* in Chinese speakers' L2 English be sensitive to the veridical versus non-veridical environments and be subject to the distributional restrictions?
- (d) In particular, will Chinese speakers' L2 English require that *wh-on-earth* be licensed by [+Q], and will their L2 English be able to make a distinction between verbs with [V<sub>veri</sub>] and [V<sub>non-veri</sub>] features, or between the affirmative form and the negative form of verbs with a [V<sub>veri</sub>] feature, or between a [wh<sub>Prop</sub>] feature and a [wh<sub>Q</sub>] feature in licensing *wh-on-earth*?
- (e) Will their L2 *wh-on-earth* acquire the [+negative rhetorical] and [-information seeking] features?
- (f) Will *wh-on-earth* in Chinese speakers' L2 English be attached with the [-D-link] feature?

### 2 Subjects

In total, 104 Chinese speakers participated as subjects in the empirical study and 20 native speakers of English participated as controls. The majority of the Chinese speakers were students from China doing postgraduate courses at British universities,

and the others were teaching or research staff. The native English speakers were students in a British university.

On the basis of their scores in their IELTS tests, the Chinese-speaking learners of English were divided into 5 English proficiency groups: Pre-Intermediate (Pre-Int) Group, Intermediate (INT) Group, Post-Intermediate (Post-Int) Group, Advanced (AD) Group, and Very Advanced (VAD) Group.<sup>9</sup> Information about each group is given in Table 2.

Table 2: Information of each group

Groups	No. of subjects	Average age	Average number of years of studying English	Average number of months in English-speaking countries	IELTS results
Pre-Int	15	25	12.5	7	6.0
INT	19	25	12	17	6.5
Post-Int	28	24	13	13	7.0
AD	24	25	14	22	7.5
VAD	18	27	15	51	8.0
NS	20	21	N/A	N/A	N/A

### *3 Instruments and procedures*

Each subject undertook three tasks, an acceptability judgment task, a discourse-completion task and an interpretation task.

#### *Acceptability Judgment Task*

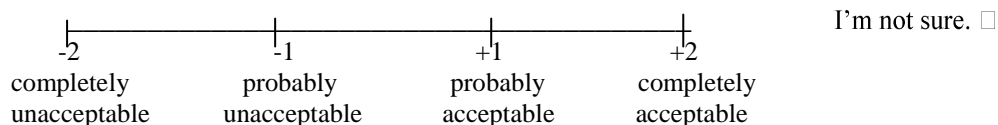
The acceptability judgment task included, among other things, 13 sentence types related to the research questions above, and each type had 4 tokens. So in total, there were 52 test sentences concerning the focus of the article.<sup>10</sup> All sentences were presented in English, but instructions were given to the Chinese speakers in Chinese and to native English speakers in English. The subject was asked to judge each test

<sup>9</sup> The Post-Int Group includes four subjects with TOEFL iBT Test scores of 105-108, the Advanced Group includes four subjects with TOEFL iBT Test scores of 110-114, and the VAD Group includes two subjects with IELTS scores of 8.5 and two subjects with TOEFL iBT Test scores of 115 and 116.

<sup>10</sup> In the acceptability judgment task, there were also 32 sentences testing different aspects of L2 Chinese grammars, which will not be reported here. These 32 sentences also served as distracters.

sentence by circling a number on a Likert scale, as shown in (16), which was presented below each test sentence.

(16)



In order to minimize any possible effect of vocabulary on the subjects' judgment, efforts were made to include only basic words of daily life. The 13 sentence types used in the test and their examples are listed in (17).

(17) Sentence types and their examples in the acceptability judgment task

**A. Synthetic form “wh-on-earth” vs. discontinuous form \*“(wh...on-earth)”<sup>11</sup>**

(a) *yes-no question (control)*

Do you want to see that film?

(b) *\*on-earth in yes-no questions*

\*Do you on earth want to see that film?

(c) *\*what...on-earth (discontinuous)*

\*What are you on earth doing here?

**B. [+Q] as a licenser for wh-on-earth**

(d) *wh-subject (control)*

Who would trust him?

(e) *wh-subject-on-earth*

Who on earth would trust him?

(f) *wh-object (control)*

What are you doing here?

(g) *wh-object-on-earth*

What on earth are you doing here?

**C. Wh-on-earth in the complement of (non-)veridical verbs**

(h) *veridical verb (control)*

I know what she bought yesterday.

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<sup>11</sup> The control sentences for (c) are the sentences in (f) and (g).

(i) *\*wh-on-earth in the complement of a veridical verb*

\*I know what on earth she bought yesterday.

(j) *non-veridical verb control*

I wonder what she bought yesterday.

(k) *wh-on-earth in the complement of a non-veridical verb*

I wonder what on earth she bought yesterday.

#### **D. Wh-on-earth in the complement of the negated form of “know”**

(l) *\*wh-on-earth in the complement of the affirmative form of “know”*

\*I know who on earth I should trust.

(m) *wh-on-earth in the complement of the negated form of “know”*

I don't know who on earth I should trust.

#### *Discourse Completion Task*

The aim of the discourse completion task was to examine whether *wh-on-earth...modal* in Chinese-speaking learners' L2 English can acquire the [+negative rhetorical] and [-information seeking] features. More specifically, it was designed to investigate whether Chinese speakers were able to correctly interpret the English *wh-on-earth...modal* question as a non-genuine information question and were able to respond to it with a negative reinforcement or without any answer. The subject was presented with *wh-on-earth...modal* questions, and after each question were multiple answers for the subjects to complete the discourse with. Subjects were told that all the questions and responses are GRAMMATICALLY CORRECT, but some responses are APPROPRIATE to the questions given and some are NOT APPROPRIATE, and they were asked to indicate to what degree each response was appropriate to the question given, by circling one number (-2, -1, +1, +2) after EACH response. They were told that -2 stands for “completely inappropriate”, -1 “probably inappropriate”, 1 “probably appropriate” and 2 “completely appropriate”. In (18), an example is provided of a question and the multiple responses used in the discourse completion task. As we can see, the set of responses included an answer of genuine information, as in (18c), a negative reinforcement, as in (18b), “not necessarily need an answer”, as in (18d), as well as a response irrelevant to the question, as in (18a). Subjects could choose “I don't understand the question or answers”, as in (18e), if this was the case. There were 4 tokens of the *wh-on-earth...modal* question in the task and there were also 4



tokens of the corresponding question without the use of *on earth*. In addition, there were 8 distracters. Before subjects started the discourse completion task, they were given three examples for practice. One purpose of this practice was to make sure that they mark ALL the responses in terms of appropriateness and that they feel free to mark more than one answer as appropriate or inappropriate.

(18) **What (on earth) can he do?**

- a. I think that his girlfriend can do something for him. (-2, -1, +1, +2)
- b. (I agree)<sup>12</sup> He can't do anything. (-2, -1, +1, +2)
- c. He can teach French and probably also Spanish. (-2, -1, +1, +2)
- d. This question does not necessarily need an answer. (-2, -1, +1, +2)
- e. I don't understand the question or the answers. ( )

*Interpretation Task*

The interpretation task was used to investigate whether *wh-on-earth* in Chinese speakers' L2 English carries the [-D-link] feature, that is, whether it is governed by the constraint of non-presupposition that does not allow *wh-on-earth* to refer to an entity in the discourse. Each item in the interpretation task contains a *wh*-word or *wh-on-earth* and a potential antecedent, both of which are underlined. The subject was asked to indicate whether the sentence is acceptable and to what extent the two underlined words can be linked, as shown in (19a,b). There were 4 control items (i.e. items without the use of *on earth*) and 4 experimental items (i.e. items with the use of *on earth*). The control item and its corresponding experimental item were exactly the same except for one difference, that is, the latter used both *on earth* and a *wh*-word but the former only the *wh*-word without the use of *on earth*. Test sentences like (19) are to examine the possibility of *wh-on-earth* having the [+D-link] feature in Chinese speakers' L2 English.

- (19) a. \***When my mother said that my father had bought something for my birthday, I had already learned what on earth he had bought for me.**

If the above sentence is correct, to what extent can “what” be linked to “something” in the sentence?

- (a) definitely linked.
- (b) probably linked.
- (c) probably not linked.
- (d) definitely not linked.

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<sup>12</sup> Subjects were told that the words in the brackets indicate an implied meaning and may not necessarily be included in the actual response.

(e) the sentence is unacceptable to me.

**b. When my mother said that my father had bought something for my birthday, I had already learned what he had bought for me.**

If the above sentence is correct, to what extent can “what” be linked to “something” in the sentence?

- (a) definitely linked. (b) probably linked.  
(c) probably not linked. (d) definitely not linked.  
(e) the sentence is unacceptable to me.

To test the subject’s general ability in recognizing the presence and absence of linking between regular wh-phrases and an entity mentioned in the discourse, we also included in the interpretation task 8 sentences like (20a) and (20b). In the latter, the wh-word is linked to the underlined word, but in the former it is not.

(20) **a. She had a car accident, and the injury to her head was what the doctor was most worried about.**

If the sentence is acceptable to you, to what extent can “what” be linked to “accident” in the sentence?

- (a) definitely linked. (b) probably linked.  
(c) probably not linked. (d) definitely not linked.  
(d) this sentence is unacceptable to me.

**b. I think that clothes sold in that fashion shop are precisely what she would like to wear.**

If the sentence is acceptable to you, to what extent can “what” be linked to “clothes” in the sentence?

- (a) definitely linked. (b) probably linked.  
(c) probably not linked. (d) definitely not linked.  
(d) this sentence is unacceptable to me.

#### *4 Results*

##### *Results of Acceptability Judgment Task*

As we can see in the second column of Table 3, except for the Pre-Int and INT Groups, all learner groups reject or tend to reject the discontinuous form of *wh...on earth*<sup>13</sup> in their L2 English wh-questions like *\*What are you on earth doing here?*. A one-way ANOVA result shows that there is a significant difference between groups in judging the discontinuous form ( $F = (5, 490) 23.429, p < 0.001$ ), and the *post hoc* Scheffé tests indicate that except for the Pre-Int and INT Groups, none of the other learner groups is significantly different from the NS Group here.

Table 3: Mean scores in the acceptability judgment test on whether *wh-on-earth* is a synthetic entity

Groups	<i>*what...on-earth</i>	<i>*on-earth</i> in yes-no questions	Yes-no question control
Pre-Int	0.45***	-0.10***	1.52
INT	0.12***	-0.22***	1.53
Post-Int	-0.96	-1.09**	1.53
AD	-1.07	-1.24	1.68
VAD	-1.32	-1.40	1.79
NS	-1.44	-2.00	2.00

\*\* = significantly different from the NS Group at  $p < 0.01$

\*\*\*=Significantly different from the NS Group at  $p < 0.001$

Similar results are also obtained in the judgment of *on-earth* in English yes-no questions; although a significant difference is found in a one-way ANOVA ( $F = (5, 490) 29.101, p < 0.001$ ), the *post hoc* Scheffé tests indicate that AD and Very-Advanced Groups, like the NS Group, do not accept *on-earth* in English yes-no questions. From Column 3 of Table 3, we can see that the mean scores of the Post-Int, AD and VAD Groups for *on-earth* in yes-no questions are all below -1. This suggests that in Chinese speakers' L2 English at post-intermediate, advanced and very advanced levels, the wh-phrase and *on-earth* are synthesized in their L2 English grammars and do not allow the discontinuous form *\*wh...on-earth* or just *on-earth* by itself without the wh-phrase in their L2 English interrogative sentences. This is confirmed by the mean scores in the last column of Table 4, which show that the Advanced and VAD Groups, like the NS Group, accept the synthetic use of *wh-on-earth* in sentences like *What on earth are you doing here?*, and that no significant difference is found between either group and the NS Group in their judgment of sentences of this type.

<sup>13</sup> We use “...” to indicate “discontinuous”.

Recall that the [+Q] feature is assumed to be base-generated in C in all questions, which can function as a licenser of a PI. As we can see in Table 4, Chinese speakers do not have much difficulty with the licenser-licensee relationship between the [+Q] feature in C and *wh-on-earth* in English *wh*-question; like that of the NS Group, the mean scores of all learner groups on *wh-on-earth* questions, whether *wh-on-earth* is in the subject or object position of the question, are above +1, the threshold for acceptance. Although significant differences are found between the NS Group and the learner groups in *wh-subject-on-earth* questions and *wh-object-on-earth* questions,<sup>14</sup> the data in Table 4 clearly suggest that *wh-on-earth* can be properly licensed by the [+Q] feature in Chinese speakers' L2 English, at least at advanced and very advanced levels because no significant difference is found between the NS Group and either the AD Group or the VAD Group in *wh-subject-on-earth* and *wh-object-on-earth* questions.

Table 4: Mean scores in the acceptability judgment test on *wh-on-earth* licensed by [+Q]

Groups	<i>wh-subject</i>	<i>wh-subject-on-</i>	<i>wh-object</i>	<i>wh-object-on-</i>
	control	<i>earth</i>	control	<i>earth</i>
Pre-Int	1.75	1.32	1.90	1.18*
INT	1.42*	1.22*	1.79	1.26*
Post-Int	1.67	1.12*	1.89	1.07**
AD	1.74	1.49	1.90	1.57
VAD	1.94	1.68	1.94	1.67
NS	1.99	1.88	2.00	1.86

\* = significantly different from the NS Group at  $p < 0.05$

\*\* = significantly different from the NS Group at  $p < 0.01$

The data in Tables 3-4 have indicated that the [+Q] feature in Chinese speakers' L2 English can properly function as a licenser for *wh-on-earth*, and Chinese speakers do not have much difficulty in establishing the licenser-licensee relationship between the [+Q] feature and *wh-on-earth* in English *wh-on-earth* questions. However, it is not clear at this stage whether such a relationship can be established between *wh-on-earth* and other licensers.

<sup>14</sup> For *wh-subject-on-earth*, the result of a one-way ANOVA is  $F = (5, 490) 6.761, p < 0.001$ , and for *wh-object-on-earth*, the result is  $F = (5, 490) 7.168, p < 0.001$ .

As discussed above, *wh-on-earth* can be licensed by a verb with a [ $V_{\text{non-veri}}$ ] feature like *wonder* in its complement, but not by a verb with a [ $V_{\text{veri}}$ ] feature like *know*, and this can be seen in the judgment data by the NS Group of the two types of sentences in Table 5 (see the last row). All learner groups, like the NS Group, seem to have no problem with the regular *wh*-phrase in the complement of the veridical verb *know* or the non-veridical verb *wonder* as there is no significant difference between the NS Group and any of the learner groups in judging the control sentences with either of these two verbs except for the INT Group in judging the control sentences of *wonder*.<sup>15</sup>

Table 5: Mean scores in the acceptability judgment test on *wh-on-earth* in the complement of the veridical verb *know* and the non-veridical verb *wonder*

Groups	<i>know</i> control		<i>*know what-on-earth</i>		<i>wonder</i> control		<i>wonder what-on-earth</i>
Pre-Int	1.75	↔	0.35***		1.53	↔	0.90*
INT	1.66	↔	0.67***		1.16**	↔	0.71***
Post-Int	1.73	↔	0.06***		1.38	↔	1.03*
AD	1.67	↔	0.03***		1.52		1.46
VAD	1.89	↔	0.06***		1.75		1.56
NS	1.99	↔	-1.55		1.89	↔	1.59

\* = significantly different from the NS Group at  $p < 0.05$

\*\* = significantly different from the NS Group at  $p < 0.01$

\*\*\* = significantly different from the NS Group at  $p < 0.001$

“ ↔ ” stands for a significant difference between the two values

However, when *wh-on-earth* is embedded in the complement of verbs *know* and *wonder*, significant differences are found between the NS Group and the learner groups.<sup>16</sup> In judging *wonder wh-on-earth* sentences, the Pre-Int, INT and Post-Int Groups behave significantly differently from the NS Group, as shown in the last column of Table 5. In contrast, no significant difference is found between the NS Group and the AD or VAD Group in judging *wonder wh-on-earth* sentences. This

<sup>15</sup> For the control sentences with *know*, the result of a one-way ANOVA is  $F = (5, 490) 2.687, p < 0.05$ , and for the control sentences with *wonder*, the result is  $F = (5, 490) 4.933, p < 0.001$ .

<sup>16</sup> For *\*know wh-on-earth*, the result of a one-way ANOVA is  $F = (5, 490) 21.384, p < 0.001$ , and for *wonder wh-on-earth*, the result is  $F = (5, 490) 8.422, p < 0.001$ .

suggests that *wh-on-earth* can be licensed by the non-veridical verb *wonder* in Chinese speakers' L2 English grammars, at least at advanced or very advanced levels. However, in judging \**know wh-on-earth* sentences, none of the learner groups demonstrates any native-like behaviour, including the AD and VAD Groups; as shown in the 3<sup>rd</sup> column of Table 5, every learner group is found significantly different from the NS Group, and their mean scores are all around 0, an indication of indeterminacy. What is most interesting in this set of results is that, in spite of the indeterminacy in judging \**know wh-on-earth* sentences, all learner groups, like the NS Group, make a significant distinction between sentences with a regular *wh*-phrase in the complement of *know* and sentences with *wh-on-earth* in the complement of *know*.<sup>17</sup> This suggests that Chinese speakers are sensitive to the ungrammaticality of *wh-on-earth* in the complement of the non-veridical verb *know* even though they are unable to reject sentences of this type. This is supported by data of the AD and VAD Groups' judgment; these two groups clearly allow both the regular *wh*-phrase and *wh-on-earth* in the complement of *wonder* as no significant difference is found in these two groups' judgment between the two types of sentences;<sup>18</sup> and at the same time, they are able to make a significant distinction between sentences with a regular *wh*-phrase in the complement of *know* and sentences with *wh-on-earth* in the complement of *know*. This shows that although Chinese speakers have difficulty in rejecting sentences with *wh-on-earth* in the complement of *know*, they are sensitive to the non-veridicality as a licenser for *wh-on-earth*.

As shown in Table 5 (column 3), Chinese speakers have persistent difficulty in rejecting sentences with *wh-on-earth* in the complement of the veridical verb *know* because there is no improvement in accuracy as their English proficiency progresses, and the intuition in this aspect of their L2 English grammars seems to be persistently at random in the process of their L2 acquisition of English. An examination of individual data indicates that no subject in any of the learner groups consistently (4 out of the 4 tokens) reject \**know... wh-on-earth* except for 2 subjects in the Post-Int

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<sup>17</sup> The paired-samples t-test result for the Pre-Int Group is  $t(59)=5.636, p<0.001$ ; for the Int Group is  $t(75)=5.363, p<0.001$ ; for the Post-Int Group,  $t(111)=810.594, p<0.001$ ; for the AD Group,  $t(95)=8.139, p<0.001$ ; for the VAD Group,  $t(71)=8.758, p<0.001$ ; for the NS Group,  $t(79)=48.310, p<0.001$ .

<sup>18</sup> The paired-samples t-test result for the AD Group is  $t(95)=0.469, p=0.64$ ; for the VAD Group,  $t(71)=1.87, p=0.07$ .

Group and 1 subject in the VAD Group.<sup>19</sup> As we can see from the last row of Table 5, the English speakers unambiguously take the verb with a [ $V_{\text{non-veri}}$ ] feature as a licenser for *wh-on-earth* as they clearly reject the *know...wh-on-earth* sentences and accept the *wonder...wh-on-earth* sentences. Nineteen out of the 20 subjects in the NS Group are found to be able to consistently (4 out of the 4 tokens) reject the *know...wh-on-earth* sentences.<sup>20</sup>

Similar results are also found in the contrast between *wh-on-earth* in the complement of the affirmative form of the veridical verb *know* and in the complement of the negative form of the verb. As we discussed above, the [+neg] feature can function as a licenser for *wh-on-earth*, and this is confirmed by the data of the NS Group in Table 6 (see the last row), who allow *wh-on-earth* in the complement of the negative form of the veridical verb *know* but not of the affirmative form of the verb. All learner groups also allow *wh-on-earth* in the complement of the negative form of the veridical verb *know* (see the last column of Table 6), and there is no significant difference between groups in accepting *wh-on-earth* in the complement of the negative form of the veridical verb *know* ( $F = (5, 490) 1.718, p = 0.129$ ). However, none of the learner groups is found to be able to reject *\*know who-on-earth*, and they all seem to be at random in judging this type of incorrect English sentences because their mean scores are all around 0. The *post hoc* Scheffé tests following a one-way ANOVA indicate that every learner group is significantly different from the NS Group in judging *\*know wh-on-earth* sentences.<sup>21</sup> However, the most interesting finding here is that all learner groups, like the NS Group, are sensitive to the contrast between the affirmative form and the negative form of the verb *know*; our paired-samples t-test results indicate that like the NS Group, all learner groups are able to make a significant distinction between the two forms of the veridical verb *know* in their judgment.<sup>22</sup> This indicates that the [+neg] feature can properly function as a licenser for *wh-on-earth* in Chinese speakers' L2

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<sup>19</sup> One of the two subjects in the Post-Int Group who consistently rejected *\*know who-on-earth* sentences failed to consistently accept *wonder wh-on-earth* sentences.

<sup>20</sup> Our paired-samples t-test indicates that there is a significant difference in the NS Group's judgment between *wonder wh-phrase* sentences and *wonder wh-on-earth* sentences ( $t(79)=4.297, p<0.001$ ). This is likely to be due to the absence of contexts for *wonder wh-on-earth* sentences. In any case, their mean score for *wonder wh-on-earth* sentences is 1.59, well above the acceptance threshold of +1.

<sup>21</sup> The result of a one-way ANOVA is  $F = (5, 490) 17.834, p < 0.001$ .

<sup>22</sup> The paired-samples t-test result for the Pre-Int Group is  $t(59)=-2.735, p<0.01$ ; for the Int Group is  $t(75)=-3.729, p<0.001$ ; for the Post-Int Group,  $t(111)=-5.588, p<0.001$ ; for the AD Group,  $t(95)=-5.706, p<0.001$ ; for the VAD Group,  $t(71)=-4.903, p<0.001$ ; for the NS Group,  $t(79)=-18.518, p<0.001$ .

English even though their L2 English grammars are persistently at random about the affirmative form of *know* as a licenser for *wh-on-earth*. An examination of individual data reveals that none of the learner subjects, except for one in the AD Group and one in the VAD Group, is able to consistently (i.e. 4 out of the 4 tokens) reject *\*know who-on-earth*. In contrast, 17 out of the 20 native English speakers are able to do so.

Table 6: Mean scores in the acceptability judgment test on *wh-on-earth* in the complement of *know* and in the complement of the negated *know*

Groups	<i>*know...who-on-earth</i>		negated <i>know...who-on-earth</i>
Pre-Int	0.15***	↔	0.75
INT	0.62***	↔	1.22
Post-Int	0.21***	↔	1.06
AD	0.08***	↔	1.16
VAD	0.04***	↔	1.28
NS	-1.39	↔	1.20

\*\*\*=Significantly different from the NS Group at  $p < 0.001$

“ ↔ ” stands for a significant difference between the two values

### *Results of Discourse Completion Task*

Recall that it is argued in the literature (cf. Dikken and Giannakidou 2002) that *wh-on-earth...modal* converts the question into a negative rhetorical question, which can only be answered felicitously by a negative rhetorical reply and cannot be naturally read as a genuine information question. In our Discourse Completion Task, subjects were asked to indicate to what degree it was appropriate for an English *wh-on-earth...modal* question to be followed by a genuine information answer, a negative reinforcement answer, or no answer. The subject was asked to circle one number (-2, -1, +1, +2) after each response. They were told that -2 stands for “completely inappropriate”, -1 “probably inappropriate”, +1 “probably appropriate” and +2 “completely appropriate”.

Table 7 provides data from the discourse completion task, which suggest that, contrary to what is argued for in the literature, both native English speakers and Chinese speaking learners of English seem to find it appropriate to answer *wh-on-earth...modal* questions with a genuine information answer. As we can see in the 2<sup>nd</sup>



column of Table 7, the mean scores of both the NS Group and the learner groups for the genuine information answers are above (or close to) +1, and there is no significant difference between the groups in answering *wh-on-earth...modal* questions with genuine information answers ( $F = (5, 490) 1.450, p = 0.205$ ). This seems to suggest that *wh-on-earth...modal* questions have the [+information seeking] feature in both native speakers' English grammar and Chinese speakers' L2 English grammars. However, we would argue that the similarity between the NS Group and the learner groups in their mean scores are likely to be superficial and that the mean score of 1.05 by the NS Group does not necessarily mean that *wh-on-earth...modal* questions have the [+information seeking] feature in native speakers' English grammar. We will have a more detailed discussion in Section VI.

Table 7: Mean scores of types of responses to *wh-on-earth...modal* questions in the discourse-completion task

Groups	genuine information	negative reinforcement	no answer
Pre-Int	1.35 ↑	↔ 0.38**	0.30*** ↑
INT	1.05 ↑	0.55*	0.04*** ↑
Post-Int	0.91	0.51**	0.48***
AD	1.20	1.07	0.72***
VAD	1.31	1.25	1.15
NS	1.05 ↑	↔ 1.36	1.70 ↑

\*\* = significantly different from the NS Group at  $p < 0.01$

\*\*\* = Significantly different from the NS Group at  $p < 0.001$

“ ↔ ” stands for a significant difference between the two values

Table 7 also provides us with evidence that the *wh-on-earth...modal* question can be acquired by Chinese speakers as a negative rhetorical question, and this can be seen in the mean scores of the AD and VAD Groups' selections of negative-reinforcement responses to *wh-on-earth...modal* questions. These two groups' mean scores are both above +1, an indication that the [+negative rhetorical] feature is attached to the *wh-on-earth...modal* question in their L2 English. No significant difference is found between either of these two learner groups and the NS Group in answering *wh-on-*

*earth...modal* questions with negative-reinforcement responses.<sup>23</sup> The acquisition of “no answer” to the *wh-on-earth...modal* question seems to take place rather late in Chinese speakers’ L2 English. As we can see in the last column of Table 7, it is not until the very advanced level that Chinese speakers find it appropriate to keep silent to the English *wh-on-earth...modal* question. A one-way ANOVA indicates that there is a significant difference between the groups in selecting “no answer” to *wh-on-earth...modal* questions ( $F = (5, 490) 13.910, p < 0.001$ ), and the *post hoc* Scheffé tests show that the Pre-Int, INT, Post-Int and AD Groups are each significantly different from the NS Group in this aspect of their L2 English grammars. These four groups are at random in allowing silence as a possible response to the English *wh-on-earth...modal* question as their mean scores are all around 0.

The data in Table 7 also suggest that native English speakers prefer “no answer” and *negative reinforcement* over *genuine information* as responses to *wh-on-earth...modal* questions (see the arrows in the last row of Table 7). The *post hoc* Scheffé tests following a one-way ANOVA reveal a significant difference between “no answer” and “genuine information”, between “negative reinforcement” and “genuine information”, but no significant difference between “no answer” and “negative reinforcement”, in native English speakers’ selection of answers to *wh-on-earth...modal* questions.<sup>24</sup> These results, combined with the NS group’s mean scores suggest that the *wh-on-earth...modal* question in English has the [+negative rhetorical] feature and that the negative reinforcement and “no answer” are taken as more appropriate responses than the genuine-information response to the *wh-on-earth...modal* question in English speakers’ L1 grammar. However, the preference seems to be just opposite in the Pre-Int Group’s L2 English. Unlike the NS Group, who take the *genuine information* to be the least preferred option as a response to the *wh-on-earth...modal* question, the Pre-Int Group take the *genuine information* as the most preferred response to the *wh-on-earth...modal* question, and they do not seem to consider silence or negative reinforcement to be an appropriate response to the *wh-on-earth...modal* question, as there is a significant difference between the *genuine information* and “no answer” and also between the *genuine information* and the *negative reinforcement* in the Pre-Int

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<sup>23</sup> The result of a one-way ANOVA for selecting negative-reinforcement responses to *wh-on-earth...modal* questions by the groups is  $F = (5, 490) 8.204, p < 0.001$ .

<sup>24</sup> The result of a one-way ANOVA for selecting responses to *wh-on-earth...modal* questions by the NS Group is  $F = (2, 237) 8.902, p < 0.001$ .

Group's selection of responses to the *wh-on-earth...modal* question, but no significant difference is found between the *negative reinforcement* and "no answer" in this group's selection of responses.<sup>25</sup> This indicates that the *wh-on-earth...modal* question in Chinese speakers' L2 English at early stages has the [+information seeking] feature. An interesting observation is that while the appropriateness of the *genuine information* remains unchanged among the learner groups (as there is no significant difference between the groups in selecting the *genuine information* as responses to the *wh-on-earth...modal* question), the learner groups gradually find it more appropriate to select the *negative-reinforcement* and "no answer" responses to the *wh-on-earth...modal* question as their English language proficiency improves (see the last two columns of Table 7). By the time they reach an advanced or a very advanced level, they, like the NS Group, accept the negative reinforcement and silence as appropriate responses to the *wh-on-earth...modal* question, as shown by the AD and VAD Groups in the last columns of Table 7. There is no significant difference between the *genuine information*, the *negative reinforcement* and "no response" in the VAD Group's selection of responses to the *wh-on-earth...modal* question, nor is there any significant difference in the INT or AD Groups', which suggest that the [+negative rhetorical] and [+information seeking] features are both attached to the *wh-on-earth...modal* question in these groups' L2 English grammars.

The data in Table 8, in contrast to the data in Table 7, provide us with evidence that with a regular *wh*-phrase without *on-earth*, the *wh*-question has the [+information seeking] feature and is taken as a *genuine information* question both in the native English grammar and in Chinese speakers' L2 English grammars, and it is less likely to be treated as a negative rhetorical question. As we can see in Table 8, all the learner groups, just like the NS Group, allow *wh*-questions with regular *wh*-phrases to be answered with *genuine information*, and there is no significant difference between any group in their selection of this type of response ( $F = (5, 490) 1.367, p = 0.235$ ). There is also no significant difference between any group in their selection of the *negative reinforcement* ( $F = (5, 490) 1.607, p = 0.157$ ). However, a one-way ANOVA reveals a significant difference in the groups' selection of "no answer" to *wh*-questions with regular *wh*-phrases ( $F = (5, 490) 10.816, p < 0.001$ ), and the *post hoc*

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<sup>25</sup> The result of a one-way ANOVA for selecting responses to *wh-on-earth...modal* questions by the Pre-Int Group is  $F = (2, 177) 9.819, p < 0.001$ .

Scheffé tests indicate that the Pre-Int, INT and Post-Int Groups are significantly different from the NS Group in their selection of “no answer” to wh-questions with regular wh-phrases. In general, all learner groups, like the NS Group, seem to be at random in allowing a negative reinforcement or silence to be used as a response to the wh-question with a regular wh-phrase because none of the groups’ mean scores is above +1 (or below -1). This is probably due to the fact, as observed by Dikken and Giannakidou (2002), that wh-questions like *Who would buy that house?* can also have a negative rhetorical reading although not as saliently as *Who on earth would buy that house?*. L2 learners as well as native English speakers may occasionally have this interpretation in mind when they select the negative reinforcement or “no answer” as a response to wh-questions with regular wh-phrases. Table 8 shows clearly that there is a clear preference for the *genuine information* as an answer to the wh-question with a regular wh-phrase.

Table 8: Mean scores of types of responses to *wh-...modal* questions in the discourse-completion task.

Groups	genuine information	negative reinforcement	no answer
Pre-Int	1.52	0.55	-0.57***
INT	1.61	0.28	-0.34***
Post-Int	1.44	0.52	-0.03*
AD	1.58	0.44	-0.29***
VAD	1.75	0.92	0.76
NS	1.64	0.64	0.78

\*= significantly different from the NS Group at  $p < 0.05$

\*\*\*=Significantly different from the NS Group at  $p < 0.001$

### *Results of Interpretation Task*

Will *wh-on-earth* in Chinese speakers’ L2 English have the [-D-link] feature, which does not allow *wh-on-earth* to refer to an entity in the discourse? The interpretation task was designed to answer this question. In our analysis, if subjects considered the wh-phrase “definitely linked” to the underlined word in the discourse, we converted it to “+2”; if “probably linked”, it was converted to “+1”; if “probably not linked”, it was converted to “-1”; and if “definitely not linked”, it was converted to “-2”.

As we can see in the second column of Table 9, almost all learner groups, like the NS Group, are able to link the regular *wh*-phrase to its antecedent in the discourse in sentences like (20b) and there is no significant difference between the groups in interpreting sentences of this type. Although subjects in the Pre-Int, INT and Post-Int Groups are at random in detecting the absence of linking between a regular *wh*-phrase and an entity in the discourse like (20a), the AD and VAD Groups, like the NS Group, are able to do so, as shown in the last column of Table 9.<sup>26</sup> All groups, including the Pre-Int, INT and Post-Int Groups, are able to make a significant distinction between the linking and non-linking of the regular *wh*-phrase to an entity in the discourse as paired-samples t-tests indicate that there is a significant difference between the two types of sentences in each group' interpretation of the sentences in the interpretation task.<sup>27</sup> These results suggest that L2 learners are, in general, able to recognize the absence and presence of linking between the regular *wh*-phrase and an entity in the discourse, particularly at advanced and very advanced levels.

Table 9: Mean scores in the interpretation of the possible linking between the regular *wh*-phrase and a discourse entity<sup>§</sup>

Groups	<i>wh</i> - = a D-entity	<i>wh</i> - ≠ a D-entity
Pre-Int	1.33 ←→	-0.35***
INT	1.25 ←→	-0.45***
Post-Int	1.02 ←→	-0.7**
AD	1.18 ←→	-1.26
VAD	1.19 ←→	-1.35
NS	1.48 ←→	-1.49

§“=”: “linked to”; “≠”: “not linked to”

\*\* = significantly different from the NS Group at  $p < 0.01$

\*\*\*=Significantly different from the NS Group at  $p < 0.001$

Having established Chinese speakers' general ability of detecting the absence and presence of linking between the regular *wh*-phrase and an entity in the discourse in their L2 English, let's look at the data in Table 10, which provide information about

<sup>26</sup> The result of a one-way ANOVA for detecting the absence of linking between a regular *wh*-phrase and an entity in the discourse by the groups is  $F = (5, 422) 9.767, p < 0.001$ .

<sup>27</sup> The paired-samples t-test result for the Pre-Int Group is  $t(39)=4.790, p < 0.001$ ; for the INT Group is  $t(59)=6.749, p < 0.001$ ; for the Post-Int Group,  $t(91)=7.971, p < 0.001$ ; for the AD Group,  $t(87)=13.474, p < 0.001$ ; for the VAD Group,  $t(67)=12.840, p < 0.001$ ; for the NS Group,  $t(79)=22.996, p < 0.001$ .

whether Chinese speakers' L2 English infelicitously allows *wh-on-earth* to be linked to a discourse entity. In order to ensure that subjects' interpretation of the impossible linking of *wh-on-earth* to a discourse entity is not affected by the ungrammaticality of the test sentences, we first identify subjects in each group who consistently (i.e. 4 out of the 4 tokens) considered the test sentences, as in (19a), as acceptable and exclude those who marked the choice of "The sentence is not acceptable to me" in any of the 4 tokens. As a result of this screening, the analyses of the interpretation task are based only on the data of those in the learner groups who consistently considered the test sentences in the task as acceptable. None of the 20 native speakers consistently considered the test sentences "acceptable", but we include their data for the sake of comparison. In contrast to the NS Group, in which 16 out of the 20 native speakers consistently considered the sentences "unacceptable", a large proportion of subjects in each learner group consistently judged test sentences like (19a) as acceptable (see the numbers in the brackets in the first column of Table 10), and none of the subjects in any learner group, except for one in the Pre-Int Group,<sup>28</sup> consistently rejected unacceptable sentences like (19a).

Table 10: Mean scores of the groups in interpreting the (im)possible linking between the *wh-(on-earth)* and a discourse(D) entity<sup>§</sup> (The information in the brackets indicates the changes to the number of subjects in each group as a result of the screening process)

Groups	<i>wh-</i> = a D-entity	<i>wh-on-earth</i> ≠ a D-entity
Pre-Int ( <i>n</i> =15-6=9)	0.89*	0.67
INT ( <i>n</i> =19-6=13)	1.14	0.71
Post-Int ( <i>n</i> =28-15=13)	1.14	←→ 0.37
AD ( <i>n</i> =24-8=16)	1.27	←→ 0.45
VAD ( <i>n</i> =18-7=11)	1.43	←→ 0.91
NS	1.59	X <sup>†</sup>

\* = significantly different from the NS Group at  $p < 0.05$

<sup>§</sup>"=": "referring to"; "≠": "not referring to"; "X<sup>†</sup>": none of the 20 native speakers consistently considered the sentences "acceptable".

In interpreting sentences like (19b), where a regular *wh*-phrase is linked to a discourse entity, all learner groups, except for Pre-Int Group, demonstrate native-like

<sup>28</sup> This one subject also consistently rejected correct sentences like (19b).

interpretations; their mean scores for the linking are all above +1, as shown in Column 2 of Table 10.<sup>29</sup> However, those subjects who consistently accept incorrect sentences like (19a) variably allow the infelicitous linking of *wh-on-earth* to an entity in the discourse, as shown by the learner groups' mean scores in the last column of Table 10. A close examination of individual subjects' interpretations reveals that none of the subjects in any learner group is able to consistently recognize the impossibility of linking *wh-on-earth* to a discourse entity in the interpretation task. Moreover, 5 out of the 9 subjects in the Pre-Int Group, 3 out of the 13 in the INT Group, 4 out of the 13 in the Post-Int Group, 3 out of the 16 in the AD Group and 6 out of the 11 in the VAD Group are found to consistently allow the infelicitous linking between *wh-on-earth* and an entity in the discourse in the interpretation task. No evidence shows that Chinese speakers' interpretation of this infelicitous linking becomes more accurate as their English language proficiency improves, as shown in the last column of Table 10, as no significant difference is found between any of the learner groups in detecting this infelicitous linking ( $F = (4, 243) 1.578, p = 0.181$ ). This leads to the possibility that the illegitimate linking between *wh-on-earth* and a discourse entity is permanently vulnerable in Chinese speakers' L2 English grammars. What is of great interest here is that in spite of their inability to rule out the infelicitous linking of *wh-on-earth* to an entity in the discourse, Chinese-speaking learners of English, particularly those at post-intermediate, advanced and very advanced levels, are able to make a distinction between the felicitous linking of the regular *wh*-phrase to a discourse entity and the infelicitous linking of the *wh-on-earth* to a discourse entity, as our paired-samples t-tests indicate that subjects in the Post-Int, AD and VAD Groups make a significant distinction in their interpretations between these two types of interpretations,<sup>30</sup> even though they are at random in rejecting the impossible linking in the interpretation task.

## VI Discussion

Table 11 is a summary of the findings in our empirical study. As our data show, all learner groups, like the NS Group, reject or tend to reject the discontinuous form of *wh...on*

<sup>29</sup> The result of a one-way ANOVA for linking a regular *wh*-phrase to an entity in the discourse by the groups is  $F = (5, 322) 3.030, p < 0.05$ .

<sup>30</sup> The paired-samples t-test results for the Post-Int Group are  $t(51)=3.899, p < 0.001$ ; for the AD Group,  $t(63)=4.216, p < 0.001$ ; for the VAD Group,  $t(43)=2.699, p < 0.01$

*earth* in their L2 English wh-questions like \**What are you on earth doing here?*, and they also reject incorrect yes-no questions with *on-earth* embedded in it. Chinese-speaking learners, particularly those at advanced and very advanced levels, also accept the synthetic use of *wh-on-earth* in sentences like *What on earth are you doing here?* All this suggests that *wh-on-earth* can be acquired as a synthetic entity in Chinese speakers' L2 English. As the learners involved in our study were already considerably beyond the earliest stages of L2 acquisition of English, we cannot rule out the possibility that Chinese-speaking learners transfer the discontinuous *wh...daodi* from their L1 Chinese into their L2 English and allow the discontinuous form \**wh...on-earth* or just *on-earth* by itself without the wh-phrase in the earlier stages of their L2 English. However, with their increased exposure to the TL input, Chinese-speaking learners should be able to re-analyze \**wh...on-earth* in their L2 English and acquire *wh-on-earth* as a synthesized lexical item. That is, their increased English language input should be able to help them to make a good sense that if *on-earth* occurs in an English question, there is a good chance that it occurs in a wh-question, there is a good chance that it goes together or "is collocated" with a wh-phrase, and there is a good chance that this "collocated" phrase moves to the initial position of the wh-question.

Table 11: Summary of the properties of *wh-on-earth* in L1 English and Chinese speakers' L2 English

<i>Properties of wh-on-earth</i>	<i>Native English speakers</i>	<i>Chinese-speaking learners</i>
synthesized	+	+
licensed by [Q]	+	+
licensed by [neg]	+	+
licensed by [V <sub>non-veri</sub> ]	+	+
licensed by [V <sub>veri</sub> ]	-	?
[wh <sub>Q</sub> ] feature	+	+
[wh <sub>Prop</sub> ] feature	-	?
[negative rhetorical] feature	+	? at intermediate levels + at advanced levels
[information seeking] feature	≈	+
[D-link] feature	-	?

"+" = Yes; "-"=No; "?"=Random; "≈"=Apparently Yes.



The establishment of the licensor-licensee relationship between the [+Q] feature and *wh-on-earth* in English *wh*-questions does not seem to cause much difficulty to Chinese-speaking learners of English. If we adopt the FT/FA or FLT Hypotheses (Schwartz and Sprouse, 1994, 1996; Sprouse, 2006), this result should not be unexpected, as the morphosyntactic relationship is also available in learners' L1 Chinese, where *daodi...wh*, the closest Chinese counterpart of *wh-on-earth*, is licensed by the [+Q] feature in Chinese *wh*-questions. This can provide us with an account for the ease with which *wh-on-earth* can be properly licensed by the [+Q] feature in Chinese speakers' L2 English in both *wh-subject-on-earth* and *wh-object-on-earth* questions, because when they come to acquire English, there is positive evidence in the TL input to confirm this licensor-licensee relationship, and there is no need for Chinese-speaking learners to reassemble features in this aspect of grammar, as predicted by Lardiere's (2008, 2009) FR Hypothesis.

A similar explanation can be used to account for the native-like behaviour that Chinese speakers demonstrate in allowing *wh-on-earth* to be licensed by the [+neg] feature. All learner groups allow *wh-on-earth* in the complement of the negative form of the veridical verb *know*, and there is no significant difference between any of the learner groups and the NS Group in accepting *wh-on-earth* in this position. The [+neg] and [+Q] features are typical licensors for PIs both within and across languages, and it should not come as a surprise that they can properly function as licensors for *wh-on-earth* if the latter is treated as a PI in Chinese speakers' L2 English grammars.

However, when *wh-on-earth* is embedded in the complement of the affirmative form of the verb *know*, all learner groups, including the AD and VAD Groups, significantly deviate from native English speakers in their judgment; native English speakers reject sentences of this type, whereas all learner groups make random<sup>31</sup> judgment of sentences of this type. Examinations of individual data reveal that almost all Chinese-speaking learners of English randomly allow *wh-on-earth* to be licensed by the veridical verb *know*, and there is no evidence of improvement in accuracy in this aspect of their L2 English grammars as they become more proficient in English. This suggests that it is a persistent problem that *wh-on-earth* is randomly licensed by the

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<sup>31</sup> It should be noted here that by "random", we do not mean that L2 grammars are wild grammars. On the contrary, behaviours of dormant features are still within the range of natural languages. In fact, what dormant features do is unsystematically let one setting or another on a given occasion. We are grateful to an anonymous *SLR* reviewer for drawing our attention to this potential confusion.

verb with a [V<sub>veri</sub>] feature in Chinese speakers' L2 English, and this is in striking contrast with their judgment of *wh-on-earth* licensed by the verb *wonder*, a verb with a [V<sub>non-veri</sub>] feature; Chinese-speaking learners at advanced and very advanced levels, like native English speakers, determinately and consistently accept sentences with *wh-on-earth* licensed by the verb *wonder*.

A particularly interesting finding of our study is that, in spite of their wavering in judging *wh-on-earth* incorrectly licensed by the veridical verb *know*, all learner groups, like native English speakers, make a significant distinction between sentences with a regular *wh*-phrase in the complement of *know* and sentences with *wh-on-earth* in the complement of *know*; they accept the former but judge the latter at random. This suggests that Chinese speakers are sensitive to the distinction between the two types of sentences, and that in their L2 English, the [V<sub>veri</sub>] feature can consistently and determinately license a regular *wh*-phrase, but randomly allows *wh-on-earth* in the complement of the verb with a [V<sub>veri</sub>] feature. This is supported by data of learners at advanced and very advanced levels, because the AD and VAD Groups clearly allow both the regular *wh*-phrase and *wh-on-earth* in the complement of *wonder*, and at the same time, they are able to make a significant distinction between sentences with a regular *wh*-phrase in the complement of *know* and sentences with *wh-on-earth* in the complement of *know*. This shows that the [V<sub>non-veri</sub>] feature functions as a proper licenser for *wh-on-earth* in Chinese speakers' L2 English, just as in the native English grammar, but at the same time, *wh-on-earth* is incorrectly licensed by the [V<sub>veri</sub>] feature in their L2 English in a random fashion. This is probably an example of what Juffs (2009) describes as a form-meaning disassociation in L2 lexicon. That is, the phonological and written forms of *wh-on-earth* are acquired by Chinese speakers, but without appropriate semantic features properly attached to them.

Like the [+neg] feature, the [V<sub>non-veri</sub>] feature serves as a licenser for PIs in both English and Chinese. Although *diaodi...wh*, the closest Chinese counterpart of *wh-on-earth*, does not share all the behaviours of typical PIs, it can be licensed by the [V<sub>non-veri</sub>] feature, as in (21). This will facilitate Chinese-speaking learners in recognizing the [V<sub>non-veri</sub>] feature as a licenser of *wh-on-earth* in their L2 acquisition of English. This can account for the fact that Chinese-speaking learners at advanced and very advanced levels, like native English speakers, determinately accept sentences with

*wh-on-earth* licensed by the verb *wonder*. However, recall that *daodi...wh* is allowed in the complement of the veridical verb in Chinese but *wh-on-earth* in English is not, as shown in the Chinese sentence and its English translation in (22). If Chinese speakers transfer the [V<sub>veri</sub>] feature as a licenser for *daodi...wh* from their L1 Chinese to *wh-on-earth* in their L2 English, as would be predicted by the FT/FA (Schwartz and Sprouse, 1994, 1996) and FLT (Sprouse, 2006) Hypotheses, there is likely to be a problem of poverty of stimulus because no evidence in the English input that Chinese learners are exposed to will trigger the necessary reassembly of features and remove the [V<sub>veri</sub>] feature as a licenser of *wh-on-earth* in their L2 English. The absence of either confirming evidence or disconfirming evidence in the TL input for the [V<sub>veri</sub>] feature to function as a licenser of *wh-on-earth* will lead to a persistent problem in their L2 English. A possible consequence is that the [V<sub>veri</sub>] feature as a licenser of *wh-on-earth* will become dormant in Chinese speakers' L2 English grammars, allowing *wh-on-earth* to be licensed by veridical verbs in a random fashion in their L2 acquisition of Chinese, as suggested by the data in our study.

(21) Wo xiang zhidao [wh-Q ta daodi mai-le shenme].

I want know he daodi buy-PFV what  
 “I wonder what on earth he has bought.”

(22) Wo zhidao [wh-Prop ta daodi mai-le shenme].

I know he daodi buy-PFV what  
 \*“I know what on earth he has bought.”

There can be an additional problem of poverty of stimulus as well. Unlike *wh-on-earth* in English, which is endowed with a [wh<sub>Q</sub>] feature but not a [wh<sub>Prop</sub>] feature, *daodi...wh* in Chinese is not subject to such a distinction; it is only required to occur in a wh-complement, whether the complement is a question, as in (21), or a proposition, as in (22). Sentences like *I wonder what on earth he could do in this situation* or *I wonder who on earth would buy that house* in the English input can only confirm the [wh<sub>Q</sub>] feature attached to *wh-on-earth* in English, but nothing in the input will be able to help to remove the [wh<sub>Prop</sub>] feature transferred from *daodi...wh* in their L1 Chinese to *wh-on-earth* in their L2 English. As a result, this feature, although it may not be as alive and active as it is in Chinese, remains attached to *wh-on-earth* in

their L2 English in a dormant state, randomly allowing *wh-on-earth* to occur in a proposition in their L2 English, as shown in our data, and resulting in a permanent divergence from the target language grammar.

Our data show that Chinese speakers demonstrate sensitivity to the difference between the regular *wh*-phrase and *wh-on-earth* in the complement of a veridical verb, and also to the difference between *wh-on-earth* licensed by a veridical verb and by a non-veridical verb. This is likely to be due to the difference between the active and dormant status of relevant features in their L2 English lexicon. The *wh-on-earth* in Chinese speakers' L2 English shares many properties with a standard PI like *any*; as a synthesized item, it can be licensed by [Q], [neg], [V<sub>non-veri</sub>], etc. This is the case with *daodi...wh* in learners' L1 Chinese, and there is also positive evidence in their English input to confirm these features as licensers of *wh-on-earth* if we assume positive transfer of these features from *daodi...wh* in their L1 Chinese to *wh-on-earth* in their L2 English. All this will enable these features to be alive and active in their L2 English grammars in licensing *wh-on-earth* as a PI in non-veridical environments. In this sense, whether the features have an active status or a dormant status in learners' L2 English can account for the difference between the determinate acceptance of *wh-on-earth* licensed by [Q], [neg], [V<sub>non-veri</sub>], etc. and the random rejection/acceptance of *wh-on-earth* incorrectly licensed by the [V<sub>veri</sub>] and [wh<sub>prop</sub>] features. Those features transferred from learners' L1 which cannot be confirmed or disconfirmed by the TL input will not remain as alive and active as in the L1 but gradually become dormant in learners' L2 grammars. We believe that this is a reasonable account for Chinese learners' random rejection/acceptance of *wh-on-earth* licensed by the veridical verb *know*.

- (23) a. JOHN knows who on earth wrote this report.  
b. Even Peter knows what on earth Mark has done.  
c. NOW I know who on earth stole my car.

Dormant features can be reactivated if L2 learners are able to notice some relevant data. In the English sentences in (23), adapted from (23) in Dikken and Giannakidou (2002), *wh-on-earth* is in the complement of the veridical verb *know*, and this should not be allowed. However, these sentences are acceptable in English. According to

Dikken and Giannakidou, the *wh-on-earth* in English sentences like those in (23) is actually not licensed by the veridical verb *know*, but by what they call *negative implicature*. That is, *who on earth* in (23a) is licensed by the negative implicature that *Nobody else knows who wrote this report*; in (23b), *what on earth* is licensed by the negative implicature that *There is no one who does not know what Mark has done*; and in (23c), *who on earth* is licensed by the negative implicature that *I did not know before*. In these sentences, the focus structure imposes a set of alternatives, and this, in turn, yields the required negative inference for sanctioning *wh-on-earth* in the sentences. Here, the challenge that L2 learners of English are faced with is to detect the semantic subtlety underlying sentences like those in (23). Given that the negative implicature of sentences of this type is so subtle and opaque, and even though L2 learners may be able to notice the focus structure involved in the sentences, it is likely that L2 learners of English just take the *face values* of the sentences like (23); that is, *wh-on-earth* can sometimes occur in the complements of veridical verbs in English. If this happens, it may reactivate the dormant features, but only temporarily, because the *face values* of sentences like (23) are unlikely to be robust and salient in the input and may have more confusing effects than triggering effects on *wh-on-earth* in Chinese speakers' L2 English.

Recall that the *wh-on-earth...modal* question in English has [-information seeking] and [+negative rhetorical] features, and it is argued in the literature that it can only be answered felicitously by a negative rhetorical reply and should not be answered with a genuine information answer. However, the data from our discourse completion task show that both native English speakers and Chinese-speaking learners of English seem to find it appropriate to answer *wh-on-earth...modal* questions with a genuine information answer, and that there is no significant difference between the groups in answering *wh-on-earth...modal* questions with genuine information answers. Given the fact that the *daodi...wh...modal* question in learners' L1 Chinese has a [+information seeking] feature, it does not come as a surprise that this feature is alive and active in Chinese-speaking learners' L2 English at earlier stages, which enables them to answer the English *wh-on-earth...modal* question with genuine information. What is unexpected is native English speakers' selection of genuine information in answering the *wh-on-earth...modal* question in the discourse completion task. It seems likely that the information provided by Chinese-speaking learners at earlier

stages and that by native English speakers actually have different discourse functions; the former is to provide genuine information, but the latter has an additional function, that is, to dispute or refute the negative rhetorical tone of the *wh-on-earth...modal* question. For example, the answer in (24) is to challenge the negative implication of the question that *Nobody would buy that house*. In this sense, the *wh-on-earth...modal* question in English still has [-information seeking] and [+negative rhetorical] features, as described in the literature.

(24) Q: Who on earth would buy that house?

A: I think Peter would.

Although the methodology used in the study is unable to inform us whether the above analysis of native English speakers in the discourse completion task will also apply to Chinese speaking learners at advanced or very advanced levels, the assumption that the [-information seeking] and [+negative rhetorical] features are attached to native English speakers' the *wh-on-earth...modal* question is supported by the data concerning native English speakers' selection of *negative reinforcement* and "no answer" to the *wh-on-earth...modal* question in the discourse completion task. Our data show that native English speakers clearly prefer "no answer" and *negative reinforcement* over *genuine information* as responses to *wh-on-earth...modal* questions and there is a significant difference between "no answer" and *genuine information* and between *negative reinforcement* and *genuine information*, but no significant difference between "no answer" and *negative reinforcement* in their selection of answers to *wh-on-earth...modal* questions. These results suggest that the *wh-on-earth...modal* question in English has the [-information seeking] and [+negative rhetorical] features and that the *negative reinforcement* and "no answer" are taken as more appropriate responses than the *genuine information* to the *wh-on-earth...modal* question in English speakers' L1 grammar.

In contrast, the preference order of Chinese-speaking learners at early stages is just the opposite. Unlike the NS Group, who take the *genuine information* to be the least preferred option as a response to the *wh-on-earth...modal* question, the Pre-Int Group take the *genuine information* as the most preferred response to the *wh-on-earth...modal* question, and they do not seem to consider "no answer" or *negative*

*reinforcement* to be an appropriate response to the *wh-on-earth...modal* question. This is not unexpected because the *daodi...wh* question in their L1 Chinese requires answers with genuine information and cannot be responded to with negative reinforcement or silence. This indicates that the [+information seeking] feature is transferred to Chinese speakers' L2 English and that it is alive and active in their L2 English *wh-on-earth...modal* questions at early stages. However, as their English language proficiency improves, Chinese-speaking learners gradually find it more appropriate to select the *negative reinforcement* or "no answer" as a response to the *wh-on-earth...modal* question. By the time they reach an advanced or very advanced level, they, like the NS Group, accept the *negative reinforcement* and silence as appropriate responses to the *wh-on-earth...modal* question, as shown in the selection of answers by the AD and VAD Groups. Chinese-speaking learners of English at advanced and very advanced stages seem to have no preference between the genuine information answer, the negative reinforcement answer and "no answer" as there is no significant difference between these three categories of responses in the INT, AD and VAD Groups' selection of responses to the *wh-on-earth...modal* question in the discourse completion task, which suggest that the [+negative rhetorical] and [+information seeking] features are both attached to the *wh-on-earth...modal* question in advanced and very advanced Chinese-speaking learners' L2 English grammars. This can be accounted for on the basis of L1 transfer and availability of positive evidence in the English input. L1 transfer of the [+information seeking] feature attached to the Chinese *daodi...wh* question to the *wh-on-earth...modal* question in Chinese speakers' L2 English would enable them to answer the English *wh-on-earth...modal* question with genuine information, and there is no disconfirming evidence in their English input which can reset the discourse feature to [-information seeking]. However, this does not make the [+information seeking] feature dormant, because Chinese speakers are likely to take the *face value* of sentences like (24) as confirming evidence that English *wh-on-earth...modal* questions have the [+information seeking] feature, without realizing the disputing or refuting function of the answer to the question.<sup>32</sup> Obviously, there is positive evidence in their English input that the English *wh-on-earth...modal* has a [+negative rhetorical] feature, and

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<sup>32</sup> Of course, we cannot rule out the possibility that the Chinese-speaking learners at advanced or very advanced levels in the discourse completion task used genuine information to dispute or refute the negative rhetorical tone of the *wh-on-earth...modal* question, as native English speakers do.

this can be seen in the example sentences in (25), which are taken from the British National Corpus.

- (25) a. ‘Why on earth should I be frightened of you?’  
b. ‘How on earth can he be the son of God, because God didn't have a wife.’  
c. She told him: ‘Kenneth, how on earth can we make love if you keep coughing?’  
d. One said: ‘Who on earth would want Clouties with Irish whiskey?’  
e. ‘What on earth can have possessed me to take a job like this?’ she said to me.

The negative rhetorical tones in sentences like those in (25), the punctuation, i.e. the use of a full stop rather than a question mark, in (25b) and the use of “told” and “said” in (25c, d, e) provide learners with clear positive evidence and enable the [+negative rhetorical] feature to be attached to the *wh-on-earth...modal* question in their L2 English. This accounts for the fact that Chinese speakers at advanced and very advanced levels, like native English speakers, accept the negative reinforcement and silence as appropriate responses to the *wh-on-earth...modal* question.

- (26) Our classroom window was broken by someone last night, and the police know who (on earth) did it.

In the interpretation task, we used sentences like (26) to investigate whether Chinese-speaking learners who incorrectly accept *wh-on-earth* in the complement of veridical verbs would infelicitously allow *wh-on-earth* to be linked to a discourse entity, that is, whether *wh-on-earth* in their L2 English has a [+D-link] feature. The majority of native English speakers consistently reject sentences with *wh-on-earth* in the complement of a veridical verb. In contrast, Chinese speakers who accept incorrect sentences of this type allow the wh-phrase in *wh-on-earth* to be randomly linked to an entity in the discourse. None of these Chinese speakers is able to consistently recognize the impossibility of linking *wh-on-earth* to a discourse entity in the target language. This shows that the [+D-link] feature is transferred from their L1 Chinese *daodi..wh* to their L2 *wh-on-earth* and cannot be removed from their L2 English due



to the absence of disconfirming evidence in the input, and as a result, this discourse feature becomes dormant in the process of their L2 acquisition of English, leading to random linking of *wh-on-earth* to a discourse entity in Chinese speakers' L2 English. However, in spite of the random linking, Chinese speakers are sensitive to the distinction between linking the regular *wh*-phrase and linking the *wh-on-earth* to a discourse entity, even though they accept the former but judge the latter at random. We argue that this is due to the distinction between the active and dormant status of features in Chinese speaker's L2 English grammars, where the [+D-link] feature attached to the regular *wh*-phrase belongs to the former category, while the one attached to *wh-on-earth* the latter category.

Recall that in the FT/FA model (Schwartz and Sprouse, 1994, 1996), the FLT model (Sprouse, 2006) and the FR model (Lardiere, 2008, 2009), it is hypothesized that the L1 grammar in its entirety, including L1 lexical features, is transferred to the initial state of the L2 grammar. All the three models recognize the importance of the availability of positive evidence in the target language input for any necessary revision and modification in the L2 lexicon or feature reconfiguration. However, none of these models makes any explicit prediction about features which are transferred from the L1 to the L2 but are neither confirmed nor disconfirmed by any target language input. What happens to this type of features? The data in our study have shown that features of this type are not lost in the L2 lexicons, but gradually lose their vigour and vitality and become dormant because of the absence of either confirming or disconfirming evidence in the input.

Based on Lardiere's (2008, 2009) FR hypothesis, one of the most pervasive challenges for L2 learners is to reassemble features selected by the L1 into a new cluster of features required by the TL. This involves disassociating relevant features from L1 lexical items and reassembling them into new configurations in order to acquire the TL. To illustrate her argument, Lardiere uses the Chinese plural marker – *men* as an example, which has a [+definite] feature (as well as [+plural] and [+human] features). Given that “learners use L1 feature configurations as a departure point for what to look for in the L2” (Lardiere, 2009, p. 219), it is assumed that a task for Chinese-speaking learners of English is to disassociate the [+definite] feature from the L1 Chinese transfer and reassemble it to the configuration of the English definite

article *the*. This scenario suggests that the reassembly is closely related to the disassociation. A question that may arise here is whether Chinese speakers are able to assemble features for the English definite article *the*, irrespective of any successful or unsuccessful disassociation of the [+definite] feature from the L1 Chinese transfer. The findings of our study reported in this article indicate that it is certainly possible. For example, as in the native English grammar, Chinese speakers are able to assemble the [-information seeking] and [+negative rhetorical] features onto their L2 English *wh-on-earth...modal* questions, in spite of the fact that the [+information seeking] feature, transferred from their L1 Chinese, is still attached to their L2 English *wh-on-earth...modal* questions. The implication of this finding is that the assembly of features for L2 lexical items does not always necessarily depend upon the disassociation of a relevant feature from the L1 transfer.<sup>33</sup>

The analysis of dormant features proposed in this article is also supported by findings in Yuan's (2013) study of English speakers' L2 acquisition of Chinese *daodi...wh* questions. Recall that in English, the *wh*-question with *wh-on-earth* cannot be interpreted as a genuine information question when used with a modal verb and that it can only be felicitously interpreted as a negative rhetorical question. However, Chinese *daodi...wh...modal* questions cannot be interpreted as negative rhetorical questions and can be naturally answered by providing genuine information. In Yuan's study, English speakers were found to readily interpret Chinese *daodi...wh...modal* questions as genuine information questions as they were as frequent as native Chinese speakers in providing answers of genuine information to this type of question. This suggests that the [+information seeking] feature is correctly assembled to English speakers' L2 Chinese *daodi...wh...modal* questions. However, this does not result in removing the [+negative rhetorical] feature from English speakers' L2 Chinese *daodi...wh...modal* questions; English speakers were found to optionally interpret the Chinese questions as negative rhetorical questions, and this optional interpretation exists even at very advanced levels of L2 Chinese. This finding suggests that in spite of the native-like assembly of the [+information seeking] feature to English speakers'

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<sup>33</sup> Further supporting evidence can be seen from studies by White (2008a,b), in which she finds that although Chinese does not have articles, Chinese speakers are able to successfully assemble the [+definite] features onto the English definite article *the* at quite early stages. White did not examine the relationship between the disassociation and the reassembly in her study, but there does not seem to be any reason to assume that this successful assembly depends upon the disassociation of the [+definite] feature from the L1 transfer of the Chinese plural marker *-men*.

L2 Chinese *daodi...wh...modal* questions, the [+negative rhetorical] feature is not removed but remains attached as a dormant feature. Learners are exposed to the Chinese discourse where *daodi...wh...modal* questions are answered with genuine information, which can provide them with clear evidence that this type of questions can be genuine information questions in the target language Chinese. However, there is no positive evidence in the input data that this type of questions CANNOT be answered with a negative rhetorical answer. In other words, nothing in the input can confirm or disconfirm the L1-based [+negative rhetorical] feature attached to English speakers' L2 Chinese *daodi...wh...modal* questions, which leads to a dormant state of the feature.

## VII Conclusion

The findings in our empirical study support the decompositional approach to items in the lexicon (cf. Pustejovsky, 1995, 1998; Jackendoff, 2002a,b). Our data have shown that the written or phonetic form of *wh-on-earth* is acquired separately from its other features in Chinese speakers' L2 English, and this is in line with the proposal for the separation of syntactic-semantic components from the phonological components in L2 studies (cf. Hawkins, 2009; Juffs, 2009; White, 2009). In Chinese speakers' L2 English, the form of *wh-on-earth* can be learned and stored in a native-like manner, but without being endowed with fully elaborated features.<sup>34</sup>

Our data suggest that there is a distinction between active features and dormant features in L2 lexicon,<sup>35</sup> and that the TL form can be acquired and stored with some features attached active and some dormant. Features transferred from learners' L1 to their L2 are likely to lose their vigour and vitality in their L2 lexicon and become dormant if there is no evidence in the TL input to confirm or disconfirm them. A typical consequence of a dormant feature is random behaviours of a related structure

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<sup>34</sup> It is reported in Mai and Yuan (2014) that feature reassembly in L2 acquisition can take place in a rather uneven feature-by-feature manner.

<sup>35</sup> An anonymous *SLR* reviewer raised an issue of the difference between dormant and active features in bilinguals and asked whether this is what an early bilingual has too. We don't claim that dormant features only occur in adult L2 acquisition, and there is no reason to believe that there are no dormant features in bilinguals. However, we would like to leave this for future research.

in L2 learners' production and interpretation. The dormant status of a feature can result from long-term absence of either confirming or disconfirming evidence in the TL input, or lack of robustness or salience of the relevant positive evidence, or shortage of sophistication in learners' L2 grammars to detect the feature. In the latter two cases, the dormant status can be just temporary because the feature can be acquired or reassembled when it becomes noticed or when the L2 grammars become sophisticated enough to perceive it. However, in the former case, the dormant status is likely to be permanent and become "fossilized".<sup>36</sup> Semantic features, discourse features as well as morphosyntactic features can all become dormant in L2 lexicon, as is the case with the [V<sub>veri</sub>], [+D-link] [wh<sub>prop</sub>] features in Chinese speakers' L2 English *wh-on-earth* questions.

### **Acknowledgements**

I am very grateful to all the people who participated as subjects in the empirical study. Without their kind help and support, this project would have been very difficult, if not impossible. I would also like to thank the three anonymous *Second Language Research* reviewers for their valuable feedback and many insightful comments. In addition, I acknowledge the assistance that the National Research Centre for Foreign Language Education of Beijing Foreign Studies University gave to me as its Overseas Research Fellow.

### **References:**

- Adger D and Quer J (2001) The syntax and semantics of unselected embedded questions. *Language* 77:107-134.
- Baker C L (1970) Notes on the description of English questions: The role of an abstract question morpheme. *Foundations of Language* 7:197-238.
- Berman S (1991) On the Semantics and Logical Form of Wh-clauses. Unpublished doctoral dissertation, Amherst, MA: University of Massachusetts.
- Bresnan J (1972) Theory of complementation in English syntax. Doctoral dissertation, MIT, Cambridge, Mass.

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<sup>36</sup> This is a term first used by Selinker (1972) to refer to a phenomenon where a certain part of the L2 ceases to develop in spite of being short of native-like attainment.

- Cheng L L-S (1991) On the Typology of Wh-questions. Doctoral dissertation, MIT, Cambridge, Mass.
- Chomsky N (1981) *Lectures on Government and Binding*. Dordrecht: Foris.
- Chomsky N (1993) A minimalist program for linguistic theory. In Hale K and Keyser S J (eds) *The View from Building 20: Essays in linguistics in honor of Sylvain Bromberger*. Cambridge MA: MIT Press, 1-52.
- Chomsky N (1995) *The Minimalist Program*. Cambridge MA: MIT Press.
- Chou C-T (2012) Syntax-pragmatics interface: Mandarin Chinese wh-the-hell and point-of-view operator. *Syntax* 15: 1-24.
- Dikken M den and Giannakidou A (2002) From *Hell* to Polarity: “Aggressively Non-D-Linked” Wh-Phrase as Polarity Items. *Linguistic Inquiry* 22: 31-61.
- Giannakidou A (1999) Affective Dependencies. *Linguistics and Philosophy* 22: 367-421.
- Groenendijk J and Stokhof, M (1982) Semantic analysis of wh-complements. *Linguistics and Philosophy* 5:175-233.
- Hawkins R (2009) Second language acquisition of morphosyntax. In Ritchie W C and Bhatia T K (eds) *The New Handbook of Second Language Acquisition*. Bingley: Emerald Group Publishing Ltd., 211-236.
- Hawkins R and Hattori H H (2006) Interpretation of English multiple wh-questions by Japanese speakers: a missing uninterpretable feature account. *Second Language Research* 22: 269-301
- Huang C-T J (2010) *Between Syntax and Semantics*. New York: Routledge.
- Huang C-T J and Ochi M (2004) Syntax of the hell: Two types of Dependencies. *Proceedings of the 34<sup>th</sup> Conference of the North Eastern Linguistic Society*.
- Jackendoff R S (2002a) What’s in the Lexicon? In Nooteboom S, Weerman F and Wijnen F (eds) *Storage and Computation in the Language Faculty*. Dordrecht: Kluwer, 23-58.
- Jackendoff R S (2002b) *Foundations of Language*. New York: Oxford University Press.
- Juffs A (2009) Second language acquisition of the lexicon. In Ritchie W C and Bhatia T K (eds) *The New Handbook of Second Language Acquisition*. Bingley: Emerald Group Publishing Ltd., 181-204.
- Katz J and Postal P (1964) *An integrated theory of linguistics descriptions*. Cambridge, Mass: MIT Press.

- Lahiri U (1991) Embedded interrogatives and predicates that embed them. Unpublished doctoral dissertation, MIT, Cambridge, MA.
- Lardiere D (2008) Feature assembly in second language acquisition. In Liceras J M, Zobl H and Goodluck H (eds) *The Role of Formal Features in Second Language Acquisition*. Mahwah, NJ: Lawrence Erlbaum Association, 106-140.
- Lardiere D (2009) Some thoughts on the contrastive analysis of features in second language acquisition. *Second Language Research* 25: 173-227.
- Lü S-X (1981) *Xiandai Hanyu Babai Ci* [Eight Hundred Words in Modern Chinese]. Beijing: Commercial Press.
- Mai, Z and Yuan, B (2014) Uneven reassembly of tense, telicity and discourse features in L2 acquisition of the Chinese *shì...de* cleft construction by adult English speakers. Ms., Chinese University of Hong Kong, Hong Kong.
- Pesetsky D (1987) Wh-in-situ: Movement and unselective binding. In Reuland E J and Meulen A G B (eds) *The Representation of (In)definiteness*. Cambridge, Mass: MIT Press, 98-130.
- Progovac L (1994) *Positive and negative polarity: A binding approach*. Cambridge: Cambridge University Press.
- Pustejovsky J (1995) *The Generative Lexicon*. Cambridge, MA: MIT press.
- Pustejovsky J (1998) Generativity and explanation in semantics: A reply to Fodor and Lepore. *Linguistic Inquiry* 29: 289-311.
- Schwartz B and Sprouse R A (1994) Word order and nominative case in non-native language acquisition: A longitudinal study of (L1 Turkish) German interlanguage. In Hoekstra T and Schwartz B D (eds) *Language Acquisition Studies in Generative Grammar: Papers in Honor of Kenneth Wexler from the 1991 GLOW Workshops*. Philadelphia: John Benjamins, 317-368.
- Schwartz B and Sprouse R A (1996) L2 cognitive states and the full transfer/full access model. *Second Language Research* 12:40-72.
- Selinker L (1972) Interlanguage. *International Review of Applied Linguistics* 10: 209-231.
- Sprouse R A (2006) Full transfer and relexification: second language acquisition and creole genesis. In Lefebvre C, White L, and Jourdan C (eds) *L2 Acquisition and Creole Genesis: Dialogues*, Amsterdam: John Benjamins, 169-181.

- Tsimpli I M and Dimitrakopoulou M (2007) The Interpretability Hypothesis: evidence from wh-interrogatives in second language acquisition. *Second Language Research* 23: 215-242.
- White L (2008a) Different? Yes. Fundamentally? No. Definiteness effects in the L2 English of Mandarin speakers. In Slabakova R, Rothman J, Kempchinsky P, and Gavruseva E (eds) *Proceedings of the 9<sup>th</sup> Generative Approaches to Second Language Acquisition Conference (GASLA 2007)*. Somerville, MA: Cascadilla Proceedings Project, 251-61.
- White L (2008b) Definiteness effects in the L2 English of Mandarin and Turkish speakers. In Chan H, Jacob H, and Kapia E (eds) *Proceedings of the 32<sup>nd</sup> Annual Boston University Conference on Language Development*. Somerville, MA: Cascadilla Press, 550-61
- White L (2009) Grammatical theory: Interfaces and L2 knowledge. In Ritchie W C and Bhatia T K (eds) *The New Handbook of Second Language Acquisition*. Bingley: Emerald Group Publishing Ltd., 49-68.
- Yuan B (2007a) Superficial native-likeness and fossilization in Japanese speakers' L2 Chinese wh-questions: a lexical morphological feature defect account. *Second Language Research* 23: 329-357.
- Yuan B (2007b) Behaviours of wh-words in English speakers' L2 Chinese wh-questions: Evidence of no variability, temporary variability and persistent variability in L2 grammars'. *Bilingualism: Language and Cognition* 10: 277-298.
- Yuan B (2010). Domain-wide or variable-dependent vulnerability of the semantics-syntax interface in L2 acquisition? Evidence from wh-words used as existential polarity words in L2 Chinese grammars. *Second Language Research* 26: 219-260.
- Yuan B (2013) Is Chinese “daodi” “the hell” in English speakers' L2 acquisition of Chinese daodi... wh... questions? -- Effects and recoverability of L1 transfer at L2 interfaces. *International Journal of Bilingualism* 17: 403-430.
- Zwarts (1998) Three types of Polarity. In Hamn F and Hinrichs E (eds) *Plurality and Quantification*, Dordrecht: Kluwer, 177-238.

### **Dictionaries consulted**

*A Chinese-English Dictionary* (1997) Beijing, China: Foreign Language Teaching and Research Press.

*Concise English-Chinese Chinese-English Dictionary* (1992) Beijing, China:  
Commercial Press and Oxford University Press.

*Oxford Chinese Beginner's Dictionary* (2001) Oxford, UK: Oxford University Press.