MANDARIN DISCOURSE ADVERBS AS PRESUPPOSITION TRIGGERS

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漢語副詞類話語標記的語義預設研究

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Abstract

In cooperative human communication, the speaker needs to mark the relationship between his utterance and the given information, because the hearer interprets the utterance with respect to the information she has already got. Languages adopt various devices to mark the relationship between the utterance and the context, and this dissertation is concerned with two of them, i.e., Mandarin adverbs *dique* 'indeed' and *zhende* 'really'. These two adverbs do not contribute to the truth-conditional meaning of an utterance, but rather convey information about how utterances containing them are connected to the previous discourse, hence belong to the group of discourse markers. This dissertation explores the semantic contribution of discourse markers through a detailed study of *dique* and *zhende*.

On the basis of empirical data and a naturalness rating experiment, I show that *dique* and *zhende* impose different restrictions on the previous discourse of a sentence, hence they are analyzed as presupposition triggers. *Dique* presupposes that its prejacent is old information, while *zhende* presupposes that its prejacent is old information and it is challenged by some discourse participant. This difference in presuppositional content explains the distinct behaviors of *dique* and *zhende*. I also provide a syntactic analysis of the discourse adverbs that corresponds to the semantic account.

The interaction between *dique*/*zhende* and interrogative clauses reveals some interesting semantic properties of questions. VP-initial *dique*/*zhende* can occur in *ma* questions. These adverbs presuppose that a possible answer has been suggested, while the question indicates that the speaker is still seeking an answer. Thus, *ma* questions are modified by the adverbs so that the modified questions express the speaker's bias towards the suggested answer. Unlike *ma* questions, the other three kinds of questions,

i.e., A-not-A questions, alternative questions and *wh*-questions, cannot co-occur with VP-initial *dique/zhende*. This distributional difference suggests that these three kinds of questions have distinct semantics from *ma* questions. I show how the syntactic and prosodic features of the three kinds of questions derive an assertion of ignorance, which requires a neutral context. The neutrality requirement contradicts the presuppositions triggered by VP-initial adverbs, resulting in the incompatibility between these questions and VP-initial adverbs.

This dissertation shows how discourse adverbs mark various relationships between the utterance and the previous discourse, and demonstrates how discourse adverbs modify assertions and questions by contributing to presuppositional contents.

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Chapter 1

Background and overview

1.1 General introduction

In daily language use, most utterances we make are not isolated from their preceding and following utterances. Utterances are always connected with each other to form a longer unit of language, i.e., discourse. In order to make the discourse coherent and easy to understand, we use a class of lexical expressions to connect individual utterances and 'glue' them together. These expressions are often referred to as discourse markers.[1] Discourse markers are a syntactically heterogeneous group of words, consisting of expressions from different syntactic categories such as conjunction, prepositional phrase, adverb, etc. They are not classified syntactically but rather in terms of semantic and pragmatic functions. Generally, discourse markers do not contribute to the propositional content of the utterance. Instead, they convey information about how

[1] A variety of terms are used to refer to this class of expressions, including discourse marker (Schiffrin, 1987), pragmatic marker (Fraser, 1996; Brinton, 1996), discourse particle (Schourup, 1985), connective (Blakemore, 1987), etc. The term discourse marker and discourse particle are both frequently used. I did not adopt the term discourse particle, since the adverbs I study in this dissertation (i.e., *dique* and *zhende*) are polysyllabic and contain significant phonetic content, and thus do not fit the label 'particle'.

the utterance that contains them is related to some prior portion of discourse (Schiffrin, 1987; Fraser, 1990; Blakemore, 2002). For example, the markers *uhuh* and *right* in (1) indicate that B's utterance is an acceptance of the previous utterance made by A.

(1) A: Mary has left.
B: *Uhuh*/*Right*, she has left.

The marker *well* in (2) indicates that the current utterance *Well, I am tired.* slightly changes the topic of the earlier utterances (Zimmermann, 2011).

(2) A: What a funny game!
B: Let's go on all night long!
C: *Well*, I am tired. (Zimmermann 2011: 2015)

In (3), the word *so* signals that the utterance in which it occurs is a conclusion to the previous utterances.

(3) Context: the teacher has been talking about the nineteenth century literature for two hours.
Teacher: *So*, that's all for today.

All the discourse markers shown in the above examples can be deleted with no change in the propositional content of the utterance that contains them. The function of these markers is to provide the addressee with the information on how to interpret the current utterance with respect to the interpretation of the prior discourse.

During the last thirty years, the study of discourse markers has occupied a large space in the literature, and a variety of proposals and approaches have been developed on this subject. Studies on Mandarin discourse markers have also been growing rapidly. Nonetheless, the majority of these Mandarin studies are carried out from a discourse analysis or a cognitive-pragmatic point of view.[2] Few semantic accounts have been provided for Mandarin discourse markers, let alone formal semantic accounts. In this dissertation, I explore the semantic contribution of discourse markers by concentrating on two adverbs in Mandarin Chinese, i.e., *dique* 'indeed' and *zhende* 'really'. Typical examples of assertions containing *dique* or *zhende* are given below.

(4) *Dique*, Li chuguo le.
indeed Li go-abroad PERF
'Indeed, Li went abroad.'

(5) *Zhende*, Li chuguo le.
really Li go-abroad PERF
'Really, Li went abroad.'

Dique and *zhende* exhibit the same semantic/pragmatic property as discourse markers. These two adverbs do not contribute to the propositional content of an utterance. (4), (5) and (6) have the same propositional content and the same truth conditions. (6) is true if and only if Li went abroad, so are (4) and (5).

(6) Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

[2]Studies adopting a discourse analysis approach include Fang (2000), Li (2003) and Yu (2006). Studies from the cognitive-pragmatic perspective are generally based on the Relevance Theory (Wilson & Sperber, 2002), including He & Ran (1999), Mo (2004), etc. See a complete review on studies of Mandarin discourse markers in Shi (2006).

Dique and *zhende* do not contribute to the propositional content, but rather convey information about the how the utterance containing these two adverbs is related to the prior discourse. As a first approximation, *dique* in (4) suggests that this utterance is an agreement with the previous utterance. As in (7), B uses *dique* to show his agreement with A's utterance.

(7) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

B: *Dique*, ta chuguo le.
Indeed he go-abroad PERF
'Indeed, he went abroad.'

Zhende works differently. (5) suggests that the speaker is trying to convince the addressee of p 'Li went abroad', that is, the addressee does not quite believe in p in the previous discourse. For example, in (8), by using *zhende*, the speaker C shows C's disagreement with B's utterance and C's agreement with A's utterance.

(8) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

B: Bu keneng!
no possible
'Impossible!'

C: *Zhende*, ta chuguo le.
really he go-abroad PERF
'Really, he went abroad.'

Deleting the two adverbs in (7) and (8) does not change the propositional content of the utterances in which they occur. However, without *dique* and *zhende*, the utterances

become isolated from the prior discourse, and it sounds like B in (7) and C in (8) are speaking to themselves rather than responding to the former utterances. Like *uhuh*, *right*, *well*, and *so*, *dique* and *zhende* reveal information about the relationship between the current utterance and the prior discourse.

In the next two sections, I will go through past studies on *dique* and *zhende* and then introduce the theoretical background of this dissertation.

1.2 Previous studies on *dique* and *zhende*

This section briefly reviews past studies on *dique* and *zhende*. These studies reveal some semantic similarities between *dique* and *zhende*, but they do not adequately account for the distinctions between these two adverbs. I also look into Romero & Han's (2004) study on the English word *really* and some studies on German stressed particle DOCH. These analyses are not adopted in the study of Mandarin *zhende*, since they do not make correct prediction about the behaviors of *zhende*.

It is generally recognized that *dique* and *zhende* are associated with affirmation and the speaker's certainty. Lü (1980: 168) defines *dique* as indicating that 'the addressed event is completely true, showing that the speaker is very affirmative'. Qi (2002: 226) also claims that *dique* indicates the speaker's affirmation. For example, (9) indicates that the speaker is affirmative that 'It rained last night' is true.

(9) *Dique*, zuowan xiayu le.
indeed last-night rain PERF
'Indeed, it rained last night.'

Similarly, *zhende* is claimed to express the speaker's certainty (Jiang, 2000: 270). For

example, (10) shows that the speaker is certain that 'It rained last night' is true.

(10) *Zhende*, zuowan xiayu le.
really last-night rain PERF
'Really, it rained last night.'

The only study that touches upon both *dique* and *zhende* is Xu (2009). Xu (2009) claims that *dique* and *zhende* both function as a confirmation of old information. Since these two adverbs have the same function in Xu's (2009) analysis, they are predicted to occur in the same kind of context. This turns out to be a wrong prediction. For example, in (11), since A has asserted p 'It rained last night', p is old information to B. Xu (2009) would predict that B could use either *dique* or *zhende* to confirm this old information. However, it is infelicitous for B to use *zhende* to confirm p, indicating that there must be some differences between *dique* and *zhende*. None of the previous analyses have explained these differences so far.

(11) A: Zuowan xiayu le.
last-night rain PERF
'It rained last night.'

(B heard the sound of raining last night and he knows that it rained.)

B: *Dique*/#*Zhende* xiayu le.
indeed/really rain PERF
'It indeed rained.'/'It really rained.'

In order to find the answer to this puzzle, I also look into studies on similar words to *dique*/*zhende* in other languages. The meaning of *zhende* is similar to that of English *really*. Romero & Han (2004) argue that *really* has the meaning identical to the semantic operator VERUM. The VERUM operator is an abstract operator manifested as the VERUM focus, which is a contrastive focus on the verb or the complementizer. For example, in

(12-a), the speaker uses focal stress on the verb *did* to emphasize that the proposition 'It rained' is true. This focus signals the presence of the VERUM operator. Romero & Han (2004) claim that both *really*(p) and VERUM(p) are used to assert that the speaker is certain that p should be added to the Common Ground (Stalnaker, 1978, see Section 1.3.1). For example, both (12-a) and (12-b) indicate that the speaker has a high level of certainty that 'It rained last night' should be a common belief shared by every discourse participant.

(12) a. It DID rain.

b. It really rained.

Several problems arise from this view of *really* as VERUM operator. First, it is not clear what *really* and VERUM operator do in cases where both of them appear, as in (13).

(13) It really DID rain.

Second, this analysis cannot explain the difference between the VERUM operator and *really* as shown in (14). It is felicitous to respond to A's assertion with the VERUM operator but not with *really*.

(14) A: It rained last night.

B: It DID rain./ #It really rained.

Romero & Han's (2004) analysis of *really* is not adopted in the study of Mandarin *zhende*, because this analysis cannot explain why *zhende* is infelicitous in (11). Suppose *zhende* has the same semantics as *really*, both indicating the speaker's certainty that p should be a common belief. In (11), A is committed to p 'It rained last night', and A's

assertion can be understood as inviting B to accept p as a common belief. Thus, it would be appropriate for B to use *zhende* to show his acceptance of p as a common belief. It is not clear why the use of *zhende* by B turns out to be infelicitous.

Another discourse marker that is similar to Mandarin *zhende* is the German stressed particle DOCH.[3] The stressed DOCH is claimed to be a correction marker that triggers a correction presupposition (Zeevat, 2003; Karagjosova, 2006; Grosz, 2014, among others). An assertion containing the particle DOCH, represented as DOCH(p), presupposes that ¬p has been asserted. For example, in (15), the proposition ¬p 'Karl was not at my party' is asserted by A. The presupposition triggered by DOCH is satisfied and thus the use of DOCH is felicitous. By using DOCH, B is correcting the old information ¬p. In other words, B refuses to accept ¬p as a common belief and proposes to add p into the Common Ground.

(15) A: Karl war nicht auf meiner Party.
'Karl was not at my party.'
B: DOCH. (= Karl war auf deiner Party.)
'He was.'

(Karagjosova, 2006)

The adverb *zhende* is similar to DOCH in that *zhende* is often used in corrections. As shown in (16), by using *zhende*, A rejects B's statement that Li didn't go abroad and asserts that, on the contrary, he went abroad. A is correcting B's statement.

(16) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

[3]Following the previous work, the small capitals indicate stress.

B: Ta meiyou.
he not
'He didn't.'

A: Ta *zhende* chuguo le.
he really go-abroad PERF
'He really went abroad.'

Like DOCH(p), *zhende*(p) requires that ¬p has been asserted in the previous discourse. When this requirement is not met, as in (17), where ¬p has not been asserted, the use of *zhende* is unacceptable.

(17) B: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

A: #Ta *zhende* chuguo le.
he really go-abroad PERF
'He really went abroad.'

Both *zhende* and DOCH require that the negation of their prejacents is old information. However, *zhende* seems to have other requirements. For example, in (18), although ¬p has been asserted by B, A's use of *zhende* is still unacceptable.[4] In this context, the speaker A will use a bare assertion without *zhende* to respond to B.

(18) B: Li mei chuguo.
Li not go-abroad
'Li didn't went abroad.'

A: #Ta *zhende* chuguo le.
he really go-abroad PERF
'He really went abroad.'

[4]As we will see in Chapter 2, this is because *zhende* has an additional requirement that its prejacent is old information, and this requirement is not shared by German stressed DOCH. This requirement is not satisfied in (18), and thus the use of *zhende* is not licensed.

As can be seen, Mandarin adverb *zhende* exhibits some semantic properties that are not shared by German stressed DOCH. The previous analysis of German DOCH is enlightening but will not be adopted directly in the study of Mandarin *zhende*.

To summarize, previous studies on *dique*/*zhende* and Romero & Han's (2004) study of English *really* provide no satisfactory answer for the distinction between *dique* and *zhende*. Previous studies on German stressed DOCH cannot fully account for the behaviors of Mandarin *zhende*. A new semantic account is needed to explain the distinct properties of Mandarin *dique* and *zhende*. This is what I attempt to provide in this dissertation.

1.3 Theoretical background

Section 1.3.1 introduces the theory of dynamic semantics, which has been widely adopted in the studies of discourse items. The dynamic semantics framework lays the foundation for the formal analysis presented in this dissertation. Section 1.3.2 discusses the concept of sentential forces. The view that sentential forces have syntactic representation is adopted throughout this dissertation.

1.3.1 Dynamic semantics

As pointed out in Section 1.1, one core property of discourse markers is that they do not contribute to the truth conditions of an utterance. Therefore, discourse markers present a problem for traditional truth-conditional semantics, in which meanings are characterized in terms of truth conditions. The dynamic approaches towards meaning, which include discourse representation theory (Kamp, 1981), file change semantics (Heim, 1982), and dynamic semantics (Groenendijk & Stokhof, 1991; Chierchia, 1995),

are more promising in dealing with the semantics of discourse markers. In this section, I will briefly review the dynamic semantics framework proposed by Stalnaker (1978) and elaborated by Heim (1982), Gunlogson (2003), Roberts (1996) and Farkas & Bruce (2010). This framework lays the foundation for the formal analysis presented in this dissertation.

1.3.1.1 Stalnaker (1978)

In the paper 'Assertion' (1978), Stalnaker discusses in depth the interaction between content and context and how assertions act on the context in which they are made.

Stalnaker (1978) proposes the following four truisms about an act of assertion:

(19) Four Truisms about an assertion:

a. An assertion expresses a proposition; the proposition is the content of the assertion;

b. An assertion is made within a context;

c. The content of the assertion is dependent on the context in which the assertion is made;

d. Acts of assertion will affect the context (especially the attitudes of the discourse participants) in a way that is dependent on its content.

(Modified from Stalnaker, 1978)

(19-c) says that the interpretation of an assertion depends on the context, which has been generally acknowledged in traditional semantics. (19-d) presents a new point of view that has not been claimed before: The interpretation of an assertion not only depends on the context, but also changes and creates a context.

Then, in what way does an assertion affect the context? Stalnaker (1978) builds a possible-world model and introduces the concept of 'the Common Ground'. In his model, a proposition is construed as (a characteristic function of) a set of worlds, the worlds of which the proposition is true. The Common Ground (hereafter, the CG) represents all the mutual beliefs of the discourse participants in the discourse, and it is characterized as a set of possible worlds, the context set.

In Stalnaker's (1978) model, an assertion uttered by any discourse participant acts as a proposal to change the CG of the speaker and his audience. An update of the CG with the content of an assertion is performed by taking the intersection of the context set and the set of worlds representing the content of the assertion. For example, at the beginning of a conversation, A said to B, *John arrived*. The context set is the set of worlds that are compatible with common background knowledge shared by all the discourse participants (i.e., A and B) before A's utterance, noted as P_0. The proposition expressed by the assertion *John arrived* is interpreted as the set of worlds Q_0, $Q_0 = \lambda w.\ arrived_w(John)$. The update of the CG is then represented as taking the intersection of P_0 and Q_0: $P_1 = P_0 \cap Q_0 = \lambda w.P_0\ (w)$ & $arrived_w(John)$. The context set is updated and its output value is the set P_1. In P_1, the worlds in which John did not arrive are deleted from the original context set. P_1 only contains the worlds in which John arrived.

Stalnaker's (1978) claim that acts of assertion affect the context has led to the founding of dynamic semantics. Stalnaker (1978) interprets an assertion as adding the content of the assertion to what is presupposed in the context, which has laid the foundation for the later studies on context change potential.

1.3.1.2 Heim (1982)

On the basis of Stalnaker's (1978) view of context and assertion, Heim (1982) explores how utterances changes the context and builds a framework of file change semantics.

Heim (1982) identifies the meaning of an utterance with its 'file change potential'. A sentence is evaluated with respect to a file, and can cause changes to the file. For example, A and B are carrying out a conversation. A is speaking and B is listening to A. While interpreting A's utterances, B is in fact constructing and updating a file. Suppose A has made the following four utterances:

(20) a. A woman was bitten by a dog.
b. She hit him with a paddle.
c. It broke in half.
d. The dog ran away. (Heim 1982: 275)

Before A's utterances, B's file is empty. After A utters (20-a), B takes out two new cards: card 1 and card 2. B writes 'is a woman' and 'was bitten by 2' on card 1, and writes 'is a dog' and 'bit 1' on card 2, as depicted in (21-a). Now, B's file contains these two cards. After A utters (20-b), B takes out a new card, i.e., card 3, and writes on it 'is a paddle' and 'was used by 1 to hit 2'. What is more, B updates card 1 and card 2 by adding on card 1 'hit 2 with 3' and adding on card 2 'was hit by 1 with 3', as in (21-b). After A utters (20-c), B adds on card 3 'broke in half', as in (21-c). After the utterance of (20-d), B adds on card 2 'ran away', as in (21-d). The parts in bold type are where the file changes and gets updated, whereas others are where the file stays the same.

(21) B's file: empty

⇓ (20-a)

a. B's file:

card 1 — 'is a woman'; 'was bitten by 2'

card 2 — 'is a dog'; 'bit 1'

⇓ (20-b)

b. B's file:

card 1 — 'is a woman'; 'was bitten by 2', **'hit 2 with 3'**

card 2 — 'is a dog'; 'bit 1', **'was hit by 1 with 3'**

card 3 — 'is a paddle'; 'was used by 1 to hit 2'

⇓ (20-c)

c. B's file:

card 1 — 'is a woman'; 'was bitten by 2', 'hit 2 with 3'

card 2 — 'is a dog'; 'bit 1', 'was hit by 1 with 3'

card 3 — 'is a paddle'; 'was used by 1 to hit 2'; **'broke in half'**

⇓ (20-d)

d. B's file:

card 1 — 'is a woman'; 'was bitten by 2', 'hit 2 with 3'

card 2 — 'is a dog'; 'bit 1', 'was hit by 1 with 3'; **'ran away'**

card 3 — 'is a paddle'; 'was used by 1 to hit 2'; 'broke in half'

Then, how does such a file relate to truth? Heim (1982) proposes that a file is true if one can find a sequence of individuals that satisfies it. A sequence satisfies a file if the first individual in the sequence fits the description on card 1 in the file, the second individual fits the description in card 2 in the file, and so on. After A's utterance of (20-a), B has constructed a file F which contains card 1 and card 2. Suppose there is a sequence $\mathrm{a_N}$ whose first member $\mathrm{a_1}$ is a woman, whose second member $\mathrm{a_2}$ is a dog, and $\mathrm{a_2}$ bit $\mathrm{a_1}$. Then, $\mathrm{a_N}$ satisfies F. If the first member of the sequence is not a woman, or the second member is not a dog, or the second member did not bite the first member, the sequence does not satisfy F.

Now, the conversation between A and B can be divided into five stages and each stage is associated with a different file (here 'file' refers to 'momentary state of a file'). Before A utters anything, the file is $\mathrm{F_0}$. After A utters (20-a), it is $\mathrm{F_1}$, and so on.

(22) $\mathrm{F_0}$: $\mathrm{A_N}$ (i.e., the set of all sequences whatsoever)

$\mathrm{F_1}$: $\{\mathrm{a_N}$: $\mathrm{a_1}$ is a woman, $\mathrm{a_2}$ is a dog, and $\mathrm{a_2}$ bit $\mathrm{a_1}\}$

$\mathrm{F_2}$: $\{\mathrm{a_N}$: $\mathrm{a_1}$ is a woman, $\mathrm{a_2}$ is a dog, $\mathrm{a_3}$ is a paddle, $\mathrm{a_2}$ bit $\mathrm{a_1}$, $\mathrm{a_1}$ hit $\mathrm{a_2}$ with $\mathrm{a_3}\}$

etc.

(Heim 1982: 278)

The set on the right of the file is the 'satisfaction set' of the file, written as Sat($\mathrm{F_1}$), Sat($\mathrm{F_2}$), etc. The satisfaction set for a file F is the set of all sequences that satisfy the formulae in F. For example, the satisfaction condition for (20-b) is defined as follows:

(23) $\mathrm{a_N}$ satisfies sentence (20-b) iff $\mathrm{a_3}$ is a paddle and $\mathrm{a_1}$ hit $\mathrm{a_2}$ with $\mathrm{a_3}$.

Then, the change from $\mathrm{F_1}$ to $\mathrm{F_2}$ can be described as:

(24) $\text{Sat}(\text{F}_2) = \text{Sat}(\text{F}_1) \cap \{\text{a}_\text{N}\text{: a}_\text{N}$ satisfies sentence (20-b)$\}$

The satisfaction condition of an utterance can be generalized as the following principle:

(25) If sentence S is uttered under the reading represented by logical form ϕ, and F is the file that obtains at that stage of the conversation at which the utterance occurs, and F′ is the file that obtains after that utterance, then the following relation holds between F and F′: $\text{Sat}(\text{F}') = \text{Sat}(\text{F}) \cap \{\text{a}_\text{N}\text{: a}_\text{N}$ satisfies $\phi\}$

(Heim 1982: 280)

The file change potential of a logical form ϕ is a function from every file F to the result file F′, and 'F + ϕ = F′' indicates that the file change potential of ϕ takes in an input argument F and returns an output value F′.

In summary, Heim (1982) puts Stalnaker's (1978) idea of context change into practice by interpreting the meaning of a sentence in terms of its file change potential, a function which maps input contexts into updated contexts. Kamp's (1981) work has much in common with Heim's (1982), both contributing to the dynamic semantic approach.

1.3.1.3 Gunlogson (2003)

Gunlogson (2003) follows Heim (1982) and Kamp (1981) in treating the meaning of a sentence in terms of its context change potential (hereafter, CCP).

In Gunlogson's (2003) model, each discourse participant is associated with a set of propositions that can be taken as their public beliefs (PB). The public belief is defined in (26).

(26) Let $\mathrm{PB_A}$ and $\mathrm{PB_B}$ be sets of propositions representing the public beliefs of A and B, respectively, with respect to a discourse in which A and B are the participants, where:

a. p is a public belief of A iff 'A believes p' is a mutual belief of A and B

b. p is a public belief of B iff 'B believes p' is a mutual belief of A and B

(Gunlogson 2003: 42)

The context is construed as an ordered pair of sets of worlds, as in (27). In (27), 'cs' refers to the commitment set of an individual. The commitment set of an individual A is the set of worlds of which A's public beliefs are true. The context set is then taken as the intersection of the commitment sets of every discourse participant in that context.

(27) Let a discourse context $\mathrm{C_{\{A,B\}}}$ be $\langle \mathrm{cs_A}, \mathrm{cs_B} \rangle$, where:

A and B are the discourse participants

a. $\mathrm{cs_A}$ of $\mathrm{C_{\{A,B\}}}$ = $\{w \in$ W: the propositions representing A's public beliefs are all true of $w\}$

b. $\mathrm{cs_B}$ of $\mathrm{C_{\{A,B\}}}$ = $\{w \in$ W: the propositions representing B's public beliefs are all true of $w\}$

(Gunlogson 2003: 43)

Gunlogson (2003) interprets the CCP of a sentence in terms of an update to a substructure of the context, i.e., the commitment set of a discourse participant. The semantics of a declarative sentence is then treated as an update of the public beliefs by some discourse participant X, modeled as a function from a commitment set of X to an updated commitment set of X. This function is generated by the combination of a declarative operator 'decl' with a propositional complement. The intonation of the

declarative will serve to identify which discourse participant is to be identified with X. Falling intonation indicates that X is the speaker, thus a falling declarative denotes an update of the speaker's public beliefs. The CCP of a falling declarative is given by Gunlogson (2003) in (28). For example, if A makes an assertion *It is raining* with a falling intonation, it means that the speaker A commits himself to the proposition p 'It is raining'. Before this assertion, p is not a discourse commitment of A, i.e., there exists at least one world in which p is not true in A's commitment set ($\mathrm{cs_A(C)} \not\subseteq p$). After the assertion, p is a discourse commitment of A, i.e., all the worlds in A's commitment set are worlds in which p is true ($\mathrm{cs_A(C')} \subseteq p$). This assertion does not make any change to the commitment set of the addressee ($\mathrm{cs_{Addr}(C')} = \mathrm{cs_{Addr}(C)}$).

(28) CCP of falling declarative:

$\mathrm{C}{+}{\downarrow}\ \mathrm{S_{decl}} = \mathrm{C'}$ such that:

a. $\mathrm{cs_{Spkr}(C')} = \mathrm{cs_{Spkr}(C)} + \mathrm{S_{decl}}$

b. $\mathrm{cs_{Addr}(C')} = \mathrm{cs_{Addr}(C)}$

(Gunlogson 2003: 52)

I will follow Gunlogson (2003) in interpreting the CG as the intersection of the public beliefs of the discourse participants.

1.3.1.4 Roberts (1996) and Farkas & Bruce (2010)

The previous sections introduced the central idea of dynamic semantics and how assertions are interpreted in dynamic semantics. In this section, I will first review the study of questions in dynamic semantics provided by Roberts (1996), and then introduce the analysis of Farkas & Bruce (2010) which accounts for the similarities

and differences between assertion and question.

The most influential analysis of questions in traditional semantics is from Hamblin (1973). According to Hamblin (1973), a question requires the addressee to identify a true proposition or propositions among a group of alternatives. Thus, a question is defined as a set of propositions that count as possible answers to it. For example, a bare polar question 'p?' denotes a set of two propositions which count as possible answers to that question, as in (29).

(29) $[\![p?]\!] = \{p, \neg p\}$

Now, let us see how questions are interpreted in dynamic semantics. As introduced in Section 1.3.1.1, in dynamic semantics, an assertion of p changes the context by ruling out all the possible worlds in which p is not true. Roberts (1996) argues that a question also changes the context. Roberts (1996) extends the possible-world model of Stalnaker (1978) by proposing a set of questions called the Question Under Discussion (QUD) along with the CG. The QUD is a set of questions representing contextually salient issues and it is temporarily ordered. The question at the topmost level of the QUD is the question that is most recently asked, and it is also the most immediate question under discussion. If the answer to a question cannot be found in the CG and all the participants have the intention to answer this question, this question will be added onto the QUD and the context is updated. In this framework, questions indicate an update in the QUD, while assertions indicate an update in the Common Ground.

Farkas & Bruce (2010) point out that question and assertion share a similarity that has not received enough attention before. A question raises an issue and brings this issue into discussion, so does an assertion. As shown in (30) and (31), Anne's assertion in (30)

and her question in (31) both raise the issue of Sam's whereabouts, and the addressee Ben can have either a positive or a negative reaction to this issue. The difference between Anne's assertion in (30) and her question in (31) is that the former commits Anne to the proposition 'Sam is home', while the latter does not.

(30) Anne: Sam is home.
Ben: Yes/Yeah, he's home./No, he isn't home. (Farkas & Bruce 2010: 83)

(31) Anne: Is Sam home?
Ben: Yes/Yeah, he's home./No, he isn't home. (Farkas & Bruce 2010: 83)

In order to capture the similarity and difference between assertion and question, Farkas & Bruce (2010) follow Roberts (1996), Ginzburg (1996) and Büring (2003) to present a model of context structure that contains a discourse component called 'the Table'. The Table records what is 'at issue' in the conversation. It is a set of sets of propositions representing issues under discussion and it is temporarily ordered. Initiating a conversational move, such as initiating an assertion move or a question move, will add the denotation of the assertion/question onto the Table. When the Table is not empty, the immediate goal of the conversation is to settle the issue and empty the Table. In this framework, an assertion is defined as in (32). The assertion operator ASSERT takes in a proposition and returns a function from an input context C_i to an output context C_o.

(32) ASSERT(p)(C_i) = C_o such that:

a. $\mathrm{PB}_{\mathrm{Spkr}}(\mathrm{C}_o) = \mathrm{PB}_{\mathrm{Spkr}}(\mathrm{C}_i) + \mathrm{p}$

b. $\mathrm{T}(\mathrm{C}_o) = \mathrm{T}(\mathrm{C}_i) \oplus \{\mathrm{p}\}$

(Modified from Farkas & Bruce 2010: 92)

A default assertion changes the context in two ways. First, it adds the propositional content of the assertion into the public beliefs of the speaker, as shown in (32-a). Second, it adds the content of the assertion (represented as a singleton set $\{p\}$) onto the top of the Table, as shown in (32-b).[5] For example, Anne's assertion in (30) commits Anne to the proposition p 'Sam is home' and adds the issue {'Sam is home'} onto the top of the Table.

Of course, not all assertions add a new issue onto the Table. When the addressee uses an assertion to confirm a previous assertion made by the speaker, the addressee commits himself to the propositional content of the assertion without raising any new issue. Farkas & Bruce (2010) define an assertion confirmation operator, AC, as in (33).

(33) Assertion Confirmation (AC)

a. Input context conditions:

$p \in PB_{Spkr}(C_i)$

$T(C_i)[0] = \{p\}$

b. $AC(p)(C_i) = C_o$ such that $PB_{Addr}(C_o) = PB_{Addr}(C_i) + p$

(Modified from Farkas & Bruce 2010: 98)

A confirmation of an assertion p presupposes that this assertion has already been made by the speaker (i.e., the speaker commits himself to p and the issue $\{p\}$ is the 0th (topmost) element of the Table), as shown in (33-a), and adds the propositional content of the assertion into the public beliefs of the addressee, as shown in (33-b). For example, Ben's assertion *Yes/Yeah, he's home* in (30) adds the proposition 'Sam is home' into the

[5]The $\oplus$ is the update function which adds a set of propositions onto the top of the Table.

public beliefs of Ben. When all of the discourse participants have p in their public beliefs, p enters the Common Ground and the issue $\{p\}$ is solved and removed from the Table.

Like assertions, questions raise new issues, but they do not change discourse participants' commitments. Farkas & Bruce (2010) define the question operator Q as in (34), where Q is a set of propositions that count as possible answers to the question. One difference between question and assertion is that a question adds a non-singleton set of propositions onto the Table, while an assertion adds a singleton set onto the Table.

(34) $Q(Q)(C_i) = C_o$ such that:

$T(C_o) = T(C_i) \oplus Q$

(Modified from Farkas & Bruce 2010: 95)

Farkas & Bruce (2010) provide a semantic analysis that captures the similarity and difference between assertion and question. A default assertion changes the commitments of discourse participants and adds a new issue onto the Table. A default question only adds a new issue onto the Table. Farkus & Bruce's (2010) analysis of assertions and questions will be modified and adopted in the formal analysis of Mandarin assertions and questions.

1.3.1.5 Section summary

This section presented a brief review of previous studies in dynamic semantics, illustrating the concepts of 'the Common Ground', 'context change potential', 'the public belief', 'Question-Under-Discussion' and 'the Table'. In dynamic semantics, to know the meaning of an utterance is to know in what ways it changes the context.

The formal analysis of *dique* and *zhende* will be formed within the dynamic semantics framework reviewed in this section.

1.3.2 Sentential forces

Section 1.3.1 introduced how assertion and question are interpreted in dynamic semantics. In the rest of this dissertation, I will study the interactions between discourse adverbs such as *dique*/*zhende* on one hand and so-called sentential forces such as assertion/question on the other. Assertion and question are generally referred to as sentential forces (Chierchia & McConnell-Ginet, 1990). To pave the way for the later discussion, I will introduce the concept of sentential force and two different views concerning sentential force in this section. This dissertation adopts the view that sentential forces have syntactic representations.

There are two concepts of force that are commonly adopted by researchers, i.e., illocutionary force (Searle, 1965) and sentential force (Chierchia & McConnell-Ginet, 1990). The illocutionary force of an utterance refers to the speaker's intention in making that utterance. For example, an English sentence like (35) expresses the speaker's intention to impose an obligation of cleaning the room on the addressee, and thus this sentence has the illocutionary force of ordering.

(35) Can you clean the room?

a. Illocutionary force: order

b. Sentential force: question

Unlike the notion of illocutionary force, the notion of sentential force is concerned with the form of the sentence instead of the speaker's intention. The form of (35) is

conventionally associated with the force of questioning, and thus (35) has the sentential force of question. In this dissertation, I label the force conventionally associated with a declarative as assertion, and the force conventionally associated with an interrogative as question.

Sentences having different sentential forces may share the same content (Frege, 1892). For example, (36-a) is an assertion, (36-b) is a command, and (36-c) is a question. These three sentences have different sentential forces but share the same content.

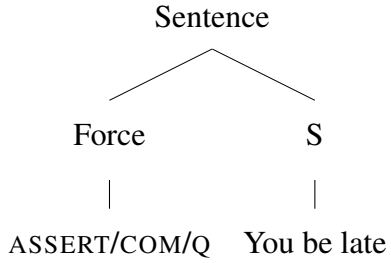
(36) a. *You are late*.

b. *Be late!*

c. *Are you late?* (Lewis 1970: 55)

Although the existence of sentential force is widely recognized, it is still debated whether sentential force is represented syntactically or is a merely pragmatic notion. Arguments for both of these views are found in the literature. The first view holds that sentential force is encoded within grammar. Sentences are classified through the presence of some grammatical features or markers, which are seen as representing the force of the sentence (Sadock & Zwicky, 1985; Han, 1998; König & Siemund, 2007, among others). For example, Lewis (1970) proposes that the three sentences in (36) denote the same proposition, i.e., 'You be late', but contain different force markers: the assertive operator ASSERT, the command operator COM and the question operator Q, as depicted in (37). These force markers are generally located at a high position in the structure, typically at the highest head position in the CP domain (Rizzi, 1997) or the IP domain (Cinque, 1999).

(37) (Modified from Lewis 1970: 55)

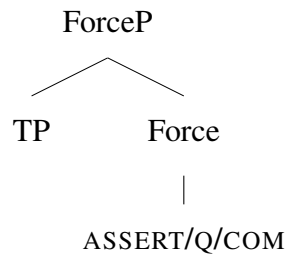


Arguments for this view are mainly based on cross-linguistic investigations. Supporters of this view study the grammatical representations of forces in various kinds of languages and show that forces in these languages are classified through the presence of some grammatical features. For example, Han (1998) carries out a cross-linguistic investigation into the command force, and shows that the syntax of command across languages contains a command operator, which is a group of morphosyntactic features. König & Siemund (2007) demonstrate that the three basic sentential forces, assertion, question and command, are identifiable on the basis of only one formal property in the vast majority of languages they studied.

The other view is that sentential force is purely a pragmatic notion and has no direct correlation with formal features (Zanuttini & Portner, 2003; Portner, 2004). Supporters of this view argue that there is no particular element in syntax that introduces the force, since such an element can hardly account for the diversity of structures among sentences with the same force. For example, it is difficult to explain how the force marker Q can unify various questions with different structures, such as polar questions, alternative questions and *wh*-questions.

In this dissertation, I adopt the first view and assume that sentential forces have syntactic representation. The force operators such as the assertive operator ASSERT, the question operator Q and the command operator COM, project a Force Phrase and occupy the head position of this Force Phrase, as shown in (38).

(38)



I assume that forces have syntactic representation since this assumption is convenient for the analysis of the discourse adverbs in dynamic semantics. As shown in Section 1.3.1, in dynamic semantics, the meaning of an assertion or a question is a CCP. The force marker would then work as a function that maps a proposition or a set of propositions onto the appropriate kind of CCP. Since a force marker has its own semantic contribution, it should have a corresponding syntactic position following the principle of Compositionality. Furthermore, as we will see in Chapter 4, *dique* and *zhende* at the sentence-initial position are modifying sentential forces. Therefore, assuming that there are linguistic elements representing sentential force would be convenient for the analysis of *dique* and *zhende*.

Let us see how these force operators are represented in Mandarin, that is, what element occupies the head of ForceP. In Indo-European languages, sentential force most often manifests as an affix on the verb (Cinque, 1999: 84). Such affixes occupy the head position of ForceP in these languages.

Mandarin lacks inflectional morphology and uses sentence-final particles to mark the force of an utterance (Lü, 1982: 257). These particles occupy the head position of ForceP in Mandarin. For example, a question can be marked by the particles *ma* or *ne*, and thus the ForceP of a question is headed by the operator Q, manifested overtly as the particles *ma*/*ne*.[6] Assertion and command in Mandarin are not overtly marked. I

[6]See more discussions about the particles *ma* and *ne* in Chapter 5.

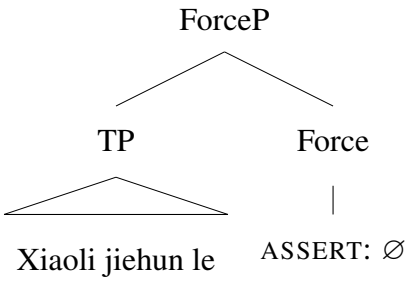
assume that ASSERT and COM are phonologically null operators in Mandarin, occupying the same position as *ma*/*ne*. Following Gasde & Paul (1996),[7] a ForceP is analyzed as head-final, since the particles that mark questions and commands occur in sentence-final position in Mandarin.

For example, the assertion in (39-a) has the structure in (40-a), where the ForceP is headed by the covert operator ASSERT. The question in (39-b) has the structure in (40-b), where the ForceP is headed by the operator Q, manifested overtly by *ma*.

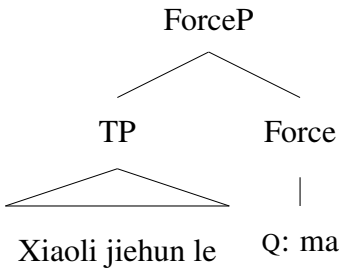
(39) a. Xiaoli jiehun le.
Xiaoli get-married PERF
'Xiaoli got married.'

b. Xiaoli jiehun le ma?
Xiaoli get-married PERF Q
'Did Xiaoli get married?'

(40) a.



b.



Given the syntactic position of force operators, now we are ready to see their semantics.

[7] Gasde & Paul (1996) first propose that CP is head-final in Chinese. In their analysis, mood particles that mark different sentence types are taken as complementizers. Since these particles occur at the end of the sentence, CP should be head-final in surface structure. See also Erlewine (2010) and Paul (2014).

I will present the formal definitions of the assertive operator ASSERT and the question operator Q, and these definitions will be adopted in the later discussions about assertions and questions. Following Stalnaker (1978), I assume that an assertion of p denotes an update of the context set with p, as defined in (41).[8]

(41) $[\![\text{ASSERT}]\!] = \lambda p.\lambda \text{C}.\text{CS}(\text{C}) + p$

The assertive operator ASSERT is construed as a function taking in a propositional argument and returning a function from contexts to contexts (i.e., a CCP). The '$+$' is the notation for assertive update, and $\text{CS}(\text{C}) + p$ denotes the intersection of the context set $\text{CS}(\text{C})$ with the set of p-worlds. That is, an assertion of p updates the context set CS(C) and the updated context set is the set of possible worlds in which p is true.

Following Roberts (1996) and Farkas & Bruce (2010), I assume that a question Q indicates an update of the Table with Q, as defined in (42). In (42), the question operator Q is construed as a function from a set of propositions to a context change potential. The '$\oplus$' is the update function which adds a set of propositions onto the top of the Table. $\text{T}(\text{C}) \oplus Q$ is a context that resembles C, except that $\text{T}(\text{C}) \oplus Q$ contains the set Q at the topmost level of T(C). (42) says that when a question Q is asked, the set of propositions Q has been added onto the top of the Table. That is, the speaker is raising the issue Q and trying to solve Q.

(42) $[\![\text{Q}]\!] = \lambda Q.\lambda \text{C}.\ \text{T}(\text{C}) \oplus Q$

[8]Following Farkas & Bruce (2010), a default assertion updates discourse participants' commitments and adds a new issue onto the Table, while an assertion acting as a confirmation of a previous assertion only updates discourse participants' commitments. As we will see in Chapter 2, *dique* and *zhende* are presupposition triggers and cannot be used in an out-of-the-blue context. An assertion containing these adverbs always acts as a confirmation of a previous assertion. Therefore, for the analysis of *dique* and *zhende*, it is enough to define an assertion as an update of discourse participants' commitments.

In summary, this dissertation adopts the view that sentential forces are syntactically represented as force operators like ASSERT, Q and COM. These force operators occupy the head position of a Force Phrase. The semantic definitions of the force operators presented in this section will be used in the rest of the dissertation.

1.4 Overview of the dissertation

In this chapter, I have introduced the previous studies on the discourse markers *dique* and *zhende*, and the theoretical background for studying these markers. The semantic analysis of *dique* and *zhende* will be presented in the rest of this dissertation.

Chapter 2 investigates the basic data concerning *dique* and *zhende*, and proposes an analysis of *dique*/*zhende* as presupposition triggers. It is shown that the intuitive difference between these two adverbs is that utterances containing *dique* express a confirmation of old information, while utterances containing *zhende* express an emphasis on truth. Motivated by this intuition, I propose that *dique* presupposes that its prejacent is old information, whereas *zhende* presupposes that its prejacent is old and challenged by some discourse participant. This analysis accounts for the differences between these two adverbs. In the formalization of *dique* and *zhende*, I introduce the dynamic approach to presupposition (Karttunen, 1974), which assumes that presuppositions are evaluated in different contexts and must always be satisfied in the local context. In matrix clauses, the local context refers to the context set, and thus utterances containing *dique*/*zhende* are defined if all the discourse participants take for granted that the presupposition triggered by *dique*/*zhende* is true. The analysis of *dique* and *zhende* as presupposition triggers is also supported by a naturalness rating experiment carried out among Mandarin native speakers.

Chapter 3 moves on to examine the semantics of *dique* and *zhende* in embedded cases. Two types of embeddings are discussed: under attitude verbs and conditional structures. It is shown that *dique* and *zhende* exhibit the same behaviors as typical presupposition triggers in these two embeddings. The parallelism in the behaviors between *dique*/*zhende* and typical presupposition triggers supports the analysis of *dique* and *zhende* as presupposition triggers. Chapter 3 also demonstrates how the dynamic approach to presupposition accounts for the projection behaviors of the presupposition triggered by *dique*/*zhende*. When *dique*/*zhende* is embedded under an attitude verb, the presupposition triggered by the adverbs is relativized to the attitude-holder. This is because the presupposition triggered by the adverbs needs to be satisfied in the local embedded context, which refers to the belief worlds of the attitude-holder. In conditional structures, when the presupposition is triggered by *dique*/*zhende* in the consequent and entailed by the antecedent, this presupposition is not inherited by the whole conditional. This is because the presupposition is satisfied in the local context that is created by the antecedent.

Chapter 4 concentrates on the differences between sentence-initial *dique*/*zhende* and VP-initial *dique*/*zhende*. I look into the data of questions and show that sentence-initial adverbs scope over the question force and modify the question, whereas VP-initial adverbs are within the scope of the question force and modify the proposition. This motivates the proposal that sentence-initial adverbs are sentential force modifiers, which take a force head as an argument, while VP-initial adverbs are propositional modifiers, which do not need a force head. This analysis correctly predicts that VP-initial adverbs can be embedded but sentence-initial adverbs cannot, as forces cannot be embedded in Mandarin. Another difference between sentence-initial and VP-initial adverbs is that certain noun phrases can co-occur with sentence-initial adverbs but not

with VP-initial adverbs. I explain this difference by proposing that the noun phrases preceding VP-initial adverbs occupy a topic position, and thus noun phrases that exhibit no topic properties cannot occur in this position.

Chapter 5 starts with another difference between sentence-initial and VP-initial adverbs, i.e., VP-initial adverbs co-occur with *ma* questions but not with A-not-A questions, alternative questions and *wh*-questions. In contrast, sentence-initial adverbs are compatible with all these questions. To explain this difference, Chapter 5 provides a detailed semantic account for these four types of Mandarin questions. It is argued that A-not-A questions, alternative questions and *wh*-questions belong to Group B questions, which differ from Group A questions (i.e., *ma* questions) in syntactic form, prosody and semantics. Due to the existence of the sentence-final particle *ne* and the low boundary tone L%, all Group B questions have an assertion meaning. This assertion indicates the speaker's ignorance towards the issue, and thus requires a neutral context. Consequently, Group B questions cannot be used in biased contexts. Group A questions do not have the assertion meaning and thus can be used in biased contexts. I also explain why Group A and Group B exhibit different behaviors in co-occurrence with VP-initial adverbs, and extend the analysis of Group B questions to Mandarin unconditional structures.

Chapter 6 concludes with suggestions for future studies.

Chapter 2

Semantic analysis: *dique* and *zhende* as presupposition triggers

2.1 Introduction

As mentioned in Chapter 1, the adverbs *dique* and *zhende* exhibit different behaviors in examples like (1), and none of the previous analyses can explain this contrast.

(1) A: Zuowan xiayu le.
last-night rain PERF
'It rained last night.'

(B heard the sound of raining last night and he knows that it rained.)

B: *Dique*/#*Zhende* xiayu le.
indeed/really rain PERF
'It indeed rained.'/'It really rained.'

This chapter provides a semantic analysis for *dique* and *zhende* that explains the difference between these two adverbs in (1). The proposal is that *dique* and *zhende*

are both presupposition triggers, which modify an utterance by contributing to the presuppostional content of the utterance. *Dique* and *zhende* differ from each other in the content of the presupposition, resulting in their different behaviors in (1).

This chapter is structured as follows: Section 2.2 presents informal characterizations of the behaviors of *dique* and *zhende* in assertions. Intuitively, assertions containing *dique* indicate a confirmation of old information, while assertions containing *zhende* indicate an emphasis on truth. These intuitions motivate the analysis of *dique* and *zhende* as presupposition triggers. Section 2.3 presents the formal definitions for *dique* and *zhende* in assertions. A dynamic approach to presupposition is adopted and a binary presupposition operator is used to formalize the presuppositions triggered by these two adverbs. Section 2.4 reports a naturalness rating experiment on assertions containing *dique* and *zhende*, which verifies the conclusions about the specific presuppositions that *dique* and *zhende* introduce. Section 2.5 moves on to examine the semantics of *dique* and *zhende* in questions. Section 2.6 gives a conclusion to this chapter.

2.2 The behaviors of *dique* and *zhende* in assertions

The informal descriptions of the distributions of *dique* and *zhende* in assertions are presented respectively in Sections 2.2.1 and 2.2.2. The data show that *dique* is a presupposition trigger which marks information as old, whereas *zhende* marks information as old and challenged by some discourse participant. This explains the intuitions that assertions containing *dique* indicate a confirmation of old information, whereas assertions containing *zhende* indicate an emphasis on the truth of the old information.

2.2.1 *Dique* in assertions

The intuition about assertions containing *dique* is summarized in (2).

(2) Assertions containing *dique* indicate a confirmation of old information.

(2) can be illustrated by the example in (3). Native speakers report an intuition that the speaker B in (3) is confirming the old information 'Li went abroad' by using *dique*. 'Li went abroad' is old information since it has been asserted by A in the prior context, and now B is showing his agreement with this old information.

(3) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

B: *Dique*, ta chuguo le.
indeed he go-abroad PERF
'Indeed, he went abroad.'

It is noteworthy that B cannot start a conversation with the assertion *Dique, Li chuguo le* 'Indeed, Li went abroad'. Without A's utterance, B's use of *dique* would be infelicitous, as shown in (4). In other words, *dique* requires that its prejacent 'Li went abroad' is old information.

(4) B: #*Dique*, Li chuguo le.
indeed Li go-abroad PERF
'Indeed, Li went abroad.'

(Here, # means 'infelicitous as discourse initial')

In contrast, a bare assertion like (5) is felicitous at the beginning of a conversation. This bare assertion does not have the meaning of confirmation. The speaker B is simply

introducing a piece of new information 'Li went abroad'.

(5) B: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

The intuition in (2) motivates my proposal that the adverb *dique* is a presupposition trigger. I will first illustrate the presuppositions of *dique* in detail, and then show how these presuppositions give rise to the meaning of confirmation and agreement.

An assertion containing *dique*, represented as *dique*(p), imposes the following requirements on the previous context:

(6) Requirements of *dique*(p) on the previous context:

a. p has been suggested by some individual x.

b. All of the discourse participants believe that p has been suggested, and recognize that they share this belief.

Let us illustrate these requirements with examples. The requirement in (6-a) is illustrated by the discourse in (7). Here, Li's utterance indicates that someone must have predicted the rain on 1^{st} June some time before 1^{st} June. In other words, the proposition 'It rains on 1^{st} June' must have been suggested by some individual in the previous context. That individual can be the speaker (i.e., Li) or the addressee (i.e., Li's wife), or someone else (such as the weather reporter). If no one had predicted that it would rain on 1^{st} June, Li's use of *dique* would be infelicitous.

(7) Context: On 1^{st} June, waking up in the morning, Li looks outside and says to his wife:

Li: Waimian *dique* xiayu le.
outside indeed rain PERF
'It indeed rains outside.'

If p has been suggested by some individual x, as stated in (6-a), then it follows that x indicates that x is biased towards p. If x is not biased towards p in the prior context, *dique* cannot be used. For instance, if A's utterance in (3) was 'Li didn't go abroad' (A is committed to $\neg p$), as in (8), the use of *dique* would be infelicitous, since 'Li went abroad' has not been suggested.

(8) A: Li mei chuguo.
Li not go-abroad
'Li didn't go abroad.'

B: #*Dique*, ta chuguo le.
indeed he go-abroad PERF
'Indeed, he went abroad.'

On the other hand, modal adverbs, such as *keneng* and *yexu* 'probably', indicate that the speaker is biased towards p. Thus, B's use of *dique* in (9) is felicitous.

(9) A: Li keneng chuguo le.
Li probably go-abroad PERF
'Li probably went abroad.'

B: *Dique*, ta chuguo le.
indeed he go-abroad PERF
'Indeed, he went abroad.'

The first requirement of *dique*(p) in (6-a) is also shown by the fact that *dique* can occur in answers to biased questions, but not in answers to unbiased questions. Among the various types of questions in Mandarin Chinese, *ba* questions (marked by the particle *ba* in sentence-final position) and *shi bu shi* questions (with *shi bu shi* 'be not be' located in front of the predicate) are compatible with answers containing *dique*:

(10) A: Ta xihuan tian shi ba?
he like sweet food Q
'Does he like sweet food? (I suppose he does)'

B: *Dique*, ta xihuan tian shi.
indeed he like sweet food
'Indeed, he likes sweet food.'

(11) A: Ta shi bu shi xihuan tian shi?
he be not be like sweet food
'Is it the case that he likes sweet food?'

B: *Dique*, ta xihuan tian shi.
indeed he like sweet food
'Indeed, he likes sweet food.'

Ba questions (Li & Thompson 1981: 309-310; Liu et al. 2004: 788) and *shi bu shi* questions (Liu et al. 2004: 792) are considered requests for confirmation, where the speaker is biased towards the affirmative answer. *Dique* is felicitous in answers to these questions because the first requirement of *dique*(p) is met: the proposition p (i.e., the affirmative answer) has been suggested by some individual (the questioner) in the previous context.

Other types of questions in Mandarin, such as A-not-A questions, can only be used in a neutral context and indicate no bias (See Chapter 5, and also Li & Thompson 1981:

550).[1] *Dique* is banned in answers to A-not-A questions, since the questioner is not biased toward the affirmative answer:

(12) A: Ta xi-bu-xihuan tian shi?
he like-not-like sweet food
'Does he like sweet food or not?'

B: #*Dique*, ta xihuan tian shi.
indeed he like sweet food
'Indeed, he likes sweet food.'

The second requirement of *dique*(p) in (6-b) is that all of the discourse participants believe that the proposition p has been suggested and that they all recognize that they share this belief. For example, in (7), Li and his wife both believe that p 'It rains on 1^{st} June' has been suggested, and they both recognize that they share this belief. If the speaker Li is not aware of the suggestion of p, or if Li does not believe that his wife believes that p has been suggested, Li's use of *dique* will be infelicitous. In the above two cases, 'It rains on 1^{st} June' is new information to at least one discourse participant, and the speaker Li will choose a bare assertion *Xiayu le* 'It rains' to inform his wife about this new information (new to Li himself or new to his wife).

One thing worth emphasizing is that 'p has been suggested by x' entails that x makes his bias towards p verbally or linguistically explicit. In other words, the individual x makes a conversational move indicating that x is biased towards p. A mere common belief shared by discourse participants is not enough to license the use of *dique*. Rather, *dique* is licensed by discourse participants' common belief about x's explicit expression of his bias. Take (13) as an example. According to the world knowledge that it is to rain

[1] As will be seen in Chapter 5, *ma* questions (marked by the particle *ma* in sentence-final position) can be used in neutral or nonneutral contexts. When used in neutral contexts, *ma* questions indicate no bias, just like A-not-A questions. As predicted, *dique* cannot be used in the answers to *ma* questions that are used in neutral contexts.

if it is thundering and lightening and the contextual knowledge that it is thundering and lightening, it is reasonable to assume that people are biased towards the proposition 'It will rain'. So, it is a common belief that B is biased towards p 'It will rain' in (13), but it is not a common belief that B explicitly expresses his bias towards p. The requirement of *dique* is not satisfied, and thus the use of *dique* is infelicitous.

(13) Context: It is thundering and lightening outside. A says to B:

A: #*Dique* yao xiayu le.
indeed will rain PERF
'It will indeed rain.'

In summary, *dique*(p) has two requirements on the prior context, as in (6), repeated here as (14).

(14) Requirements of *dique*(p) on the previous context:

a. The proposition p has been suggested by some individual x.

b. All of the discourse participants believe that p has been suggested and recognize that they share this belief.

The analysis of *dique* as a presupposition trigger is in line with the intuition in (2), i.e., assertions containing *dique* indicate a confirmation of old information. This confirmation meaning results from the combination of the assertion meaning and the presupposition of *dique*. As shown in Figure 2.1, a bare assertion p encodes the speaker's commitment to p, and *dique* triggers a presupposition that p has already been suggested by some individual x. Thus, the combination of p with *dique* indicates the speaker's confirmation of the old p and the speaker's agreement with x.

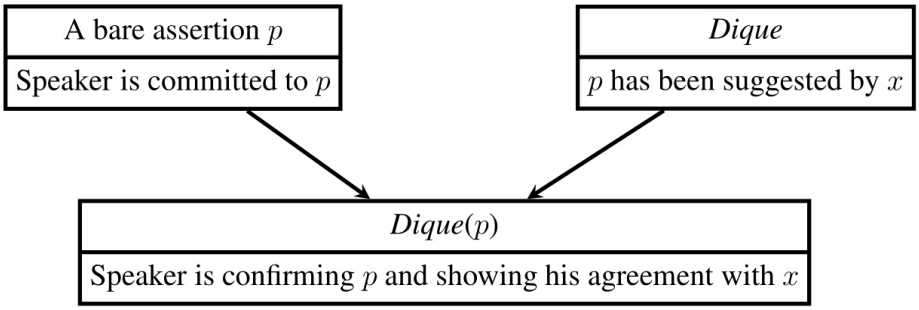


Figure 2.1: An assertion containing *dique* indicates a confirmation of old information

2.2.2 *Zhende* in assertions

The adverb *zhende* 'really' is derived from the morpheme *zhen* 'truth/reality'. This morpheme gives rise to the intuition that *zhende* is used to emphasize truth, as in (15).

(15) By using *zhende* in an assertion, the speaker is emphasizing that the propositional content of the assertion is true.

(15) can be illustrated with the example in (16). Intuitively, the speaker C in (16) is using *zhende* to emphasize that the proposition p 'it rained last night' is true. C finds it necessary to emphasize the truth of p, because B refused to believe in p even though p has been asserted by A. C is emphasizing the truth of p in order to convince B of p.

(16) A: Zuowan xiayu le.
last-night rain PERF
'It rained last night.'

B: Meiyou xiayu.
not rain
'It didn't rain.'

C (to B): *Zhende*, zuowan xiayu le.
really last-night rain PERF
'Really, it rained last night.'

C's use of *zhende* in (16) would be unacceptable if no one had suggested p, as in (17). Here, 'It rained last night' is new information and should be expressed without *zhende*.

(17) B: Zuowan meiyou xiayu.
last-night not rain
'It didn't rain last night.'

C (to B): #*Zhende*, zuowan xiayu le.
really last-night rain PERF
'Really, it rained last night.'

If B believed in p initially or began to believe in p after hearing A's suggestion, it would also be infelicitous for C to use *zhende*, as in (18). This is because all of the discourse participants believe in p, and thus there is no need for C to emphasize the truth of p.

(18) A: Zuowan xiayu le
last-night rain PERF
'It rained last night.'

B: Shide, xiayu le.
yes rain PERF
'Yes, it rained.'

C (to B): #*Zhende*, zuowan xiayu le.
really last-night rain PERF
'Really, it rained last night.'

The intuition in (15) motivates my proposal that the adverb *zhende* triggers two presuppositions: First, the prejacent of *zhende* is old information. Second, some discourse participant is uncommitted to the old information. Due to the uncommitment of the participant, the speaker of *zhende* finds it necessary to emphasize the truth of the

old information. I will illustrate the presuppositions of *zhende* in more detail, and show how these presuppositions give rise to the intuitive meaning of 'emphasis on truth'.

An assertion containing *zhende*, represented as *zhende*(p), imposes three requirements on the previous discourse.

(19) Requirements of *zhende*(p) on the previous context:

a. The proposition p has been suggested by some individual x.

b. All of the discourse participants believe that p has been suggested, and recognize that they share this belief.

c. Some participant y remains publicly uncommitted to p even after knowing that p has been suggested by x.

As can be seen, the first two requirements of *zhende*(p) are the same as the two requirements of *dique*(p), while the third requirement of *zhende*(p) is not shared by *dique*(p).

Like *dique*(p), *zhende*(p) requires that p has been suggested in the prior context and all discourse participants recognize that they all believe that p has been suggested. For example, in (20), the first two requirements of *zhende*(p) are both met: the proposition p 'It rained last night' has been suggested by A and every participant recognizes this.

(20) A: Zuowan xiayu le.
last-night rain PERF
'It rained last night.'

(B is not sure. He opens the window and sees that the ground is wet.)

B: Zuowan *zhende* xiayu le.
last-night really rain PERF
'It really rained last night.'

If no one had suggested p (the first requirement of *zhende*(p) is not met) or if B did not recognize that A had suggested p (the second requirement of *zhende*(p) is not met), it would be infelicitous to use *zhende*. In (21), 'It rained last night' is new information to B and should be expressed without *zhende*.

(21) Context: B opens the window in the morning and sees that the ground is wet.

B: #Zuowan *zhende* xiayu le.
last-night really rain PERF
'It really rained last night.'

Besides the requirements shared with *dique*(p), *zhende*(p) imposes a third requirement on the prior context: *zhende*(p) requires that some discourse participant y remains publicly uncommitted to the proposition p even after recognizing that p has been suggested by x. For example, in (20), A is the suggester x and B is the participant y. Initially, B was not committed to p 'It rained last night' even though he recognized that A had suggested p. After checking the evidence, B commits himself to p by using an assertion modified by *zhende*. If B was already committed to p before A's suggestion, the use of *zhende* would be unacceptable, as in (1), repeated here as (22). This is because all the discourse participants were committed to p, and thus the third requirement of *zhende*(p) is not met.

(22) A: Zuowan xiayu le.
last-night rain PERF
'It rained last night.'

(B heard the sound of raining last night and he knows that it rained.)

B: #*Zhende* xiayu le.
really rain PERF
'It really rained.'

One difference between the first and the third requirement is that the individual x needs to express his bias towards p, while the participant y does not need to express his uncommitment to p. The third requirement is satisfied as long as some participant y is publicly uncommitted to p, that is, every participant shares the belief that y is uncommitted to p. For example, in (23), the participant B makes no conversational move indicating his uncommitment to p 'Eating meat is necessary'. However, since both A and B share the belief that B is uncommitted to p, B is publicly uncommitted to p and the third requirement is satisfied. By using *zhende*, A is emphasizing the truth of p and trying to convince B of p.

(23) Context: A and B are watching TV. The TV program says that eating meat is indispensable to health. A knows that B is a vegetarian and never considers meat as a necessity. A says to B:

A: Chi rou *zhende* hen biyao.
eat meat really very necessary
'Eating meat is really very necessary.'

In summary, an assertion containing *zhende* has three requirements on the previous discourse, as in (19), repeated here as (24).

(24) Requirements of *zhende*(p) on the previous context:

a. The proposition p has been suggested by some individual x.

b. All of the discourse participants believe that p has been suggested, and recognize that they share this belief.

c. Some participant y remains publicly uncommitted to p even after knowing that p has been suggested by x.

The analysis of *zhende* as a presupposition trigger is consistent with the intuition in (15), i.e., assertions containing *zhende* indicate an emphasis on truth. The meaning of 'emphasis on truth' results from the interaction between the meaning of a bare assertion and the presupposition of *zhende*. As shown in Figure 2.2, a bare assertion p indicates the speaker's commitment to p, and *zhende* triggers a presupposition that p has been suggested by some individual x but y remains uncommitted to p. Thus, the combination of p with *zhende* indicates that the speaker is emphasizing the truth of p in order to convince y of p.

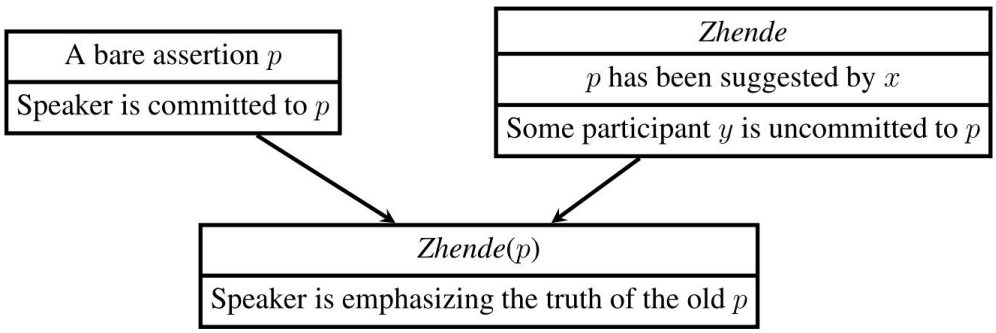


Figure 2.2: An assertion containing *zhende* indicates an emphasis on truth

2.2.3 Summary

This section provided informal generalizations for the semantics of *dique* and *zhende* in assertions based on introspection-based data. According to native-speaker intuitions, assertions containing *dique* indicate a confirmation of old information, whereas assertions containing *zhende* indicate an emphasis on truth. These intuitions motivate the proposal that *dique* and *zhende* are presupposition triggers. The adverb *dique* modifies an assertion of p by introducing a presupposition that p has been suggested by some individual x. Since a bare assertion of p encodes the speaker's commitment to p,

dique(p) indicates the speaker's confirmation of the old information p and the speaker's agreement with x. The adverb *zhende* modifies p by introducing a presupposition that p has been suggested by x, and some participant y failed to commit himself to p. Since a bare assertion of p encodes the speaker's commitment to p, *zhende*(p) indicates the speaker's emphasis on the truth of p. These introspection-based generalizations regarding the semantics of *dique* and *zhende* are empirically supported by a naturalness rating experiment presented later in Section 2.4.

2.3 Formal analysis of *dique* and *zhende*

This section provides formal definitions for *dique* and *zhende* in assertions. As discussed in Section 2.2, both *dique* and *zhende* are presupposition triggers. In order to capture the presuppositions triggered by *dique* and *zhende*, I adopt a binary presupposition operator from Beaver & Krahmer (2001) and define this operator within dynamic semantics framework.

2.3.1 Definitions of presupposition and the transplication operator

In this section, I will first introduce the definitions of presupposition in traditional truth-conditional semantics and dynamic semantics. Since the traditional static approach to presupposition cannot account for presupposition projection behaviors, I adopt the dynamic approach to presupposition in this dissertation. Then, I will adopt the transplication operator from Beaver & Krahmer (2001) to characterize presuppositions. The definition of this operator is modified so that it applies to dynamic semantics.

In traditional truth-conditional semantics, presuppositions are understood as definedness conditions. That is, when the presupposition of a sentence is not true, the

sentence is not defined, i.e., has no truth value, as shown by the definition in (25).

(25) One sentence presupposes another iff whenever the first is true or false, the second is true.

(Strawson's (1950) definition summarized Beaver & Geurts (2013))

This definition of presupposition was challenged during 1970s, when the problem of presupposition projection began to gain attention (Langendoen & Savin (1971), Kartunnen (1973, 1974), see Chapter 3 for more discussions about presupposition projection). The projection behaviors of presuppositions are complex and pose great difficulties for the truth-conditional approach. In some cases, the presuppositions of the embedded clause are projected up to the matrix clause, while in others, the presuppositions of the embedded clause are blocked from projecting up. The truth-conditional approach cannot make correct predictions about projection behaviors in every case. It was at this time that dynamic semantics took up the issue and provided a new definition for presupposition.

As mentioned in Chapter 1, an utterance denotes an update of the context in dynamic semantics. Presuppositions are thus regarded as requirements on the context. This means that a presupposition must be evaluated in a context that already entails this presupposition. For example, when an assertion *John's cat is hungry* is made, the context c, which is construed as a set of possible worlds, is updated with the proposition 'John's cat is hungry'. Since this proposition carries a presupposition that John has a unique cat, the update of c with 'John's cat is hungry' is defined only if c entails that John has a unique cat, i.e., when c is a subset of the worlds in which John has a unique cat, as shown in (26).

(26) $c +$ 'John's cat is hungry' is defined iff $c \subseteq \{w$: John has a unique cat in $w\}$

(Heim 1992: 186)

To be more precise, the context c in this example refers to the context set (Stalnaker, 1978), which denotes the set of possible worlds in which all the common beliefs of discourse participants are true. Thus, (26) says that the assertion *John's cat is hungry* requires that every discourse participants believe that John has a unique cat. However, to say that a presupposition must be satisfied in the context set is an over-simplification. It makes wrong predictions in complex sentences, as in (27). Unlike the assertion *John's cat is hungry*, (27) does not require that every discourse participants already take for granted that John has a unique cat, as the proposition 'John has a unique cat' is already asserted in the first conjunct.

(27) John has a cat and John's cat is always hungry.

Karttunen (1974) solves this problem by proposing that presuppositions are not always evaluated in the same context, i.e., the context set. Instead, presuppositions are evaluated in different contexts, and presuppositions always need to be satisfied in the local context, as defined in (28). For example, the second conjunct in (27) is evaluated with respect to the local context, which is created by updating the context set with the content of the first conjunct. Since the local context already entails that John has a unique cat, the presupposition of the second conjunct is satisfied and thus the entire sentence does not carry this presupposition.

(28) Context X satisfies the presupposition of S just in case the presuppositions of each of the constituent sentences in S are satisfied by the local context.

(Karttunen 1974: 187)

The definition of presupposition in (28) will be adopted throughout this dissertation. In order to formalize (28), I adopt a binary presupposition operator '$\langle\ \rangle$' from Beaver & Krahmer (2001), which is called *transplication*.

(29) If φ, π are formulae, then $\varphi_{\langle\pi\rangle}$ is a formula. (Beaver & Krahmer 2001: 150)

In (29), π is an elementary presupposition of φ. Elementary presuppositions are presuppositions that are triggered in the lexicon. For example, the English verb *regret* triggers an elementary presupposition that the proposition which is regretted is true. Thus, (30) can be represented by a formula $q_{\langle p\rangle}$, where p represents the proposition that Mary is sad, and q is the proposition that Bill regrets that Mary is sad.

(30) *Bill regrets that Mary is sad.* (Beaver & Krahmer 2001: 150)

Based on the definition of presupposition in (28), transplication is defined as in (31).[2] If the formula π contains an unbound context variable C_i, then an assignment function $g[\mathrm{C}_{local}/\mathrm{C}_i]$ assigns the local context C_{local} to the variable C_i. The presupposition $[\![\pi]\!]^{g[\mathrm{C}_{local}/\mathrm{C}_i]}$ is evaluated with respect to a certain set of possible worlds σ and needs to be satisfied in σ.

(31) Let σ be a set of possible worlds. $[\![\varphi_{\langle\pi\rangle}]\!]$ is defined with respect to σ iff $\sigma \subseteq [\![\pi]\!]^{g[\mathrm{C}_{local}/\mathrm{C}_i]}$.

[2]Beaver & Krahmer (2001) provide a truth-conditional definition for transplication. That is, $[\![\varphi_{\langle\pi\rangle}]\!]$ is defined only if π is true. Here, I redefine the definition of transplication in the dynamic semantics framework so that it can account for the problem of presupposition projection. See Chapter 3 for more discussions about presupposition projection.

The value of σ varies in different environments. For instance, we will see that in matrix clauses, C_{local} is the utterance context C_u, and σ refers to the context set of the utterance context, as shown in (32). We will also see in Chapter 3 that the values of C_{local} and σ are different from (32) when $\varphi_{\langle\pi\rangle}$ occurs in embedded clauses.

(32) When $\varphi_{\langle\pi\rangle}$ occurs in a matrix clause, $[\![\varphi_{\langle\pi\rangle}]\!]$ is defined with respect to $\mathrm{CS}(\mathrm{C}_u)$ iff $\mathrm{CS}(\mathrm{C}_u) \subseteq [\![\pi]\!]^{g[\mathrm{C}_u/\mathrm{C}_i]}$, where $\mathrm{CS}(\mathrm{C}_u)$ is the context set of the utterance context.

In the next two subsections, transplication is adopted to characterize the presuppositions triggered by *dique* or *zhende*.

2.3.2 Formal definition of *dique* in assertions

As discussed in Section 2.2.1, *dique*(p) imposes two requirements on the previous discourse. First, *dique*(p) requires that p has been suggested by some individual x. Here, 'p is suggested by x' means that x expresses his bias towards p. In order to model the epistemic state of the individual x, I will introduce the subjective probability distribution from Davis et al. (2007).[3] Davis et al. (2007) model a proposition (i.e., a set of possible worlds) as a probability distribution:

(33) A probability distribution for a countably finite set W is a function P^W from subsets of W into real numbers in the interval [0,1] obeying the conditions:[4]

a. $P^W(W) = 1$

[3] A number of approaches to probability and epistemic states have been developed in the field of philosophy. See a complete summary of these approaches in Hájek (2012). Here, I adopt Davis et al. (2007) since it takes use of semantic objects in dynamic semantics (such as $\mathrm{Dox}_{\mathrm{A,C}}$) and hence convenient for the framework of this dissertation.

[4] Since there is no uniform distribution over a countably infinite set, W is assumed to be a finite set for simplicity.

b. $P^W(\{w\}) \geqslant 0$ for all $w \in W$

c. If p and q are disjoint subsets of W, then $P^W(p \cup q) = P^W(p) + P^W(q)$.

(We henceforth suppress the superscript W.)

(Davis et al. 2007: 77)

In order to use a probability distribution to model individuals' epistemic states, Davis et al. (2007) take the proposition $\mathrm{Dox}_{\mathrm{A,C}}$ (a finite set of possible worlds that are doxastically accessible for A in the context C, see Heim, 1992) as representing the epistemic state of the individual A in context C. Then, Davis et al. (2007) conditionalize a uniform distribution, as in (34).

(34) Let $P(\text{-}|p)$ be the function that maps any proposition q to

$$P(q|p) = \frac{P(q \cap p)}{P(p)}$$

where P is a probability distribution. That is, $P(\text{-}|p)$ maps propositions to their conditional probabilities (for P) given p. $P(q|p)$ is undefined if $P(p) = 0$.

(Davis et al. 2007: 77)

This uniform distribution is then adopted to define a function $\mathrm{Cred}_{\mathrm{A,C}}$ (Cred for 'credence'), as in (35). The function $\mathrm{Cred}_{\mathrm{A,C}}$ maps any proposition p to the individual A's degree of belief in p in context C.

(35) The subjective probability distribution for an individual A in context C:

$\mathrm{Cred}_{\mathrm{A,C}} = P(\text{-}|\mathrm{Dox}_{\mathrm{A,C}})$

in which P is a uniform distribution over W, i.e., $P(\{w\}) = \frac{1}{|W|}$ for all $w \in W$.

(Modified from Davis et al. 2007: 77)

Following (34) and (35), an individual A's degree of belief in a proposition p in the context C would be like (36).

(36)

$$\mathrm{Cred}_{\mathrm{A,C}}(\mathrm{p}) = P(\mathrm{p}|\mathrm{Dox}_{\mathrm{A,C}}) = \frac{P(\mathrm{p} \cap \mathrm{Dox}_{\mathrm{A,C}})}{P(\mathrm{Dox}_{\mathrm{A,C}})}$$

Let us see how (36) characterizes different belief states. When the individual A is committed to the proposition p, it means that all the worlds in $\mathrm{Dox}_{\mathrm{A,C}}$ are worlds in which p is true, i.e., $\mathrm{p} \cap \mathrm{Dox}_{\mathrm{A,C}} = \mathrm{Dox}_{\mathrm{A,C}}$. Thus, $\mathrm{Cred}_{\mathrm{A,C}}$ maps the proposition p to the number 1, as shown below:

(37)

$$\mathrm{Cred}_{\mathrm{A,C}}(\mathrm{p}) = P(\mathrm{p}|\mathrm{Dox}_{\mathrm{A,C}}) = \frac{P(\mathrm{p} \cap \mathrm{Dox}_{\mathrm{A,C}})}{P(\mathrm{Dox}_{\mathrm{A,C}})} = \frac{P(\mathrm{Dox}_{\mathrm{A,C}})}{P(\mathrm{Dox}_{\mathrm{A,C}})} = 1$$

When the individual A is committed to ¬p, no worlds in $\mathrm{Dox}_{\mathrm{A,C}}$ are worlds in which p is true. In this case, $\mathrm{Cred}_{\mathrm{A,C}}$ will map p to the number 0:

(38)

$$\mathrm{Cred}_{\mathrm{A,C}}(\mathrm{p}) = P(\mathrm{p}|\mathrm{Dox}_{\mathrm{A,C}}) = \frac{P(\mathrm{p} \cap \mathrm{Dox}_{\mathrm{A,C}})}{P(\mathrm{Dox}_{\mathrm{A,C}})} = \frac{\frac{0}{|W|}}{P(\mathrm{Dox}_{\mathrm{A,C}})} = 0$$

When the individual A is unbiased towards p, it can be interpreted as half of the worlds in $\mathrm{Dox}_{\mathrm{A,C}}$ are worlds in which p is true, and thus $\mathrm{Cred}_{\mathrm{A,C}}$ will map p to the number 0.5.

(39)

$$\mathrm{Cred}_{\mathrm{A,C}}(\mathrm{p}) = P(\mathrm{p}|\mathrm{Dox}_{\mathrm{A,C}}) = \frac{P(\mathrm{p} \cap \mathrm{Dox}_{\mathrm{A,C}})}{P(\mathrm{Dox}_{\mathrm{A,C}})} = \frac{\frac{1}{2}P(\mathrm{Dox}_{\mathrm{A,C}})}{P(\mathrm{Dox}_{\mathrm{A,C}})} = 0.5$$

I employ the function $\mathrm{Cred}_{x,\mathrm{C}}$ to model the epistemic states of individuals. The first requirement of *dique*(p) says that some individual x expresses his bias towards p. The bias of x can be formalized as '$\mathrm{Cred}_{x,\mathrm{C}}(p) > 0.5$', as shown in (40).

(40) x is biased towards p in the context C iff $\mathrm{Cred}_{x,\mathrm{C}}(p) > 0.5$
where $x \in$ I(C) and I(C) is a set of individuals in the context C.

Now, let us see how the formal definition represents the expression of x's bias. When the individual x is expressing his bias towards a proposition p, he is making an assertion in the form of $O(p)$, where O is an operator such as *probably*, x *suggests that*, x *believes that*, x *speculates that*, etc. In the framework of Farkas & Bruce (2010), initiating an assertion of p adds the issue $\{p\}$ onto the top of the Table. I extend their definition and propose that initiating a suggestion of p adds the issue $\{p\}$ onto the top of the Table. In other words, if an individual expresses his bias towards p by asserting $O(p)$, this individual is adding the issue $\{p\}$ onto the top of the Table, as defined in (41). The first requirement of *dique*(p) can be formalized as $\mathrm{T}(\mathrm{C})[0] = \{p\}$, i.e., some individual has raised the issue of $\{p\}$ and added it onto the top of the Table.

(41) If an individual x asserts $O(p)$ in a context C and $\mathrm{Cred}_{x,\mathrm{C}}(p) > 0.5$, then $\mathrm{T}(\mathrm{C})[0] = \{p\}$.

The second requirement of *dique*(p) is that all discourse participants believe that p has been suggested and they recognize that they share this belief. This requirement amounts to saying that the proposition '$\{p\}$ is on the top of the Table' is in the Common Ground. We will see how this requirement is captured by the definition of presupposition presented in the previous section.

Using transplication, the semantics of *dique* in assertions is defined as (42) on the basis of (40) and (41). In (42), p is a proposition of type $\langle s, t\rangle$, and *dique* is a modifier of type $\langle\langle s, t\rangle, \langle s, t\rangle\rangle$.

(42) $[\![\textit{dique}]\!] = \lambda p.p_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{p\}\rangle}$

The semantics of *dique* consists of two parts. The first part $\lambda p.p$ says that *dique* takes in a proposition p and returns the same proposition p. The second part is the formula within the angle brackets, i.e., $\mathrm{T}(\mathrm{C}_i)[0] = \{p\}$. This says that the combination of *dique* with a proposition p triggers a presupposition that p has been suggested in the context C_i. Therefore, the modified proposition *dique*(p) carries a presupposition that p has been suggested in C_i, as in (43).

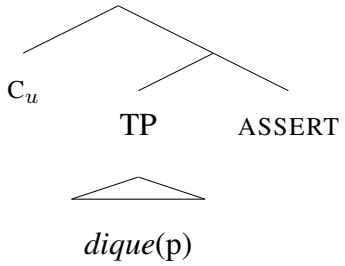
(43) $[\![\textit{dique}(\mathrm{p})]\!] = \mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$

As mentioned in Chapter 1, it is assumed that there exists an assertive operator ASSERT in an assertion, which is a function from a proposition to a context change potential, as defined in (44). (44) says that when an assertion of p is made, the context set CS(C), i.e., the set of possible worlds in which all the propositions in the Common Ground is true, is assertively updated and becomes the set of worlds in which p is true.

(44) $[\![\text{ASSERT}]\!] = \lambda p.\lambda \text{C}.\text{CS}(\text{C}) + p$

Now, we are ready to see the syntactic structure of assertions containing *dique* and the corresponding semantic composition. Following Speas (2004), Tenny (2006) and Hara (2006a, 2008), I assume that a context has a syntactic representation. The utterance context of an assertion is represented as C_u, and thus an assertion containing *dique* has the structure as in (45).

(45)



Following (45), the assertive force head ASSERT combines with the modified proposition *dique*(p) to form a CCP, i.e., an assertion containing *dique*. As summarized in (46), the semantics of an assertion containing *dique* consists of two parts: 1) $\lambda \text{C}.\text{CS}(\text{C}) + \text{p}$, a CCP of type $\langle \text{C}, \text{C} \rangle$, which denotes the meaning of the assertion; 2) $\text{T}(\text{C}_i)[0] = \{\text{p}\}$, which formalizes the presupposition added by *dique*.

(46) $[\![\text{ASSERT}(\textit{dique}(\text{p}))]\!]$
= $[\lambda p.\lambda \text{C}.\ \text{CS}(\text{C}) + p](\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}\ )$
= $\lambda \text{C}.\text{CS}(\text{C}) + \text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}$

According to (46), $\text{ASSERT}(\textit{dique}(\text{p}))$ is defined if $\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}$ is defined. Following the definition of presupposition in (31), $\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}$ is defined with respect to a set of possible worlds σ only if the presupposition $[\![\text{T}(\text{C}_i)[0] = \{\text{p}\}]\!]^{g[\text{C}_{local}/\text{C}_i]}$ is satisfied in

σ. As can bee seen from (45), the only context and the nearest context to TP (i.e., the modified proposition *dique*(p)) in the structure is the utterance context C_u. Thus, C_u is the local context C_{local} for the computation of the presupposition carried by *dique*(p):

(47) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to σ iff σ satisfies $[\![\mathrm{T}(\mathrm{C}_i)[0] = \{\mathrm{p}\}]\!]^{g[\mathbf{C}_{local}/\mathbf{C}_i]}$, i.e., when σ satisfies $[\![\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}]\!]$

Now we need to know the value of σ, i.e., what set of possible worlds satisfies this presupposition. An assertion containing *dique* updates the utterance context set $\mathrm{CS}(\mathrm{C}_u)$ with p, and thus the presupposition carried by p is evaluated in $\mathrm{CS}(\mathrm{C}_u)$ and must be satisfied by it. That is, σ refers to $\mathrm{CS}(\mathrm{C}_u)$. I intensionalize the propositional content of the presupposition $\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}$ as a set of possible worlds, hence it can be entailed by σ:

(48) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to $\mathrm{CS}(\mathrm{C}_u)$ iff $\mathrm{CS}(\mathrm{C}_u) \subseteq \lambda w.\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}$ at w.

This amounts to saying that an assertion containing *dique* is defined only if all of the discourse participants in the utterance context share the belief that p has been suggested in this context, which captures the second requirement of *dique*(p). When ASSERT(*dique*(p)) is defined, the context set $\mathrm{CS}(\mathrm{C}_u)$ is assertively updated with p.

Let us illustrate how (46) works with (3), repeated here as (49). The assertion containing *dique* used by B indicates an update of $\mathrm{CS}(\mathrm{C}_u)$ with the proposition p 'Li went abroad' ($\mathrm{CS}(\mathrm{C}_u)$ + p). This entails that the speaker commits himself to p ($\mathrm{CS}_{\mathrm{spkr}}(\mathrm{C}_u)$ + p), and presupposes that p has been suggested by someone, i.e., A, as characterized by the formula $\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}$. The combination of the assertion

meaning and the presupposition results in the indication that B is confirming the old information p and showing his agreement with A. Since both participants have p in their public beliefs, p enters the Common Ground and the issue {p} is solved and removed from the Table.

(49) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

B: *Dique*, ta chuguo le.
indeed he go-abroad PERF
'Indeed, he went abroad.'

In short, the adverb *dique* modifies the proposition by introducing a presupposition that p has been suggested.

2.3.3 Formal definition of *zhende* in assertions

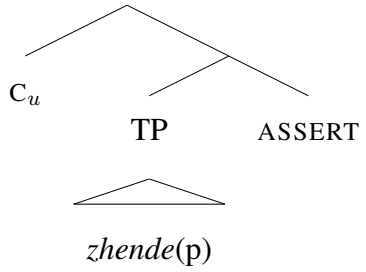
As discussed in Section 2.2.2, *zhende*(p) imposes three requirements on the previous discourse: First, the proposition p has been suggested. Second, all the discourse participants share the belief that p has been suggested. Third, some discourse participant y remains uncommitted to p. This third requirement amounts to saying that p is not contained in the public beliefs of y. The semantics of *zhende* in assertions is defined as in (50). Here, *zhende* is a modifier of type $\langle\langle s,t\rangle,\langle s,t\rangle\rangle$.

(50) $[\![\textit{zhende}]\!] = \lambda p.p_{\langle(\mathrm{T}(\mathrm{C}_i)[0]=\{p\})\wedge(\exists y.p\notin \mathrm{PB}_y(\mathrm{C}_i))\rangle}$
where $y \in \mathrm{D}(\mathrm{C}_i)$ and $\mathrm{D}(\mathrm{C}_i)$ is the set of discourse participants in the context C_i.

The semantics of *zhende* has two parts. The first part $\lambda p.p$ says that *zhende* takes in a propositions p and returns the same proposition p. The second part, $(\mathrm{T}(\mathrm{c}_i)[0] = \{p\}) \wedge (\exists y.p \notin \mathrm{PB}_y(\mathrm{c}_i))$, says that the combination of *zhende* with a proposition p triggers two presuppositions: First, the proposition p has been suggested in a certain context c_i ($\mathrm{T}(\mathrm{c}_i)[0] = \{p\}$). Second, some participant y is uncommitted to p in the context c_i ($\exists y.p \notin \mathrm{PB}_y(\mathrm{c}_i)$).

Let us illustrate the semantic composition of an assertion containing *zhende*. An assertion containing *zhende* has the structure as in (51).

(51)



The force head ASSERT takes in the modified set *zhende*(p) to yield a CCP, i.e., an assertion containing *zhende*, as shown in (52).

(52) $[\![\textsc{assert}(\textit{zhende}(\mathrm{p}))]\!]$

$= [\lambda p.\lambda \mathrm{C}.\textsc{cs}(\mathrm{C}) + p](\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle})$

$= \lambda \mathrm{C}.\textsc{cs}(\mathrm{C}) + \mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle}$

According to (52), ASSERT(*zhende*(p)) is defined if $\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle}$ is defined. According to the structure in (51) and the definition of presupposition, $\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle}$ is defined only if the context set $\textsc{cs}(\mathrm{c}_u)$ satisfies the presupposition $(\mathrm{T}(\mathrm{c}_u)[0] = \{\mathrm{p}\}) \wedge (\exists y.\mathrm{p} \notin \mathrm{PB}_y(\mathrm{c}_u))$, as shown in (53). This amounts to saying that an assertion containing *zhende* is defined only if all the discourse

participants in the utterance context share the belief that p has been suggested but some participant remains uncommitted to p in this context.

(53) $[\![\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle}]\!]$ is defined with respect to $\mathrm{CS}(\mathrm{c}_u)$ iff
$\mathrm{CS}(\mathrm{c}_u) \subseteq [\lambda w.(\mathrm{T}(\mathrm{c}_u)[0] = \{\mathrm{p}\} \text{ at } w) \wedge (\exists y.\mathrm{p} \notin \mathrm{PB}_y(\mathrm{c}_u) \text{ at } w)]$

Let us illustrate (52) with example (16), repeated below as (54). C's use of the assertion modified by *zhende* indicates an update of the context set with p 'It rained last night' ($\mathrm{CS}(\mathrm{c}_u) + \mathrm{p}$) and entails C's commitment to p ($\mathrm{CS}_{\mathrm{C}}(\mathrm{c}_u) + \mathrm{p}$). This assertion also carries two presuppositions. First, p has been suggested, as characterized by the formula $\mathrm{T}(\mathrm{c}_u)[0] = \{\mathrm{p}\}$. Second, some participant, i.e., B, remains uncommitted to p, as shown by $\mathrm{p} \notin \mathrm{PB}_{\mathrm{B}}(\mathrm{c}_u)$. Since C is committed to p but B is uncommitted to p, the assertion modified by *zhende* indicates that C is emphasizing the truth of p and C is trying to convince B of p.

(54) A: Zuowan xiayu le.
last-night rain PERF
'It rained last night.'

B: Meiyou xiayu.
not rain
'It didn't rain.'

C (to B): *Zhende*, zuowan xiayu le.
really last-night rain PERF
'Really, it rained last night.'

In short, the adverb *zhende* modifies the proposition by introducing a presupposition that p has been suggested and some participant remains uncommitted to p.

2.4 Naturalness rating experiment

The previous sections concluded that *dique* and *zhende*, as presupposition triggers, impose different requirements on the previous discourse. These conclusions are validated by a naturalness rating experiment on assertions containing *dique* and *zhende* presented in this section (See Schütze (1996) and Cowart (1997) for why such an experiment can validate the conclusions).

In Section 2.2, it is hypothesized that an assertion containing *dique*, i.e., *dique*(p), requires the context to be one in which p has been suggested by some individual x, whereas *zhende*(p) requires the context to be one in which p has been suggested by x and another participant y is uncommitted to p. Based on this hypothesis, I make the predictions in (55), which will be tested in the experiment.

(55) Predictions:

a. *Dique*(p) is judged more natural in a context where p has been suggested than in a context where p has not been suggested.

b. *Zhende*(p) is judged more natural in a context where p has been suggested by x and some participant y is uncommitted to p, than in a context where p has not been suggested.

c. *Zhende*(p) is judged more natural in a context where p has been suggested by x and some participant y is uncommitted to p, than in a context where p has been suggested and all participants are committed to p.

Method In this experiment, the participants judged the naturalness of assertions containing *dique*/*zhende* in different contexts. For *dique*, each stimulus consists of a context, which distinguished suggestedness, and a target sentence, i.e., an assertion

containing *dique*. There are two conditions in this part of the experiment, suggested and unsuggested. Each condition has 10 items, and thus 20 target stimuli were created. In the unsuggested context of (56), the proposition p 'Xiaolan went out for jogging' has not been suggested, whereas in the suggested context, p has been suggested by Mr. Lan. Thus, according to the prediction in (55), the target sentence *Dique, Xiaolan qu paobu le* in the suggested context should be judged more natural than in the unsuggested context.

(56) a. Unsuggested Context:

Mr. Lan arrives home and finds that his son Xiaolan is not at home. Mrs. Lan tells Mr. Lan:

Target Sentence:

Dique, Xiaolan qu paobu le. 'Indeed, Xiaolan went out for jogging.'

b. Suggested Context:

Mr. Lan arrives home and finds that his son Xiaolan is not at home. He sees that Xiaolan's sneakers are not in the shoe cabinet, so he says to Mrs. Lan: 'I suppose Xiaolan went out for jogging?'. Mrs. Lan answers:

Target Sentence:

Dique, Xiaolan qu paobu le. 'Indeed, Xiaolan went out for jogging.'

As for *zhende*, each stimulus also consists of a context and a target sentence, i.e., an assertion containing *zhende*. In this part of the experiment, there are three conditions: *unsuggested*, *suggested and agreed*, and *suggested and opposed*. Each condition has 10 items, and thus 30 target stimuli were created. As shown in (57), in the unsuggested context, the proposition p 'There was an earthquake last night' has not been suggested. In the suggested and agreed context, p has been suggested by A and all discourse

participants are committed to p. In the suggested and opposed context, p has been suggested by A's roommate and A is uncommitted to p. According to the predictions in (55), the target sentence *Zuowan zhende dizhen le* in the suggested and opposed context should be judged more natural than in the other two contexts.

(57) a. Unsuggested Context:

Waking up in the morning, A's roommate says to A:

Target Sentence:

Zuowan zhende dizhen le. 'There was really an earthquake last night.'

b. Suggested and Agreed Context:

Waking up in the morning, A tells his roommate 'There was an earthquake last night.' A's roommate says to A:

Target Sentence:

Zuowan zhende dizhen le. 'There was really an earthquake last night.'

c. Suggested and Opposed Context:

Waking up in the morning, A's roommate tells A 'There was an earthquake last night.' A doesn't believe it and says 'Are you sure? I didn't feel anything.' A's roommate says to A:

Target Sentence:

Zuowan zhende dizhen le. 'There was really an earthquake last night.'

Thus, 50 stimuli (20 of *dique* and 30 of *zhende*) and 50 fillers were added to the experiment. The 50 stimuli and 50 fillers, all in Chinese characters, were presented to the participants in an anonymous questionnaire in Qualtrics.[5] The questionnaire was organized into ten blocks, each block containing 5 stimuli and 5 fillers.[6] The order of the 10 items within each block was randomized by Qualtrics, ensuring that no minimal pair stimuli appeared together. Each participant completed the questionnaire on a laptop, accompanied by an assistant. The participants were required to judge how natural the target sentences were in the contexts by ticking the numbers on a 5-point scale: completely natural, somewhat natural, undecidable, somewhat unnatural, completely unnatural. 20 native Mandarin speakers, 10 male and 10 female, were paid 80 Hong Kong dollars to participate in the experiment. All participants were undergraduate or postgraduate students from the City University of Hong Kong. The ratings were converted to numerical values as follows: completely natural=5, somewhat natural=4, undecidable=3, somewhat unnatural=2, completely unnatural=1. The t-values and p-values were calculated by the statistical software package SPSS (IBM, 2011).

Results The average naturalness ratings of the 10 assertions containing *dique* are presented in Figure 2.3. Figure 2.3 shows that native speakers judged *dique*(p) in the context where p has been suggested as much more natural than in the context where p has not been suggested (t = -14.289, $p < .001$).

The average ratings of the 10 assertions modified by *zhende* are presented in Figure 2.4. Figure 2.4 shows that native speakers judged *zhende*(p) in the context where p

[5]Qualtrics is a web-based system that conducts online surveys. Version 45634 of the Qualtrics Research Suite. Copyright©2013 Qualtrics. Qualtrics and all other Qualtrics product or service names are registered trademarks or trademarks of Qualtrics, Provo, UT, USA. http://www.qualtrics.com.

[6]See the English translation of the complete questionnaire in Appendix A.

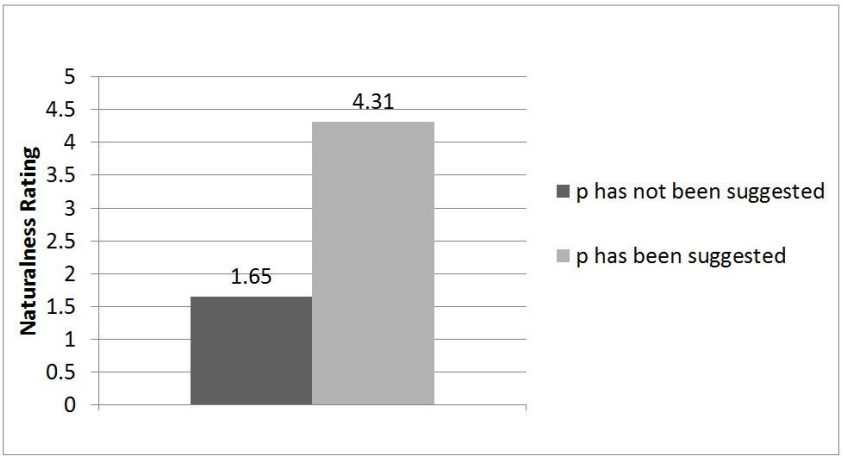


Figure 2.3: Average naturalness ratings of assertions modified by *dique*

has been suggested by x and y is uncommitted to p as more natural than in the context where p has not been suggested (t = -24.715, $p < .001$). Figure 2.4 also shows that native speakers judged *zhende*(p) in the context where p has been suggested by x and y is uncommitted to p as more natural than in the context where p has been suggested and all participants are committed to p (t = -12.309, $p < .001$).

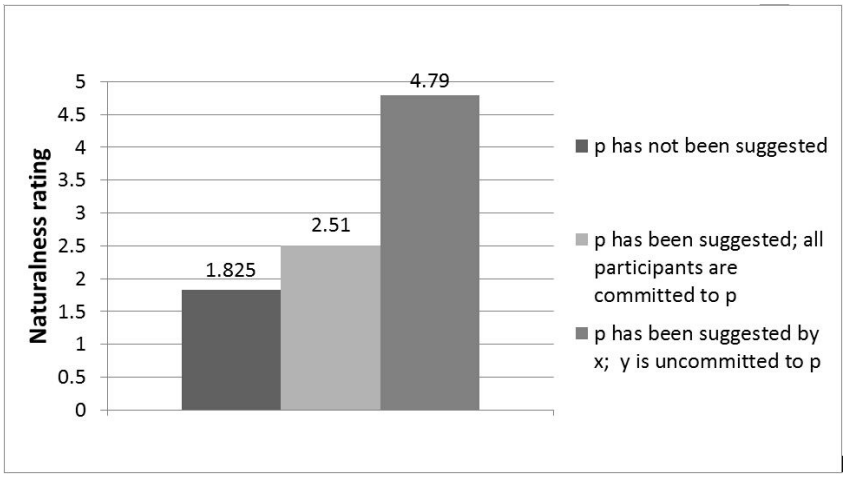


Figure 2.4: Average naturalness ratings of assertions modified by *zhende*

The results support the predictions in (55) about the specific presuppositions that *dique* and *zhende* add to an assertion.

2.5 *Dique* and *zhende* in questions

The previous sections discussed the semantics of *dique* and *zhende* in assertions. In this section, I move on to examine the semantics of *dique* and *zhende* in questions. I show that questions containing *dique*/*zhende* have similar intuitive meanings as assertions containing *dique*/*zhende*. Questions containing *dique* indicate a reiteration of old questions, and questions containing *zhende* indicate an emphasis on truth. The adverbs *dique* and *zhende*, as presupposition triggers, make consistent contributions in assertions and questions. I will examine the behaviors of *dique* in questions and provide a formal definition for it in Section 2.5.1, and then discuss the semantics of *zhende* in questions in Section 2.5.2.

2.5.1 *Dique* in questions

Section 2.2.1 mentioned an intuition that an assertion containing *dique* indicates a confirmation of old information. A question containing *dique* has a similar intuitive meaning, as summarized in (58).

(58) Questions containing *dique* indicate a reiteration of old questions.

(58) can be illustrated by the example in (59). Here, the question Q 'Where did you go last Friday?' has been asked by Mr. Li in the prior context. By using *dique*, Mrs. Li is reiterating this old question Q and showing her agreement with Mr. Li in that Q

should be asked.

(59) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are now talking with Xiaoli:

Mr. Li: Shang zhouwu ni qu naer le?
last Friday you go where PERF
'Where did you go last Friday?'

Mrs. Li: *Dique*, ni qu naer le?
indeed you go where PERF
'Indeed, where did you go?'

Mrs. Li cannot start a conversation with the question *Dique, ni qu naer le?* 'Indeed, where did you go?'. Without Mr. Li's question, Mrs. Li's use of *dique* would be infelicitous, as shown in (60). In other words, *dique* requires that its prejacent 'Where did you go?' is an old question.

(60) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are now talking with Xiaoli:

Mrs. Li: #*Dique*, shang zhouwu ni qu naer le?
indeed last Friday you go where PERF
'Indeed, where did you go last Friday?'

In contrast, the bare question in (61) is felicitous at the beginning of a conversation. This bare question does not indicate Mrs. Li's agreement with any old question.

(61) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are now talking with Xiaoli:

Mrs. Li: Shang zhouwu ni qu naer le?
last Friday you go where PERF

'Where did you go last Friday?'

Motivated by the intuitive meaning of reiteration, *dique* in questions is analyzed as a presupposition trigger, as in assertions. A question Q containing *dique*, represented as *dique*(Q), imposes two requirements on the previous context:

(62) Requirements of *dique*(Q) on the previous context:

a. The question Q has been asked by some individual x.

b. All of the discourse participants believe that Q has been asked, and recognize that they share this belief.

The requirement in (62-a) can be illustrated by the discourse in (63). Here, the question Q 'Why did you come to this small company?' has been asked by A in the prior context, and thus the first requirement of *dique*(Q) is met. B is reiterating the question Q and showing his agreement with A in that Q should be asked.

(63) Context: A and B are talking with a new college C.

A: Ni hen youxiu. Weishenme lai zhe ge xiao gongsi?
you very excellent why come this CL small company
'You are excellent. Why did you come to this small company?'

B: *Dique*, weishenme lai zheli ne?
indeed why come here Q
'Indeed, why did you come here?'

Without A's question, B's use of *dique* would be infelicitous, as shown in (64). Here, Q 'Why did you come to this small company?' is a new question and should be expressed without *dique*.

(64) Context: A and B are talking with a new college C.

B: #*Dique*, weishenme lai zhe ge xiao gongsi?
indeed why come this CL small company
'Indeed, why did you come to this small company?'

The second requirement of *dique*(Q) in (62-b) is that all of the discourse participants believe that the question Q has been asked and that they all recognize that they share this belief. For example, in (63), both B and C are aware that the question 'Why did you come here?' was asked by A, and they both recognize that they share this belief. If B does not recognize that this question has been asked, or if B does not believe that C believes that this question has been asked, B's use of *dique* is infelicitous. In these two cases, 'Why did you come here?' is a new question to at least one discourse participant, and the speaker B should choose a bare question *Weishenme lai zheli?* 'Why did you come here?' to seek an answer from C.

The analysis of *dique* as a presupposition trigger is in line with the intuition in (58), i.e., questions containing *dique* indicate a reiteration of old questions. This reiteration meaning results from the combination of the question meaning and the presupposition of *dique*. As shown in Figure 2.5, a bare question Q encodes the speaker's commitment to solving Q, and *dique* triggers a presupposition that Q has already been asked by some individual x. Thus, the combination of Q with *dique* indicates the speaker's reiteration of the old Q and the speaker's agreement with the individual who asked Q.

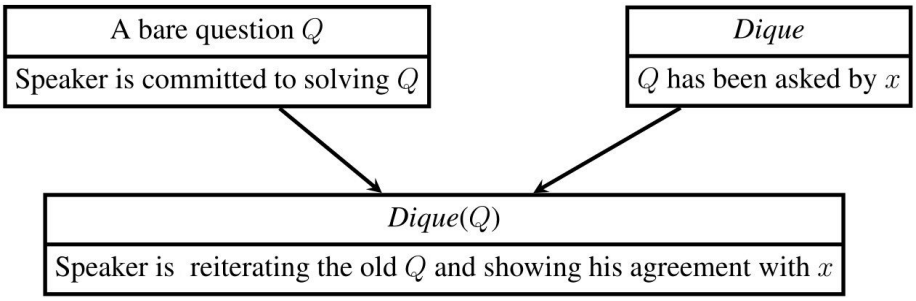


Figure 2.5: A question containing *dique* indicates a reiteration of old question

For example, in (63), the question containing *dique* used by B indicates that B is seeking an answer to Q 'Why did you come to this small company?' (the meaning of a bare question) and presupposes that Q has already been asked by someone, i.e., A (the meaning of *dique*). The combination results in an indication that B is showing his agreement with A in finding an answer to the question Q.

After illustrating the presuppositions triggered by *dique*, we are now ready to see the formal analysis of *dique*. As discussed above, *dique*(Q) imposes two requirements on the previous context: First, the question Q has been asked. Second, all the discourse participants believe that Q has been asked and they recognize that they share this belief. Using the notion of the Table (Farkas & Bruce, 2010), 'the question Q has been asked' amounts to saying that the question Q, i.e., a set of propositions, has already been added onto the top of the Table. The semantics of *dique* in questions is defined as in (65). Here, Q is a set of propositions of type $\langle\langle s,t\rangle,t\rangle$, and *dique* is a modifier of type $\langle\langle\langle s,t\rangle,t\rangle,\langle\langle s,t\rangle,t\rangle\rangle$.

(65) $[\![\textit{dique}]\!] = \lambda Q.Q_{\langle \mathrm{T}(\mathrm{C}_i)[0]=Q\rangle}$

The semantics of *dique* consists of two parts. The first part $\lambda Q.Q$ says that *dique* takes in a set of propositions Q and returns the same set Q. The second part $\mathrm{T}(\mathrm{C}_i)[0] = Q$ says that the combination of *dique* with a set Q requires that Q has been added onto the topmost level of the Table. For example, *dique* takes in a set of propositions $\{\mathrm{p}, \mathrm{q}\}$ and returns a modified set $\{\mathrm{p}, \mathrm{q}\}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p},\mathrm{q}\}\rangle}$, as shown in (66).

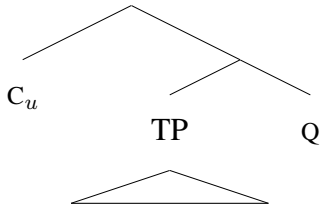
(66) $[\![\textit{dique}(\{\mathrm{p}, \mathrm{q}\})]\!] = \{\mathrm{p}, \mathrm{q}\}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p},\mathrm{q}\}\rangle}$

As mentioned in Chapter 1, it is assumed that there exists a question operator Q in questions. This operator takes in a set of propositions and adds this set onto the top of the Table, as defined in (67).

(67) $[\![\mathrm{Q}]\!] = \lambda Q.\lambda \mathrm{C}.\mathrm{T}(\mathrm{C}) \oplus Q$

Now, we are ready to see the syntactic structure and semantic composition of a question containing *dique*. The utterance context of a question is C_u, and thus a question containing *dique* has the structure as in (68).

(68)



The force head Q takes in the modified set *dique*$(\{\mathrm{p}, \mathrm{q}\})$ to form a CCP, i.e., a question containing *dique*. As summarized in (69), the semantics of a question containing *dique* consists of two parts: 1) $\lambda \mathrm{C}.\ \mathrm{T}(\mathrm{C}) \oplus \{\mathrm{p}, \mathrm{q}\}$, a CCP of type $\langle \mathrm{C}, \mathrm{C}\rangle$, which encodes the meaning of a question; 2) $\mathrm{T}(\mathrm{C}_i)[0] = \{\mathrm{p}, \mathrm{q}\}$, which formalizes the

presupposition added by *dique*.

(69) $[\![\text{Q}(\textit{dique}(\{\text{p}, \text{q}\}))]\!]$
= $[\lambda Q.\lambda \text{C}.\text{T}(\text{C}) \oplus Q](\{\text{p}, \text{q}\}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p,q}\}\rangle})$
= $\lambda \text{C}.\ \text{T}(\text{C}) \oplus \{\text{p}, \text{q}\}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p,q}\}\rangle}$

The formula $\text{Q}(\textit{dique}(\{\text{p}, \text{q}\}))$ is defined if $\{\text{p}, \text{q}\}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p,q}\}\rangle}$ is defined. According to the definition of presupposition in (31) and the structure in (68), $\{\text{p}, \text{q}\}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p,q}\}\rangle}$ is defined only if the presupposition $\text{T}(\text{C}_i)[0] = \{\text{p}, \text{q}\}$ is satisfied in the context set $\text{CS}(\text{C}_u)$, as shown in (70). That is, a question containing *dique* is defined if every discourse participant in the utterance context share the belief that this question has been asked in the utterance context.

(70) $[\![\{\text{p}, \text{q}\}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p,q}\}\rangle}]\!]$ is defined with respect to $\text{CS}(\text{C}_u)$ iff
$\text{CS}(\text{C}_u) \subseteq [\lambda w.\text{T}(\text{C}_u)[0] = \{\text{p}, \text{q}\}$ at $w]$.

Let us illustrate the working of (69) with (59), repeated here as (71). Suppose that the question Q 'Where did you go last Friday?' has three possible answers p, q and r. The question containing *dique* used by Mrs. Li indicates that Mrs. Li adds the question Q onto the topmost level of the Table ($\text{T}(\text{C}_u) \oplus \{\text{p}, \text{q}, \text{r}\}$). At the same time, this question presupposes that some individual, i.e., Mr. Li, also added this question onto the top of the Table, as exhibited by the formula $\text{T}(\text{C}_u)[0] = \{\text{p}, \text{q}, \text{r}\}$. In other words, both Mr. Li and Mrs. Li are committed to seeking an answer to the question Q. This accounts for the intuition that a question containing *dique* indicates the speaker's reiteration of the old question and the speaker's agreement with the intention of the previous asker.

(71) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are talking with Xiaoli:

Mr. Li: Shang zhouwu ni qu naer le?
last Friday you go where PERF
'Where did you go last Friday?'

Mrs. Li: *Dique*, qu naer le?
indeed go where PERF
'Indeed, where did you go?'

As can be seen from the above discussions, the contribution of *dique* is constant in assertions and questions. The semantics of *dique* in assertions and questions are summarized in (72). The adverb *dique* triggers a presupposition that its prejacent is old information: In an assertion, *dique* modifies a proposition by introducing a presupposition that this proposition has been suggested, while in a question, *dique* modifies a question (i.e., a set of propositions) by introducing a presupposition that this question has been asked. The similarity of the contributions made by *dique* in assertions and questions is characterized by the parallel between the formula $\mathrm{T}(\mathrm{C}_i)[0] = \{p\}$ in (72-a) and the formula $\mathrm{T}(\mathrm{C}_i)[0] = Q$ in (72-b).

(72) The semantics of *dique*:

a. $[\![\textit{dique}]\!] = \lambda p.p_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{p\}\rangle}$ if the sister constituent of *dique* denotes a semantic object of type $\langle s,t\rangle$.

b. $[\![\textit{dique}]\!] = \lambda Q.Q_{\langle \mathrm{T}(\mathrm{C}_i)[0]=Q\rangle}$ if the sister constituent of *dique* denotes a semantic object of type $\langle\langle s,t\rangle,t\rangle$.

2.5.2 *Zhende* in questions

Section 2.2.2 mentioned an intuition that an assertion containing *zhende* indicates an emphasis on truth. A question containing *zhende* also indicates an emphasis on truth, but in a slightly different way from assertions containing *zhende*, as stated in (73).

(73) By using *zhende* in a question, the speaker is emphasizing that the question should truly be solved.

(73) can be illustrated by (74). By using a question containing *zhende*, the speaker Mrs. Li is emphasizing that the addressee Xiaoli should truly solve the question Q 'Where did you go last Friday?' asked by Mr. Li. Mrs. Li finds it necessary to emphasize this, because Xiaoli provides an answer to Q but Mrs. Li believes that this answer does not solve the question Q.

(74) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are talking with Xiaoli:

Mr. Li: Shang zhouwu ni qu naer le?
last Friday you go where PERF
'Where did you go last Friday?'

Xiaoli: Wo zai xuexiao.
I at school
'I was at school.'

Mrs. Li: Women zhidao ni bu zai xuexiao. *Zhende*, ni qu naer le?
we know you not at school really you go where PERF
'We know that you were not at school. Really, where did you go?'

If no one had asked the question Q, it would be infelicitous to use *zhende*. As shown in (75), 'Where did you go last Friday?' is a new question and should be expressed

without *zhende*.

(75) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. After the meeting, Mrs. Li asks Xiaoli:

Mrs. Li: #*Zhende*, shang zhouwu ni qu naer le?
really last Friday you go where PERF
'Really, where did you go last Friday?'

If Xiaoli provided an answer to Q and Mrs. Li believed that this answer can solve the question, as in (76), the use of *zhende* would also be unacceptable.

(76) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are talking with Xiaoli:

Mr. Li: Shang zhouwu ni qu naer le?
last Friday you go where PERF
'Where did you go last Friday?'

Xiaoli: Wo qu wangba le.
I go internet-bar PERF
'I went to an internet bar.'

Mrs. Li: Mingbai le. #*Zhende*, ni qu naer le?
understand PERF really you go where PERF
'I see. Really, where did you go?'

Motivated by the intuition in (73), *zhende* in questions is analyzed as a presupposition trigger. A question Q containing *zhende*, represented as *zhende*(Q), imposes the following three requirements on the previous context.

(77) Requirements of *zhende*(Q) on the previous context:

a. The question Q has been asked by some individual x.

b. All of the discourse participants believe that Q has been asked, and recognize that they share this belief.

c. Some discourse participant y provided an answer to Q, but the speaker of *zhende*(Q) believes that this answer cannot solve Q partially or completely.

Let us use (78) as an example to illustrate the requirements of *zhende*(Q). Like *dique*(Q), *zhende*(Q) requires that Q has been asked in the prior context and all of the discourse participants share the belief that Q has been asked. In (78), the first two requirements of *zhende*(Q) are both met: the question Q 'Why did you come here?' has been asked by A and every participant recognizes this.

(78) Context: A and B are talking with a new colleague C.

A: Ni hen youxiu. Weishenme lai zhe ge xiao gongsi?
you very excellent why come this CL small company
'You are excellent. Why did you come to this small company?'

C: Weile neng yujian nimen zheyang de meinv!
for can meet you such GEN beauty
'So that I can meet you such beauties!'

B: Bie kaiwanxiao. *Zhende*, weishenme lai zheer?
don't kid really why come here
'Don't be kidding. Really, why did you come here?'

B's use of *zhende* in (78) would be unacceptable if no one had asked Q, as in (79), since the first requirement of *zhende*(Q) that 'Q has already been asked' would not be met. If A asked Q but B is not aware of this asking, or if A asked Q but B does not believe that C knows that Q has been asked, B cannot use *zhende* either, as the second requirement of *zhende*(Q) is not met.

(79) Context: A and B are talking with a new colleague C.

B: #*Zhende*, weishenme lai zhe ge xiao gongsi?
really why come this CL small company
'Really, why did you come to this small company?'

Besides the requirements shared with *dique*(Q), *zhende*(Q) imposes a third requirement on the prior context: *zhende*(Q) requires that some participant y provided an answer to Q but the speaker of *zhende*(Q) believes this answer cannot solve Q completely or partially. In (78), C provides an answer to the question 'Why did you come here?' asked by A. B believes that C's answer does not solve Q partially or completely by saying 'Don't be kidding'. If no one provided any answer to this question, or if C provided an answer and the speaker B regarded this answer as a complete resolution to Q, it would be infelicitous for B to use *zhende*, as in (80) and (81). This is because the third requirement of *zhende*(Q) is not met.

(80) Context: A and B are talking with a new colleague C.

A: Ni hen youxiu. Weishenme lai zhe ge xiao gongsi?
you very excellent why come this CL small company
'You are excellent. Why did you come to this small company?'

B: #*Zhende*, ni weishenme lai zheer?
really you why come here
'Really, why did you came here?'

(81) Context: A and B are talking with a new colleague C.

A: Ni hen youxiu. Weishenme lai zhe ge xiao gongsi?
you very excellent why come this CL small company
'You are excellent. Why did you come to this small company?'

C: Weile neng yujian nimen zheyang de meinv!
for can meet you such GEN beauty
'So that I can meet you such beauties!'

B: Liaojie le. #*Zhende*, weishenme lai zheer?
Understand PERF really why come here
'I see. Really, why did you come here?'

If C provided a partial answer and B regarded this answer as a partial resolution to Q, it would also be infelicitous for B to use *zhende*, as in (82). Here, C provides a partial answer to the question 'Why did you come here?', and B believes that C's answer solves Q partially. The third requirement of *zhende*(Q) is not met.

(82) Context: A and B are talking with a new colleague C.

A: Ni hen youxiu. Weishenme lai zhe ge xiao gongsi?
you very excellent why come this CL small company
'You are excellent. Why did you come to this small company?'

C: Wo bushi yinwei qian.
I not for money
'I didn't come here for money.'

B: Liaojie le. #*Zhende*, weishenme lai zheer?
Understand PERF really why come here
'I see. Really, why did you come here?'

The analysis of *zhende* as a presupposition trigger is consistent with the intuition in (73), i.e., questions containing *zhende* indicate an emphasis on truth. The meaning of 'emphasis on truth' results from the interaction between the meaning of a bare question and the presupposition of *zhende*. As shown in Figure 2.6, a bare question Q indicates the speaker's commitment to solving Q, and *zhende* triggers a presupposition that Q has been asked by some individual x and the speaker does not take the answer provided by y as a true resolution to Q. Thus, the combination of Q with *zhende* indicates that the speaker is emphasizing that y should provide an answer that can truly solve Q.

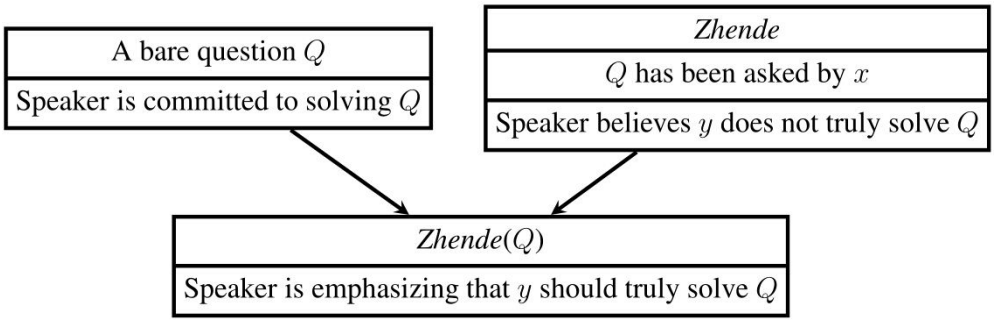


Figure 2.6: A question containing *zhende* indicates an emphasis on truth

For example, in (78), repeated here as (83), the question containing *zhende* indicates that the speaker B is seeking an answer to the question Q 'Why did you come here?' (the meaning of a bare question) and presupposes that B did not take the answer provided by C as a true resolution to Q (the meaning of *zhende*). The combination results in an indication that B is emphasizing that C should provide an answer that can truly solve this question.

(83) Context: A and B are talking with a new colleague C.

A: Ni hen youxiu. Weishenme lai zhe ge xiao gongsi?
you very excellent why come this CL small company
'You are excellent. Why did you come to this small company?'

C: Weile neng yujian nimen zheyang de meinv!
for can meet you such GEN beauty
'So that I can meet you such beauties!'

B: Bie kaiwanxiao. *Zhende*, weishenme lai zheer?
don't kid really why come here
'Don't be kidding. Really, why did you come here?'

Now, let us turn to the formal analysis of *zhende* in questions. As discussed above, *zhende*(Q) has three requirements on the previous discourse: First, the question Q has

been asked. Second, all discourse participants believe that Q has been asked and they recognize that they share this belief. Third, some participant y answers Q by committing himself to a proposition p but the speaker of *zhende*(Q) believes that p cannot solve Q partially or completely. Given that the speaker is asking the question Q and the speaker believes that p does not solve Q, p cannot be a partial or a complete answer to Q. Thus, the third requirement amounts to saying that y commits himself to a proposition p and p is not in the set of partial answers to Q (a complete answer is also a partial answer). In other words, the public beliefs of y has no intersection with the set of partial answers to Q. According to Roberts (1996), a partial answer to a question Q is a proposition which contextually entails the evaluation — either true or false — of at least one element of Q. Thus, the third requirement can be formalized as $\mathrm{PB}_y(\mathrm{c}_i) \cap \{p|\exists q \in Q.(p \subseteq q) \vee (p \subseteq \neg q)\} = \varnothing$.

The semantics of *zhende* in questions is defined as in (103). According to (103), *zhende* is a modifier which takes in a set of propositions Q and returns a modified set $Q_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=Q)\wedge(\exists y.\mathrm{PB}_y(\mathrm{c}_i)\cap\{p|\exists q\in Q.(p\subseteq q)\vee(p\subseteq\neg q)\}=\varnothing)\rangle}$. This modified set carries a presupposition that Q has been asked ($\mathrm{T}(\mathrm{c}_i)[0] = Q$) and some participant y fail to provide a partial or a complete answer to Q ($\exists y.\mathrm{PB}_y(\mathrm{c}_i) \cap \{p|\exists q \in Q.(p \subseteq q) \vee (p \subseteq \neg q)\} = \varnothing$).

(84) $[\![\textit{zhende}]\!] = \lambda Q.Q_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=Q)\wedge(\exists y.\mathrm{PB}_y(\mathrm{c}_i)\cap\{p|\exists q\in Q.(p\subseteq q)\vee(p\subseteq\neg q)\}=\varnothing)\rangle}$

Let us illustrate the semantic composition of a question containing *zhende*. According to (103), *zhende* combines with a set of propositions (e.g., $\{\mathrm{r}, \mathrm{s}\}$) to form a modified set, and then the question force head combines with this modified set to form a question containing *zhende*. As summarized in (85), the semantics of a question

containing *zhende* consists of two parts: 1) λC. [T(C) $\oplus$ {r, s}], a CCP of type $\langle$C, C$\rangle$, which encodes the meaning of a question; 2) $(\mathrm{T}(\mathrm{C}_i)[0] = \{\mathrm{r}, \mathrm{s}\}) \wedge (\exists y.\mathrm{PB}_y(\mathrm{C}_i) \cap \{p|\exists q \in \{\mathrm{r}, \mathrm{s}\}.(p \subseteq q) \vee (p \subseteq \neg q)\} = \varnothing)$, which formalizes the presuppositions added by *zhende*.

(85) $[\![\mathrm{Q}(\textit{zhende}(\{\mathrm{r}, \mathrm{s}\}))]\!]$
= λC. $\mathrm{T}(\mathrm{C}) \oplus \{\mathrm{r}, \mathrm{s}\}_{\langle(\mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{r},\mathrm{s}\})\wedge(\exists y.\mathrm{PB}_y(\mathrm{C}_i)\cap\{p|\exists q\in\{\mathrm{r},\mathrm{s}\}.(p\subseteq q)\vee(p\subseteq\neg q)\}=\varnothing)\rangle}$

Q(*zhende*({r, s})) is defined if $\{\mathrm{r}, \mathrm{s}\}_{\langle(\mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{r},\mathrm{s}\})\wedge(\exists y.\mathrm{PB}_y(\mathrm{C}_i)\cap\{p|\exists q\in\{\mathrm{r},\mathrm{s}\}.(p\subseteq q)\vee(p\subseteq\neg q)\}=\varnothing)\rangle}$ is defined, and this is defined only if the context set CS(C_u) satisfies the presupposition $(\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{r}, \mathrm{s}\}) \wedge (\exists y.\mathrm{PB}_y(\mathrm{C}_u) \cap \{p|\exists q \in \{\mathrm{r}, \mathrm{s}\}.(p \subseteq q) \vee (p \subseteq \neg q)\} = \varnothing)$, as shown in (86). This amounts to saying that a question containing *zhende* is defined only if all the discourse participants in the utterance context share the belief that this question has been asked but some participant fails to solve this question in the utterance context.

(86) $\{\mathrm{r}, \mathrm{s}\}_{\langle(\mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{r},\mathrm{s}\})\wedge(\exists y.\mathrm{PB}_y(\mathrm{C}_i)\cap\{p|\exists q\in\{\mathrm{r},\mathrm{s}\}.(p\subseteq q)\vee(p\subseteq\neg q)\}=\varnothing)\rangle}$ is defined with respect to CS(C_u) iff
CS(C_u) $\subseteq [\lambda w.(\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{r}, \mathrm{s}\}$ at $w) \wedge (\exists y.\mathrm{PB}_y(\mathrm{C}_u) \cap \{p|\exists q \in \{\mathrm{r}, \mathrm{s}\}.(p \subseteq q) \vee (p \subseteq \neg q)\} = \varnothing$ at $w)]$.

To illustrate how (85) works, let us return to the example (74), repeated here as (87). Suppose that the question Q *Shang zhouwu ni qu naer le?* 'Where did you go last Friday?' has three possible answers r, s and t. Mrs. Li's use of the question modified by *zhende* indicates an update of the Table with the question Q $(\mathrm{T}(\mathrm{C}_u) \oplus \{\mathrm{r}, \mathrm{s}, \mathrm{t}\})$ and presupposes that the question Q has been asked $(\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{r}, \mathrm{s}, \mathrm{t}\})$ but Xiaoli failed to solve this question $(\mathrm{PB}_{\mathrm{Xiaoli}}(\mathrm{C}_u) \cap \{p|\exists q \in \{\mathrm{r}, \mathrm{s}, \mathrm{t}\}.(p \subseteq q) \vee (p \subseteq \neg q)\} = \varnothing)$. Since

Mrs. Li is seeking an answer to the question Q and Xiaoli failed to solve this question, the question containing *zhende* indicates that Mrs. Li is emphasizing that Xiaoli should truly solve this question.

(87) Context: Mr. Li and Mrs. Li just had a meeting with the teacher of their son Xiaoli. The couple are talking with Xiaoli:

Mr. Li: Shang zhouwu ni qu naer le?
last Friday you go where PERF
'Where did you go last Friday?'

Xiaoli: Wo zai xuexiao.
I at school
'I was at school.'

Mrs. Li: Women zhidao ni bu zai xuexiao. *Zhende*, ni qu naer le?
we know you not at school really you go where PERF
'We know that you were not at school. Really, where did you go?'

As can be seen from the above discussion, the contribution of *zhende* is consistent in assertions and questions. The semantics of *zhende* in assertions and questions are summarized in (88). The adverb *zhende* modifies a proposition p by introducing a presupposition that p has been suggested but some participant y remains uncommitted to p. *Zhende* modifies a set of propositions Q by introducing a presupposition that Q has been asked and some participant y failed to solve Q.

(88) The semantics of *zhende*:

a. $[\![\textit{zhende}]\!] = \lambda p.p_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{p\})\wedge(\exists y.p\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle}$ if the sister constituent of *zhende* denotes a semantic object of type $\langle s,t\rangle$.

b. $[\![\textit{zhende}]\!] = \lambda Q.Q_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=Q)\wedge(\exists y.\mathrm{PB}_y(\mathrm{c}_i)\cap\{p|\exists q\in Q.(p\subseteq q)\vee(p\subseteq\neg q)\}=\varnothing)\rangle}$ if the sister constituent of *zhende* denotes a semantic object of type $\langle\langle s,t\rangle,t\rangle$.

where $y \in \text{D}(\text{C}_i)$ and $\text{D}(\text{C}_i)$ is the set of discourse participants in the context C_i.

2.6 Chapter summary

This chapter provided a semantic account of the two adverbs *dique* and *zhende*. Intuitively, utterances containing *dique* indicate a confirmation of old information, and utterances containing *zhende* indicate an emphasis on truth. These intuitions motivate the proposal that *dique* and *zhende* are presupposition triggers, which modify an utterance by introducing different presuppositions.

A bare assertion of p encodes an update of the context set with p. If the assertion is modified by *dique*, it presupposes that p has been suggested, and thus an assertion containing *dique* indicates the speaker's confirmation of the old information p. If the assertion is modified by *zhende*, it presupposes that p has been suggested but some participant y remains uncommitted to p. Thus, an assertion containing *zhende* indicates that the speaker is emphasizing the truth of p in order to convince y of p.

A bare question of Q encodes an update of the Table with Q. If the question is modified by *dique*, it presupposes that Q has already been asked, and thus a question containing *dique* indicates that the speaker is reiterating the old question. If the question is modified by *zhende*, it presupposes that Q has been asked but some participant y failed to solve Q. Thus, a question containing *zhende* indicates that the speaker is emphasizing that y should truly solve Q.

All data presented in this chapter are assertions and questions. In the next chapter, I will move to more complicated cases such as embedded clauses and examine whether the semantics of these two adverbs in embedded clauses is consistent with their

semantics in matrix clauses. The studies of embedded clauses provide more evidence for the analysis of *dique* and *zhende* as presupposition triggers. We will also see how the dynamic approach to presupposition presented in this chapter accounts for presupposition projection behaviors in the next chapter.

Chapter 3

Dique and *zhende* as presupposition triggers: Evidence from embedded clauses

3.1 Introduction

The previous chapter investigated the semantics of the adverbs *dique* and *zhende* in matrix clauses. These two adverbs were analyzed as presupposition triggers, which add different presuppositions to assertions or questions. One well-recognized feature of presuppositions is that they exhibit specific projection behaviors in embedded clauses. Other aspects of meanings, such as entailments and conversational implicatures, do not exhibit such projection behaviors when embedded (Beaver & Geurts, 2013). In this chapter, I will examine the behaviors of *dique* and *zhende* in embedded clauses. The investigations of embedded cases will provide more evidence for the analysis of *dique* and *zhende* as presupposition triggers.

Presupposition differs sharply from other aspects of meaning in that presupposition can be projected.[1] That is, the presuppositions of the embedded clause can be inherited by the matrix clause. For example, (1) presupposes that there is a king of France because of the presupposition trigger *the*.[2] When (1) is embedded in various environments in (2), the presupposition of (1) is inherited by the matrix clauses: all sentences in (2) carry the presupposition that there is a king of France.

(1) The king of France is bald.
≫ There is a king of France.

(2) a. The king of France isn't bald. (negation)
b. Is the king of France bald? (question)
c. If the king of France shows up, let me know. (antecedent of a conditional)
d. The king of France may be bald. (epistemic modal)

In contrast, entailments cannot be projected. For example, (3) has an entailment that John owns an animal.[3] When (3) is embedded in various contexts in (4), this entailment is not inherited by the matrix clauses: no sentence in (4) has the entailment that John owns an animal.

(3) John has a cat.
⊨ John owns an animal.

(4) a. John doesn't have a cat. (negation)
b. Does John have a cat? (question)

[1] The word 'projection' was first used in Langendoen & Savin (1971), and the phenomenon of presupposition projection was also first discussed in this work.
[2] 'A ≫ B' indicates that A presupposes B.
[3] 'A ⊨ B' indicates that A entails B.

c. If John has a cat, he cannot travel that often. (antecedent of a conditional)

d. John may have a cat. (epistemic modal)

What makes the projection phenomenon complicated is that presuppositions cannot be projected in every embedded case. When embedded under certain operators, presuppositions are blocked from projecting up to the matrix clause. For example, although the presupposition 'There is a king of France' can be projected in (2), it cannot be projected in (5). Both sentences in (5) do not presuppose that there is a king of France.

(5) a. John believes that the king of France is bald. (belief)

b. If there is a king of France, then the king of France is bald. (consequent of a conditional)

In short, presuppositions exhibit distinct projection behaviors: they can be projected up from certain embeddings but are blocked from projecting from other embeddings. Therefore, these various embedding environments can be adopted to test if *dique* and *zhende* are really presupposition triggers. In this chapter, I will examine the behaviors of *dique* and *zhende* in two types of embeddings: the embedding under attitude verbs (Section 3.2) and the embedding under conditional structures (Section 3.3). It is found that the meanings that are contributed by *dique* and *zhende* are projected up in the same way as presuppositions. This supports the proposal that these adverbs contribute to presuppositional content.

3.2 *Dique* and *zhende* embedded under attitude verbs

This section discusses the behaviors of *dique* and *zhende* embedded under attitude verbs. Section 3.2.1 shows that *dique* and *zhende* exhibit the same behaviors as typical presupposition triggers when embedded under attitude verbs. This supports my hypothesis that the two adverbs are presupposition triggers. Section 3.2.2 illustrates how the dynamic approach to presupposition presented in Chapter 2 captures the meaning of embedded presuppositions. Sentences containing attitude verbs that embed *dique*/*zhende* indicate an update of the attitude-holder's belief worlds, and therefore the presupposition triggered by *dique*/*zhende* is evaluated in the attitude-holder's belief worlds instead of the utterance context set. Consequently, the presuppositions triggered by *dique* and *zhende* when embedded under attitude verbs are associated to the attitude-holder.

3.2.1 Presupposition projection behaviors

The adverbs *dique* and *zhende* can be embedded under propositional attitude verbs like *xiangxin* 'believe', *xiwang* 'hope', ect., as exemplified in (6) and (7).

(6) Zhang xiangxin Li *dique* chuguo le.
Zhang believe Li indeed go-abroad PERF
'Zhang believes that Li indeed went abroad.'

(7) Hu xiwang Lin *zhende* cizhi le.
Hu hope Lin really resign PERF
'Hu hopes that Lin really resigned.'

Before showing the behaviors of these two adverbs embedded under attitude verbs, let us have a look at the behaviors of typical presupposition triggers embedded under

attitude verbs. As observed by Kartunnen (1973, 1974), presuppositions embedded under attitude verbs exhibit specific projection behaviors: If the complement of an attitude verb presupposes p, then the whole sentence containing the attitude verb presupposes that the attitude-holder believes p. For example, in (8), the possessive noun phrase *his cello* triggers a presupposition that Patrick owns a cello, and thus (8) carries this presupposition.

(8) Patrick sells his cello.
≫ Patrick has a cello.

When *sells his cello* is embedded under the attitude verb *want*, the presupposition that Patrick owns a cello is not inherited by the whole sentence, as in (9).[4]

(9) Patrick wants to sell his cello.
∼≫ Patrick has a cello.

(9) presupposes 'Patrick believes that he owns a cello' rather than 'Patrick owns a cello'. This is shown by the fact that (9) can occur in a context like (10). The second clause in (10) carries the presupposition that Patrick believes that he owns a cello, and this presupposition is satisfied by the context created by the first clause. Therefore, the conjunction of these two clauses does not carry the presupposition that Patrick believes that he owns a cello.

(10) Patrick is under the misconception that he owns a cello, and he wants to sell his cello.

[4] 'A ∼≫ B' indicates that A does not presuppose B.

Karttunen (1973, 1974) concludes that presuppositions embedded under all attitude verbs, such as *believe*, *think*, *want*, *expect*, *fear*, *intend*, *suspect*, *assume* and *hope*, have this specific projection behavior, which is summarized in (11). (11) says that if the embedded clause φ has a presupposition p, then the matrix clause $\alpha\sigma\varphi$ (where α is the attitude-holder) presupposes that the attitude holder α believes in p.

(11) If σ is a verb of propositional attitude, then a context C satisfies the presupposition of '$\alpha\sigma\varphi$' only if B_α(C) satisfies the presuppositions of φ; where B_α(C) stands for the set of beliefs attributed to α in C.

(Modified from Karttunen 1974: 189)

In the previous chapter, I hypothesized that the adverbs *dique* and *zhende* are presupposition triggers. This hypothesis predicts that *dique* and *zhende* exhibit the same behaviors as typical presupposition triggers like *his cello* when embedded under attitude verbs. This turns out to be a correct prediction. To see this, let us move on to the behaviors of *dique* and *zhende* embedded under attitude verbs.

Following the analysis in Chapter 2, an assertion containing *dique* such as (12) carries a presupposition that the proposition p 'Li went abroad' has been suggested.

(12) Li *dique* chuguo le.
Li indeed go-abroad PERF
'Li indeed went abroad.'
$\gg$ 'Li went abroad' has been suggested.

However, an assertion containing an attitude verb that embeds *dique*, such as (6), repeated here as (13), does not carry this presupposition. The presupposition of (13) is that the attitude-holder Zhang believes that p has been suggested, not that p actually has been suggested.

(13) Zhang xiangxin Li *dique* chuguo le.
Zhang believe Li indeed go-abroad PERF
'Zhang believes that Li indeed went abroad.'
≫ Zhang believes that 'Li went abroad' has been suggested.

This can be shown by the fact that (13) is felicitous in the discourse in (14). The second clause in (14-a) carries the presupposition that Zhang believes that p 'Li went abroad' has been suggested, and this presupposition is satisfied in the local context created by the first clause. Therefore, the conjunction of these two clauses does not carry this presupposition anymore. (14-a) can be used at the beginning of the discourse. If the presupposition of the second clause was that p has been suggested, this presupposition could not be satisfied in the local context created by the first clause, and thus (14-a) would presuppose that p has been suggested, which is a wrong prediction.

(14) Context: Wu and Zhang are talking about what Li has been up to over the phone, but Zhang cannot hear Wu very clearly due to the bad signal.

a. Zhang wu yiwei Wu shuo Li chuguo le. Zhang xiangxin Li
Zhang mistake think Wu say Li go-abroad PERF Zhang believe Li
dique chuguo le.
indeed go-abroad PERF
'Zhang mistakenly thinks that Wu said that Li went abroad. Zhang believes that Li indeed went abroad.'

The adverb *zhende* exhibits similar behaviors when embedded under attitude verbs. Following the analysis in the previous chapter, a bare assertion containing *zhende* like (15) carries a presupposition that the proposition p 'Lin resigned' has been suggested.

(15) Lin *zhende* cizhi le.
Lin really resign PERF
'Lin really resigned.'
≫ 'Lin resigned' has been suggested.

However, an assertion containing an attitude verb that embeds *zhende*, such as (7), repeated here as (16), does not carry this presupposition. The presupposition of (16) is that the attitude-holder Hu believes that p has been suggested.

(16) Hu xiwang Lin *zhende* cizhi le.
Hu hope Lin really resign PERF
'Hu hopes that Lin really resigned.'
≫ Hu believes that 'Lin resigned' has been suggested.

This is shown by the fact that (16) is felicitous in the discourse in (17). The second clause in (17-a) carries the presupposition that Hu believes that p 'Li resigned' has been suggested, and this presupposition is satisfied in the local context created by the first clause. Therefore, the conjunction of these two clauses does not carry this presupposition anymore. (17-a) can be used at the beginning of the discourse.

(17) Context: Xu and Hu are talking about what Lin has been up to over the phone, but Hu cannot hear Xu clearly due to the bad signal.

a. Hu wu yiwei Xu shuo Lin cizhi le. Hu xiwang Lin *zhende*
Hu mistake think Xu say Lin resign PERF Hu hope Lin realy
cizhi le.
resign PERF
'Hu mistakenly thinks that Xu said that Lin resigned. Hu hopes that Lin really resigned.'

As can be seen from above data, the presupposition triggered by embedded *dique*/*zhende* is relativized to the attitude-holder. In other words, *dique* and *zhende*

exhibit the same behaviors as typical presupposition triggers when embedded under attitude verbs. This is correctly predicted by the hypothesis that *dique* and *zhende* are presupposition triggers.

3.2.2 Embedded presuppositions and local context

This section shows how the dynamic approach to presupposition presented in Chapter 2 captures the projection behaviors shown in Section 3.2.1. Sentences containing attitude verbs that embed *dique*/*zhende* indicate an update of the attitude-holder's belief worlds, and thus the presupposition triggered by *dique*/*zhende* is evaluated in the attitude-holder's belief worlds instead of the utterance context set. Therefore, the presuppositions triggered by *dique* and *zhende* when embedded under attitude verbs are associated to the attitude-holder.

Before deriving the presuppositions of *dique*/*zhende* when embedded under attitude verbs, we need a semantic analysis for attitude verbs. I adopt the formal definition of attitude verbs from Heim (1992). According to Heim (1992), a sentence like (18) is true in a context C if and only if it is raining in every world w that is doxastically accessible for Zhang to C. A world w is doxastically accessible for a participant x to a context C if and only if w is compatible with the beliefs that x holds in C.

(18) Zhang xiangxin xianzai zhengzai xiayu.
Zhang believe now is rain
'Zhang believes that it is raining.'

For instance, the relation of doxastic accessibility for Zhang corresponds to the function $\mathrm{Dox}_{\mathrm{Z,C}}$ ('Z' for 'Zhang'), as shown in (19). $\mathrm{Dox}_{\mathrm{Z,C}}$ represents the worlds that are doxastically accessible for Zhang to C. To put simply, $\mathrm{Dox}_{\mathrm{Z,C}}$ represents Zhang's

belief worlds in C.

(19) $\mathrm{Dox}_{\mathrm{Z,C}}$= $\{w \mid w$ conforms to what Zhang believes in the context C.$\}$

(Modified from Heim 1992: 187)

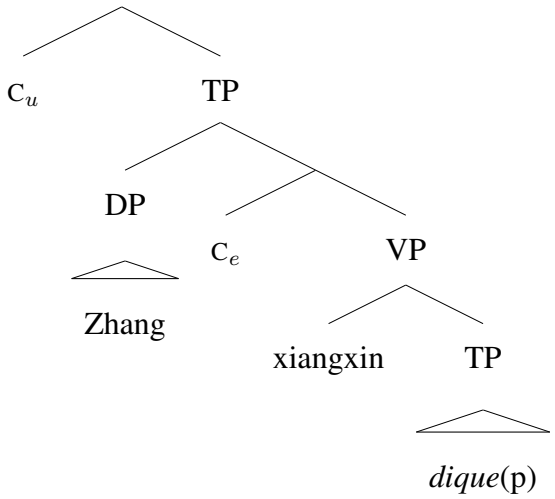
On the basis of (19), the semantics of *xiangxin* 'believe' is defined as in (20). The attitude verb *xiangxin* takes in a proposition p and an entity x to yield a context change potential λC. $\mathrm{Dox}_{x,\mathrm{C}} + p$. This says that the utterance of a sentence containing *xiangxin* changes the context by updating x's belief worlds in the context C with the p worlds.

(20) $[\![$*xiangxin*$]\!] = \lambda p.\lambda x.\lambda$C. $\mathrm{Dox}_{x,\mathrm{C}} + p$

Now, we are ready to see the syntactic structure of sentences containing attitude verbs. Take (13), repeated here as (21), as an example. The structure of (21) is as in (22).

(21) Zhang xiangxin Li *dique* chuguo le.
Zhang believe Li indeed go-abroad PERF
'Zhang believes that Li indeed went abroad.'

(22)



As can be seen from (22), there are two contexts in the structure. The utterance

context C_u occupies a higher position, and the embedded context C_e is lower. The nearest context to *Li dique chuguo le* (i.e., the modified proposition *dique*(p)) is the embedded context C_e rather than the utterance context C_u.

Following this structure, the attitude verb *xiangxin* takes in the modified proposition *dique*(p) and the entity Zhang to yield a context change potential, as shown in (23).

(23) $[\![$*xiangxin*(*dique*(p))(Zhang)$]\!]$

= $(\lambda p.\lambda x.\lambda \mathrm{C}.\ \mathrm{Dox}_{x,\mathrm{C}} + p)\ (\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle})(\mathrm{Z})$

= $\lambda \mathrm{C}.\ \mathrm{Dox}_{\mathrm{Z,C}} + \mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$

p = 'Li went abroad'

$[\![$*xiangxin*(*dique*(p))(Zhang)$]\!]$ is defined if $\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$ is defined. According to the definition of presupposition in Chapter 2, $\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$ is defined with respect to a set of worlds σ only if σ satisfies the presupposition $[\![\mathrm{T}(\mathrm{C}_i)[0] = \{\mathrm{p}\}]\!]^{g[\mathrm{C}_{local}/\mathrm{C}_i]}$. According to the structure in (22), the local context C_{local} to the TP (i.e., the modified proposition *dique*(p)) is the embedded context C_e, and thus the context variable C_i is bound by C_e, as shown in (24).

(24) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to a set of possible worlds σ iff
$\sigma \subseteq \lambda w.\mathrm{T}(\mathrm{C}_e)[0] = \{\mathrm{p}\}$ at w.

Now we need to know what set of possible worlds satisfies this presupposition. According to (23), *xiangxin*(*dique*(p))(Zhang) updates Zhang's belief worlds $\mathrm{Dox}_{\mathrm{Z,C}_u}$ with the proposition p, and thus the presuppositions carried by p are requirements imposed on $\mathrm{Dox}_{\mathrm{Z,C}_u}$ and must be satisfied in $\mathrm{Dox}_{\mathrm{Z,C}_u}$. That is, σ refers to $\mathrm{Dox}_{\mathrm{Z,C}_u}$:

(25) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to $\mathrm{Dox}_{\mathrm{Z},\mathbf{C}_u}$ iff
$\mathrm{Dox}_{\mathrm{Z},\mathbf{C}_u} \subseteq \lambda w.\mathrm{T}(\mathrm{c}_e)[0] = \{\mathrm{p}\}$ at w.

(25) says that for (21) to be defined, all the worlds in $\mathrm{Dox}_{\mathrm{Z},\mathbf{C}_u}$ are worlds in which p has been suggested in c_e. In other words, (21) is defined only if the attitude-holder Zhang believes that p has been suggested by some individual in the embedded context c_e. When defined, Zhang's belief worlds is updated with the proposition 'Li went abroad'. This is the correct interpretation of the presuppositions embedded under attitude verbs.

Now let us derive the presuppositions of *zhende* when embedded under attitude verbs. Sentences containing attitude verbs that embed *zhende*, such as (26), has the semantics in (27).

(26) Hu xiangxin Lin *zhende* cizhi le.
Hu believe Lin really resign PERF
'Hu believes that Lin really resigned.'

(27) $[\![$*xiangxin*(*zhende*(p))(Hu)$]\!]$
= $(\lambda p.\lambda x.\lambda \mathbf{C}.\ \mathrm{Dox}_{x,\mathbf{C}} + p)\ (\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin \mathrm{PB}_y(\mathrm{c}_i))\rangle})$(H)
= $\lambda \mathbf{C}.\ \mathrm{Dox}_{\mathrm{H},\mathbf{C}} + \mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin \mathrm{PB}_y(\mathrm{c}_i))\rangle}$
p = 'Lin resigned'

According to the definition of presupposition in Chapter 2, $\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin \mathrm{PB}_y(\mathrm{c}_i))\rangle}$ is defined with respect to a set of worlds σ if σ satisfies the presupposition $[\![(\mathrm{T}(\mathrm{c}_e)[0] = \{\mathrm{p}\}) \wedge (\exists y.\mathrm{p} \notin \mathrm{PB}_y(\mathrm{c}_e))]\!]$. Now we need to know what set of possible worlds satisfies this presupposition. According to (27), *xiangxin*(*zhende*(p))(Hu) updates Hu's belief worlds $\mathrm{Dox}_{\mathrm{H},\mathbf{C}_u}$ with the proposition p, and thus the presuppositions carried by p are

requirements imposed on $\mathrm{Dox}_{\mathrm{H},\mathrm{C}_u}$ and must be satisfied in $\mathrm{Dox}_{\mathrm{H},\mathrm{C}_u}$. That is, σ refers to $\mathrm{Dox}_{\mathrm{H},\mathrm{C}_u}$:

(28) $[\![\mathrm{p}_{\langle(\mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\})\wedge(\exists y.\mathrm{p}\notin\mathrm{PB}_y(\mathrm{c}_i))\rangle}]\!]$ is defined with respect to $\mathrm{Dox}_{\mathrm{H},\mathrm{C}_u}$ iff
$\mathrm{Dox}_{\mathrm{H},\mathrm{C}_u} \subseteq \lambda w.[(\mathrm{T}(\mathrm{c}_e)[0] = \{\mathrm{p}\} \text{ at } w) \wedge (\exists y.\mathrm{p} \notin \mathrm{PB}_y(\mathrm{c}_e) \text{ at } w)]$.

(28) says that for (26) to be defined, all the worlds in $\mathrm{Dox}_{\mathrm{H},\mathrm{C}_u}$ are worlds in which p has been suggested in c_e and some participant y remains uncommitted to p in c_e. In other words, (26) is defined only if the attitude-holder Hu believes that p has been suggested and some participant is uncommitted to p in the embedded context c_e. When defined, Hu's belief set is updated with the proposition 'Lin resigned'.

3.2.3 Section summary

When *dique* and *zhende* are embedded under attitude verbs, the presuppositions triggered by these adverbs are relativized to the attitude-holder. This is the same as the behaviors of typical presupposition triggers. The parallelism in the behaviors between *dique*/*zhende* and typical presupposition triggers supports the hypothesis that *dique* and *zhende* are presupposition triggers. The projection behavior of presuppositions embedded under attitude verbs is captured by the dynamic approach to presupposition presented in Chapter 2. Sentences containing attitude verbs update the attitude-holder's belief worlds with p, and therefore the presupposition carried by p is evaluated in the attitude-holder's belief worlds and must be satisfied there. That is, sentences containing attitude verbs that embed *dique*/*zhende* are defined only if the attitude-holder's belief worlds entail the presupposition triggered by *dique*/*zhende*.

3.3 *Dique* and *zhende* embedded under conditionals

This section discusses another type of embedding, the embedding of *dique* and *zhende* under conditional structures. Section 3.3.1 introduces the projection behavior of presuppositions embedded under English conditionals, and illustrates how the formal analyses provided by Stalnaker (1968), Lewis (1973) and Heim (1992) account for this projection behavior. Section 3.3.2 shows that the adverbs *dique* and *zhende* exhibit the same behaviors as typical presupposition triggers when embedded under conditionals, and adopts the Stalnaker-Lewis-Heim theory to formally analyze Mandarin conditionals. Section 3.3.3 shows how this formal analysis explains the intuition that conditionals containing *dique*/*zhende* express the speaker's doubt towards old information.

3.3.1 Presupposition projection and the Stalnaker-Lewis-Heim analysis

Before showing the behaviors of *dique* and *zhende* embedded under Mandarin conditionals, I will first introduce the general behaviors of presupposition triggers embedded under conditionals in this section. I will also illustrate how the projection behavior of embedded presuppositions is captured by the Stalnaker-Lewis-Heim analysis of English conditionals and the dynamic approach to presupposition.

A conditional structure refers to a complex sentence made up of two clauses, in which the truth of the main clause is conditional on the truth of the adjoined clause. For example, in (29), the truth of 'I will stay at home' is dependent on the truth of 'It rains tomorrow'. The adjoined clause marked by the word *if*, i.e., *If it rains tomorrow*, is referred to as the antecedent, whereas the main clause, i.e., *I will stay at home*, is

referred to as the consequent.

(29) If it rains tomorrow, I will stay at home.

In the study of presupposition projection, a conditional structure is considered as a *filter* (Karttunen, 1973, 1974). This is because the presuppositions of the constituents can only be projected up to the whole conditional structure under certain conditions. If the conditions are not met, the embedded presuppositions will be blocked from projecting up. For example, in all three sentences in (30), the phrase *Jack's children* triggers a presupposition that Jack has children. This presupposition is inherited by the entire conditionals in (30-a) and (30-b), but not inherited by the conditional in (30-c).

(30) a. If baldness is hereditary, then all of Jack's children are bald.

b. If all of Jack's children are bald, then baldness is hereditary.

c. If Jack has children, then all of Jack's children are bald.

(Karttunen 1973: 177)

Karttunen (1973) summarizes this projection behavior as a filtering condition for conditional structures, as shown in (31). (31) says that the presuppositions of the consequent that are entailed by the antecedent will be blocked from projecting up.

(31) Filtering Condition for a conditional in the form of 'if p, then q':
The presuppositions of the parts will be inherited by the whole conditional unless q presupposes r and p entails r.

(Modified from Karttunen 1973: 178)

(31) can be illustrated by (30). For example, in (30-c), the presupposition of the

consequent, that Jack has children, is entailed by the antecedent 'Jack has children', and this presupposition is not inherited by the whole conditional. In contrast, in (30-a), the presupposition of the consequent that Jack has children is not entailed by the antecedent 'baldness is hereditary'. In (30-b), the presupposition that Jack has children is triggered in the antecedent 'all of Jack's children are bald'. In both cases, the presupposition is inherited by the whole conditional, as summarized in (31).

In order to capture this projection behavior of presuppositions embedded in conditionals, Heim (1992) provides a formal analysis of English conditionals on the basis of Stalnaker (1968) and Lewis (1973). Let us show how this formal analysis together with the dynamic approach to presupposition makes correct predictions about the projection behavior.

Stalnaker (1968) and Lewis (1973) provide similar analyses for conditional structures. The key point of their analyses is the relationship of comparative similarity among worlds. By using a conditional 'if p, q', we select the worlds which are most familiar to the world of evaluation (i.e., the world in which the truth of the conditional is evaluated) from all the worlds in which p is true and claim that these p-worlds are q worlds. In other words, a conditional 'if p, q' is true in a world w if and only if all p-worlds that are maximally similar to w are q worlds. To characterize the comparable similarity among worlds, Heim (1992) adopts a selection function Sim_w. As shown in (32), the function Sim_w maps each proposition p to the set of p-worlds that are maximally similar to w.

(32) Sim_w(p) = $\{w' \in$ W: $w' \in$ p and w' resembles w no less than any other world in p$\}$

(Heim 1992: 195)

The definition of conditionals is given in (33) on the basis of (32). (33) says that when a context *c* (i.e., the context set) is updated with a conditional 'if φ, ψ', all the φ-worlds in *c* that are maximally similar to w are ψ-worlds.

(33) c + if φ, ψ = $\{w \in c : \mathrm{Sim}_w(c + \varphi) + \psi = \mathrm{Sim}_w(c + \varphi)\}$

(Heim 1992: 196)

Following this definition, the semantics of (30-b), repeated here as (34-a), would be like (34-b). As shown in (34-b), the whole conditional is defined if $\mathrm{p}_{\langle \mathrm{r} \rangle}$ is defined. Following the dynamic approach to presupposition, $\mathrm{p}_{\langle \mathrm{r} \rangle}$ is defined if r is satisfied in the local context. As can been seen from (34-b), the local context to $\mathrm{p}_{\langle \mathrm{r} \rangle}$ is *c*, and thus (34-a) is defined when the context *c* entails r, i.e., when all the participants believe that Jack has children. (34-a) inherits the presupposition of its antecedent.

(34) a. If all of Jack's children are bald, then baldness is hereditary.

b. c + if $\mathrm{p}_{\langle \mathrm{r} \rangle}$, q = $\{w \in c : \mathrm{Sim}_w(c + \mathrm{p}_{\langle \mathrm{r} \rangle}) + \mathrm{q} = \mathrm{Sim}_w(c + \mathrm{p}_{\langle \mathrm{r} \rangle})\}$

p = 'All of Jack's children are bald'

q = 'Baldness is hereditary'

r = 'Jack has children'

The semantics of (30-c), repeated as (35-a), is as in (35-b). By the definition of the selection function in (32), Sim_w(*c* + p) denotes the set of p-worlds (i.e., the worlds in which p is true) that are maximally similar to w, and thus Sim_w(*c* + p) is a subset of *c* + p. According to the dynamic definition of presupposition, $\mathrm{q}_{\langle \mathrm{r} \rangle}$ is defined if r is satisfied in the local context. As can be seen from (35-b), the local context to $\mathrm{q}_{\langle \mathrm{r} \rangle}$ is $\mathrm{Sim}_w(c + \mathrm{p})$, i.e., the set of p-worlds maximally similar to w. Thus, (35-a) is defined if Sim_w(*c* + p)

entails r. Since c + p entails r, $\mathrm{Sim}_w(c + \mathrm{p})$ also entails r. Once the presupposition r is satisfied in the local context, the conditional as a whole does not presuppose r anymore. In Karttunen's (1973) term, the presupposition r is 'filtered out'.

(35) a. If Jack has children, then all of Jack's children are bald.

b. c + if p, $\mathrm{q}_{\langle \mathrm{r} \rangle} = \{w \in c : \mathrm{Sim}_w(c + \mathrm{p}) + \mathrm{q}_{\langle \mathrm{r} \rangle} = \mathrm{Sim}_w(c + \mathrm{p})\}$

p = 'Jack has children'

q = 'All of Jack's children are bald'

r = 'Jack has children'

In short, presuppositions embedded under conditionals will be inherited by the whole conditional, unless the presupposition is triggered in the consequent and entailed by the antecedent. This projection behavior is explained by the Stalnaker-Lewis-Heim analysis and the dynamic approach to presupposition: When the presupposition of the consequent is satisfied in the local context created by the antecedent, the whole conditional does not carry this presupposition anymore.

3.3.2 Mandarin conditionals

This section examines the behaviors of *dique* and *zhende* embedded under Mandarin conditionals. It is found that *dique* and *zhende* exhibit the same behaviors as typical presupposition triggers when embedded under conditionals, which is consistent with the analysis of these adverbs as presupposition triggers.

A Mandarin conditional structure is made up of two clauses. As shown in (36), the adjoined clause marked by the word *ruguo* 'if', i.e., *ruguo Xiaoli qu*, is the antecedent,

whereas the main clause, i.e., *wo ye qu*, is the consequent.[5]

(36) Ruguo Xiaoli qu, wo ye qu.
if Xiaoli go I also go
'If Xiaoli goes, I will go too.'

Let us have a look at the behaviors of *dique* and *zhende* embedded in conditionals. Take *dique* as an example. I hypothesized that *dique* is a presupposition trigger. This hypothesis, together with the filtering condition in (31), predicts that the presupposition triggered by *dique* in the antecedent can always be projected up. This is a correct prediction. For example, the antecedent of (37) presupposes that p 'It will rain tomorrow' has been suggested, and so does the whole conditional.

(37) Ruguo mingtian *dique* xiayu, wo hui dai zai jiali.
if tomorrow indeed rain I will stay at home
'If it indeed rains tomorrow, I will stay at home.'

This is shown by the fact that (37) is felicitous in the discourse in (38), where p has been suggested by A and thus the presupposition of (37) is satisfied. If the proposition 'It will rain tomorrow' had never been suggested, (37) would be infelicitous.

(38) A: Mingtian hui xiayu.
tomorrow will rain
'It will rain tomorrow.'

[5]Mandarin also has unmarked conditionals, i.e., conditionals that are not marked by the word *ruguo*, as in (i).

(i) Xiaoli qu, wo ye qu.
Xiaoli go I also go
'If Xiaoli goes, I will go too.'

B: Ruguo mingtian *dique* xiayu, wo hui dai zai jiali.
if tomorrow indeed rain I will stay at home
'If it indeed rains tomorrow, I will stay at home.'

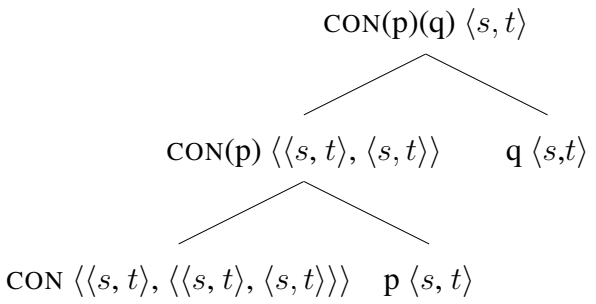
The hypothesis of *dique* as a presupposition trigger also predicts that when the presupposition triggered by *dique* in the consequent is entailed by the antecedent, this presupposition will be blocked from being projected up. This is also a correct prediction. For example, the consequent of (39) presupposes that 'It will rain tomorrow' has been suggested. This presupposition is entailed by the antecedent, and the whole conditional does not carry this presupposition. (39) is felicitous even when 'It will rain tomorrow' has never been mentioned in the prior context.

(39) Ruguo tianqiyubaoyuan shuo mingtian hui xiayu, na mingtian *dique*
if weather-reporter say tomorrow will rain then tomorrow indeed
hui xiayu.
will rain
'If the weather reporter says that it will rain tomorrow, then it will indeed rain tomorrow.'

In order to capture the projection behavior of presuppositions embedded in conditionals, I adopt the Stalnaker-Lewis-Heim analysis for Mandarin conditionals. I propose that the word *ruguo* 'if' in Mandarin conditionals represents a conditional operator CON,[6] and CON takes in two propositions (denoted by the antecedent and the consequent) to yield one proposition, as shown by the typed tree in (40).

[6]I assume that there exists a covert CON in unmarked conditionals.

(40)



Based on Heim's (1992) formalization in (32) and (33), the semantic definition for the conditional operator is given in (41). CON(p)(q) denotes a set of possible worlds w in the context set, such that all p-worlds maximally similar to w are worlds where q is true.

(41) $[\![\text{CON}]\!] = \lambda p.\lambda q.\ \lambda w \in \text{CS(C)}.[\text{Sim}_w(\text{CS(C)} + p) + q = \text{Sim}_w(\text{CS(C)} + p)]$

(41) shows that a conditional involves a two-step update procedure. As stated in (42-a), the first update is that the context set is updated with the antecedent p to create a set of p-worlds, as characterized by '$\text{CS(C)} + p$' in (41). The second update, as shown in (42-b), is that the set of p-worlds that are most similar to w in the context set is updated with the consequent q, as characterized by '$\text{Sim}_w(\text{CS(C)} + p) + q$' in (41).

(42) Two-step update of conditionals:

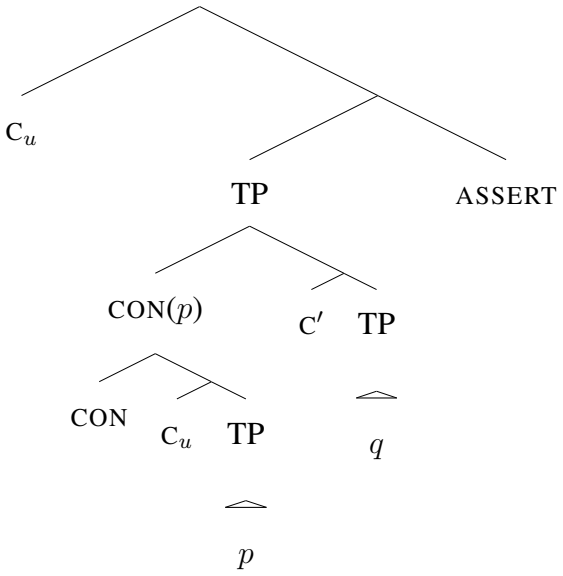
a. The context set is updated with p:
   $\text{CS(C)} + p$

b. The set of p-worlds that are most similar to w is updated with q:
   $\text{Sim}_w(\text{CS(C)} + p) + q$

Based on this two-step update, I propose that the syntactic structure of a conditional

'If p, q' is as in (43). A conditional is a declarative sentence and hence an assertion. Thus, the ASSERT morpheme occupies the head position of the ForceP and the utterance context C_u occupies the highest position. The fist step in the semantic update is that the antecedent p updates the utterance context. In order to implement this update, I assume that there exists a context between the conditional operator CON and p in the structure in (43), and this context is bound by the utterance context C_u. Suppose the utterance context C_u is updated with the antecedent p to create a temporary context C'. The second step, then, is that the temporary context C' is updated with the consequent q. To implement this update, I assume that the context C' c-commands the consequent q in (43). The context C' is like the context C_u in every respect, except that $CS(C')$ is a set of p-worlds that are most similar to w in $CS(C_u)$.

(43)



The definition of the conditional operator in (41) and the structure in (43) correctly predict that the presupposition triggered by *dique*/*zhende* in the antecedent is inherited by the whole conditional. Take (37), repeated here as (44), as an example.

(44) Ruguo mingtian *dique* xiayu, wo hui dai zai jiali.
if tomorrow indeed rain I will stay at home
'If it indeed rains tomorrow, I will stay at home.'

The conditional operator takes in a modified proposition *dique*(p) and another proposition q to yield the proposition in (45).

(45) $[\![\text{CON}(\textit{dique}(\text{p}))(\text{q})]\!]$

$= (\lambda p.\lambda q.\ \ \lambda w \in \text{CS}(\text{C}).\ \ [\text{Sim}_w(\text{CS}(\text{C}) + p) + q = \text{Sim}_w(\text{CS}(\text{C}) + p)])$
$(\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle})(\text{q})$

$= \lambda w \in \text{CS}(\text{C}).\ \ [\text{Sim}_w(\text{CS}(\text{C}) + \text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}) + \text{q} = \text{Sim}_w(\text{CS}(\text{C}) + \text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle})]$

p = 'It will rain tomorrow', q = 'I will stay at home'

Then, the assertive operator combines with the proposition CON(*dique*(p))(q) to yield a context change potential, i.e., an assertion, as in (46).

(46) $[\![\text{ASSERT}(\text{CON}(\textit{dique}(\text{p}))(\text{q}))]\!]$

$= \lambda \text{C}.\ \text{CS}(\text{C}) + [\lambda w \in \text{CS}(\text{C}).\ [\text{Sim}_w(\text{CS}(\text{C}) + \text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}) + \text{q} = \text{Sim}_w(\text{CS}(\text{C}) + \text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle})]]$

p = 'It will rain tomorrow', q = 'I will stay at home'

As can be seen from (46), ASSERT(CON(*dique*(p))(q)) is defined if $\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}$ is defined, and $\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}$ is defined if a set of possible worlds σ satisfies $[\![\text{T}(\text{C}_i)[0] = \{\text{p}\}]\!]^{g[\text{C}_{local}/\text{C}_i]}$. According to the structure in (43), the local context to *dique*(p) is the utterance context C_u, and thus the context variable C_i is bound by C_u, as shown below:

(47) $[\![\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}]\!]$ is defined with respect to a set of possible worlds σ iff

$\sigma \subseteq \lambda w.\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}$ at w

Now we need to know the value of σ. Since the antecedent p updates the context set of the utterance context $\mathrm{CS}(\mathrm{C}_u)$, the presuppositions carried by p are requirements imposed on $\mathrm{CS}(\mathrm{C}_u)$ and must be satisfied in $\mathrm{CS}(\mathrm{C}_u)$. That is, σ refers to $\mathrm{CS}(\mathrm{C}_u)$:

(48) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to $\mathrm{CS}(\mathrm{C}_u)$ iff
$\mathrm{CS}(\mathrm{C}_u) \subseteq \lambda w.\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}$ at w.

That is to say, (44) is defined only if p has been suggested in the Common Ground of the utterance context. (44) inherits the presupposition of its antecedent.

Now, how about the cases in which presuppositions are blocked from projecting up? For example, in (39), repeated here as (49), the presupposition of the consequent, that 'It will rain tomorrow' has been suggested, is not inherited by the whole conditional.

(49) Ruguo tianqiyubaoyuan shuo mingtian hui xiayu, na mingtian *dique*
if weather-reporter say tomorrow will rain then tomorrow indeed
hui xiayu.
will rain
'If the weather reporter says that it will rain tomorrow, then it will indeed rain tomorrow.'

In (49), the semantics of the antecedent *tianqiyubao shuo mingtian hui xiayu* 'The weather reporter says that it will rain tomorrow' is defined in (50), where WR denotes the individual 'The weather reporter'.

(50) $[\![$*tianqiyubao shuo mingtian hui xiayu*$]\!]$ = say(p)(WR)
p = 'It will rain tomorrow'

Then, the semantics of (49) is given in (51).

(51) $[\![$ASSERT(CON(say(p)(WR))(*dique*(p)))$]\!]$

= λC. CS(C) + [$\lambda w \in$ CS(C). [Sim_w(CS(C) + say(p)(WR)) + $\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$

= Sim_w(CS(C) + say(p)(WR))]]

p = 'It will rain tomorrow'

It is reasonable to assume that if a discourse participant x says a proposition p in a context C, then p has been suggested in this context, as shown in (52).

(52) λw.say(p)(x)(w) $\subseteq$ [$\lambda w.\mathrm{T}(\mathrm{C})[0] = \{p\}$ at w]

As mentioned above, the temporary context C′ is like the context C_u in every respect, except that CS(C′) is a set of worlds that are most similar to w in CS(C_u) where the antecedent holds. Therefore, in (49), CS(C′) is a set of worlds where say(p)(WR) is true:

(53) CS(C′) $\subseteq \lambda w$. say(p)(WR)(w)

Since the weather reporter says p in the context C′, the weather reporter indicates that he is biased towards p in this context. In other words, $\{\mathrm{p}\}$ has been added onto the top of the Table:

(54) λw. say(p)(WR)(w) $\subseteq$ [$\lambda w.\mathrm{T}(\mathrm{C}')[0] = \{\mathrm{p}\}$ at w]

(53) and (54) derive that CS(C′) entails the presupposition carried by *dique*:

(55) CS(C′) $\subseteq$ [$\lambda w.\mathrm{T}(\mathrm{C}')[0] = \{\mathrm{p}\}$ at w]

(51) shows that the conditional ASSERT(CON(say(p)(WR))(*dique*(p))) is defined if $\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$ is defined, and this is defined if a set of worlds σ satisfies $[\![\mathrm{T}(\mathrm{C}_i)[0] = \{\mathrm{p}\}]\!]^{g[\mathrm{C}_{local}/\mathrm{C}_i]}$. Since the local context to the consequent *dique*(p) is the temporary context C′, the context variable C_i is bound by C′:

(56) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to a set of worlds σ iff
$\sigma \subseteq [\lambda w.\mathrm{T}(\mathrm{C}')[0] = \{\mathrm{p}\}$ at $w]$.

Since the consequent updates the context set of the temporary context CS(C′), presuppositions carried by the consequent are requirements imposed on CS(C′) and must be satisfied in CS(C′), as shown in (57). This has been proved in (55). Since the presupposition is satisfied, the whole conditional is defined and does not inherit the presupposition of the consequent.

(57) $[\![\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}]\!]$ is defined with respect to CS(C′) iff
CS(C′) $\subseteq [\lambda w.\mathrm{T}(\mathrm{C}')[0] = \{\mathrm{p}\}$ at $w]$.

In short, the presupposition triggered by *dique*/*zhende* is inherited by the whole conditional, unless the presupposition is triggered in the consequent and entailed by the antecedent. This is consistent with the hypothesis that *dique* and *zhende* are presupposition triggers. The projection behavior of embedded presuppositions is explained by the Stalnaker-Lewis-Heim analysis and the dynamic approach to presupposition: The presupposition of the consequent will not be projected up because it is satisfied in the local context created by the antecedent.

3.3.3 Conditional containing the adverbs: doubt towards old information

The previous section adopted the Stalnaker-Lewis-Heim analysis for conditionals containing *dique* and *zhende*. In this section, I will show how this analysis accounts for the intuition that conditionals containing *dique* and *zhende* express the speaker's doubt towards old information.

Jiang (2000) discusses the semantics of conditionals containing the adverb *zhende*. Jiang (2000) claims that *zhende* is a marker of counterfactual conditionals, and thus conditionals containing *zhende* always indicate the speaker's disbelief in the antecedent and the consequent. For example, by using *zhende* in the antecedent of the conditional in (58), the speaker appears to be claiming that 'It rained last night' is false.

(58) Ruguo zuowan *zhende* xiayu le, dishang bu hui zheme gan.
if last-night really rain PERF ground not will so dry
'If it really rained last night, the ground cannot be so dry.'

I believe that examples like (58) cannot be taken as evidence for the claim that *zhende* is a counterfactual marker. The first reason is that (58) without *zhende* is also a counterfactual conditional. Thus, it is not the adverb *zhende* that marks the sentence as a counterfactual conditional. The second reason is *zhende* can occur in indicative conditionals as well, as shown in (59).

(59) Ruguo mingtian *zhende* xiayu, wo hui dai zai jiali.
if tomorrow really rain I will stay at home
'If it really rains tomorrow, I will stay at home.'

Since *zhende* can occur in contexts other than counterfactual conditionals and counterfactual conditionals are felicitous without *zhende*, *zhende* cannot be taken as a marker for counterfactual conditionals. However, Jiang's (2000) observation captures the intuition that the speaker of conditionals containing *zhende* (and also *dique*) expresses some doubt towards the proposition 'It rained last night'. This intuition is summarized in (60).

(60) A conditional containing *dique* or *zhende* expresses that the speaker is doubtful towards the proposition denoted by the antecedent or the consequent.

First, let us use *dique* to illustrate the intuition in (60). Due to the presupposition trigger *dique*, the conditional with *dique* in (61) cannot be used at the beginning of a conversation. For *dique* to be felicitous, the proposition p 'There are mistakes' must have been suggested in the previous discourse, as in (62), where the suggester is A.

(61) Ruguo *dique* you cuowu, fanyimen yiding hui gaizheng.
if indeed have mistake translators surely will correct
'If there are indeed mistakes, the translators will surely correct them.'

(62) Context: A read the translations done by a translation company, and A is now calling the customer service of this company.

A: Nimen gongsi zuo de fanyi cuowulianpian.
you company do GEN translations full-of-mistakes
'The translations done by your company are full of mistakes.'

B: Ruguo *dique* you cuowu, fanyimen yiding hui gaizheng.
if indeed have mistake translators surely will correct
'If there are indeed mistakes, the translators will surely correct them.'

In (62), what does B want to express by using a conditional containing *dique*? According to native-speaker intuition, this conditional says something about B's attitude to A's assertion: B is doubtful towards the proposition p 'There are mistakes' asserted by A. At the beginning, A makes an assertion of p. B responds to A's assertion by uttering a conditional, which shows that B is neither committed to p nor to ¬p. A is proposing to add p into their common belief, but B remains uncommitted to p. The combination results in an indication that B is not convinced by A, and B is doubtful towards the suggested p. B seems to suggest that he needs more evidence before committing himself to p.

This intuition is shown more clearly by the discourse in (63). Here, the conditional containing *dique* indicates the speaker's doubt towards p 'There are mistakes', whereas the follow-up assertion indicates that the speaker is committed to p. That is, the speaker is doubtful towards p and committed to p at the same time. Because of the contradictory belief states of the speaker, (63) is infelicitous.

(63) #Ruguo *dique* you cuowu, fanyimen yiding hui gaizheng. Wo yijing
if indeed have mistakes translators surely will correct I already
faxian yixie cuowu le.
find some mistakes PERF
'If there are indeed mistakes, the translators will surely correct it. I already found some mistakes.'

In contrast, a conditional without *dique* is felicitous in this case, as shown in (64). Since a conditional does not indicate the speaker's doubt towards p, the speaker can commit himself to p in the follow-up assertion.[7]

[7]According to the theory of conversational implicature (Grice, 1975), a bare conditional 'If p, then q' has an implicature that the speaker does not know whether p is true. However, since this is an implicature, it can be cancelled, as shown in (64).

(64) Ruguo you cuowu, fanyimen yiding hui gaizheng. Wo yijing faxian
if have mistakes translators surely will correct I already find
yixie cuowu le.
some mistakes PERF
'If there are mistakes, the translators will surely correct it. I already found some mistakes.'

This intuition can be explained by the formal analysis presented in the previous section. The meaning of doubtfulness is a discourse effect resulting from the combination of the conditional meaning and the presupposition triggered by *dique*. The semantics of (61) is shown in (65).

(65) $[\![$ASSERT(CON(*dique*(p))(q))$]\!]$

= λC. CS(C) + [$\lambda w \in$ CS(C). [Sim_w(CS(C) + $\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$) + q = Sim_w(CS(C) + $\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$)]]

p = 'There are mistakes in the translations'

q = 'The translators will surely correct them'

As can be seen from the semantics in (65), by using a conditional, the speaker is claiming that all the worlds in which p 'There are mistakes in the translations' is true that are maximally similar to w (i.e., the world of evaluation) are worlds where q 'The translators will surely correct them' is true. The speaker does not say whether w is a world in which p is true or not, i.e., the speaker is not publicly committed to the truth of p. Now, the presupposition $\mathrm{T}(\mathrm{C}_i)[0] = \{\mathrm{p}\}$ indicates that some individual, i.e., A, suggested that p is true in w. This shows that A is proposing to add p into the Common Ground of A and B. B uses a conditional indicating B's uncommitment to p after A's proposal to add p into the Common Ground, which gives rise to a discourse effect that

B refused to accept A's proposal and B is doubtful towards the truth of p.

Similarly, conditionals containing *dique* in the consequent expresses the speaker's doubt towards the proposition denoted by the consequent. For example, in (66), by using a conditional, B is claiming that all the worlds in which p 'It will rain tomorrow' is true that are maximally similar to w are worlds where q 'Li will stay at home' is true. B does not assert whether the world of evaluation w is a world in which q 'Li will stay at home' is true or not, i.e., B is not publicly committed to the truth of q. The presupposition indicates that some discourse participant, i.e., A, suggested that q is true in w. In other words, A is proposing to add q into the Common Ground. B responds to A's proposal by using a conditional indicating B's uncommittment to q. This results in a discourse effect that B is doubtful towards the truth of q and B is requesting for more evidence for p.

(66) A: Li mingtian hui dai zai jia.
Li tomorrow will stay at home
'Li will stay at home tomorrow.'

B: Ruguo mingtian xiayu, Li *dique* hui dai zai jia.
if tomorrow rain Li indeed will stay at home
'If it rains tomorrow, Li will indeed stay at home.'

A conditional containing *zhende* also expresses the speaker's doubt towards the proposition denoted by the antecedent or the consequent. For example, by using a conditional containing *zhende*, B is expressing his doubt towards the proposition p 'There are mistakes' asserted by A.

(67) Context: A read the translations done by a translation company, and A is now calling the customer service of this company.

A: Nimen gongsi zuo de fanyi cuowulianpian.
you company do GEN translations full-of-mistakes
'The translations done by your company are full of mistakes.'

B: Ruguo *zhende* you cuowu, fanyimen yiding hui gaizheng.
if really have mistake translators surely will correct
'If there are really mistakes, the translators will surely correct them.'

This intuition can be explained by the formal analysis presented in the previous section. The meaning of doubtfulness is a discourse effect resulting from the combination of the conditional meaning and the presupposition triggered by *zhende*. The semantics of the conditional in (67) is shown in (68).

(68) $[\![\text{ASSERT}(\text{CON}(\textit{dique}(\text{p}))(\text{q}))]\!]$

$= \lambda \text{C}.\ \text{CS}(\text{C}) + [\lambda w \in \text{CS}(\text{C}).\ [\text{Sim}_w(\text{CS}(\text{C}) + \text{p}_{\langle(\text{T}(\text{C}_i)[0]=\{\text{p}\})\wedge(\exists y.\text{p}\notin\text{PB}_y(\text{C}_i))\rangle}) + \text{q}$

$= \text{Sim}_w(\text{CS}(\text{C}) + \text{p}_{\langle(\text{T}(\text{C}_i)[0]=\{\text{p}\})\wedge(\exists y.\text{p}\notin\text{PB}_y(\text{C}_i))\rangle})]]$

p = 'There are mistakes in the translations'

q = 'The translators will surely correct them'

As can be seen from the semantics in (68), by using a conditional, the speaker is claiming that all the worlds in which p 'There are mistakes in the translations' is true that are maximally similar to w (i.e., the world of evaluation) are worlds where q 'The translators will surely correct them' is true. The speaker does not say whether w is a world in which p is true or not, i.e., the speaker is not publicly committed to the truth of p. Now, the presupposition $\text{T}(\text{C}_i)[0] = \{\text{p}\}$ indicates that some individual, i.e., A, suggested that p is true in w. This shows that A is proposing to add p into the Common Ground of A and B. B uses a conditional indicating B's uncommitment to p after A's proposal to add p into the Common Ground, which gives rise to a discourse effect that

B refused to accept A's proposal and B is doubtful towards the truth of p.

Intuitively, a conditional containing *dique*/*zhende* expresses the speaker's doubt towards the proposition p denoted by the antecedent or the consequent. This intuition is explained by my formal analysis. The adverb *dique*/*zhende* introduces a presupposition that p has already been suggested, but the speaker responds to this suggestion by using a bare conditional indicating his uncommitment to p. This gives rise to a discourse effect that the speaker is doubtful towards the old information p.

3.3.4 Section summary

This section discussed the embedding of *dique* and *zhende* under conditional structures. When the presupposition is triggered by *dique*/*zhende* in the consequent and entailed by the antecedent, this presupposition is not inherited by the whole conditional. This is the same as the behaviors of typical presupposition triggers. The parallelism between *dique*/*zhende* and typical presupposition triggers supports the hypothesis that *dique* and *zhende* are presupposition triggers. In order to capture the projection behaviors of embedded presuppositions, I adopted the analysis of Stalnaker (1968), Lewis (1973) and Heim (1992) in my formal analysis of Mandarin conditionals. This analysis also explains the intuition that a conditional containing *dique*/*zhende* expresses the speaker's doubt towards old information.

3.4 Chapter summary

This chapter examined the behaviors of *dique* and *zhende* in embedded clauses. I showed that the adverbs *dique* and *zhende* exhibit the same behaviors as typical presupposition triggers when embedded under attitude verbs and conditional structures,

which is consistent with the hypothesis that *dique* and *zhende* are presupposition trigger.

When *dique* and *zhende* are embedded under attitude verbs, the presuppositions triggered by these adverbs are associated to the attitude-holder. This projection behavior is captured by the dynamic approach to presupposition presented in Chapter 2. Sentences containing attitude verbs that embed *dique*/*zhende* indicate an update of the attitude-holder's belief worlds, and thus the presuppositions triggered by *dique*/*zhende* are evaluated in the attitude-holder's belief worlds and must be satisfied there. Therefore, a sentence containing an attitude verb that embeds *dique*/*zhende* is defined when the belief worlds of the attitude-holder entails the presuppositions triggered by *dique*/*zhende*, i.e., when the attitude-holder believes that p has been suggested.

The adverbs *dique* and *zhende* can also be embedded under conditional structures. When the presupposition is triggered by *dique*/*zhende* in the consequent and entailed by the antecedent, this presupposition is not inherited by the whole conditional. In order to capture this projection behavior, I adopted the Stalnaker-Lewis-Heim analysis in the formalization of Mandarin conditionals. This analysis, together with the dynamic approach to presupposition, provides an explanation for the projection behavior of embedded presupposition: The presupposition of the consequent is not projected up to the entire conditional because it is satisfied in the local context that is created by the antecedent. This analysis also accounts for the intuition that conditionals containing *dique* and *zhende* express the speaker's doubt towards old information. *Dique* and *zhende* trigger a presupposition that p (denoted by either the antecedent or the consequent) has been suggested, that is, that some discourse participant has proposed to add p into the Common Ground. However, the speaker responds to this proposal by using a conditional indicating his uncommitment to p. This results in a discourse

effect that the speaker refused the proposal of adding p into the Common Ground and the speaker is doubtful towards p.

Chapter 4

Sentence-initial adverbs and VP-initial adverbs

4.1 Introduction

The adverbs *dique* and *zhende* can occur at two positions, sentence-initial position and VP-initial position, as shown respectively in (1) and (2).

(1) *Dique*/*Zhende*, Li chuguo le.
indeed/really Li go-abroad PERF
'Indeed/Really, Li went abroad.'

(2) Li *dique*/*zhende* chuguo le.
Li indeed/really go-abroad PERF
'Li indeed/really went abroad.'

In this chapter, I present the different behaviors of sentence-initial adverbs and VP-initial adverbs, and provide different denotations for the adverbs at these two positions.

In the previous two chapters, I mainly focused on the common semantic property shared by sentence-initial and VP-initial adverbs, i.e., these adverbs (both sentence-initial and VP-initial ones) are presupposition triggers. The adverb *dique* (both sentence-initial and VP-initial *dique*) triggers a presupposition that its prejacent is old information, while the adverb *zhende* (both sentence-initial and VP-initial *zhende*) triggers a presupposition that its prejacent is old information and is challenged by some participant. Take *dique* as an example. An assertion containing sentence-initial *dique* like (1) presupposes that 'Li went abroad' has been suggested by someone, and so does the assertion containing VP-initial *dique* in (2). Thus, both these assertions are felicitous in the discourse in (3).

(3) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

B: *Dique*, Li chuguo le.
indeed Li go-abroad PERF
'Indeed, Li went abroad.'

B′: Li *dique* chuguo le.
Li indeed go-abroad PERF
'Li indeed went abroad.'

Although sentence-initial and VP-initial adverbs make similar semantic contribution, the adverbs at these two positions exhibit some different behaviors, as summarized in (4).

(4) Differences between sentence-initial adverbs and VP-initial adverbs

a. VP-initial adverbs can be embedded, whereas sentence-initial adverbs cannot.

b. Certain noun phrases can co-occur with sentence-initial adverbs but not with VP-initial adverbs.

The first difference, as stated in (4-a), is that VP-initial adverbs are embeddable but sentence-initial adverbs are not. As exemplified in (5), (6) and (7), sentence-initial adverbs cannot be embedded under attitude verbs, conditional structures and relative clauses.

(5) a. Zhang xiangxin [Li *dique*/*zhende* chuguo le].
Zhang believe Li indeed/really go-abroad PERF
'Zhang believes that Li indeed/really went abroad.'

b. *Zhang xiangxin [*dique*/*zhende*, Li chuguo le].
Zhang believe indeed/really Li go-abroad PERF
'Zhang believes that indeed/really Li went abroad.'

(6) a. Ruguo [Li *dique*/*zhende* chuguo le], Li jiu buneng canjia juhui.
if Li indeed/really go-abroad PERF Li then cannot attend party
'If Li indeed/really went abroad, Li cannot attend the party.'

b. ?Ruguo [*dique*/*zhende*, Li chuguo le], Li jiu buneng canjia juhui.
if indeed/really Li go-abroad PERF Li then cannot attend party
'If indeed/really, Li went abroad, Li cannot attend the party.'

(7) a. Qing geichu [Li *dique*/*zhende* chuguo le] de zhengju.
please show Li indeed/really go-abroad PERF GEN evidence
'Please show the evidence that Li indeed/really went abroad.'

b. *Qing geichu [*dique*/*zhende*, Li chuguo le] de zhengju
please show indeed/really Li go-abroad PERF GEN evidence
'Please show the evidence that indeed/really, Li went abroad.'

The second difference between sentence-initial and VP-initial adverbs, as stated in (4-b), is that certain noun phrases can co-occur with sentence-initial adverbs but not with VP-initial adverbs. As shown in (8), the noun phrase *zhiyou zui nuli de ren* 'only

the most hard-working people' can co-occur with the sentence-initial *dique* in (8-a), but not with the VP-initial *dique* in (8-b).

(8) a. *Dique*, [zhiyou zui nuli de ren] neng chenggong.
indeed only most hard-working GEN person can succeed
'Indeed, only the most hard-working people can succeed.'

b. *[Zhiyou zui nuli de ren] *dique* neng chenggong.
only most hard-working GEN person indeed can succeed
'Only the most hard-working people indeed can succeed.'

These two differences between sentence-initial adverbs and VP-initial adverbs can be explained by two proposals made in this chapter. The first proposal, presented in Section 4.2, is that sentence-initial and VP-initial adverbs have different denotations. Sentence-initial adverbs are defined as sentential force modifiers, whereas VP-initial adverbs are defined as propositional modifiers. Since sentence-initial adverbs require a force head as an argument and forces cannot be embedded in Mandarin, sentence-initial adverbs cannot be embedded. The second proposal, presented in Section 4.3, is that the noun phrase preceding VP-initial adverbs occupies a topic position, whereas the noun phrase following sentence-initial adverbs occupies a subject position. This explains why noun phrases exhibiting no topic properties cannot precede VP-initial adverbs. Section 4.4 summarizes this chapter.

4.2 Sentence-initial adverbs as sentential force modifiers

In order to account for the difference between sentence-initial and VP-initial adverbs, I modify the semantics provided for *dique* and *zhende* in this section. Motivated by the

intuition that sentence-initial adverbs scope over sentential forces, I define sentence-initial adverbs as sentential force modifiers, which require a force head as an argument. In contrast, VP-initial adverbs are within the scope of sentential forces and are thus analyzed as propositional modifiers. This semantic analysis explains the contrast between sentence-initial and VP-initial adverbs presented in (4-a).

As pointed out in Section 4.1, one difference between sentence-initial and VP-initial adverbs is that the latter can be embedded but the former cannot. As shown in (5), repeated here as (9), sentence-initial *dique* and *zhende* cannot be embedded under the attitude verb *xiangxin*.

(9) a. Zhang xiangxin [Li *dique*/*zhende* chuguo le].
Zhang believe Li indeed/really go-abroad PERF
'Zhang believes that Li indeed/really went abroad.'

b. *Zhang xiangxin [*dique*/*zhende*, Li chuguo le].
Zhang believe indeed/really Li go-abroad PERF
'Zhang believes that indeed/really Li went abroad.'

This difference cannot be explained by the semantic analysis presented so far. The semantics of the adverb *dique* in an assertion was defined as in (10). Following this definition, *dique* in (9-b) would combine with the proposition p 'Li went abroad' to yield a modified proposition $\mathrm{p}_{\langle \mathrm{T}(\mathrm{c}_i)[0]=\{\mathrm{p}\}\rangle}$. The attitude adverb *xiangxin* could take in this modified proposition and the entity 'Zhang' to yield a context change potential, as shown in (11). There is nothing wrong in terms of the semantic composition. In other words, the analysis presented in the previous chapters wrongly predicts that (9-b) is grammatical.

(10) $[\![\textit{dique}]\!] = \lambda p.p_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{p\}\rangle}$

(11) $[\![\textit{xiangxin}(\textit{dique}(\mathrm{p}))(\mathrm{Zhang})]\!]$

$= (\lambda p.\lambda x.\lambda \mathrm{C}.\ \mathrm{Dox}_{x,\mathrm{C}} + p)\ (\mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle})(\mathrm{Z})$

$= \lambda \mathrm{C}.\ \mathrm{Dox}_{\mathrm{Z},\mathrm{C}} + \mathrm{p}_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{\mathrm{p}\}\rangle}$

p = 'Li went abroad'

One problem with the definition in (10) is that it does not capture the intuition that sentence-initial *dique* takes wider scope than VP-initial *dique*. Take (12) as an example. The question containing sentence-initial *dique* in (12-a) and the question containing VP-initial *dique* in (12-b) impose different requirements on the previous discourse. (12-a) requires that the question 'Did Li go abroad?' has already been asked by some individual, whereas (12-b) requires that the proposition 'Li went abroad' has been suggested by some individual.

(12) a. *Dique*, Li chuguo le ma?
indeed Li go-abroad PERF Q
'Indeed, did Li go abroad?'

b. Li *dique* chuguo le ma?
Li indeed go-abroad PERF Q
'Did Li indeed go abroad?'

This is shown by the fact that (12-a) is felicitous in the discourse in (13), but (12-b) is felicitous in the discourse in (14). This contrast gives one the impression that sentence-initial adverbs scope over the question force and modify the question, whereas VP-initial adverbs are within the scope of the question force and modify the proposition.[1]

[1]The formal analysis of questions containing VP-initial adverbs will be provided in the next chapter.

(13) A: Li chuguo le ma?
Li go-abroad PERF Q
'Did Li go abroad?'

B: *Dique*, Li chuguo le ma?
indeed Li go-abroad PERF Q
'Indeed, did Li go abroad?'

B′: #Li *dique* chuguo le ma?
Li indeed go-abroad PERF Q
'Did Li indeed go abroad?'

(14) A: Li chuguo le.
Li go-abroad PERF
'Li went abroad.'

B: #*Dique*, Li chuguo le ma?
indeed Li go-abroad PERF Q
'Indeed, did Li go abroad?'

B′: Li *dique* chuguo le ma?
Li indeed go-abroad PERF Q
'Did Li indeed go abroad?'

In order to capture this intuition, I redefine the semantics of sentence-initial *dique* as in (15).

(15) The semantics of sentence-initial *dique*:

a. $[\![\textit{dique}]\!] = \lambda p.\lambda F.\lambda \mathrm{C}.[F(p)(\mathrm{C})]_{\langle \mathrm{T}(\mathrm{C})[0]=\{p\}\rangle}$ if the sister constituent of *dique* denotes a semantic object of type $\langle s,t\rangle$.

b. $[\![\textit{dique}]\!] = \lambda Q.\lambda F.\lambda \mathrm{C}.[F(Q)(\mathrm{C})]_{\langle \mathrm{T}(\mathrm{C})[0]=Q\rangle}$ if the sister constituent of *dique* denotes a semantic object of type $\langle\langle s,t\rangle,t\rangle$.

According to (15-a), *dique* combines with a proposition p and a force head ASSERT to form an assertion containing *dique*. This captures the intuition that sentence-initial

dique scopes over the assertive force. As shown in (16), the semantics of an assertion containing sentence-initial *dique* consists of two parts: 1) λC.CS(C) + p, a CCP encoding the meaning of the assertion; 2) $\mathrm{T(C)[0]} = \{\mathrm{p}\}$, which formalizes the presupposition added by *dique*.

(16) $[\![$*dique*(p)(ASSERT)$]\!]$

= $(\lambda p.\lambda F.\lambda \mathrm{C}.[F(p)(\mathrm{C})]_{\langle \mathrm{T(C)[0]}=\{p\}\rangle}$)(p)(ASSERT)

= λC.$[\mathrm{ASSERT(p)(C)}]_{\langle \mathrm{T(C)[0]}=\{\mathrm{p}\}\rangle}$

= λC.$[\mathrm{CS(C)} + \mathrm{p}]_{\langle \mathrm{T(C)[0]}=\{\mathrm{p}\}\rangle}$

According to the definition of presupposition presented in Chapter 2, $[\mathrm{CS(C)} + \mathrm{p}]_{\langle \mathrm{T(C)[0]}=\{\mathrm{p}\}\rangle}$ is defined only when the context set $\mathrm{CS}(\mathrm{C}_u)$ satisfies $\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}\}$. That is, an assertion containing sentence-initial *dique* is defined when p has been suggested in the Common Ground of the utterance context. When defined, the context set $\mathrm{CS}(\mathrm{C}_u)$ is updated with p.

Let us turn to questions containing sentence-initial *dique*. Following (15-b), *dique* combines with a set of propositions (e.g., the set {p, q}) and the question force head Q to form a question containing *dique*. This captures the intuition that sentence-initial *dique* scopes over the question force. As summarized in (17), the semantics of a question modified by *dique* consists of two parts: 1) λC. $[\mathrm{T(C)} \oplus \{\mathrm{p},\ \mathrm{q}\}]$, a CCP encoding the meaning of a question; 2) $\mathrm{T(C)[0]} = \{\mathrm{p}, \mathrm{q}\}$, which formalizes the presupposition added by *dique*. The question *dique*({p, q})(Q) is defined when the presupposition $\mathrm{T}(\mathrm{C}_u)[0] = \{\mathrm{p}, \mathrm{q}\}$ is satisfied in the context set $\mathrm{CS}(\mathrm{C}_u)$, i.e., when all the discourse participants share the belief that {p, q} has been asked.

(17) $[\![$*dique*({p, q})(Q) $]\!]$

$= (\lambda Q.\lambda F.\lambda \mathrm{C}.[F(Q)(\mathrm{C})]_{\langle \mathrm{T(C)[0]}=Q\rangle})(\{\mathrm{p}, \mathrm{q}\})(\mathrm{Q})$

$= \lambda \mathrm{C}.[\mathrm{Q}(\{\mathrm{p}, \mathrm{q}\})(\mathrm{C})]_{\langle \mathrm{T(C)[0]}=\{\mathrm{p,q}\}\rangle}$

$= \lambda \mathrm{C}.[\mathrm{T}(\mathrm{C}) \oplus \{\mathrm{p}, \mathrm{q}\}]_{\langle \mathrm{T(C)[0]}=\{\mathrm{p,q}\}\rangle}$

In short, sentence-initial *dique* is defined as a sentential force modifier, which modifies the CCP by imposing restrictions on the input context.

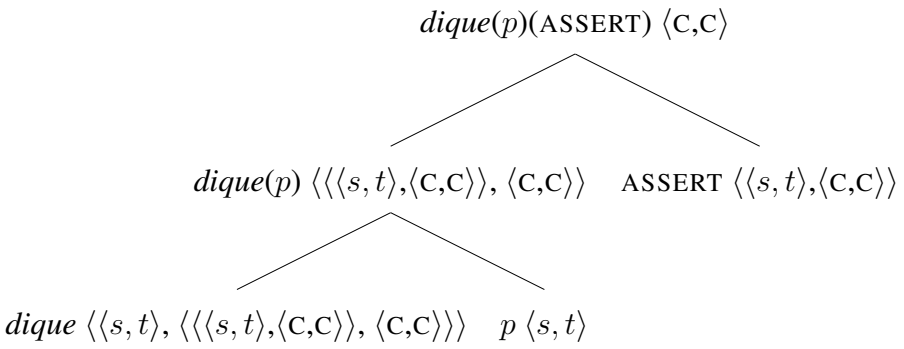
In contrast, VP-initial *dique* does not scope over sentential forces. VP-initial *dique* is analyzed as a propositional modifier and retains the previous definition, as in (18). According to (18), VP-initial *dique* modifies a proposition by introducing a presupposition that p has been suggested.

(18) The semantics of VP-initial *dique*:

$\lambda p.p_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{p\}\rangle}$

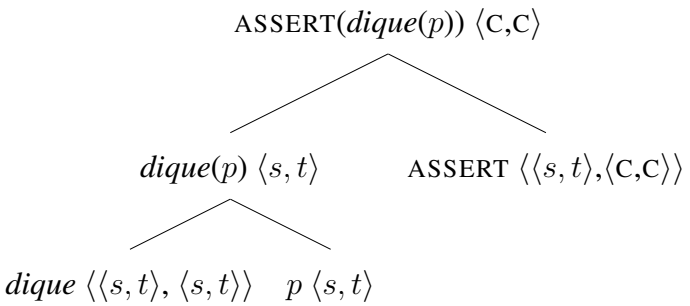
Now, I can explain the first difference between sentence-initial and VP-initial adverbs, i.e., why VP-initial adverbs can be embedded but sentence-initial adverbs cannot. Following the semantic definition in (15), the semantic computation of an assertion containing sentence-initial *dique* is shown in (19). First, sentence-initial *dique* combines with a proposition p to yield *dique*(p), which is a function from a force head to a CCP. Second, *dique*(p) takes in the assertive operator ASSERT to yield a CCP (i.e., an assertion).

(19)



In contrast, the semantic computation of an assertion containing VP-initial *dique* is depicted in (20). First, *dique* combines with a proposition p to yield *dique*(p), which is a proposition of type $\langle s, t\rangle$. Second, the assertive operator ASSERT takes in *dique*(p) to yield a CCP (i.e., an assertion). At first glance, this semantic computation seems to be inconsistent with the surface position of VP-initial adverbs. According to the surface structure, VP-initial adverbs do not combine with the TP (denoting a proposition), but combine with the VP (denoting a property). I will explain this discrepancy between semantics and syntax in the next section by proposing that the DP position preceding VP-initial adverbs is a topic position.

(20)



As can be seen from (19) and (20), sentence-initial *dique* is a sentential force modifier, which requires a force head as its argument, whereas VP-initial *dique*, as a propositional modifier, does not require a force head as its argument. This

correctly predicts that propositional modifiers can be embedded whereas sentential force modifiers cannot, as clauses indicating sentential forces cannot be embedded in Mandarin.

As pointed out by Han (1998), in many languages, embedded clauses cannot express forces. This is indeed the case in Mandarin. Mandarin clauses marked as questions or commands cannot be embedded. When it appears that these clauses are embedded, they are in fact direct quotations. For example, *ni xihuan wo ma* in (21) is a direct quotation of the question 'Do you like me' uttered by Li, and *ni lai wo jia ba* in (22) is a direct quotation of the command 'Come to my home' uttered by Li.

(21) Li wen [ni xihuan wo ma]
Li ask you like me Q
✓ Li asks: 'Do you like me?' ('me' = Li)
Li asks if you like me. ('me' = the speaker of the whole sentence)

(22) Li yaoqiu [ni lai wo jia ba]
Li request you come my home BA
Li requests: '(You) come to my home!' ('my home' = Li's home)

Since sentence-initial adverbs require a force head as an argument and clauses indicating sentential forces cannot be embedded in Mandarin, sentence-initial adverbs cannot be embedded. VP-initial adverbs do not require a force head as an argument, and thus can be embedded.

This section provided different denotations for sentence-initial and VP-initial adverbs. Sentence-initial adverbs are defined as sentential force modifiers, whereas VP-initial adverbs are propositional modifiers. This analysis captures the intuitive difference that sentence-initial adverbs scope over sentential forces while VP-initial adverbs are within the scope of sentential forces. Since sentence-initial adverbs require a force head

as an argument, they cannot be embedded. In the next chapter, we will see that this semantic analysis also makes correct predictions about the co-occurrence of the adverbs and questions.

4.3 Syntactic analysis of the adverbs

This section specifies the syntactic positions of *dique* and *zhende* based on the semantic computation presented in Section 4.2. The proposal regarding the syntactic structure of an assertion containing *dique*/*zhende* is summarized in (23).

(23) a. The assertive operator ASSERT is the head of a Force Phrase (ForceP).

b. *Dique* and *zhende* are TP adjuncts.

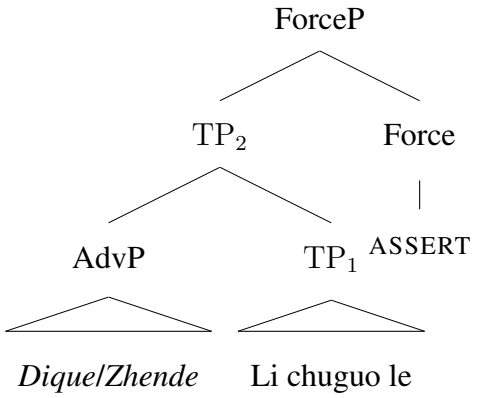
(i) First, *dique* or *zhende* attaches to a TP_1 to form a TP_2.

(ii) Then, TP_2 combines with the assertive operator ASSERT.

For example, the structure of (1), repeated here as (24), has the structure in (25).

(24) *Dique*/*Zhende*, Li chuguo le.
indeed/really Li go-abroad PERF
'Indeed/Really, Li went abroad.'

(25)

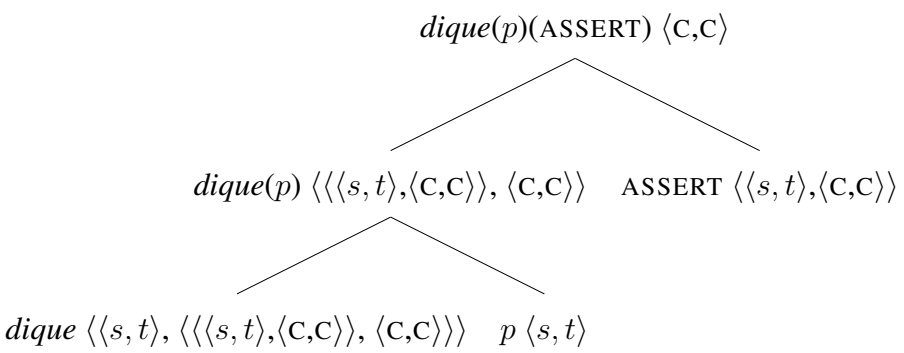


Let us explain the proposals in (23). (4) says that ASSERT is the head of a Force Phrase. As introduced in Chapter 1, I assume that sentential forces are realized syntactically by operators like ASSERT and Q. Assertion in Mandarin is not overtly marked and ASSERT is assumed to be a phonologically null operator.

(23-b) says that *dique* and *zhende* are adjuncts, as shown in (25). *Dique* and *zhende* are analyzed as adjuncts because these two adverbs are not lexically selected by a predicate and are therefore syntactically optional in a sentence. This analysis also corresponds to the traditional analysis of adverbs as adjuncts (Zubizarreta, 1982; Sportiche, 1988).

(23-b) also says that *dique* or *zhende* is first adjoined to a TP, and then the modified TP combines with ASSERT. This order is mandated by the two-step semantic computation discussed in (19), repeated here as (26). The first step in the semantic computation is the combination of *dique*/*zhende* with a proposition p. The proposition p is represented syntactically by a TP. Thus, as stated in (23-b-i), *dique* and *zhende* should be TP adjuncts. The second step is the combination of *dique*(p)/*zhende*(p) with ASSERT. Therefore, ASSERT must take the modified TP as its complement, as in (23-b-ii). Syntactic composition and semantic computation are performed in parallel, in accordance with the Principle of Compositionality.

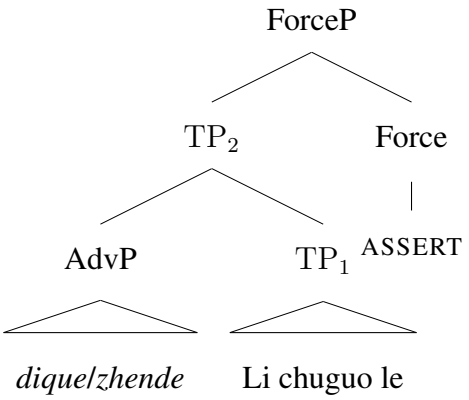
(26)



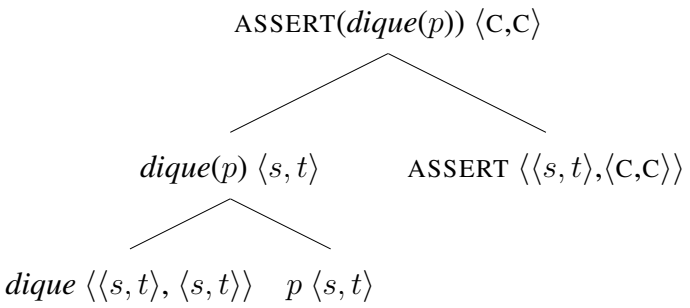
The proposals in (23) work well for sentence-initial adverbs, but they do not seem to apply to VP-initial adverbs. Following (23), an assertion containing a VP-initial adverb like (27) has a structure like (28). This corresponds to the semantic computation in (20), repeated here as (29).

(27) Li *dique*/*zhende* chuguo le.
Li indeed/really go-abroad PERF
'Li indeed/really went abroad.'

(28)



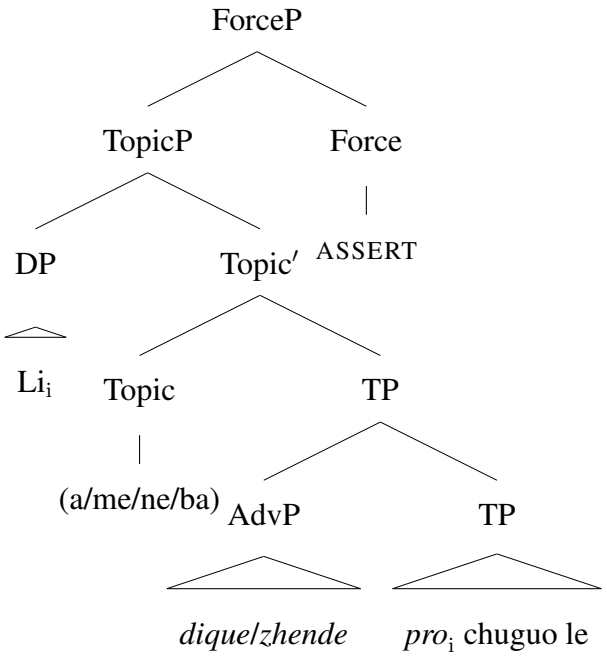
(29)



However, the surface structure of (27) appears to be inconsistent with the semantic computation. According to the surface structure in (27), it appears that *dique* or *zhende* does not combine with TP, *Li chuguo le*, but combines with VP, *chuguo le*. In the semantic computation, however, *dique* or *zhende* must combine with the entire proposition 'Li went abroad'.

To explain the discrepancy between syntax and semantics, I propose that the DP position preceding VP-initial *dique/zhende* is a topic position. Thus, the structure of (27) is revised as in (30).

(30)



The four particles *a/me/ne/ba* in (30) are topic markers (Li & Thompson, 1981: 86), which separate the topic from the rest of the sentence. Topic markers are optional and thus do not appear in (27).

According to (30), the noun phrase preceding VP-initial adverbs occupies the specifier position of a topic phrase. There is a covert pronoun (*pro*) inside the TP which is co-indexed with the noun phrase (Huang, 1984). For example, in (30), a *pro* inside the TP is co-indexed with the topic *Li*. Thus, '*pro* chuguo le' '(Li) went abroad' is still a proposition. This syntactic structure is consistent with the semantic combination of *dique/zhende* with the proposition p.

In order to verify that the DP position preceding VP-initial *dique*/*zhende* is a topic position, I will briefly review previous work on Chinese topic in Section 4.3.1, and then show that noun phrases preceding VP-initial *dique* or *zhende* exhibit topic properties in Section 4.3.2.

4.3.1 The structure and properties of Chinese topics

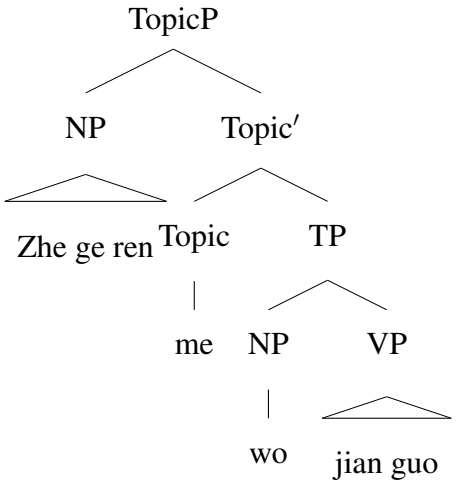
The notion of topic has different interpretations. For example, topic can be a syntactic position, or a pragmatic notion that has no representation in syntax. Since I argue that the DP position preceding VP-initial *dique*/*zhende* is a topic position, I adopt Gasde & Paul's (1996) analysis of topic and subject as two syntactic positions.

Gasde & Paul (1996) treat both topic and subject as notions in syntax. In this structure, subject is the specifier of the TP. Topic position is the specifier of a Topic Phrase (noted here as TopicP), and topic markers like *a*, *me*, *ne* and *ba* occupy the head position of this topic phrase. Therefore, the structure of (31) is as in (32).

(31) Zhe ge ren me, wo jian guo.
this CL person TM I see EXP
'As for this person, I have already met him.'

(Gasde & Paul 1996: 268)

(32) (Modified from Gasde & Paul 1996: 268)



If a position is a topic position, the noun phrase in the position is expected to have topic properties. In order to see whether this is true of noun phrases preceding VP-initial *dique* and *zhende*, let us summarize the properties of topic that have been discussed in past studies.

Since researchers have characterized topic from various perspectives, many different properties of topic have been discussed. Here, I focus on the following properties:

(33) Properties of Chinese topics

a. A topic can be followed by a pause or pause particles (i.e., topic markers).

b. Topics cannot be focalized.

c. There is a strong tendency for topics to be definite.

Let us illustrate these three properties. The first property was discussed by Li & Thompson (1981). In Chinese, a topic can be followed by topic markers, as we have seen in (31).

The second property of topic is that topic cannot be focalized. Topics generally express old information, whereas focus conveys new and prominent information. Sgall

et al. (1986: 175, 216) consider topic and focus to be in complementary distribution in a sentence. Büring (1999) holds a similar view that topic is a part of non-focal material.

The third property is that topics tend to be definite. Chao (1968) points out that subjects tend to be definite and objects tend to be indefinite. Since Chao (1968) analyzes all Chinese subjects as topics, Chao's (1968) claim amounts to saying that topics tend to be definite. In (34-a), the bare noun *shu* 'book' in object position has an indefinite referent, i.e., it does not refer to any specific book. When *shu* occurs in the topic position in (34-b), it has a definite referent, i.e., the speaker refers to a particular book.

(34) a. Wo kan wan shu le.
I read finish book PERF
'I have finished reading (for example, bedtime reading, of any book).'

b. Shu kan wan le ma?
book read finish PERF Q
'Have you finished reading the book (I lent you, you said you wanted to read, etc.)?' (Chao 1968: 76)

In summary, topic and subject are two distinct positions. Noun phrases occupying topic position share the properties in (33). The next section shows that the DP position preceding VP-initial *dique*/*zhende* has these properties.

4.3.2 The DP position before VP-initial *dique*/*zhende* is a topic position

In this section, I argue that the DP position preceding VP-initial *dique*/*zhende* is a topic position by showing that noun phrases in this position exhibit the three properties of topic in (33).

First, noun phrases preceding VP-initial *dique*/*zhende* can be followed by a pause or topic marker. For example, *Xiaoli* in (35-a) can be marked by the four topic markers, as in (35-b).

(35) a. Xiaoli *dique*/*zhende* shi ge hao ren.
Xiaoli indeed/really is CL good person
'Xiaoli is indeed/really a nice person.'

b. Xiaoli a/me/ne/ba, *dique*/*zhende* shi ge hao ren.
Xiaoli TM indeed/really is CL good person
'As for Xiaoli, (he) is indeed/really a nice person.'

Second, noun phrases preceding VP-initial *dique*/*zhende* cannot be focalized. Focalized constituents, such as structures associated with *zhiyou* 'only', cannot appear before VP-initial adverbs, as shown in (8), repeated here as (36). This indicates that the DP preceding VP-initial *dique*/*zhende* is a topic.

(36) a. *Dique*, [zhiyou zui nuli de ren] neng chenggong.
indeed only most hard-working GEN person can succeed
'Indeed, only the most hard-working people can succeed.'

b. *[Zhiyou zui nuli de ren] *dique* neng chenggong.
only most hard-working GEN person indeed can succeed
'Only the most hard-working people indeed can succeed.'

Finally, non-referential indefinite noun phrases cannot occur in the DP position preceding VP-initial *dique*/*zhende*. As discussed in Section 4.3.1, indefinite DPs tend not to occur in the topic position. These indefinite DPs include modified numerals, quantificational indefinites and some quantified noun phrases. Let us illustrate them one by one.

First, modified numerals are excluded from the DP position preceding VP-initial

dique/zhende. For example, in (37), the DP *chaoguo liushi ge xuesheng* 'more than sixty students' can occur in sentence-initial position in A's utterance, or after the sentence-initial *dique* in C1. This is because these two positions are subject positions, which impose no restrictions on indefinite noun phrases. However, *chaoguo liushi ge xuesheng* cannot occur in the DP position in front of the VP-initial *dique*, as shown in C2. This can be explained by the fact that this DP position is a topic position, which excludes such indefinite noun phrases.

(37) chaoguo + numeral (N) 'more than N'

A: Chaoguo liushi ge xuesheng zhuce le zhe men ke.
more-than sixty CL student register PERF this CL course
'More than sixty students registered in this course.'

B: Shi ma?
is Q
'Is it?'

C1: *Dique*, chaoguo liushi ge xuesheng zhuce le.
indeed more-than sixty CL student register PERF
'Indeed, more than sixty students got registered.'

C2: *Chaoguo liushi ge xuesheng *dique* zhuce le.
more-than sixty CL student indeed register PERF
'More than sixty students indeed got registered.'

Similarly, other modified numerals cannot precede VP-initial *dique* and *zhende*, as in (38) and (39).

(38) zhishao + numeral 'at least N'

a. *Zhende*, zhishao sanshi ge yuedui canjia le zheci yanchu.
really, at-least thirty CL band attend PERF this performance
'Really, at least thirty bands attended this performance.'

b. *Zhishao sanshi ge yuedui *zhende* canjia le zheci yanchu.
at-least thirty CL band really attend PERF this performance
'At least thirty bands really attended this performance.'

(39) zuiduo + numeral 'at most N'

a. *Dique*, zuiduo liang ge xuesheng mei jige.
indeed at-most two CL student not pass
'Indeed, at most two students failed.'

b. *Zuiduo liang ge xuesheng *dique* mei jige.
at-most two CL student indeed not pass
'At most two students indeed failed.'

Second, referential indefinites can precede *dique* and *zhende*, whereas quantificational indefinites cannot. Fodor & Sag (1982) propose that indefinite noun phrases are semantically ambiguous. For example, *a student* in (40) can be interpreted in two ways. The first is that some particular student, e.g., John, cheated on the final exam. With this reading, *a student* is called a referential indefinite, as it is interpreted as a referring expression. On the second interpretation, there exists a student who cheated, i.e., the set of students in the syntax class who cheated is not empty. Here, *a student* is called a quantificational indefinite, since it is interpreted as a quantified expression.

(40) A student in the syntax class cheated on the final exam.

(Fodor & Sag 1982: 355)

Quantificational indefinites obey normal scope constraints: When a quantificational indefinite and another quantified DP co-occur in a sentence, the preferred reading is the one on which the first quantifier takes wide scope over the second (Fodor & Sag, 1982: 365). However, when co-occurring with a quantified DP, referential indefinites only have wide scope readings. For example, if *a student* is interpreted referentially in

(41), the sentence only means that there is a certain student who every professor met.

(41) Every professor met a student in the syntax class. (Fodor & Sag 1982: 355)

Chinese indefinite noun phrases also exhibit such an ambiguity. In (42), the indefinite *san ge xuesheng* can be interpreted referentially, in which case it refers to three particular students which the speaker can identify. It can also have a quantificational interpretation, where all we know is that the set of students who cleaned the classroom has three members.

(42) San ge xuesheng dasao le jiaoshi.
three CL student clean PERF classroom
'Three students cleaned the classroom.'

When the indefinite DP *san ge xuesheng* occurs in front of VP-initial *dique* or *zhende*, it can only have the referential interpretation, as in (43-a). Interpretation (43-b) is not available. In other words, quantificational indefinites cannot occur before *dique*/*zhende*.

(43) San ge xuesheng *dique*/*zhende* dasao le jiaoshi.
three CL student indeed/really clean PERF classroom

a. 'Three (particular) students indeed/really cleaned the classroom.'

b. Unavailable: 'There exist three students who indeed/really cleaned the classroom (, but I don't know which).'

Furthermore, modifiers like *certain*, *particular* and relative clauses favor the referential interpretation (Fodor & Sag, 1982: 361-362). Thus, *san ge xuesheng* in (43) can be replaced with *zuobian de san ge xuesheng* 'the three students sitting on the left'.

In contrast, modifiers like *altogether* or *exactly* emphasize the quantity of the referents, and thus favor the quantificational interpretation. As a result, replacing *san ge xuesheng* with *yi gong san ge xuesheng* 'altogether three students' or *zhenghao san ge xuesheng* 'exactly three students' would make the sentence ungrammatical (see (44)), as predicted by the analysis.

(44) *Yigong san ge xuesheng *dique*/*zhende* dasao le jiaoshi.
altogether three CL student indeed/really clean PERF classroom
'Altogether three students indeed/really cleaned the classroom.'

In short, referential indefinites can occur before VP-initial *dique* or *zhende*, but quantificational indefinites cannot. This is because the DP position preceding the VP-initial adverbs is a topic position, which favors definite noun phrases. Referential indefinites resemble definites in that they are both referring expressions, and can therefore occupy the topic position. On the other hand, quantificational indefinites do not denote specific referents and are thus excluded from the topic position.

Third, noun phrases with the quantifier *meiyou* 'no' or *henshao* 'few' cannot occur before VP-initial *dique* or *zhende*, as in (45-b). This is because these quantified noun phrases do not denote specific referents. Therefore, they are excluded from the position in front of *dique*/*zhende*.

(45) a. *Dique*, meiyou ren / henshao ren neng shuo shi zhong yuyan.
indeed no person / few person can speak ten CL language
'Indeed, nobody/few people can speak ten languages.'

b. *Meiyou ren / Henshao ren *dique* neng shuo shi zhong yuyan.
no person / few person indeed can speak ten CL language
'Nobody/few people indeed can speak ten languages.'

In summary, the fact that noun phrases occurring before VP-initial *dique*/*zhende*

show the properties of topic is predicted by the proposal that the DP position preceding VP-initial *dique*/*zhende* is a topic position.

4.3.3 Section summary

This section presented a syntactic analysis for the adverbs *dique* and *zhende* that corresponds to the semantic analysis. It is shown that the DP position before VP-initial adverbs is a topic position, which ensures the consistency between semantics and syntax. This syntactic analysis correctly predicts that noun phrases exhibiting no topic properties cannot occur before VP-initial adverbs.

4.4 Chapter summary

The adverbs *dique* and *zhende* can occur at sentence-initial position and VP-initial position. In this chapter, I distinguished between sentence-initial adverbs and VP-initial adverbs, and accounted for the differences between these two kinds of adverbs.

Semantically, sentence-initial adverbs are analyzed as sentential force modifiers, which modify a context change potential by imposing restrictions on the input context. VP-initial adverbs are analyzed as propositional modifiers, which modify a proposition by introducing presuppositions. This analysis is motivated by the intuition that sentence-initial adverbs take a wider scope than VP-initial adverbs. Syntactically, both sentence-initial and VP-initial adverbs are TP adjuncts. The DP position preceding VP-initial adverbs is a topic position, whereas the DP position following sentence-initial adverbs is a subject position. This proposal is supported by the fact that noun phrases occurring before VP-initial adverbs can be marked by topic markers and cannot be focalized, and that non-referential indefinites are excluded from this position.

This semantic and syntactic analysis accounts for the two differences between VP-initial and sentence-initial adverbs. The first difference is that VP-initial *dique*/*zhende* can be embedded whereas sentence-initial *dique*/*zhende* cannot. Following my analysis, sentence-initial *dique*/*zhende* are sentential force modifiers, which require a force head as an argument, whereas VP-initial adverbs are propositional modifiers that do not require a force head. Given that forces cannot be embedded in Mandarin, my analysis correctly predicts that VP-initial adverbs can be embedded whereas sentence-initial adverbs cannot. The second difference is that certain noun phrases can co-occur with sentence-initial adverbs but not with VP-initial adverbs. Following my analysis, the noun phrases preceding VP-initial adverbs occupy a topic position, and thus noun phrases that exhibit no topic properties cannot occur in this position.

In the next chapter, we will see that sentence-initial and VP-initial adverbs also differ in the types of questions they can occur with. The analysis of the adverbs in this chapter, together with the analysis of Mandarin questions in the next chapter, will account for this difference.

Chapter 5

Mandarin questions and VP-initial adverbs

5.1 Introduction

Chapter 4 distinguished between sentence-initial adverbs and VP-initial adverbs, and provided different denotations for adverbs at these two positions. In this chapter, we will see that sentence-initial and VP-initial adverbs are also different in terms of the co-occurrence with different kinds of questions. Before showing this difference, I first introduce four types of questions in Mandarin.

First, *ma* questions (hereafter referred to as MAQs) are marked by the sentence-final particle *ma*, as in (1).

(1) Xiaoli xihuan Xiaowu ma?
Xiaoli like Xiaowu Q
'Does Xiaoli like Xiaowu?'

Second, A-not-A questions (hereafter referred to as ANAQs) conjoin a linguistic unit A, which can be the verb, the verb phrase, or the first syllable of the verb, and its negative counterpart 'not A', as shown in (2).

(2) a. Xiaoli *xihuan bu xihuan* Xiaowu (ne)?
Xiaoli like not like Xiaowu Q
'Does Xiaoli like or not like Xiaowu?' (A = verb)

b. Xiaoli *xihuan Xiaowu bu xihuan Xiaowu* (ne)?
Xiaoli like Xiaowu not like Xiaowu Q
'Does Xiaoli like Xiaowu or not like Xiaowu? (A = verb phrase)

c. Xiaoli *xi-bu-xihuan* Xiaowu (ne)?
Xiaoli like-not-like Xiaowu Q
'Does Xiaoli like or not like Xiaowu? (A= first syllable of verb)

Alternative questions (henceforth, ALTQs) consist of two or more alternatives that are connected by *haishi* 'or', as in (3).

(3) Xiaoli xihuan Xiaowu haishi xihuan Xiaozhang (ne)?
Xiaoli like Xiaowu or like Xiaozhang Q
'Does Xiaoli like Xiaowu or like Xiaozhang?'

Wh-questions (henceforth, WHQs) are questions that contain a *wh*-phrase, as in (4).

(4) Xiaoli xihuan shei (ne)?
Xiaoli like who Q
'Who does Xiaoli like?'

These four kinds of questions can be classified into two different groups. MAQs belong to Group A. ANAQs, ALTQs and WHQs share some syntactic and prosodic features and belong to Group B. Syntactically, Group A questions make the positive answer *p* syntactically explicit with the form *p-ma*. In contrast, Group B questions make

all the possible answers explicit with the surface syntactic structure. ANAQs make both the positive and negative answers explicit by conjoining a constituent and its negative counterpart. ALTQs make all the possible answers explicit by conjoining the alternatives with *haishi*. WHQs introduce an existential presupposition that is equal to the disjunction of all the possible answers to the questions. For example, (4) presupposes that there exists some individual x who is liked by Xiaoli. This is equivalent to the disjunction of all the propositions in the form of 'Xiaoli likes x', e.g., 'Xiaoli likes Xiaowu' or 'Xiaoli likes Xiaozhang' or 'Xiaoli likes Xiaowang'. In this sense, WHQs make all the possible answers explicit, just like ALTQs do. Furthermore, MAQs are obligatorily marked by the sentence-final particle *ma*, while Group B questions are optionally marked by the sentence-final particle *ne*. Prosodically, Group B questions obligatorily end with a final low tone, whereas Group A questions lack a final low tone (see Section 5.4.2). The differences between Group A and Group B are summarized as follows:

	Syntax	Prosody
Group A	make one answer explicit; end with the particle *ma*	lack a final low tone
Group B	make all answers explicit; end with the particle *ne*	a final low tone

Table 5.1: Differences between Group A and Group B

Now, let us go back to the co-occurrence of Mandarin questions with the adverbs *dique* and *zhende*. Sentence-initial adverbs can co-occur with both Group A and Group B, as shown in (5).

(5) a. *Dique*/*Zhende*, Xiaoli xihuan Xiaowu ma?
indeed/really Xiaoli like Xiaowu Q
'Indeed/Really, does Xiaoli like Xiaowu?'

b. *Dique*/*Zhende*, Xiaoli xihuan bu xihuan Xiaowu?
indeed/really Xiaoli like not like Xiaowu?

'Indeed/Really, does Xiaoli like or not like Xiaowu?'

c. *Dique/Zhende*, Xiaoli xihuan Xiaowu haishi xihuan Xiaozhang?
Indeed/Really Xiaoli like Xiaowu or like Xiaozhang
'Indeed/Really, does Xiaoli like Xiaowu or like Xiaozhang?'

d. *Dique/Zhende*, Xiaoli xihuan shei?
indeed/really Xiaoli like who
'Indeed/Really, who does Xiaoli like?'

However, Group A and Group B questions show different behaviors in co-occurrence with VP-initial adverbs. Group A can co-occur with VP-initial adverbs *dique* and *zhende*, whereas Group B questions cannot, as shown in (6).

(6) a. Xiaoli *dique/zhende* xihuan Xiaowu ma?
Xiaoli indeed/really like Xiaowu Q
'Does Xiaoli indeed/really like Xiaowu?'

b. *Xiaoli *dique/zhende* xihuan bu xihuan Xiaowu?
Xiaoli indeed/really like not like Xiaowu?
'Does Xiaoli indeed/really like or not like Xiaowu?'

c. *Xiaoli *dique/zhende* xihuan Xiaowu haishi xihuan Xiaozhang?
Xiaoli indeed/really like Xiaowu or like Xiaozhang
'Does Xiaoli indeed/really like Xiaowu or like Xiaozhang?'

d. *Xiaoli *dique/zhende* xihuan shei?
Xiaoli indeed/really like who
'Who does Xiaoli indeed/really like?'

Another difference between these two groups of questions is that Group A can be used when a possible answer to the question has been asserted, whereas Group B cannot, as shown in (7).

(7) A: Xiaoli xihuan Xiaowu.
Xiaoli like Xiaowu
'Xiaoli likes Xiaowu.'

B: ✓MAQ #ANAQ #ALTQ #WHQ

In this chapter, I will show how the interaction between VP-initial adverbs and questions reveals some intrinsic semantic properties of questions. A compositional analysis of these four kinds of questions will be provided, and this analysis accounts for the differences between Group A and Group B as observed in (6) and (7). The main proposals are: 1) MAQs indicate an update in the Table. 2) Group B questions indicate an update in the Table *and* assert a disjunction of all the possible answers to the questions.

This chapter is structured as follows: Section 5.2 presents two empirical observations. First, unlike Group A, Group B questions can only be used in neutral contexts. Second, unlike ANAQs, ALTQs with the form 'p or not p' can only be used in forceful neutral contexts. These observations are supported by a naturalness rating experiment. Section 5.3 reviews the previous studies of Mandarin questions. These studies fail to account for the distinct behaviors of Group A and Group B. Section 5.4 defines the semantics of MAQs, ANAQs, ALTQs and WHQs. All the four questions indicate an update in the Table, but only Group B questions involve an assertion meaning, which results from the syntactic and prosodic features of Group B questions. Section 5.5 derives the speaker's ignorance from the assertion meaning of Group B questions, and accounts for the neutrality requirement of Group B questions. Section 5.6 explains why Group A and Group B exhibit different behaviors in co-occurrence with VP-initial adverbs. Section 5.7 extends the analysis of Group B questions to Mandarin unconditional structures. Section 5.8 gives a conclusion to this chapter.

5.2 Different behaviors of the four kinds of questions

This section provides informal characterizations of the four kinds of questions. On the basis of empirical data and a naturalness rating experiment, I show that: 1) Group A can be used in neutral and biased contexts, whereas Group B can only be used in neutral contexts; 2) ALTQs with the form 'p or not p' can only be used in forceful neutral contexts, whereas ANAQs can be used in all neutral contexts.

5.2.1 Differences between Group A and Group B

The empirical observation regarding Group A and Group B is summarized in (8).

(8) a. Both Group A and Group B can be used in neutral contexts.

b. Group A can be used in biased contexts, whereas Group B cannot.[1]

The concept of 'biased context' in (8) is based on Gunlogson's (2003) proposal, given in (9). If a proposition p is publicly asserted by one discourse participant, it is possible that both participants commit themselves to p in the end. However, there is no possibility that both participants are committed to ¬p. In other words, the context is biased towards p in the sense that it is possible that p is in the Common Ground and it is impossible that ¬p is in the CG. Therefore, the context is neutral regarding an issue if no one publicly asserted a proposition about this issue before.

(9) If a proposition p is publicly asserted and ¬p is not publicly asserted, the context is biased towards p.

(Modified from Gunlogson 2003: 47)

[1] Li & Thompson (1981) also point out this difference between MAQs and ANAQs.

Let us illustrate (8) with examples. (8-a) states that both MAQs and ANAQs can be used in a neutral context, such as (10). No information about Xiaoli's feeling towards Xiaowu has ever been mentioned before, and thus the context is neutral towards the issue whether Xiaoli likes Xiaowu. The speaker can use either an ANAQ or a MAQ to seek the information.

(10) Context: Your friend arranged a blind date for Xiaoli and Xiaowu. After the date, you ask your friend:

A: Xiaoli xihuan bu xihuan Xiaowu (ne)?
Xiaoli like not like Xiaowu Q
'Does Xiaoli like or not like Xiaowu?' (ANAQ)

A′: Xiaoli xihuan Xiaowu ma?
Xiaoli like Xiaowu Q
'Does Xiaoli like Xiaowu?' (MAQ)

Let us turn to the examples of ALTQs and WHQs. Both (11) and (12) are neutral contexts in which no information about Xiaoli's favorite girl has been mentioned before. ALTQs and WHQs can be used in such neutral contexts.

(11) Context: Your friend introduced two girls, Xiaowu and Xiaozhang, to Xiaoli. You ask your friend:

A: Xiaoli xihuan Xiaowu haishi xihuan Xiaozhang (ne)?
Xiaoli like Xiaowu or like Xiaozhang Q
'Does Xiaoli like Xiaowu or like Xiaozhang?' (ALTQ)

(12) Context: Your friend introduced many girls to Xiaoli. You ask your friend:

A: Xiaoli xihuan shei (ne)?
Xiaoli like who Q
'Who does Xiaoli like?' (WHQ)

(8-b) states that MAQs can also be used in biased contexts. As in (7), repeated here as (13), one discourse participant A already asserted p 'Xiaoli likes Xiaowu', thus the context is biased towards p. The MAQ used by B indicates B's doubt towards A's assertion. ANAQs, ALTQs and WHQs cannot be used in such a biased context.

(13) A: Xiaoli xihuan Xiaowu.
Xiaoli like Xiaowu
'Xiaoli likes Xiaowu.'

B: ✓Xiaoli xihuan Xiaowu ma? (MAQ)

#Xiaoli xihuan bu xihuan Xiaowu? (ANAQ)

#Xiaoli xihuan Xiaowu haishi xihuan Xiaozhang? (ALTQ)

#Xiaoli xihuan shei? (WHQ)

To summarize, both Group A and Group B can be used in a neutral context where no possible answer to the question has been asserted before. Only Group A, but not Group B, can be used in a biased context where one possible answer has been asserted.

5.2.2 Differences between ANAQs and ALTQs

An ALTQ connecting two contradictory alternatives resembles an ANAQ except that *haishi* 'or' appears in the ALTQ but not in the ANAQ, as shown in (14) and (15).

(14) Xiaoli xihuan bu xihuan Xiaowu?
Xiaoli like not like Xiaowu
'Does Xiaoli like or not like Xiaowu?' (ANAQ)

(15) Xiaoli xihuan haishi bu xihuan Xiaowu?
Xiaoli like or not like Xiaowu
'Does Xiaoli like or not like Xiaowu?' (ALTQ)

The empirical observation regarding ANAQs and ALTQs is given in (16).

(16) a. Both ANAQs and ALTQs cannot be used in biased contexts.

b. ALTQs with the form 'p or not p' can only occur in forceful neutral contexts, whereas ANAQs can occur in all kinds of neutral context.

Let us illustrate (16) with examples. Like ANAQs, ALTQs belong to Group B and cannot be used in biased contexts like (13). ALTQs with the form 'p or not p' are always used in forceful neutral contexts where the speaker has previously failed to elicit an answer and is eager to try again. ANAQs are also felicitous in such contexts. In (17), Xiaoli asks a question but does not get the answer because of Xiaoming's contradictory statements. Now Xiaoli can use either an ALTQ or an ANAQ to force the addressee to provide the answer immediately (Biezma (2009) refers to this property of ALTQs as 'cornering effect').

(17) Xiaoli asks Xiaoming if he will go hiking tomorrow. Xiaoming says "Yes, I will go. Ah, I haven't finished my homework". Then, Xiaoli asks Xiaoming:

A: Ni qu haishi bu qu?
you go or not go
'Do you go or not go?' (ALTQ)

A′: Ni qu bu qu?
you go not go
'Do you go or not go?' (ANAQ)

The difference between these two kinds of questions is that ALTQs with the form 'p or not p' are infelicitous in examples like (18) whereas ANAQs are felicitous. (18) is a normal neutral context, i.e., not a forceful neutral context. It is impolite to use an ALTQ in (18), since the ALTQ with the form 'p or not p' indicates that the speaker is forcing the addressee to pick an answer from p and ¬p. The speaker hints that he will not be satisfied if the addressee gives any other answer like 'I don't know' or 'Let me think'. The ANAQ does not have such a forceful connotation, and is felicitous in such a context.

(18) Context: Your friend comes to visit your home. After he comes in, you ask him:

A: #Ni yao haishi bu yao cha?
you want or not want tea
'Do you want or not want tea?' (ALTQ)

A′: ✓Ni yao bu yao cha?
you want not want tea
'Do you want or not want tea?' (ANAQ)

To sum up, ALTQs with the form 'p or not p' can only be used in forceful neutral contexts, while ANAQs can be used in all neutral contexts.

5.2.3 A naturalness rating study

Based on introspection, I characterized the differences between Group A and Group B and the differences between ANAQs and ALTQs with the form 'p or not p' in Section 5.2.1 and Section 5.2.2. In order to validate these generalizations, this section reports a

naturalness rating experiment.

Sections 5.2.1 and 5.2.2 made the following generalizations: 1) both Group A and Group B can be used in neutral context, but only Group A can be used in biased context (I will take ANAQs as a representative of Group B questions); 2) ALTQs with the form 'p or not p' can only be used in forceful neutral context, whereas ANAQs can be used in all neutral contexts. Given the introspection-based generalizations, I make the following predictions:

(19) Predictions:

a. Both MAQs and ANAQs are judged natural in a neutral context;

b. ANAQs and ALTQs with the form 'p or not p' are judged less natural than MAQs in a biased context;

c. Both ANAQs and ALTQs with the form 'p or not p' are judged natural in a forceful neutral context;

d. ALTQs with the form 'p or not p' are judged less natural than ANAQs in a normal (i.e., not forceful) neutral context.

These predictions will be tested in the experiment.

5.2.3.1 Method

In the experiment, the participants judged the naturalness of the three questions: MAQs, ANAQs and ALTQs with the form 'p or not p' in different contexts.

Stimuli Each stimulus consisted of a context, which distinguished bias and forcefulness, as exemplified in (20-a), (20-b) and (20-c), and a target question, which

can be a MAQ, an ANAQ or an ALTQ with the form 'p or not p', as exemplified in (21-a), (21-b) and (21-c). The two factors, property of the context and type of question, generate 9 fully-crossed conditions. Each condition had 10 items. Therefore, there are 90 target stimuli (and 60 fillers) in total.

(20) a. Normal neutral context: Your friend just had supper in the new canteen. You ask him:

b. Biased context: You know that the food in the canteen is very bad. However, your friend tells you that the food there is very delicious. You ask him:

c. Forceful neutral context: Your friend just had supper in the new canteen. You ask him if the food is nice there. He hesitates for a long time and does not answer you. You feel impatient and ask him:

(21) a. Shitang de fan haochi ma?
canteen GEN food good Q
'Is the food in the canteen good?' (MAQ)

b. Shitang de fan haochi bu haochi?
canteen GEN food good not good
'Is the food in the canteen good or not good?' (ANAQ)

c. Shitang de fan haochi haishi bu haochi?
canteen GEN food good or not good
'Is the food in the canteen good or not good?' (ALTQ)

Procedure The 90 stimuli and 60 fillers, all in Chinese characters, were presented to the participants in an anonymous questionnaire in Qualtrics. The questionnaire was organized into ten blocks, each block containing 9 stimuli and 6 fillers.[2] Each participant completed the questionnaire on a laptop. The participants were required to judge how

[2]See the English translation of the complete questionnaire in Appendix B.

natural the target sentences were in the contexts by ticking the numbers on a 5-point scale from "completely natural" to "unnatural".

Participants 16 native Mandarin speakers were paid 80 Hong Kong dollars to participate in the experiment.

Statistics The ratings were treated as numerical values. The t-values and p-values were calculated by the statistical software package SPSS (IBM, 2011).

5.2.3.2 Results

From Figure 5.1, we can see that both MAQs and ANAQs are judged natural in a neutral context. There is no significant difference between the naturalness of these two questions in a neutral context (p = .466 $>$ .05). This supports (19-a), which says that both MAQs and ANAQs are judged natural in a neutral context.

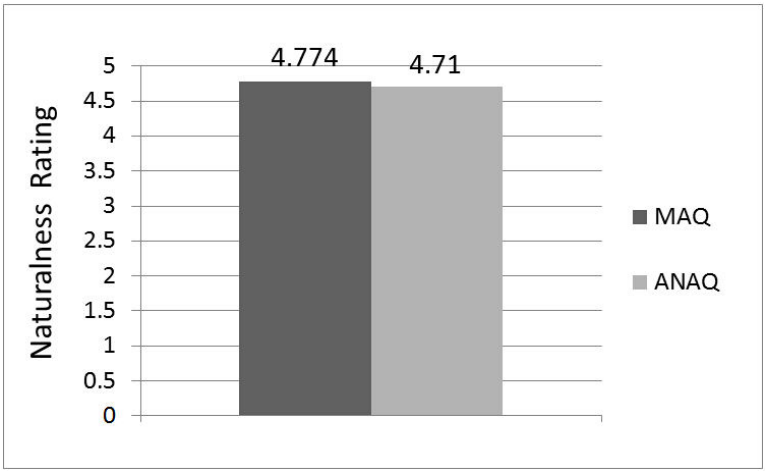


Figure 5.1: Average Naturalness Ratings of MAQs and ANAQs in neutral contexts

Figure 5.2 shows that MAQs are judged more natural than ANAQs in a biased context (t = 7.794, $p < .001$), and MAQs are judged more natural than ALTQs with the form 'p

or not p' in a biased context (t = 6.443, $p < .001$). This supports (19-b), which says that ANAQs and ALTQs with the form 'p or not p' are judged less natural than MAQs in a biased context.

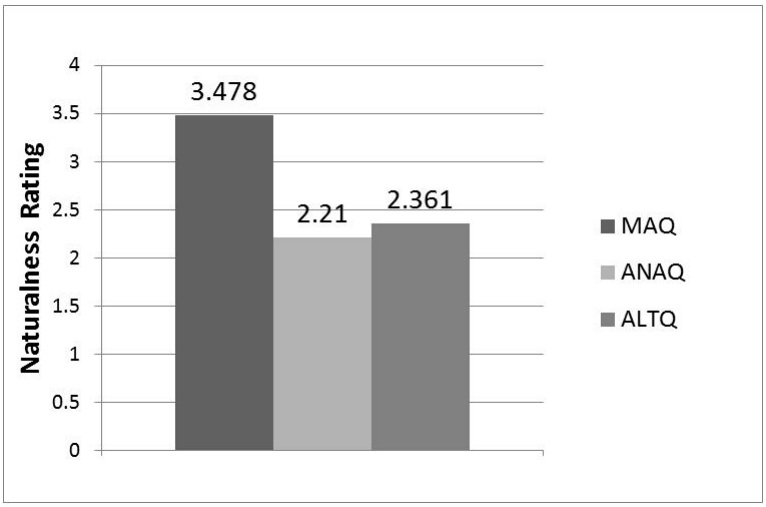


Figure 5.2: Average Naturalness Ratings of MAQs, ANAQs and p-or-not-p ALTQs in biased contexts

From Figure 5.3, we see that both ANAQs and ALTQs with the form 'p or not p' are judged natural in a forceful neutral context. There is no significant between the naturalness of these two questions in a forceful context (p = .751 $>$ .05). This supports (19-c), i.e., ANAQs and ALTQs with the form 'p or not p' are judged natural in a forceful neutral context.

Figure 5.4 shows that participants judged ANAQs more natural than ALTQs with the form 'p or not p' in a normal neutral context (t = 12.549, $p < .001$). This supports (19-d), i.e., ALTQs with the form 'p or not p' are judged less natural than ANAQs in a normal (i.e., not forceful) neutral context.

According to the introspection-based data and the experimental results, I conclude that unlike Group A, Group B questions can only be used in neutral contexts; unlike ANAQs, ALTQs with the form 'p or not p' can only be used in forceful neutral contexts.

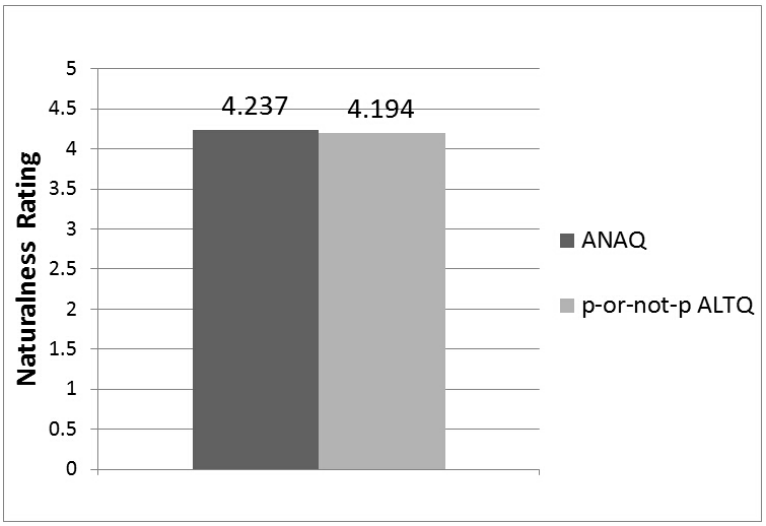


Figure 5.3: Average Naturalness Ratings of ANAQs and p-or-not-p ALTQs in forceful neutral contexts

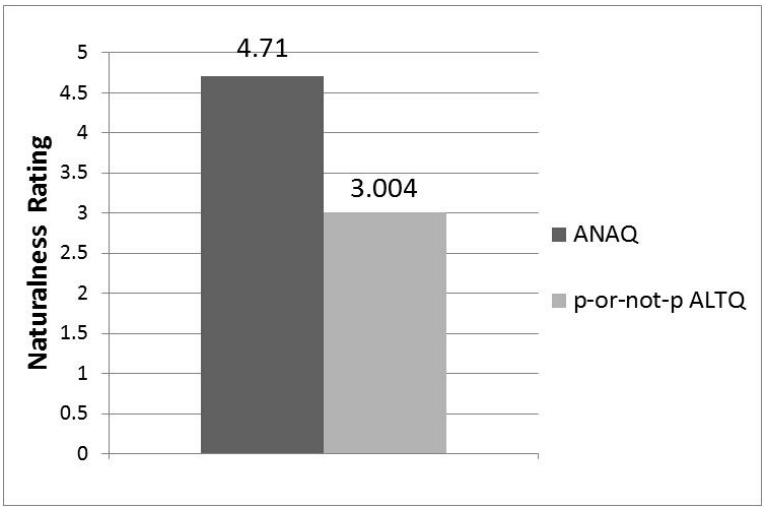


Figure 5.4: Average Naturalness Ratings of ANAQs and p-or-not-p ALTQs in normal neutral contexts

5.3 Previous studies about Mandarin questions

Before presenting my semantic analysis, I will give a brief review of previous studies about Mandarin questions in this section. One of the core features of Mandarin questions is the presence of sentence-final particles, such as *ma* and *ne*. Different analyses of these particles lead to different semantic analyses of Mandarin questions. Section 5.3.1 reviews the studies of sentence-final particles *ma* and *ne* given by Cheng (1991, 1997) and Dong (2009), and shows that both analyses give rise to problems. Section 5.3.2 reviews Dong's (2009) study on MAQs and ANAQs. In Dong's (2009) analysis, MAQs and ANAQs have identical semantics, which cannot account for the differences between these two questions that are observed in Section 5.2.

5.3.1 The studies of sentence-final particles *ma* and *ne*

As introduced in Section 5.1, MAQs are marked by the sentence-final particle *ma*, whereas Group B questions are marked by the sentence-final particle *ne*. Different accounts for these particles have been provided, but no consensus regarding the semantics and syntax of these particles has been reached. In this section, I review two representative analyses of *ma* and *ne* provided by Cheng (1991, 1997) and Dong (2009).

Cheng (1991, 1997) claims that the sentence-final particles *ne* and *ma* are both question particles. The presence of *ne* indicates that the type of the clause is *wh*-question,[3] and the particle *ma* indicates that the type of the clause is *yes*/*no* question. As clause-typing particles, *ma* and *ne* are generated in C position. Based on these generalizations, Cheng (1991, 1997) proposes a Clausal Typing Hypothesis as in (22).

[3]This generalization is not right, as ANAQs and ALTQs can also co-occur with the particle *ne* (and cannot co-occur with *ma*).

This hypothesis predicts that there is always an overt way of marking the type of a sentence. Some languages like Mandarin use question particles to mark questions, while others like English use *wh*-movement to mark questions.

(22) Clausal Typing Hypothesis

Every clause needs to be typed. In the case of typing a *wh*-question, either a *wh*-particle in C_0 is used or else fronting of a *wh*-word to the Spec of C_0 is used, thereby typing a clause through C_0 by Spec-head agreement.

(Cheng 1997: 22)

Many researchers, like Li (2006) and Dong (2009), point out that Clausal Typing Hypothesis does not hold. There are two main arguments against the claim that *ma* and *ne* are question particles. First, WHQs, ANAQs and ALTQs are acceptable without the particle *ne*. Second, both *ne* and *ma* cannot take embedded scope. Take *ne* as an example. In (23-a), the *wh*-construction without *ne*, i.e., *shei mai le shu* 'who bought books', can be embedded under the verb *wen* 'ask', while the counterpart with *ne* cannot, as in (23-b).

(23) a. Zhangsan wen wo [shei mai le shu].
Zhangsan ask me who bought PERF books
'Zhangsan asked me who bought books.'

b. *Zhangsan wen wo [shei mai le shu ne].
Zhangsan ask me who bought PERF books ne
Intended reading: Zhangsan asked me who bought books.

(Dong 2009: 32)

Therefore, Mandarin would be one of the exotic languages whose question particles only have the matrix-clause property, unlike other *wh*-in-situ languages like Navajo,

Japanese and Korean where question particles can be embedded, as shown in (24). Cheng's analysis needs to explain why Mandarin is an exception.

(24) Distribution of *wh*-particles in matrix and embedded questions

languages	matrix *wh*-questions	embedded *wh*-questions
Egyptian	∅	∅
Indonesian	∅	∅
Navajo	-l*á*/-sh	-l*á*/-sh
Japanese	-ka	-ka
Korean	ci	ci

(Cheng 1997: 26)

Next, let us have a look at Dong's (2009) study of sentence-final particles. According to Dong (2009), the particle *ne* is optional in questions and thus does not contribute to the question meaning. Dong (2009) claims that the particle *ma* is a generic form of negation, and provides evidence for this claim by introducing a subtype of ANAQs in Mandarin, which is of VO-not form. In VO-not questions, the imperfective negation *bu* or the perfective negation *mei* appears at the end of the sentence, which looks just like a sentence-final particle, as shown in (25).

(25) a. Zhangsan xihuan Lisi bu?
Zhangsan like Lisi not
'Does Zhangsan like Lisi ?'

b. Zhangsan chi fan le mei?
Zhangsan eat meal PERF not
'Did Zhangsan eat?' (Dong 2009: 67)

Dong (2009) claims that MAQs resemble VO-not questions in that *ma* is in the same position as the negation in VO-not questions. Therefore, *ma* is a generic form of negation in place of the perfective *mei* and the imperfective *bu*. Following this analysis, the syntactic structure of the MAQ in (26) is not (27) but (28).

(26) Zhangsan xihuan Lisi ma ?
Zhangsan like Lisi Q
Does Zhangsan like Lisi? (Dong 2009: 71)

(27) $[_{CP}\ [_{IP}$ Zhangsan xihuan Lisi] ma] (Dong 2009: 71)

(28) [Zhangsan $[_{VP}$ xihuan Lisi ma]] (Dong 2009: 71)

I disagree with Dong (2009) in analyzing *ma* as a form of negation, since MAQs have very different properties from VO-not questions.[4] First, VO-not questions marked by *mei* can be embedded under [+*wh*] verbs, just like other ANAQs, but MAQs cannot, as in (29).

(29) a. Wo xiang zhidao [Zhangsan chi fan le mei].
I want know Zhangsan eat meal PERF not
'I want to know whether Zhangsan had a meal or not.' (VO-not question)

b. *Wo xiang zhidao [Zhangsan chi fan le ma].
I want know Zhangsan eat meal PERF Q
Intended: 'I want to know if Zhangsan had a meal.' (MAQ)

Second, VO-not questions marked by *mei* can co-occur with the particle *ne*, just like other ANAQs, but MAQs cannot, as shown in (30).

(30) a. Zhangsan chi fan le mei ne?
Zhangsan eat meal PERF not ne

[4]Dong (2009) himself also notices some potential problems caused by this analysis.

'Did Zhangsan have meal or not?' (VO-not question)

b. *Zhangsan chi fan le ma ne?
Zhangsan eat meal PERF ma ne
Intended: 'Did Zhangsan have meal or not?' (MAQ)

Third, unlike MAQs, VO-not questions cannot co-occur with VP-initial adverbs, and they cannot be used in a biased context in which an answer has already been asserted, as shown in (31) and (32).

(31) *Xiaoli *dique/zhende* xihuan Xiaowu bu?
Xiaoli indeed/really like Xiaowu not
'Does Xiaoli indeed/really like Xiaowu or not?'

(32) A: Xiaoli xihuan Xiaowu.
Xiaoli like Xiaowu
'Xiaoli likes Xiaowu.'

B: #Xiaoli xihuan Xiaowu bu?
Xiaoli like Xiaowu not
'Does Xiaoli like Xiaowu or not?'

In summary, VO-not questions, as a subtype of ANAQs, are different from MAQs. The particle *ma* should not be analyzed as a form of negation.

The previous studies on sentence-final particles *ma* and *ne* lead to many problems. Cheng's (1991, 1997) analysis of the particles as question particles in C position cannot explain why the particles cannot be embedded, and Dong's (2009) analysis of *ma* as a form of negation fails to distinguish between MAQs and VO-not questions.

5.3.2 Dong's (2009) semantic account for ANAQs and MAQs

To my knowledge, Dong (2009) is the only work that provides a formal semantic account for Mandarin questions. This section reviews Dong's (2009) semantic analysis of Mandarin ANAQs and MAQs.

According to Dong (2009), in an ANAQ like (33), the verbal complex A-not-A creates a set of functions, as in (34).

(33) Zhangsan xi-bu-xihuan Lisi (ne)?
Zhangsan like-not-like Lisi ne
'Does Zhangsan like or not like Lisi?'

(34) $[\![\text{xi-bu-xihuan}]\!] = \{\lambda x.\lambda y.\lambda w'.\text{like}(x)(y)(w'); \lambda x.\lambda y.\lambda w'.\neg\text{like}(x)(y)(w')\}$

(Dong 2009: 60)

The two DPs *Zhangsan* and *Lisi*, each denoting a singleton set of individuals, combines with this set of functions through pointwise functional application (Hamblin, 1973) to create a set of propositions, as shown in (35). In Dong's (2009) analysis, the optional particle *ne* does not make any contribution in the semantic computation of questions. Thus, (33) denotes the set of propositions in (35).

(35) $[\![\text{Zhangsan xi bu xihuan Lisi}]\!] = \{\lambda w'.\text{like}(\text{l})(\text{z})(w'), \lambda w'.\neg\text{like}(\text{l})(\text{z})(w')\}$

(Dong 2009: 61)

Dong's (2009) analysis of MAQs is built upon his analysis of ANAQs. Since Dong (2009) proposes that *ma* is a generic form of negation, MAQs share the same semantic meaning as VO-not questions and other kinds of ANAQs, as shown in (36).

(36) ⟦Zhangsan xihuan Lisi ma⟧

= ⟦Zhangsan xihuan Lisi bu⟧

= ⟦Zhangsan xihuan-bu-xihuan Lisi⟧

= $\{\lambda w'.\text{like}(\text{l})(\text{z})(w'), \lambda w'.\neg\text{like}(\text{l})(\text{z})(w')\}$

(Modified from Dong 2009: 69)

Dong's (2009) analysis of MAQs and ANAQs fails to account for the differences between MAQs and ANAQs that are observed in Section 5.2.

5.3.3 Section summary

This section briefly reviewed the previous studies on Mandarin questions. It was shown that Cheng's (1991, 1997) analysis of sentence-final particles as question particles and Dong's (2009) analysis of *ma* as form of negation both make wrong predictions. It was also shown that Dong's (2009) analysis of MAQs and ANAQs as sharing identical semantics fails to explain the differences between these two questions. In the next section, I present my semantic analysis which avoids the shortcomings of the previous studies and provides account for the differences between MAQs and ANAQs.

5.4 Semantics of questions

In order to explain the differences among the four kinds of questions observed in Section 5.1 and Section 5.2, I examine the semantics of these questions in this section. I show that both Group A and Group B indicate an update in the Table, but only Group B questions have an assertion meaning.

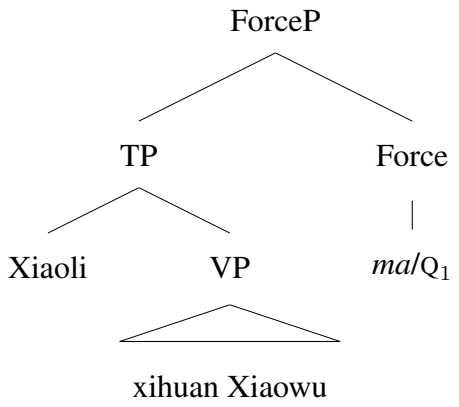
5.4.1 Mandarin *ma* questions (MAQs)

This section presents the analysis of the particle *ma* as a question force marker. This analysis makes correct predictions about the behaviors of *ma* and hence supports the view that sentential forces have syntactic representation. I also formalize the semantics of MAQs on the basis of Hamblin (1973), Roberts (1996) and Farkas & Bruce (2010).

I propose that the *ma* particle in MAQs is a force marker, which introduces a question force head Q_1. Q_1 occupies the head position of a ForceP, so the structure of (1), repeated here as (37), is (38).

(37) Xiaoli xihuan Xiaowu ma?
Xiaoli like Xiaowu Q
'Does Xiaoli like Xiaowu?'

(38)



The analysis of *ma* as a force marker correctly predicts that MAQs cannot be embedded, since clauses indicating sentential forces cannot be embedded in Mandarin (see Chapter 4). The analysis of *ma* as a force marker also avoids the problems of the previous analyses. Cheng (1991, 1997) cannot explain why *ma* cannot be embedded. Dong (2009) fails to distinguish between MAQs and VO-not questions. These problems do not arise in my analysis. This is to say, a proper analysis of *ma* can be provided

only if we assume that sentential forces are syntactically represented as force operators. If sentential forces like question were a pure pragmatic notion, the particle *ma* could only work as a set generator, which takes in a proposition p and creates the set which contains p and ¬p. Following this analysis, the MAQ *ni xihuan wo ma* in (39) would be a set of propositions, and the verb *wen* 'ask' would take in this set of propositions and the entity Li to return a single proposition. There is nothing wrong in terms of the semantic composition. In other words, this analysis wrongly predicts that MAQs can be embedded.

(39) Li wen [ni xihuan wo ma]
Li ask you like me Q
✓ Li asks: 'Do you like me?' ('me' = Li)

Li asks if you like me. ('me' = the speaker of the whole sentence)

Next, let us see the semantics of Q_1. As discussed in Chapter 1, I follow Hamblin (1973), Roberts (1996), Farkas & Bruce (2010) and assume that a question indicates an update of the Table, which is a stack of issues under discussion. Based on this, the semantics of Q_1 is defined in (40-a). Q_1 takes in a proposition, and then puts the set which contains this proposition and its negative counterpart onto the top of the Table. As shown in (40-b), the combination of Q_1 with a proposition p yields a context change potential. $T(C) \oplus \{p, \neg p\}$ is a context that resembles C, except that $T(C)$ now contains $\{p, \neg p\}$ at the topmost level.

(40) a. $[\![Q_1]\!] = \lambda p.\lambda C.\ [T(C) \oplus \{p, \neg p\}]$

b. $[\![Q_1(p)]\!] = \lambda C.\ [T(C) \oplus \{p, \neg p\}]$

To summarize, *ma* is a force marker. The utterance of p-*ma?* adds a set of

propositions {p, ¬p} onto the Table as the immediate issue under discussion in the stack.

5.4.2 Mandarin A-not-A questions (ANAQs)

This section derives the meaning of ANAQs compositionally from the meaning of a reduplication feature R, the sentence-final particle *ne* and the low boundary tone L%.

5.4.2.1 The feature R and the particle *ne*

My proposals regarding the compositional analysis of ANAQs are summarized as below:

(41) a. The feature R, located between the subject NP and the VP in the deep structure of ANAQs, is realized by a reduplication rule.

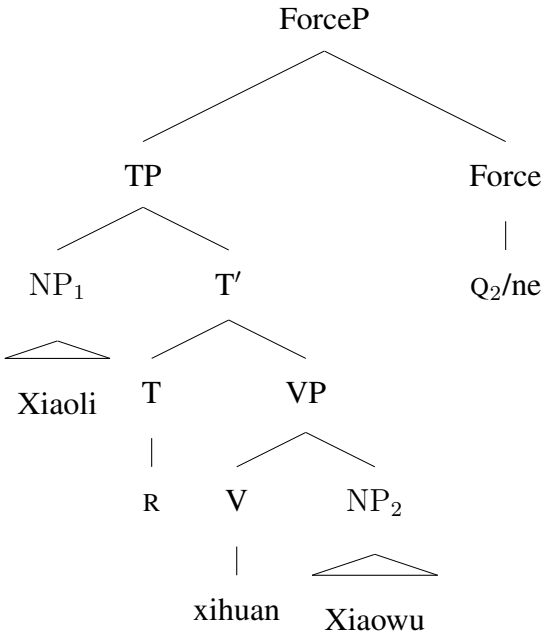
b. The feature R combines with the VP and the subject NP to create a set which contains a proposition p 'NP VP' and its negative counterpart.

c. The question operator Q_2, phonologically realized as the sentence-final particle *ne*, adds this set onto the Table and creates a disjunction, p ∨¬p.

Let us illustrate these proposals. (41-a) is based on Huang's (1991) analysis of ANAQs. The ANAQ in (2), repeated here as (42), is derived from the deep structure in (43). The feature R is realized by a reduplication rule, which copies a sequence following T and inserts *bu* 'not' between the original and its copy. Here, R copies the verb *xihuan* and gives rise to the structure in (42). The question operator Q_2, phonologically realized as the sentence-final particle *ne*, introduces the question force, and thus occupies the head position of a Force Phrase (ForceP).

(42) Xiaoli xihuan bu xihuan Xiaowu (ne)?
Xiaoli like not like Xiaowu Q?
'Does Xiaoli like or not like Xiaowu?'

(43)



The feature R derives the semantics described in (41-b). I propose that the semantics of R is as in (44). The formula $\lambda P.\lambda x.\{P(x), \neg P(x)\}$, derived from the reduplication rule, creates a set which contains a proposition and its negative counterpart, as shown in (45).

(44) $[\![\text{R}]\!] = \lambda P.\lambda x.\{P(x), \neg P(x)\}$

(45) $[\![\text{TP}]\!] = [\![\text{R(like.Xiaowu)(Xiaoli)}]\!] = \{\text{p}, \neg\text{p}\}$ p ='Xiaoli likes Xiaowu'

(41-c) characterizes the semantics of the question operator Q_2. I propose that Q_2 expresses two independent dimensions of meaning, an at-issue dimension and a side-issue dimension (Potts, 2005, 2007). The at-issue dimension represents the aspect of meaning that the speaker presents as new and under discussion, while the side-issue

dimension refers to the part of meaning presented as not under discussion, peripheral or backgrounded (See Chapter 6 for more discussions about multi-dimensionality). As in (46), the denotation of Q_2 consists of two formulae: 1) an at-issue formula $\lambda Q.\lambda\text{C}.\ [\text{T(C)} \oplus Q]$, which takes in a set of propositions and then adds this set onto the Table. 2) a side-issue formula $\lambda S.(r_1 \vee r_2 \vee ... \vee r_{|S|})$, which takes in a set of propositions and gives back the disjunction of all the propositions in the set. The operator '$\times$' is defined as in (47).

(46) $[\![\text{Q}_2]\!] = \lambda Q.\lambda\text{C}.\ [\text{T(C)} \oplus Q]\ \times\ \lambda S.(r_1 \vee r_2 \vee ... \vee r_{|S|}), r_i \in S$ for all $1 < i \leqslant |S|$
(Notation: Q and S are sets of propositions of type $\langle\langle s, t\rangle, t\rangle$.)

(47) If φ and ψ are formulae, $\varphi \times \psi$ is a formula, where φ is the at-issue formula and ψ is the side-issue formula. If φ is of type $\langle a, b\rangle$, ψ is of type $\langle a, c\rangle$ and γ is of type a, $[\![(\varphi \times \psi)(\gamma)]\!] = [\![\varphi(\gamma)]\!] \times [\![\psi(\gamma)]\!]$.

The interpretation of the ForceP in (43) is given in (48).

(48) $[\![\text{ForceP}]\!] = [\![\text{Q}_2]\!]([\![\text{TP}]\!])$

$= (\lambda Q.\lambda\text{C}.\ [\text{T(C)} \oplus Q]\ \times\ \lambda S.(r_1 \vee r_2 \vee ... \vee r_{|S|}))(\{\text{p}, \neg\text{p}\})$

$=(\lambda Q.\lambda\text{C}.\ [\text{T(C)} \oplus Q])(\{\text{p}, \neg\text{p}\}) \times (\lambda S.(r_1 \vee r_2 \vee ... \vee r_{|S|}))(\{\text{p}, \neg\text{p}\})$

$= \lambda\text{C}.\ [\text{T(C)} \oplus \{\text{p}, \neg\text{p}\}] \times (\text{p} \vee \neg\text{p})$

p = 'Xiaoli likes Xiaowu'

In summary, the reduplication feature R produces a set of propositions. The particle *ne* adds this set onto the top of the Table, i.e., produces a question meaning, and then creates a disjunction of the propositions in the set.

5.4.2.2 The low boundary tone L%

The previous section derived the meaning of the ForceP. However, the semantics of ANAQs is not complete yet. There is another element in ANAQs, i.e., the final low tone, that also contributes to the semantics of the question. This section investigates the final low tone in ANAQs and compares the intonation of ANAQs with the intonations of declaratives, ALTQs and MAQs.

Shen (1999) points out that MAQs end with a final rise tone, while ANAQs end with a final fall tone, which is the characteristic of declarative intonation. This distinction is depicted in Figure 5.5, which is a summary of Shen (1999) given by Schack (2000). Shen (1999) also concludes that ALTQs and WHQs share the same intonation pattern with ANAQs and end with a final low tone.

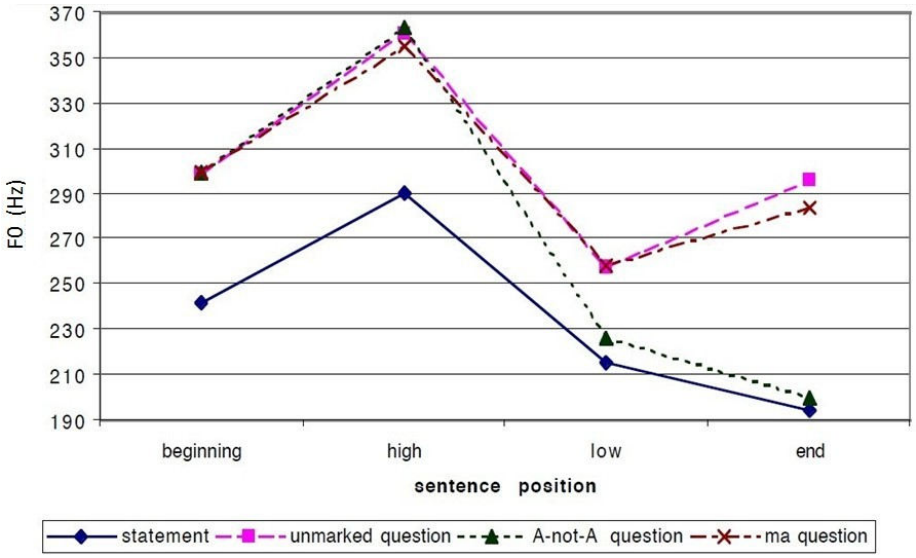


Figure 5.5: The average F0 in Shen's study (Schack 2000: 29)

Shen's (1990) conclusion is supported by the case study of one Mandarin speaker, who is the author of this dissertation. Four utterances were recorded: a declarative, a

MAQ, an ANAQ and an ALTQ, and they were analyzed in the Pan-Mandarin ToBI system (Peng et al., 2005). In the test sentence *Wulin na yinyu* 'Wulin carries silver-fish', each syllable is pronounced with tone 2 (the mid-rising tone, labeled as 35). As can be seen from Figure 5.6 to Figure 5.9,[5] ANAQs and ALTQs end with the low boundary tone L%, just like the declarative. In contrast, MAQs end with the high boundary tone H%.

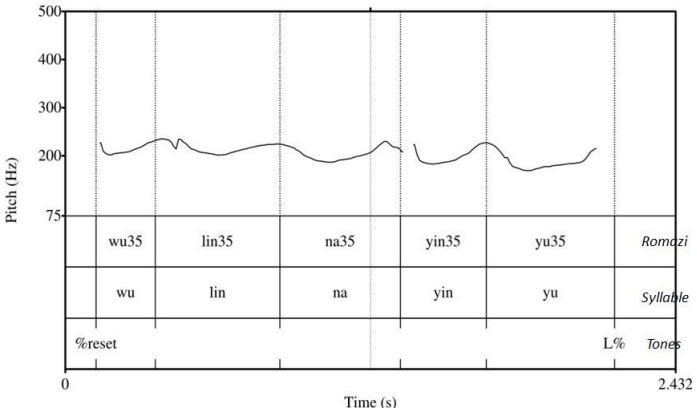


Figure 5.6: Declarative 'Wulin carries silver-fish.'

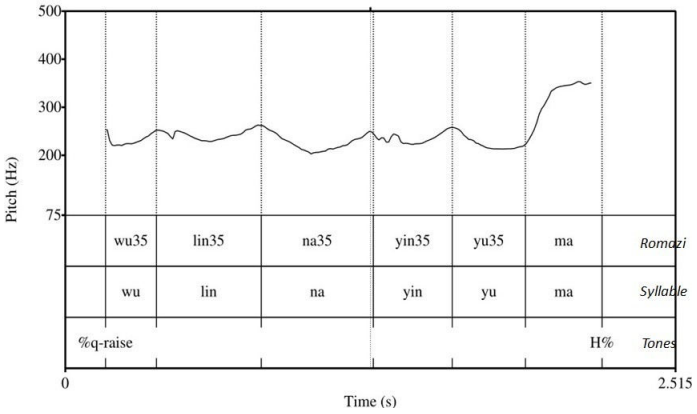


Figure 5.7: MAQ 'Does Wulin carry silver-fish?'

[5]Since I am only interested in boundary tones, I adopt only three tiers: Romanisation, Syllables and Tones, out of the seven tiers in the Pan-Mandarin ToBI annotation system.

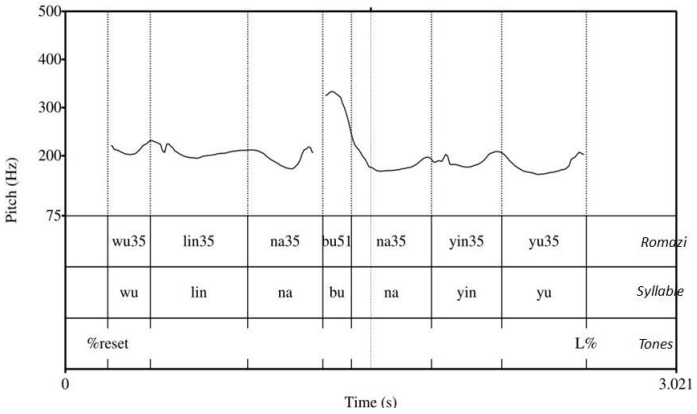


Figure 5.8: ANAQ ‘Does Wulin carry or not carry silver-fish?’

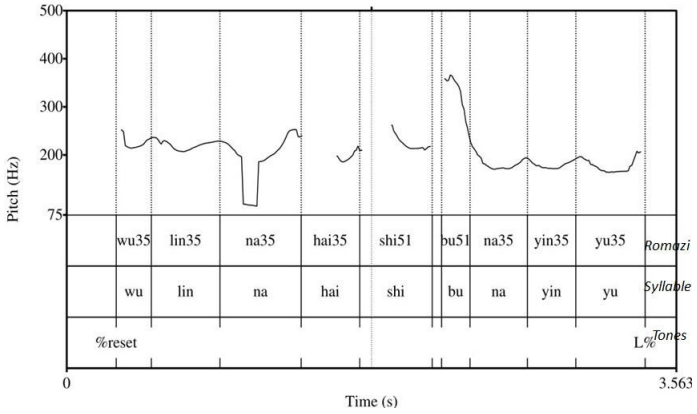


Figure 5.9: ALTQ ‘Does Wulin carry or not carry silver-fish?’

In a nutshell, declaratives, ANAQs and ALTQs are marked by the low boundary tone L%, whereas MAQs are marked by the high boundary tone H%.[6]

5.4.2.3 L% as ASSERT and paratactic association

In this section, I propose that the low boundary tone L% provides an assertive force, and show how the paratactic association of L% to the ForceP creates an assertion 'p $\vee\neg$p'.

The proposals regarding the semantics of ANAQs are summarized as below:

(49) a. L% in ANAQs and declaratives represents the abstract ASSERT morpheme.
b. ASSERT is paratactically attached to the side-issue formula 'p $\vee\neg$p' to produce an assertion 'p $\vee\neg$p'

(49-a) discusses the semantics of L% tone. To some readers, it may seem unconventional to treat intonational features as lexical elements which engage in the semantic computation. Researchers like Bartels (1997), however, present convincing evidence that certain phonological features do make semantic contributions. Regarding L% tone in ANAQs, I make the following hypothesis:

(50) a. The low boundary tone L% bears an interpretable [ASSERT] feature.
b. The question operator Q_2 bears an uninterpretable [uASSERT] feature.

(50-a) follows from the fact that the L% tone is the intonation of declaratives and thus

[6] Although ANAQs without *ne* obligatorily end with the L% tone, ANAQs containing *ne* can sometimes end with rising tone. My intuition is that when an ANAQ containing *ne* is uttered with rising tone, the speaker is more anxious to know the answer, compared with ANAQs without *ne*. This is why Shao (1996) argues that the semantics of *ne* is to reinforce the interrogative force. I believe that this reinforcing meaning is not due to *ne*, but due to the rising tone. Following Bartels (1997) and Hara & Davis (2013), the rising tone indicates that the utterance is directed at the addressee and the speaker expects the addressee to resolve the issue. Thus, when uttering ANAQs containing *ne* with rising tone, the speaker sounds more anxious in seeking an answer. The prosody of ANAQs containing *ne* is left for future study.

indicates an assertive force (Bartels, 1997). (50-b) says that Q_2 also bears the [ASSERT] feature, but this feature is uninterpretable. In the framework of the Minimalist Program (Chomsky, 1995), uninterpretable φ-features must be checked against matching φ-features in order to be eliminated from the derivation. If uninterpretable features were not checked nor eliminated by LF or PF, the derivation would crash. Therefore, the [uASSERT] feature on Q_2 has to be checked against the matching [ASSERT] feature on the L% tone. As shown in Figure 5.10, the symbol $\bigotimes$ indicates that the L% tone is paratactically associated with the ANAQ. The [uASSERT] feature on Q_2 is checked by the [ASSERT] feature on L% and is then eliminated. Then, the structure converges.

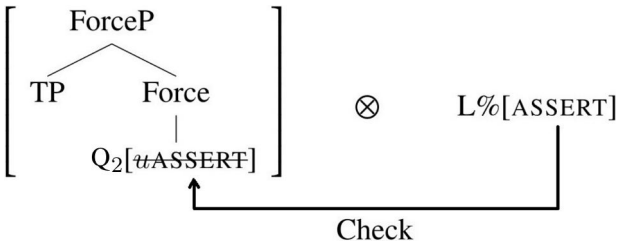


Figure 5.10: Feature Checking

This hypothesis correctly predicts that it is not grammatical to end an ANAQ with other tones, for example, a rising tone. As in (51), the covert question operator Q_2 in this ANAQ bears an [uASSERT] feature, but the final rising tone does not bear the [ASSERT] feature. The uninterpretable feature on Q_2 is not checked, and (51) is ungrammatical.

(51) *Xiaoli xihuan bu xihuan Xiaowu $_{H\%}$
Xiaoli like not like Xiaowu
'Does Xiaoli like or not like Xiaowu?'

Like ANAQs, Mandarin WHQs end with the L% tone. As Mandarin WHQs also end with the question operator Q_2 (which can be phonologically realized as *ne*), my hypothesis

predicts that it is not grammatical to end WHQs with other tones, e.g., a rising tone. This is a correct prediction, as shown in (52). When a WHQ ends with a rising tone, the *wh*-word can only be interpreted as an existential and the whole question is a polarity question, as shown in (53). Furthermore, (53) would be ungrammatical if *ne* is added. This verifies the hypothesis that the [uASSERT] feature on Q_2 must be checked by L%'s [ASSERT] feature.

(52) *Ni zhaodao shenme le $_{H\%}$
you find what PERF
'What did you find?'

(53) Ni zhaodao shenme le (*ne) $_{H\%}$
you find what PERF Q_2
'Did you find something?'

Going back to the semantics of the L% tone. (49-a) and (49-b) are based on Bartels (1997). Bartels (1997) proposes that English ALTQs obligatorily end with the final low phrasal tone L- (See also Pruitt & Roelofsen, 2013), and L- tone in declaratives and ALTQs represents the abstract ASSERT morpheme. ASSERT is paratactically associated with ALTQs and performs the dynamic assertive update. For example, the alternative statement in (54-b) is the presupposition of the ALTQ in (54-a). ASSERT attaches to the alternative statement to create an assertion meaning, that the speaker believes that Amy ordered one of the three drinks, mineral water, ice tea and lemonade. Anything else cannot have been ordered by Amy. In this sense, an ALTQ can be said to have an assertion component.

(54) a. Did Amy order mineral water, ice tea, or lemonade?
H* H- H* H- H* **L-**L%

b. Amy ordered mineral water, ice tea, or lemonade.

(Bartels 1997: 157)

In contrast, a *yes*/*no* question does not end with the final low tone L-, as shown in (55). (55) is a *yes*/*no* question as it has two answers, 'Yes, Amy ordered mineral water, ice tea or lemonade' and 'No, it is not the case that Amy ordered mineral water, ice tea or lemonade'. This *yes*/*no* question does not presuppose that Amy ordered one of the three drinks, hence does not have an assertion component.

(55) Did Amy order mineral water, ice tea, or lemonade?

(L*) (L*) L* **H-**H%

(Bartels 1997: 157)

Following Bartels (1997), I propose that the low boundary tone L% in Mandarin declaratives, ANAQs and ALTQs represents the ASSERT morpheme. ASSERT is attached to ANAQs by paratactic association. The rule of paratactic association is formulated in (56).

(56) Paratactic association:

a. If α is a sentence made up of a syntactic node β and an intonation that can be represented as a semantic feature γ, $[\![\alpha]\!] = [\![\beta]\!] \bigotimes [\![\gamma]\!] = [\![\beta \bigotimes \gamma]\!]$.

b. (i) If $\varphi \in ME_c$, $\psi \in ME_a$, and $\gamma \in ME_{\langle a,b\rangle}$, $[\![(\varphi \times \psi) \bigotimes (\gamma)]\!] = [\![\varphi]\!] \times [\![\gamma(\psi)]\!]$

(ii) If $\varphi \in ME_a$, $\psi \in ME_c$, and $\gamma \in ME_{\langle a,b\rangle}$, $[\![(\varphi \times \psi) \bigotimes (\gamma)]\!] = [\![\gamma(\varphi)]\!] \times [\![\psi]\!]$

(ME_a denote the set of all meaningful expressions of type a.)

(56-a) says that the semantic feature γ encoded in an intonational morpheme is not syntactically integrated into the main text β, but is rather attached to the main text β to return a formula $\beta \bigotimes \gamma$. Following (56-a), the syntactic structure of a ANAQ can be represented as in Figure 5.11, where the assertive morpheme ASSERT encoded by the final low tone in ANAQs is attached to the Force Phrase of ANAQs to return 'ForceP $\bigotimes$ ASSERT'.

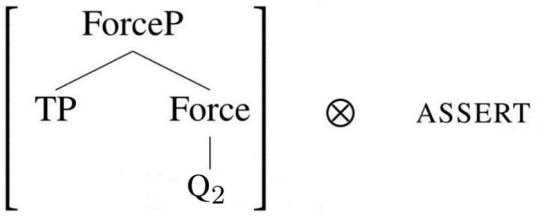


Figure 5.11: Syntactic structure of ANAQs

(56-b) tells us how to interpret the formula $\beta \bigotimes \gamma$. As depicted in (57), β projects its at-issue meaning φ and its side-issue meaning ψ.

(57)
$$\begin{array}{c} \beta \quad \bigotimes \quad \gamma \\ | \\ \varphi \times \psi \end{array}$$

The semantic feature γ has a freedom to attach to either the at-issue content φ or the side-issue content ψ. As shown in (56-b-i), γ is of type $\langle a, b \rangle$, and thus it can take the side-issue content ψ (of type a) as an argument but not the at-issue content φ (of type c). In this case, γ will attach to the side-issue content ψ to return $\gamma(\psi)$, and the at-issue content φ will remain unmodified. (56-b-ii) shows another case, where γ (of type $\langle a, b \rangle$) can take the at-issue content φ (of type a) as an argument but not the side-issue content ψ (of type c). In this case, γ will attach to the at-issue content φ to yield $\gamma(\varphi)$, and the

side-issue content ψ will remain unmodified.

Let us return to the paratactic association of ASSERT with ANAQs. ASSERT is attached to ANAQs by paratactic association, that is, ASSERT is not integrated with the sentence syntactically, but paratactically attached to either of the two formulae in (48), i.e., λC. [T(C) $\oplus$ {p, $\neg$p}] or (p $\vee$ $\neg$p). Following (56-b-i), since ASSERT is a force head of type $\langle\langle s,t\rangle, \langle \text{C}, \text{C}\rangle\rangle$, ASSERT should be attached to the side-issue formula p $\vee\neg$p (of $\langle s,t\rangle$ type) rather than the at-issue formula λC. [T(C) $\oplus$ {p, $\neg$p}] (of $\langle \text{C}, \text{C}\rangle$ type).

Now, after the paratactic association of the low boundary tone, the semantics of (42) is as in (58).[7] The semantics of an ANAQ consists of two parts: 1) the at-issue meaning λC. [T(C) $\oplus$ {p, $\neg$p}], which updates the Table with the set {p, $\neg$p}; 2) the side-issue meaning, i.e., an assertion 'p$\vee\neg$p'. ANAQs express two forces at the same time, i.e., question force and assertion force.

(58) $[\![(42)]\!]$

=[λC. [T(C) $\oplus$ {p, $\neg$p}] $\times$ (p $\vee\neg$p)] $\bigotimes$ ASSERT

= λC. [T(C) $\oplus$ {p, $\neg$p}] $\times$ ASSERT(p $\vee\neg$p)

p = 'Xiaoli likes Xiaowu'

This section showed that ANAQs indicate an update in the Table and make an assertion 'p $\vee\neg$p'. This assertion meaning is derived from the paratactic association of the low boundary tone L% with the ForceP. In Section 5.5.1, we will see how this assertion meaning gives rise to the speaker's ignorance and how the speaker's ignorance

[7] In this dissertation, I used two symbols to represent non-at-issue meanings: $\varphi_{\langle\pi\rangle}$ in which π is a presupposition of φ, and $\varphi \times \pi$ in which π is a side-issue meaning. The intuitive difference between these two meanings is as follows. In the case of the adverbs *dique* and *zhende*, 'p has been suggested' is treated as a presupposition, since it is a requirement on the prior context. In the case of ANAQs, 'an assertion p or not p' is treated as a side-issue meaning, since this assertion is inherent in the semantics of ANAQs and not a requirement on the context.

accounts for the neutrality requirement of ANAQs.

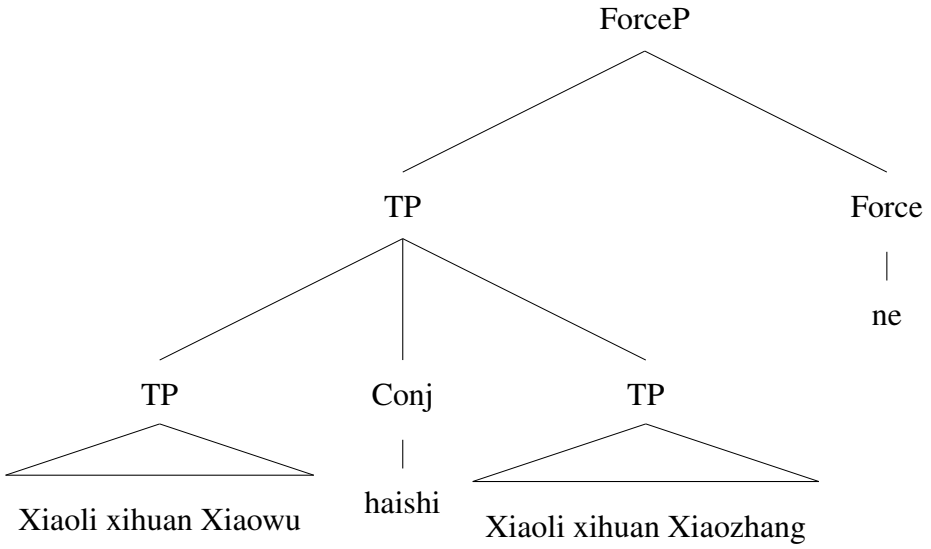
5.4.3 Mandarin alternative questions (ALTQs)

This section provides a semantic analysis of ALTQs by proposing that *haishi* generates a Hamblin-set of propositions. Like ANAQs, ALTQs involve an assertion meaning.

Following Huang (1991), I propose that the deep structure of alternative questions like (3), repeated here as (59), is as in (60). Conjunction Reduction (CR) applies to the deep structure and deletes the second occurrence of *Xiaoli*.

(59) Xiaoli xihuan Xiaowu haishi xihuan Xiaozhang (ne)?
Xiaoli like Xiaowu or like Xiaozhang Q_2
'Does Xiaoli like Xiaowu or Xiaozhang?'

(60)



The proposals regarding the semantics of ALTQs are summarized below:

(61) a. The alternative generator *haishi* in ALTQs generates a set of alternatives $\{p_1, p_2, ..., p_n\}$, n$\geqslant$2.

b. The question operator Q_2, phonologically realized as the sentence-final particle *ne*, adds this set onto the Table and creates a disjunction of the alternatives, $p_1 \vee p_2$ ... $\vee p_n$.

c. The low boundary tone attaches to the disjunction to produce an assertion '$p_1 \vee p_2$ ...$\vee p_n$'.

First, let me illustrate (61-a). Haspelmath (To appear) considers the word *haishi* 'or' as an interrogative disjunction since it is used in interrogatives. The other disjunction *huozhe* is used only in declaratives:

(62) Xiaoli xihuan Xiaowu huozhe xihuan Xiaozhang.
Xiaoli like Xiaowu or like Xiaozhang
'Xiaoli likes Xiaowu or Xiaozhang.'

I propose that *haishi* is an alternative generator rather than a disjunction for a question, as it collects two or more propositions and creates a set which contains these propositions, as shown in (63). In contrast, *huozhe* collects two or more propositions and yields the disjunction of these propositions, as in (64).

(63) $[\![\textit{haishi}]\!] = \lambda p_1.\lambda p_2. \ldots \lambda p_n.\{p_1, p_2, \ldots, p_n\}$, n$\geqslant$2.

(64) $[\![\textit{huozhe}]\!] = \lambda p_1.\lambda p_2. \ldots \lambda p_n.p_1 \vee p_2 \vee \ldots \vee p_n$, n$\geqslant$2.

The term 'alternative generator' is more suitable than 'interrogative disjunction', since my analysis can not only account for interrogtives with *haishi* but also unconditionals with *haishi*, such as (65). *Haishi* in (65) generates a set which contains two propositions: 'it rains' and 'it snows'. This set composes with the singleton set {'he goes jogging every morning'} (i.e., the denotation of the second clause *ta meitian zaoshang dou*

qu paobu) through pointwise functional application (Hamblin, 1973) to give the right interpretation of (65): a set containing two conditionals {'If it rains, he goes jogging every morning', 'If it snows, he goes jogging every morning'}. A more detailed account of Mandarin unconditionals is in Section 5.7.

(65) (Wulun) xiayu haishi xiaxue, ta meitian zaoshang dou qu paobu.
no-matter rain or snow he everyday morning DOU go jog
'No matter it rains or snows, he goes jogging every morning.'

In (60), *haishi* creates a set {'Xiaoli likes Xiaowu', 'Xiaoli likes Xiaozhang'}, as shown in (66). As stated in (61-b), the particle *ne* adds this set onto the Table and creates a disjunction of the two alternatives. Therefore, the interpretation of the ForceP in (60) will be as in (67).

(66) $[\![\text{TP}]\!]$ = {'Xiaoli likes Xiaowu', 'Xiaoli likes Xiaozhang'}

(67) $[\![\text{ForceP}]\!] = [\![\text{Q}_2]\!]([\![\text{TP}]\!])$

$= (\lambda Q.\lambda \text{C}.\ [\text{T}(\text{C}) \oplus Q]\ \times\ \lambda S.(r_1 \vee r_2 \vee ... \vee r_{|S|}))(\{\text{p, q}\})$

$= \lambda \text{C}.\ [\text{T}(\text{C}) \oplus \{\text{p, q}\}] \times (\text{p} \vee \text{q})$

p = 'Xiaoli likes Xiaowu', q = 'Xiaoli likes Xiaozhang'

After the paratactic association of the low boundary tone with the ForceP, as stated in (61-c), we get the semantics of (59) as in (68).[8] An ALTQ indicates an update in Table with the set {p, q}, and makes an assertion 'p ∨ q'.

(68) $\lambda \text{C}.\ [\text{T}(\text{C}) \oplus \{\text{p, q}\}]\ \times\ \text{ASSERT}(\text{p} \vee \text{q})$

p = 'Xiaoli likes Xiaowu', q = 'Xiaoli likes Xiaozhang'

[8] See Erlewine (To appear) for a similar derivation of the semantics of ALTQs.

The alternative generator *haishi* produces a set of possible answers. The particle *ne* adds this set onto the Table and creates a disjunction of the answers. The low boundary tone attaches to the disjunction to make an assertion. Thus, like ANAQs, ALTQs update the Table and make an assertion. See Section 5.5.2 for the differences between ANAQs and ALTQs.

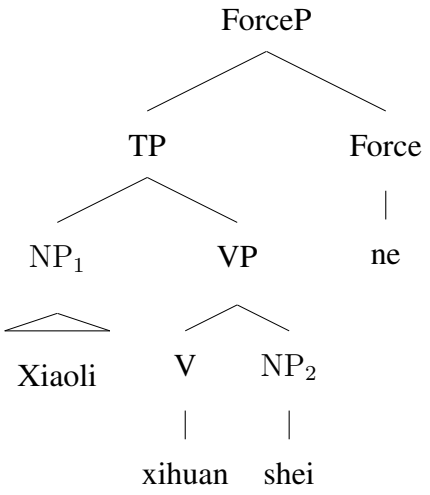
5.4.4 Mandarin *wh*-questions (WHQs)

This section derives the semantics of WHQs on the basis of Hamblin's (1973) pointwise functional application. Like ANAQs and ALTQs, WHQs involve an assertion meaning.

I propose that a WHQ like (4), repeated here as (69), has the syntactic structure as in (70).[9]

(69) Xiaoli xihuan shei (ne)?
Xiaoli like who Q_2
'Who does Xiaoli like?'

(70)



The proposals regarding the semantics of WHQs are given below:

[9]For simplicity, here I assume that *wh*-phrase is in situ and there is no *wh*-movement in Mandarin.

(71) a. The *wh*-phrase denotes a set of alternatives, and other constituents denote singleton sets.

b. The *wh*-phrase combines with other constituents through pointwise functional application to build a set of propositions.

c. The question operator Q_2, phonologically realized as the sentence-final particle *ne*, adds this set onto the Table and creates a disjunction of the propositions.

d. The low boundary tone L% attaches to the disjunction to create an assertion.

Let us illustrate these proposals. (71-a) and (71-b) are based on Hamblin (1973). According to Hamblin (1973), a WHQ denotes a set of propositions which count as the possible answers to this WHQ. Suppose that we have three individuals: Xiaowu, Xiaozhang and Xiaowang in our model. Then, the TP in (70) denotes the set in (72).

(72) {Xiaoli likes Xiaowu, Xiaoli likes Xiaozhang, Xiaoli likes Xiaowang}

Now, let us see how this semantics is achieved through point-wise functional application. Following Hamblin (1973), the *wh*-phrase *shei* 'who' denotes a set of contextually salient individuals, the verb *xihuan* 'like' denotes a singleton set which contains one function from individual to one-place predicate, and the subject NP *Xiaoli* denotes a singleton set which contains the individual Xiaoli:

(73) $[\![shei]\!]$ = $\{x|x$ is a person$\}$ = {Xiaowu, Xiaozhang, Xiaowang}

(74) $[\![xihuan]\!]$ =$\{\lambda x.\lambda y.\ y$ likes $x\}$

(75) $[\![$*Xiaoli*$]\!]$ = {Xiaoli}

The combination of *shei* with the verb *xihuan* is accomplished through point-wise application. The rule of pointwise functional application is given below:

(76) Pointwise functional application rule:
If α is a branching node with daughters β and γ, and $[\![\beta]\!] \subseteq D_{\langle\sigma\rangle}$ and $[\![\gamma]\!] \subseteq D_{\langle\sigma,\tau\rangle}$, then $[\![\alpha]\!]$ = $\{a \in D_{\langle\tau\rangle}$: $\exists b.\exists c.[b \in [\![\beta]\!]$ & $c \in [\![\gamma]\!]$ & $a = c(b)]\}$
(Modified from Kratzer & Shimoyama 2002: 7)

Following (76), each individual in the set {Xiaowu, Xiaozhang, Xiaowang} composes with the function $\lambda x.\lambda y.$ y likes x to build a set of one-place predicates. The semantics of the VP *xihuan shei* in (70) would be like:

(77) $[\![$*xihuan*(*shei*)$]\!]$
=$\{a$: $\exists b.\exists c.[b \in [\![$*shei*$]\!]$ & $c \in [\![$*xihuan*$]\!]$ & $a = c(b)]\}$
=$\{a$: $a = c(b)\}$
=$\{\lambda x.\lambda y.$ y likes x(Xiaowu), $\lambda x.\lambda y.$ y likes x(Xiaozhang), $\lambda x.\lambda y.$ y likes x(Xiaowang)$\}$
= $\{\lambda y.$ y likes Xiaowu, $\lambda y.$ y likes Xiaozhang, $\lambda y.$ y likes Xiaowang$\}$

The VP also combines with the subject NP through pointwise functional application:

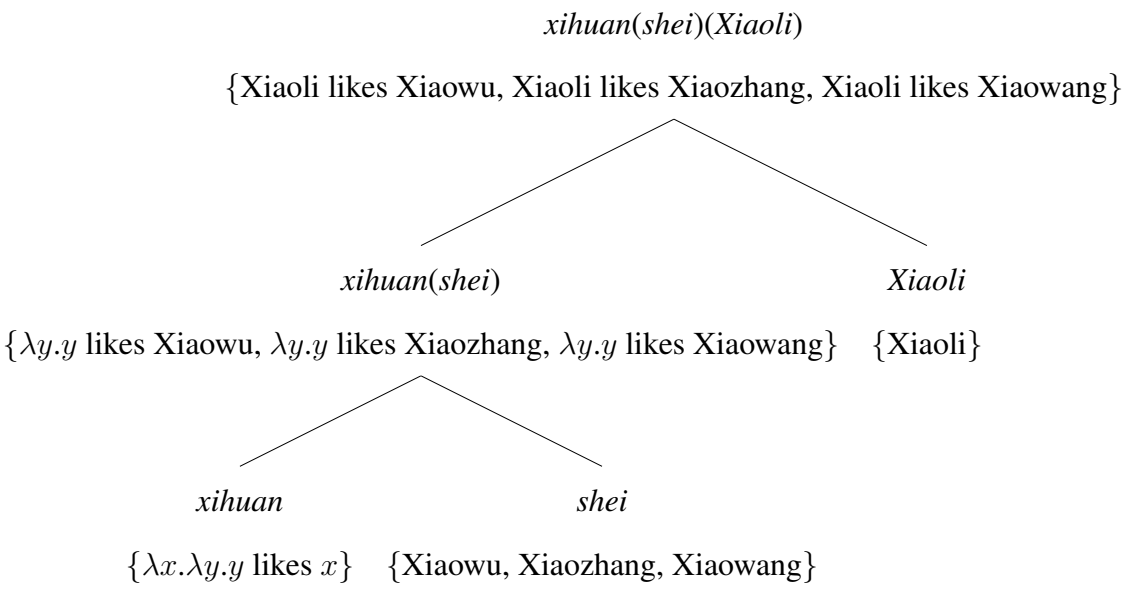
(78) $[\![$TP$]\!]$
=$[\![$*xihuan*(*shei*)(*Xiaoli*)$]\!]$
=$\{a$: $\exists b.\exists c.[b \in [\![$*Xiaoli*$]\!]$ & $c \in [\![$*xihuan*(*shei*)$]\!]$ & $a = c(b)]\}$
= $\{a$: $a = c(b)\}$

= {λy.[y likes Xiaowu](Xiaoli), λy.[y likes Xiaozhang](Xiaoli), λy.[y likes Xiaowang](Xiaoli)}

= {Xiaoli likes Xiaowu, Xiaoli likes Xiaozhang, Xiaoli likes Xiaowang}

The computation of the TP is executed based on the typed tree in (79). The TP denotes a set of propositions which count as the possible answers to the WHQ.

(79)



Now, let us illustrate (71-c) and (71-d), i.e., derive the semantics of the ForceP. As shown in (80), the question force head Q_2, realized as the particle *ne*, combines with the TP to form the ForceP. Q_2 adds the set {p, q, r} onto the Table and yields a disjunction, p $\vee$ q $\vee$ r.

(80) $[\![\text{ForceP}]\!] = [\![Q_2]\!]([\![\text{TP}]\!]) = \lambda C.\ [T(C) \oplus \{p, q, r\}] \times (p \vee q \vee r)$

p = 'Xiaoli likes Xiaowu', q = 'Xiaoli likes Xiaozhang', r = 'Xiaoli likes Xiaowang'.

Then, the low boundary tone L% attaches to the disjunction to create an assertion, as shown in (81). The semantics of a WHQ consists of two parts: 1) the at-issue meaning λC. [T(C) $\oplus$ {p, q, r}], which updates the Table with the set {p, q, r}; 2) the side-issue meaning, i.e., an assertion 'p $\vee$ q $\vee$ r'.

(81) λC. [T(C) $\oplus$ {p, q, r}] $\times$ ASSERT(p $\vee$ q $\vee$ r)
p = 'Xiaoli likes Xiaowu', q = 'Xiaoli likes Xiaozhang', r = 'Xiaoli likes Xiaowang'.

This section derived the semantics of WHQs through pointwise functional application. The *wh*-phrase denotes a set of alternatives and other constituents denote singleton sets. Each alternative composes with other constituents to yield a set of propositions. This set of propositions, after the combination with the particle *ne* and the paratactic association of L%, results in an update in the Table and an assertion of the disjunction of all the possible answers.

5.5 Comparison between different kinds of questions

The previous section showed that all Group B questions involve an assertion meaning. In Section 5.5.1, I propose that the assertion meaning of Group B questions indicate the speaker's ignorance and thus requires a neutral context. This accounts for the neutrality requirement of Group B questions and explains why Group B questions cannot be used when an answer has been suggested. Section 5.5.2 explains the differences between ANAQs and ALTQs with the form 'p or not p'. ALTQs with the form 'p or not p' are more marked than ANAQs. Thus, following Levinson's M-principle (2000), ALTQs with the form 'p or not p' can only be used in marked contexts like the forceful neutral context.

5.5.1 The assertion meaning: speaker's ignorance

As shown in Section 5.4, the semantics of all Group B questions consists of an at-issue meaning, i.e., an update in the Table, and a side-issue meaning, i.e., an assertion of the disjunction of the possible answers:

(82) a. λC. [T(C) $\oplus$ {p, $\neg$p}] $\times$ ASSERT(p $\vee$ $\neg$p) (ANAQs)

b. λC. [T(C) $\oplus$ {p, q}] $\times$ ASSERT(p $\vee$ q) (ALTQs)

c. λC. [T(C) $\oplus$ {p, q, ..., r}] $\times$ ASSERT(p $\vee$ q ... $\vee$ r) (WHQs)

I propose that the assertion meaning of Group B questions indicates the speaker's ignorance towards all the possible answers. Take ANAQs as an example. The proposition 'p $\vee\neg$p' is a tautology, i.e., the informativeness of this assertion is zero since it is always true. When the speaker asserts a tautology such as (83), the speaker can have at least three possible states of mind: First, the speaker in fact knows that Xiaoli likes Xiaowu (or knows that Xiaoli does not like Xiaowu), but does not want to provide the addressee with this information.

(83) Xiaoli likes Xiaowu or Xiaoli does not like Xiaowu.

Second, the speaker does not care whether Xiaoli likes Xiaowu or not. In other words, the speaker is indifferent to the issue. For example, in an unconditional like (84), the speaker indicates that whether Xiaoli likes Xiaowu or not does not matter to him.

(84) Whether Xiaoli likes Xiaowu or Xiaoli does not like Xiaowu, I recommend Xiaowu to be our chairman.

Third, the speaker has no idea if Xiaoli likes Xiaowu or not, i.e., the speaker is ignorant about this issue. In case of ANAQs, the first two possibilities should be ruled out due to the incompatibility with the question meaning of ANAQs; thus, the assertion 'p $\vee$ $\neg$p' in ANAQs indicates the speaker's ignorance.

The first possibility that the speaker knows p but conceals this information is eliminated, because the speaker's knowledge about p would make the question infelicitous. According to Searle (1969), a question is felicitous only when it meets the following conditions:

(85) a. Preparatory: S [= speaker] does not know the answer to the question.

b. Sincerity: S wants the missing information.

(Modified from Searle 1969: 66)

Suppose that the speaker knew p. Then, the question would be infelicitous, since both the preparatory condition and the sincerity condition are not met: the speaker knows the answer to the question, and the speaker does not want the information. Thus, the first possibility does not arise in case of ANAQs.

Now, let us see why the second possibility is eliminated. Suppose that the assertion 'p $\vee$ $\neg$p' represented the speaker's indifference towards the issue p or not p. Then, the meaning of an ANAQ would be contradictory: according to the at-issue meaning λC. [T(C) $\oplus$ {p, $\neg$p}] of an ANAQ, the speaker adds the question onto the Table, indicating that the speaker is interested in the issue and thus seeks the answer. However, the assertion meaning says that the speaker is indifferent to this issue. Therefore, the indifferent reading of a tautology is incompatible with ANAQs.

Finally, the third interpretation, the speaker's ignorance towards the issue, is compatible with the question meaning (i.e., the speaker is interested in the issue). Therefore, the assertion 'p $\vee$ $\neg$p' in ANAQs indicates that the speaker is totally ignorant about the issue whether p or $\neg$p. In other words, no bias towards either p or $\neg$p is indicated, i.e., the context is neutral towards the issue whether p or $\neg$p. Let me show in detail how the speaker's ignorance gives rise to the neutrality of context. Gunlogson (2003) provides a definition for bias context in (86). When a proposition p is publicly asserted, the speaker is committed to p. In this case, it is possible that both the speaker and the addressee commit themselves to p in the end. However, there is no possibility that both participants are committed to $\neg$p. That is, p has a larger chance to enter the CG than $\neg$p, hence the context is biased towards p.

(86) If a proposition p is publicly asserted, the context is biased towards p, i.e., $\mathrm{Prob}_{\mathrm{C}}(\mathrm{p}) > \mathrm{Prob}_{\mathrm{C}}(\neg \mathrm{p})$.
($\mathrm{Prob}_{\mathrm{C}}$ is a probability function that takes a proposition and returns its probability in context C.)

(Modified from Gunlogson 2003: 47)

Following Gunlogson (2003), I provide a definition for neutral context in (87). When the proposition p $\vee$ $\neg$p is publicly asserted and the speaker is ignorant towards p or $\neg$p, the speaker indicates no bias towards either p or $\neg$p. It is possible that both the speaker and the addressee commit themselves to p in the end, and it is possible that both participants commit themselves to $\neg$p. That is, p and $\neg$p have the same chance to enter the CG. In this sense, the context is neutral regarding the issue p or not p.

(87) If a proposition p $\vee$ $\neg$p is asserted by some discourse participant and that

participant is ignorant towards the issue p or not p, the context is neutral towards the issue p or not p, i.e., $\mathrm{Prob_C(p) = Prob_C(\neg p)}$.

Following (87), the semantics of ANAQs is rewritten as (88).

(88) The semantics of ANAQs:

λC. [T(C) $\oplus$ {p, $\neg$p}] $\times$ [$\mathrm{Prob_C(p)}$=$\mathrm{Prob_C(\neg p)}$]

Similarly, when the speaker makes an assertion 'p $\vee$ q' by using ALTQs, the assertion 'p or q' indicates that the speaker is ignorant towards the issue whether p or q. When the speaker makes an assertion 'p $\vee$ q ...$\vee$ r' by using WHQs, the assertion 'p $\vee$ q ... $\vee$ r' indicates that the speaker is ignorant towards the issue whether p, q or r. The semantics of ALTQs and WHQs can be rewritten as follows:

(89) The semantics of ALTQs:

λC.[T(C) $\oplus$ {p, q}] $\times$ [$\mathrm{Prob_C(p) = Prob_C(q)}$]

(90) The semantics of WHQs:

λC.[T(C) $\oplus$ {p, q, r}] $\times$ [$\mathrm{Prob_C(p) = Prob_C(q) = Prob_C(r)}$]

The assertion meaning of Group B questions explains why Group B questions cannot occur in biased contexts. In a biased context like (13), repeated here as (91), one possible answer p 'Xiaoli likes Xiaowu' has already been asserted and thus the context is biased towards p, i.e., $\mathrm{Prob_C(p)} > 0.5$. This contradicts the assertion meaning of ANAQs ($\mathrm{Prob_C(p) = Prob_C(\neg p)} = 0.5$), the assertion meaning of ALTQs ($\mathrm{Prob_C(p) = Prob_C(q)} = 0.5$), and the assertion meaning of WHQs ($\mathrm{Prob_C(p) = Prob_C(q) = Prob_C(r)} \approx 0.33$). Therefore, Group B questions cannot appear after the

assertion of a possible answer. Unlike Group B questions, MAQs simply indicate an update in the Table. MAQs lack the meaning of the assertion and thus can occur when an answer has already been provided.

(91) A: Xiaoli xihuan Xiaowu.
Xiaoli like Xiaowu
'Xiaoli likes Xiaowu.'

B: ✓Xiaoli xihuan Xiaowu ma? (MAQ)

#Xiaoli xihuan bu xihuan Xiaowu? (ANAQ)

#Xiaoli xihuan Xiaowu haishi xihuan Xiaozhang? (ALTQ)

#Xiaoli xihuan shei? (WHQ)

Although my semantic analysis of Group B questions presented above is compositional and accounts for the neutrality requirement, it faces some potential problems. I will present two of these problems here and discuss some possible solutions. The first problem is that a disjunction of all the possible answers is a single proposition, and thus it is not clear how each disjunct becomes a probability function. Take ANAQs as an example. An ANAQ makes an assertion $p \vee \neg p$, and then this assertion is transformed to $\mathrm{Prob_C}(p) = \mathrm{Prob_C}(\neg p)$. Although I explained informally how an assertion of p or ¬p derives the neutrality of context, the transformation from ASSERT($p \vee \neg p$) to $\mathrm{Prob_C}(p) = \mathrm{Prob_C}(\neg p)$ is formally problematic. The disjunction $p \vee \neg p$ is a single proposition, hence the disjuncts p and ¬p are embedded and not available as propositional arguments anymore. It is unclear how these disjuncts p and ¬p turn to two probabilities $\mathrm{Prob_C}(p)$ and $\mathrm{Prob_C}(\neg p)$ in the end.

This problem might be solved following the line of Biezma & Rawlins (2012). Biezma & Rawlins (2012) present a compositional semantic account for English polar

questions and alternative questions. Following Zimmermann (2000), Biezma & Rawlins (2012) propose that the final low tone L- in English alternative questions represents a closure operator. This closure operator applies to the set of alternatives spelled out in the alternative question, and gives rise to an exhaustivity presupposition which says that the spelled-out alternatives are the only alternatives available. For example, the alternative question in (92) presupposes that the only possibilities for Mary are making pasta or making fish. Anything else cannot have been made by Mary. This alternative question introduces an exhaustive list.

(92) Is Mary making pasta or fish? **L-**L%

In contrast, polar questions do not end with the final low tone and thus do not have such an exhaustivity presupposition. For example, (93) only presents one alternative among the set of available alternatives. The questioner signals that the present alternative 'Mary is making pasta' is a possibility, but leaves open what other alternatives might be available. The polar question introduces a non-exhaustive list.

(93) Is Mary making pasta? **H-**H%

Biezma & Rawlins' (2012) analysis accounts for the differences between English polar questions and alternative questions, and it can also be adopted in the analysis of Mandarin Group A and Group B questions. Following this analysis, Group A and Group B questions share the same question meaning (e.g., an update in the Table), while Group B questions have an additional side-issue meaning CLOSE(Q), where CLOSE is the closure operator signalled by the low boundary tone L% and Q is the set of propositions that count as possible answers to the questions. Although this analysis

cannot account for the neutrality requirement of Group B questions in its current form, it keeps all the propositions in Q alive instead of collapsing these propositions into a single proposition (as in my analysis). In this way, each proposition in the set Q can be transformed to its own probability, and thus the problem mentioned above can be solved.[10]

The second problem caused by my semantic analysis is concerned with the interpretation of tautology. As pointed out by Jeroen Groenendijk (personal communication), since 'p $\vee$ $\neg$p' and 'q $\vee$ $\neg$q' are both tautologies in classical truth-conditional semantics, the assertion 'p $\vee$ $\neg$p' is identical to the assertion 'q $\vee$ $\neg$q'. This means that the assertion 'p $\vee$ $\neg$p' also indicates the speaker's ignorance towards the issue q or not q, which seems to be wrong. Of course, this problem can be avoided if I adopt Biezma & Rawlins' (2012) analysis. This problem can also be solved in the framework of inquisitive semantics (Ciardelli, 2009; Groenendijk & Roelofsen, 2009, 2010, 2013, among others). In inquisitive semantics, 'p $\vee$ $\neg$p' and 'q $\vee$ $\neg$q' denotes two different objects, and thus the problem do not arise. For example, Hara (2014) adopts an inquisitive-semantics approach and proposes that ANAQs semantically negate any anticipation of prior expectation-rejection shift toward p or $\neg$p, which accounts for the neutrality requirement of ANAQs.

To sum up, Group B questions have an assertion meaning, which indicates the speaker's ignorance and requires a neutral context. Therefore, Group B questions cannot be used after an answer has been suggested. MAQs have no assertion meaning and thus can occur after the suggestion of an answer. I also pointed out two problems caused by

[10]It is also promising to transform each proposition in Q into its utility value. Following van Rooy & Safárová (2003), Biezma & Rawlins (2012) entertain a proposal that the utility values of the alternatives spelled out in alternative questions are equal, while the utility value of the content proposition is higher than its negation in polar questions. When the formal details of this proposal are worked out, the neutrality requirement of Group B questions can also be explained.

this semantic analysis and briefly showed how these problems can be solved following Biezma & Rawlins (2012) and Hara (2014).

5.5.2 Comparison between ALTQs and ANAQs

According to the analysis in Section 5.4.3, ALTQs with the form 'p or not p' have the same semantics as ANAQs. Both indicate an update in the Table with the set {p, ¬p} and make an assertion 'p ∨ ¬p':

(94) $\lambda C.[T(C) \oplus \{p, \neg p\}] \times [\mathrm{Prob}_C(p) = \mathrm{Prob}_C(\neg p)]$

The difference between these two questions is that ALTQs with the form 'p or not p' can only be used in forceful neutral context, whereas ANAQs can be used in all neutral contexts, as discussed in Section 5.2.2. ALTQs with the form 'p or not p' can only be used in forceful neutral contexts, because they are marked expressions compared with ANAQs and are thus infelicitous in unmarked contexts like the normal neutral context.

In the neo-Gricean pragmatic theory developed by Levinson (2000), Gricean maxims are reduced to three pragmatic principles: Q(uantity)-principle, I(nformativeness)-principle and M(anner)-principle. M-principle says that the speaker cannot use a marked expression without reason. In other words, an abnormal and marked expression implicates a marked meaning and thus is used in a marked context. A speaker would violate the M-principle if he used a marked expression in an unmarked context. The M-principle operates over a group of alternatives which share the same semantic content but differ in form. For example, (95-a) and (95-b) differ in form. (95-b) M-implicates that John stopped the car in an unusual way.

(95) a. John stopped the car. +> John stopped the car in the usual manner.

b. John caused the car to stop. +> John stopped the car in an unusual way.

('+>' stands for 'conversationally implicates')

ANAQs and ALTQs with the form 'p or not p' are two alternatives that are governed by M-principles. ANAQs are unmarked expressions whereas ALTQs with the form 'p or not p' are marked, since: 1) the former takes a shorter form than the latter; 2) the former can be used in more contexts (all kinds of neutral contexts) than the latter (only in forceful neutral contexts); 3) the former is used much more frequently than the latter (I found 61320 ANAQs and only 193 ALTQs with the form 'p or not p' in the Modern Chinese Corpus of Center for Chinese Linguistics in Peking University). Asking a question forcefully is a marked context compared with asking a question normally. Therefore, the marked expression, i.e., ALTQ with the form 'p or not p', is appropriate to be used in the marked forceful contexts. A speaker would violate the M-principle if he used ALTQs with the form 'p or not p' in an unmarked context like the normal neutral context.

ALTQs with the form 'p or not p' have the same semantics as ANAQs but are more marked than ANAQs. To be in accordance with the M-principle, ALTQs with the form 'p or not p' can only be used in marked contexts (forceful neutral context).

5.6 The co-occurrence of VP-initial adverbs and questions

Section 5.5 explained why Group A questions can occur in biased contexts but Group B questions cannot. In this section, I account for another difference between Group A and Group B: Group A questions can co-occur with VP-initial adverbs *dique*/*zhende*

while Group B questions cannot. This is caused by semantic incompatibility between the VP-initial adverbs and Group B questions.

As mentioned in Section 5.1, Group A questions can co-occur with VP-initial adverbs *dique* and *zhende*, but Group B questions cannot, as shown in (6), repeated here as (11).

(96) a. Xiaoli *dique*/*zhende* xihuan Xiaowu ma?
Xiaoli indeed/really like Xiaowu Q_1
'Does Xiaoli indeed/really like Xiaowu?'

b. *Xiaoli *dique*/*zhende* xihuan bu xihuan Xiaowu (ne)?
Xiaoli indeed/really like not like Xiaowu Q_2
'Does Xiaoli indeed/really like or not like Xiaowu?'

c. *Xiaoli *dique*/*zhende* xihuan Xiaowu haishi xihuan Xiaozhang (ne)?
Xiaoli indeed/really like Xiaowu or like Xiaozhang Q_2
'Does Xiaoli indeed/really like Xiaowu or like Xiaozhang?'

d. *Xiaoli *dique*/*zhende* xihuan shei (ne)?
Xiaoli indeed/really like who Q_2
'Who does Xiaoli indeed/really like?'

First, I explain why VP-initial *dique*/*zhende* can co-occur with MAQs, and discuss the contribution of *dique*/*zhende* in MAQs in Section 5.6.1. Then, I explain why VP-initial *dique*/*zhende* cannot co-occur with Group B questions in Section 5.6.2.

5.6.1 VP-initial adverb *dique*/*zhende* and MAQs

This section explains why the VP-initial *dique*/*zhende* is compatible with MAQs and discusses the contribution of *dique*/*zhende* in MAQs.

Let us have a look at VP-initial *dique* first. As discussed in Chapter 4, VP-initial *dique* modifies a proposition p by introducing a presupposition that p has been

suggested. The semantics of VP-initial *dique* is repeated here as (97).

(97) $[\![\textit{dique}]\!] = \lambda p.p_{\langle \mathrm{T}(\mathrm{C}_i)[0]=\{p\}\rangle}$

VP-initial *dique* can occur in a MAQ. *Dique* in MAQs also triggers the presupposition that p has been suggested. For example, a MAQ containing VP-initial *dique* like (98) cannot be used as the initial utterance in the discourse, unless the proposition 'Xiaoli likes Xiaowu' has been suggested before, as in (99).

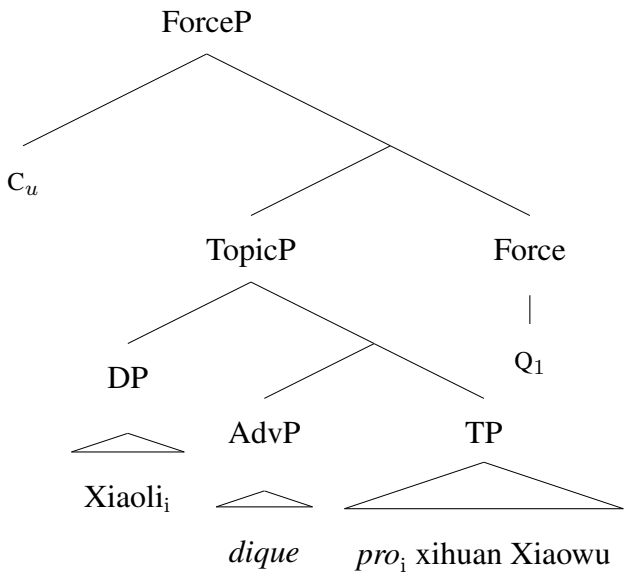
(98) Xiaoli *dique* xihuan Xiaowu ma?
Xiaoli indeed like Xiao Q_1
'Does Xiaoli indeed like Xiaowu?'

(99) A: Xiaoli xihuan Xiaowu.
Xiaoli like Xiaowu
'Xiaoli likes Xiaowu.'

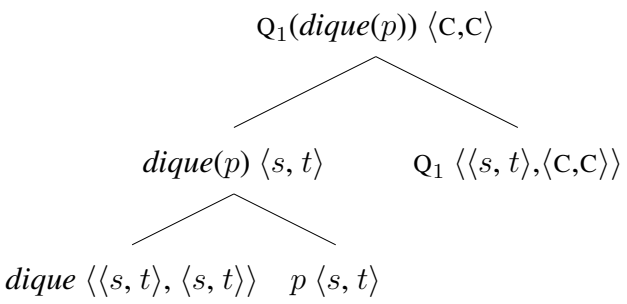
B: Xiaoli *dique* xihuan Xiaowu ma?
Xiaoli indeed like Xiao Q_1
'Does Xiaoli indeed like Xiaowu?'

Let us see why VP-initial *dique* is compatible with MAQs. (98) has the structure in (100). In (100), the TP of the MAQ denotes a proposition 'Xiaoli likes Xiaowu', of type $\langle s, t\rangle$. As can be seen from (97), the propositional modifier *dique* is of type $\langle\langle s, t\rangle, \langle s, t\rangle\rangle$, which requires a proposition of type $\langle s, t\rangle$ as an argument. Therefore, the TP of MAQs, i.e., a proposition, can be taken as an argument by VP-initial *dique*, as shown in the typed tree in (101). This is why *dique* is compatible with MAQs.

(100)



(101)



Now, let us see the semantics of MAQs containing VP-initial *dique*. In *dique*-p-*ma*?, the question force head Q_1 combines with the modified proposition *dique*(p) to yield a CCP, as shown in (102). (102) is defined if $p_{\langle T(C_i)[0]=\{p\}\rangle}$ is defined, and this is defined only if the context set CS(C_u) satisfies $T(C_u)[0] = \{p\}$. That is, one possible answer to p-*ma*? has been suggested in the Common Ground of the utterance context. One answer has already been suggested, while the at-issue content $\lambda C.[T(C) \oplus \{p, \neg p\}]$ shows that the speaker is still seeking an answer to p-*ma*?. The combination results in the indication of the speaker's doubt towards the suggested answer p and his request for more evidence for p. For example, in (99), B asks if Xiaoli likes Xiaowu although B

knows that A suggested the positive answer. This means that B needs more evidence for verification.

(102) $[\![\text{Q}_1(\textit{dique}(\text{p}))]\!] = \lambda\text{C}.\ \text{T(C)} \oplus \{\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}, \neg\text{p}_{\langle \text{T}(\text{C}_i)[0]=\{\text{p}\}\rangle}\}$

The VP-initial *zhende* works similarly in MAQs. As discussed in Chapter 4, VP-initial *zhende* modifies a proposition p by introducing a presupposition that p has been suggested and some participant remains uncommitted to p, as defined in (103).

(103) $[\![\textit{zhende}]\!] = \lambda p.p_{\langle(\text{T}(\text{C}_i)[0]=\{p\})\wedge(\exists y.p\notin \text{PB}_y(\text{C}_i))\rangle}$
where $y \in \text{D(C}_i\text{)}$ and $\text{D(C}_i\text{)}$ is the set of discourse participants in the context C_i.

VP-initial *zhende* in MAQs also triggers this presupposition. For example, a MAQ containing VP-initial *zhende* like (104) cannot be used as the initial utterance in the discourse, unless the proposition 'Xiaoli likes Xiaowu' has been suggested, as in (105). Here, the participant B is uncommitted to p, and thus the presupposition of *zhende* is satisfied.

(104) Xiaoli *zhende* xihuan Xiaowu ma?
Xiaoli really like Xiao Q_1
'Does Xiaoli really like Xiaowu?'

(105) A: Xiaoli xihuan Xiaowu.
Xiaoli like Xiaowu
'Xiaoli likes Xiaowu.'

B: Xiaoli *zhende* xihuan Xiaowu ma?
Xiaoli really like Xiao Q_1
'Does Xiaoli really like Xiaowu?'

Like VP-initial *dique*, VP-initial *zhende* is of type $\langle\langle s,t\rangle,\langle s,t\rangle\rangle$, which requires a proposition of type $\langle s,t\rangle$ as an argument. Therefore, the TP of MAQs, i.e., a proposition, can be taken as an argument by VP-initial *zhende*. This is why *dique* is compatible with MAQs. *Zhende* has similar semantic contribution as *dique* in MAQs. The question *zhende*-p-*ma*? presupposes that one possible answer to p-*ma*? has been suggested, and indicate that the speaker is still seeking an answer to p-*ma*?. The combination results in the indication of the speaker's doubt towards the suggested answer p and his request for more evidence for p. For example, in (105), B asks if Xiaoli likes Xiaowu although B knows that A suggested the positive answer. This means that B needs more evidence for verification.

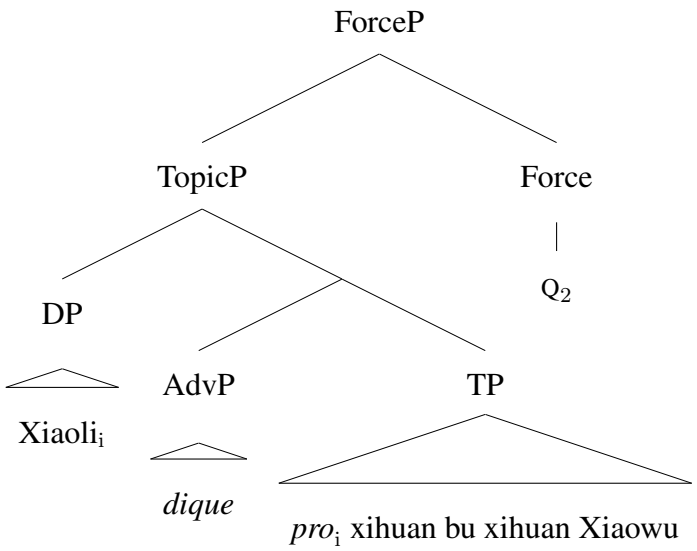
Since VP-initial *dique*/*zhende* triggers a presupposition that a proposition p has been suggested, *dique*/*zhende* must attach to a proposition of type $\langle s,t\rangle$. The TP of MAQs denotes a proposition, and thus *dique*/*zhende* can co-occur with MAQs. Due to the presupposition triggered by *dique*/*zhende*, a MAQ with VP-initial *dique*/*zhende* indicates the speaker's doubt towards the answer p and his request for more evidence for p.

5.6.2 VP-initial adverb *dique*/*zhende* and Group B questions

We are now ready to see why VP-initial *dique*/*zhende* cannot co-occur with Group B questions. I will use *dique* as a representative. Unlike a MAQ, which consists of a proposition and a force head, a Group B question is composed of a set of propositions and a force head. Suppose that VP-initial *dique* could co-occur with a Group B question, such as an ANAQ in (106). The structure of this question would be like (107).

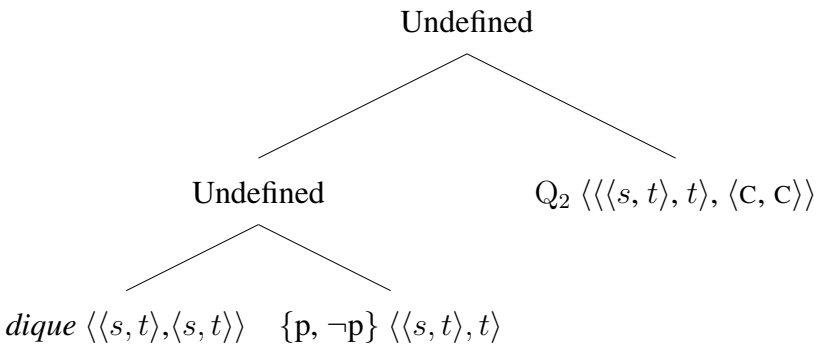
(106) *Xiaoli *dique* xihuan bu xihuan Xiaowu?
Xiaoli indeed like not like Xiaowu
'Does Xiaoli indeed like or not like Xiaowu?'

(107)



The reduplication feature R in the deep structure combines with the VP and the *pro* referring to Xiaoli to create a set {p, ¬p}. Thus, the TP in (107) denotes a set of propositions {p, ¬p}, where p = 'Xiaoli likes Xiaowu'. This set of propositions, of type $\langle\langle s,t\rangle,t\rangle$, cannot be taken by *dique*, which is of type $\langle\langle s,t\rangle,\langle s,t\rangle\rangle$, as shown in (108). The combination of *dique* with the TP leads to a type mismatch.

(108)



This type mismatch shows that the semantics of *dique* and Group B questions are incompatible. Group B questions semantically represent a set of propositions, motivated by the fact that Group B questions make all the possible answers explicit in the

syntactic structure. However, *dique* triggers a presupposition that a proposition has been suggested, and thus must combine with a single proposition rather than a set of propositions. Furthermore, *dique* presupposes that a proposition p has been suggested, which means that the context is biased towards p ($\mathrm{Prob_C(p)} > \mathrm{Prob_C}(\neg \mathrm{p})$). This contradicts the secondary meaning of Group B questions ($\mathrm{Prob_C(p)} = \mathrm{Prob_C}(\neg \mathrm{p})$). The incompatibility in semantics explains why VP-initial *dique* cannot co-occur with Group B questions syntactically.

Unlike VP-initial *dique*, adverbs like *daodi* and *jiujing* 'after all' are semantically compatible with Group B questions. These adverbs can occur in Group B questions but not in Group A questions:

(109) a. *Xiaoli *jiujing* xihuan Xiaowu ma?
Xiaoli after-all like Xiaowu Q_1
'After all, does Xiaoli like Xiaowu?'

b. Xiaoli *jiujing* xihuan bu xihuan Xiaowu?
Xiaoli after-all like not like Xiaowu?
'After all, does Xiaoli like or not like Xiaowu?'

The adverb *jiujing* requires that the question it attaches to has been asked before but not solved. As in (110), the speaker A raised the question Q 'Are you coming to the party or not coming?' before but hasn't got an answer from the addressee. Then, the speaker uses a question containing *jiujing* to urge the addressee for an answer.

(110) Context: You ask Xiaoli if he is coming to the party this weekend. Xiaoli hesitates for a long time and says nothing. Then, you ask him:

A: Ni *jiujing* lai bu lai?
you after-all come not come
'After all, are you coming or not coming?'

If this requirement is not met, the use of *jiujing* is not felicitous. For example, in (111), the question Q has not been asked before, i.e., it is a new question. *Jiujing* is not felicitous in such a context.

(111) Context: There will be a party this weekend, so you ask your friend Xiaoli:

A: #Ni *jiujing* lai bu lai?
you after-all come not come
'After all, are you coming or not coming?'

Since *jiujing* presupposes that a set of propositions has been added onto the Table, *jiujing* must combine with a set of propositions, hence it is compatible with Group B questions. Group A questions represent a single proposition (motivated by the fact that MAQs only make one answer explicit), and thus cannot co-occur with *jiujing*.

This section discussed the co-occurrence of VP-initial adverbs with Group A and Group B questions. Since VP-initial *dique* triggers a presupposition that a proposition has been suggested, *dique* must take a proposition of type $\langle s, t \rangle$ as its argument. MAQs semantically represent a single proposition, while Group B questions represent a set of propositions. Therefore, *dique* is compatible with MAQs but not with Group B questions. In contrast, adverbs like *jiujing* and *daodi* presuppose that a question (i.e., a set of propositions) has been asked but not solved, and are thus compatible with Group B questions but not Group A questions.

5.7 Unconditionals and Group B questions

Previous sections discussed the semantics of Group B questions. In this section, I extend my analysis to unconditional structures, which are closely related to Group B questions.

Unconditional structure refers to a complex sentence made up of two clauses, in which the truth of the main clause is independent of the truth of the adjoined clause. As shown in (112), the adjoined clause, i.e., *wulun Xiaoli qu naer*, is referred to as the antecedent, whereas the main clause, i.e., *wo dou hui gen ta qu* is referred to as the consequent. Mandarin unconditionals are obligatorily marked by the adverb *dou* 'all' in the consequent.

(112) (Wulun) Xiaoli qu naer, wo dou hui gen ta qu.
no-matter Xiaoli go where I DOU will with him go
'No matter where Xiaoli goes, I will go with him.'

Unconditional structures are closely related to Group B questions in that unconditional antecedents contain Group B constructions, i.e., *wh*-constructions, A-not-A constructions and p-*haishi*-q constructions, as shown in (112), (113) and (114).

(113) Wulun Xiaoli xihuan bu xihuan wo, wo dou hui gen ta qu.
no-matter Xiaoli like not like me I DOU will with he go
'No matter Xiaoli likes or not likes me, I will go with him.'

(114) Wulun Xiaoli qu Meiguo haishi Riben, wo dou hui gen ta qu.
no-matter Xiaoli go USA or Japan I DOU will with he go
'No matter Xiaoli goes to the U.S. or Japan, I will go with him.'

Other constructions, such as declarative clauses, cannot occur in the antecedent of unconditionals, as shown in (115). Furthermore, VP-initial adverbs *dique* and *zhende* cannot occur in unconditional antecedents, as in (116), just as VP-initial adverbs cannot occur in Group B questions.

(115) *Wulun Xiaoli qu Meiguo, wo dou hui gen ta qu.
no-matter Xiaoli go USA I DOU will with he go

'No matter Xiaoli goes to the U.S., I will go with him.'

(116) *Wulun Xiaoli *dique* qu naer, wo dou hui gen ta qu.
no-matter Xiaoli indeed go where I DOU will with him go
'No matter where Xiaoli indeed goes, I will go with him.'

One semantic property of unconditionals is that they have an indifference implication (Rawlins, 2008, 2013). For example, (112) indicates that the speaker is indifferent towards where Xiaoli goes, as the speaker will go with Xiaoli in any case. Rawlins (2008, 2013) derives the indifference implicature of English unconditionals from the question-denoting antecedent and a covert universal operator. I follow Rawlins (2008, 2013) in analyzing Mandarin unconditionals and propose that the covert universal operator in English is overtly marked by the adverb *dou* in Mandarin. A brief review of Rawlins (2008, 2013) will be given in Section 5.7.1. In Section 5.7.2, I show how the indifference implicature of Mandarin unconditionals is derived compositionally from Group B constructions and the universal operator *dou*, and explain why declarative clauses and VP-initial adverbs are not compatible with unconditionals.

5.7.1 Rawlins' (2008, 2013) analysis of English unconditionals

My analysis of Mandarin unconditionals is based on Rawlins (2008, 2013). Thus, in this section, I will briefly introduce Rawlins' (2008, 2013) analysis of English unconditionals.

Rawlins (2008, 2013) provides a semantic account for English unconditionals that explains the relationship between unconditionals and conditionals. Intuitively, unconditionals can be paraphrased as a list of conditionals. For example, the unconditional in (117-a) can be interpreted as a list of two conditionals in (117-b).

(117) a. Whether Alfonso has a cold or the flu, Alfonso should stay home from school. (Rawlins 2013: 136)

b. If Alfonso has a cold, Alfonso should stay home from school;
If Alfonso has the flu, Alfonso should stay home from school.

According to Rawlins (2008, 2013), one difference between conditionals and unconditionals is that unconditionals have an indifference implication but conditionals do not. For example, (117-a) shows that the speaker is indifferent towards the issue whether Alfonso has a cold or the flu. However, neither conditional listed in (117-b) has this indifference implication. Rawlins (2008, 2013) argues that this difference follows from the structure of the antecedents: unconditional antecedents denote a set of propositions (i.e., a question meaning), whereas conditional antecedents denote a single proposition.

Let us see how Rawlins (2008, 2013) derives the indifference implication of unconditionals. Rawlins (2008, 2013) claims that the antecedent of unconditionals is an interrogative structure and denotes a set of propositions. Thus, the antecedent of (117-a) denotes a set containing two propositions, as shown in (118).

(118) ⟦Whether he has a cold or the flu⟧
= {'Alfonso has a cold', 'Alfonso has the flu'}

This set of propositions combines with the consequent, which denotes a singleton set, through pointwise functional application (Hamblin, 1973) to yield a set of conditionals. Thus, (117-a) denotes a set of conditionals as in (119). This explains the intuition that unconditionals can be paraphrased as a list of conditionals.

(119) ⟦Whether he has a cold or the flu, Alfonso should stay home from school⟧
= {'If Alfonso has a cold, Alfonso should stay home from school', 'If Alfonso has a flu, Alfonso should stay home from school.'}

Inspired by Menéndez-Benito (2006), Rawlins (2008, 2013) assumes that a default universal operator, as defined in (120), is inserted in the LF of an unconditional. This operator collects a set of propositions and asserts that each of the proposition is true.

(120) $[\![\forall\alpha]\!] = \{\lambda w.\forall p \in [\![\alpha]\!] : p(w) = 1\}$ (Rawlins 2008: 140)

Thus, an unconditional like (117-a) denotes a conjunction of all the conditionals in (119), as shown in (121).

(121) ⟦Whether he has a cold or the flu, Alfonso should stay home from school⟧
='If Alfonso has a cold, Alfonso should stay home from school.' ∧ 'If Alfonso has a flu, Alfonso should stay home from school.'

(121) says that if Alfonso has a cold, he should stay home from school and if Alfonso has the flu, he should stay home from school. This means that the consequent 'Alfonso should stay at home' is true under any condition. In other words, the choice of the alternatives presented in the antecedent does not change the truth value of the consequent, which gives rise to the indifference implication. In contrast, a conditional indicates that the consequent is true under the condition presented in the antecedent. Since the truth of the consequent under other conditions is not known, conditionals do not have an indifference implication.

To summarize, Rawlins (2008, 2013) presents two important observations about

unconditional structures. First, unconditional antecedents are interrogative structures which denote Hamblin-sets of propositions. Second, there exists a default universal operator in unconditionals, which quantifies over the propositions in the Hamblin set. These semantic components give rise to the indifference implication of unconditionals. My analysis of Mandarin unconditionals in the next section is built upon these two observations.

5.7.2 Semantics of Mandarin unconditionals

This section provides a compositional analysis for Mandarin unconditional structures based on Rawlins (2008, 2013). The proposals regarding the semantic computation of Mandarin unconditionals are summarized in (122).

(122) a. Unconditional antecedents are Group B constructions, each denoting a Hamblin-set of propositions.

b. The operator *dou* 'all' universally quantifies over the propositions in the Hamblin-set. Thus, an unconditional claims that every proposition in the set denoted by the antecedent will make the consequent true.

(122-a) specifies the semantics of unconditional antecedents. As mentioned at the beginning of Section 5.7, unconditional antecedents contain Group B constructions such as A-not-A constructions, p-*haishi*-q constructions and *wh*-constructions. Recall from Section 5.4, that Group B constructions denote a set of propositions, and thus unconditional antecedents also denote a set of propositions. For example, in (112), repeated here as (123), the antecedent *Xiaoli qu naer* is a *wh*-construction and denotes a set of propositions as in (124).

(123) (Wulun) Xiaoli qu naer, wo dou hui gen ta qu.
no-matter Xiaoli go where I DOU will with him go
'Wherever Xiaoli goes, I will go with him.'

(124) ⟦*Xiaoli qu naer*⟧
= {'Xiaoli goes to Japan', 'Xiaoli goes to the U.S.', ... 'Xiaoli goes to China'}

(122-b) specifies the contribution of the adverb *dou* in unconditionals. This semantics of *dou* is based on Pan (2006), who proposes that *dou* is an universal operator and introduces tripartite structures. For example, *dou* in (125) introduces a tripartite structure as in (126). The plural element located to the left of *dou*, i.e., the noun phrase *zhexie shu* 'these books', is mapped to the restrictor, and the other part of the sentence, i.e., *ta kan guo le* 'he has read' is mapped to the nuclear scope. (126) says that for every x, such that x is a member of 'these books', he has read x.

(125) Zhexie shu ta dou kan guo le.
these book he DOU read EXP PERF
'These books he has read them all.'

(126) *dou*[$x \in$ ⟦these books⟧][he has read x]
$\forall x$[$x \in$ ⟦these books⟧ $\rightarrow$ he has read x]

Similarly, the universal operator *dou* introduces a tripartite structure in unconditionals. For example, *dou* in (123) introduces a tripartite structure as in (127). The plural element located to the left of *dou*, i.e., the *wh*-construction *Xiaoli qu naer* 'where Xiaoli goes' denoting a set of propositions, is mapped to the restrictor, and the consequent of the sentence is mapped to the nuclear scope. (127) says that for every p, if p is a proposition of the set ⟦where Xiaoli goes⟧, 'I will go with Xiaoli' is true.

(127) *dou*[$p \in$ ⟦where Xiaoli goes⟧][I will go with Xiaoli]

$\forall p$[$p \in$ ⟦where Xiaoli goes⟧ $\rightarrow$ I will go with Xiaoli]

Following this analysis, the semantics of *dou* is defined as in (128). The universal quantifier *dou* takes in a proposition r, i.e., the denotation of the consequent, and a set of propositions Q, i.e., the denotation of the antecedent, to create an unconditional structure *dou*(r)(Q). This unconditional claims that all the worlds that make the proposition p true also make r true.

(128) ⟦*dou*⟧ =$\lambda r.\lambda Q.\forall p \in Q.\forall w[p(w) \rightarrow r(w)]$

Therefore, the unconditional in (123) has the semantics as (129).

(129) ⟦*dou*(r)(Q)⟧ = $\forall p \in$ ⟦Q⟧.$\forall w[p(w) \rightarrow \text{r}(w)]$

⟦Q⟧ = {'Xiaoli goes to Japan', 'Xiaoli goes to the U.S.', ... 'Xiaoli goes to China'}

⟦r⟧ = 'I will go with Xiaoli'

(129) says that for each proposition p in the set Q denoted by the antecedent and for each world w, if w is a world where p is true, w is a world where r is true. This amounts to saying that an unconditional denotes a conjunction of a list of conditionals. (123) indicates that if Xiaoli goes to the U.S., the speaker will go with Xiaoli and if Xiaoli goes to Japan, the speaker will go with Xiaoli and if Xiaoli goes to China, the speaker will go with Xiaoli, etc. The choice of the alternatives listed in the antecedent does not change the truth value of the consequent r 'I will go with Xiaoli'. This is why unconditionals have an indifference implication.

We are now ready to see why declarative structures and VP-initial adverbs cannot occur in the antecedent of unconditionals. An unconditional requires its antecedent to be a set containing more than one proposition, so that the operator *dou* can universally quantify over these propositions. Therefore, a declarative structure, which denotes a single proposition, cannot occur in the antecedent of unconditionals. VP-initial adverbs combine with one proposition to trigger the presupposition that this proposition has been suggested. Thus, for VP-initial adverbs to trigger this presupposition, VP-initial adverbs have to combine with a single proposition. Since the unconditional antecedents are required to denote a set containing more than one proposition, VP-initial adverbs cannot co-occur with unconditional antecedents, just as they cannot co-occur with Group B questions.

5.7.3 Section summary

This section showed that Mandarin unconditionals and Group B questions involve the same Hamblin-set of propositions and provided a compositional semantics for Mandarin unconditionals. The obligatory adverb *dou* universally quantifies over the set of propositions denoted by the antecedent. Thus, an unconditional indicates that all the propositions introduced in the antecedent will make the consequent true. The choice of the alternatives listed in the antecedent does not matter to the truth of the consequent, which gives rise to the indifference implication of unconditionals.

5.8 Chapter summary

In this chapter, I have given a compositional semantics for the four kinds of questions in Mandarin: MAQs, ANAQs, ALTQs and WHQs. The analysis is summarized as below:

(130) a. MAQs: an update in the Table

λC. [T(C) $\oplus$ {p, $\neg$p}]

- The particle *ma* turns a proposition p into a set containing p and $\neg$p, and adds this set onto the Table.

b. ANAQs: an update in the Table + an assertion 'p $\vee$ $\neg$p'

λC. [T(C) $\oplus$ {p, $\neg$p}] $\times$ [$\mathrm{Prob_C}$(p)=$\mathrm{Prob_C}$($\neg$p)]

- The reduplication feature R creates a set which contains a proposition p and its negative counterpart.
- The particle *ne* adds this set onto the Table and yields a disjunction, p $\vee\neg$p.
- The low boundary tone L%, represented as ASSERT, attaches to p $\vee\neg$p to give an assertion 'p $\vee\neg$p'

c. ALTQs: an update in the Table + an assertion 'p $\vee$ q ...$\vee$ r'

λC. [T(C) $\oplus$ {p, q, ..., r}] $\times$ [$\mathrm{Prob_C}$(p)=$\mathrm{Prob_C}$(q)=...=$\mathrm{Prob_C}$(r)]

- The alternative generator *haishi* 'or' produces a set which contains two or more propositions.
- The particle *ne* adds this set onto the Table and yields a disjunction of these propositions.
- The low boundary tone L%, represented as ASSERT, attaches to the disjunction to give an assertion 'p $\vee$ q ...$\vee$ r'.

d. WHQs: an update in the Table + an assertion 'p $\vee$ q ...$\vee$ r'

λC. [T(C) $\oplus$ {p, q, ..., r}] $\times$ [$\mathrm{Prob_C}$(p)=$\mathrm{Prob_C}$(q)=...=$\mathrm{Prob_C}$(r)]

- The *wh*-phrase denotes a set of alternatives. The combination of the *wh*-phrase with other constituents through pointwise functional

application results in a set of propositions.

- The operator *ne* takes in this set to update the Table and to give a disjunction of these propositions.
- The low boundary tone L%, represented as ASSERT, attaches to the disjunction to give an assertion 'p $\vee$ q ...$\vee$ r'.

The proposal explained the similarities and differences between Group A questions and Group B questions. As can be seen from (130), due to the existence of the particle *ne* and the low boundary tone L%, all Group B questions have an assertion meaning. This assertion indicates the speaker's ignorance towards the issue, and thus requires a neutral context. Consequently, Group B questions cannot be used in biased contexts. Group A questions, i.e., MAQs, do not have the assertion meaning and thus can be used in biased contexts.

Another difference between Group A and Group B is that the TP of Group A questions denotes a proposition, whereas the TP of Group B questions denotes a set of propositions (motivated by the fact that Group B questions make all possible answers explicit in the syntactic structure). The different TP meanings account for the different behaviors of Group A and Group B in their co-occurrence with VP-initial adverbs. VP-initial *dique* and *zhende* trigger a presupposition that a proposition has been suggested, and thus must take a single proposition of type $\langle s, t\rangle$ as an argument. The TP of MAQs, i.e., a single proposition, can be taken as an argument by VP-initial adverbs, whereas the TP of Group B questions, i.e., a set of propositions, cannot. This is why VP-initial adverbs are compatible with MAQs but not with Group B questions.

Furthermore, I extended the analysis of Group B questions to Mandarin unconditional structures. Unconditional antecedents contain Group B constructions

and thus denote Hamblin-sets of propositions. The universal adverb *dou* universally quantifies over this set of propositions. Thus, an unconditional claims that every proposition in the set denoted by the antecedent will make the consequent true, which gives rise to an indifference implication. Since unconditional antecedents denote a set of more than one proposition, declarative clauses and VP-initial adverbs cannot occur in unconditional antecedents.

Chapter 6

Conclusion and future directions

6.1 Discourse adverbs as presupposition triggers

To conclude this dissertation, let us return to the discussion of discourse markers presented in Chapter 1. Human languages adopt various discourse markers to mark the relationship between the utterance and the context. In this dissertation, we have seen that the discourse adverbs *dique* and *zhende* mark different relationships between the utterance containing them and the previous discourse. *Dique* marks the information as old, while *zhende* marks the information as old and challenged. These relationships between the utterance and the context are also marked in other languages. For example, English *indeed* marks the information as old (Zeevat, 2003), and English *man* at sentence-final position marks the information as challenged (McCready, 2008). These discourse markers are universal and indispensable to human communication. Without discourse markers, the hearer would not have obvious clues as how to interpret the current utterance with respect to the given information, hence the speaker would be misunderstood. For example, if the speaker did not use *dique* to mark the old

information, his utterance would be misunderstood as new information.

Discourse adverbs convey information about the previous discourse, and this semantic property is captured by the presuppositional analysis presented in this dissertation. *Dique* and *zhende* are analyzed as presupposition triggers that impose restrictions on the previous discourse. *Dique* presupposes that its prejacent is old information, while *zhende* presupposes that its prejacent is old information and that it is challenged by some discourse participant. This difference in presuppositional content explains the distinct behaviors of *dique* and *zhende*. When a piece of information is old but not challenged, the use of *dique* is felicitous but the use of *zhende* is not. Since most discourse markers convey information about the previous discourse, the presuppositional analysis can be extended to the semantic study of other discourse markers.

The analysis of *dique* and *zhende* as presupposition triggers is also supported by the behaviors of these adverbs in embedded cases. When *dique* and *zhende* are embedded under attitude verbs, the presupposition triggered by these adverbs is associated to the attitude-holder rather than the speaker. When *dique* and *zhende* are embedded under conditionals, the presupposition triggered by *dique*/*zhende* in the consequent is not inherited by the whole conditional if this presupposition is entailed by the antecedent. These behaviors of *dique* and *zhende* are the same as the behaviors of typical presupposition triggers when embedded. The projection behaviors of the embedded presuppositions are explained by the dynamic approach to presupposition, i.e., presuppositions always need to be satisfied in the local context.

This dissertation also provided an investigation of the syntactic properties of the discourse adverbs. *Dique* and *zhende* occur at both sentence-initial position and VP-initial position. By examining question data, I proposed that sentence-initial adverbs

scope over the question force, while VP-initial adverbs are within the scope of force. This explains why sentence-initial adverbs cannot be embedded. Furthermore, it is argued that the DP position before VP-initial adverbs is a topic position, whereas the DP position following sentence-initial adverbs is a subject position. This correctly predicts that noun phrases exhibiting no topic properties cannot precede VP-initial adverbs.

The last chapter of the dissertation is concerned with discourse adverbs and questions. Studying the interaction between discourse adverbs and questions provided us with new insight into the intrinsic meaning of questions. VP-initial *dique*/*zhende* occurs in Group A questions (i.e., *ma* questions) but not in Group B questions (i.e., A-not-A questions, alternative questions and *wh*-questions), revealing the semantic distinction between these two types of questions. Group B questions make all the possible answers explicit in the syntactic form and end with a final low tone, which gives rise to an assertion of ignorance and thus requires a neutral context. This neutrality requirement contradicts the semantics of VP-initial adverbs, hence Group B questions do not co-occur with VP-initial adverbs. In contrast, Group A questions do not have the assertion meaning and are semantically compatible with the adverbs. In studying Group A questions, I analyzed the particle *ma* as a question force operator, which correctly predicts that *ma* cannot be embedded and avoids the problems of the previous studies on *ma*. This provides evidence for the view that sentential forces have syntactic representation.

6.2 Multi-dimensionality in semantics

As summarized in Section 6.1, the discourse adverbs *dique* and *zhende* convey information about the previous discourse. Thus, an utterance containing *dique* or

zhende is expressing two dimensions of meaning simultaneously. One dimension represents the propositional content of the utterance, and the other refers to the part of meaning related to the previous discourse. This is generally referred to as the issue of multi-dimensionality, that is, a single syntactic node can have multiple independent denotations.

Many recent works (Potts, 2005, 2007; Hara, 2006b, 2014; Barker et al., 2010; McCready, 2010; Liu, 2012, among others) have raised concern over multi-dimensionality in semantics. Expressions that contribute to multi-dimensionality have been studied extensively. For instance, (1), (2) and (3) all express two independent dimensions of meaning: an at-issue dimension and a side-issue dimension (Potts, 2005, 2007). At-issue meaning is the asserted meaning that the speaker presents as new and under discussion, while side-issue meaning refers to the information presented as not under discussion, peripheral or backgrounded. Various expressions, such as presupposition triggers (*too* in (1)), supplements (*who is Chinese* in (2)), expressives (*damn* in (3)), epithets, and even intonational features contribute to side-issue meaning.

(1) John left *too*.

a. At-issue: John left.

b. Side-issue: Someone other than John left.

(2) Xiaoli, *who is Chinese*, arrived.

a. At-issue: Xiaoli arrived.

b. Side-issue: Xiaoli is Chinese.

(3) I have to mow the *damn* lawn.

a. At-issue: The speaker has an obligation to mow the lawn.

b. Side-issue: The speaker has a negative attitude towards this obligation.

The adverbs I studied in this dissertation, *dique* and *zhende*, contribute to the side-issue meaning and yield semantic multi-dimensionality. Mandarin Group B questions present another example that illustrates multi-dimensionality.

6.2.1 *Dique* and *zhende*

The study of *dique* and *zhende* showed that these two adverbs do not contribute to the at-issue meaning. In assertions, deleting these two adverbs results in no change of the truth conditions of the assertion. In questions, these two adverbs are invisible to the question operator Q_1. That is, the meaning of *dique* and *zhende* do not enter the content of the question. For example, the speaker of (4) is not asking whether someone has suggested p 'Li went abroad' or not. Rather, the speaker is asking whether Li went abroad or not.

(4) Li *dique* chuguo le ma?
Li indeed go-abroad PERF Q_1
'Did Li indeed go abroad?'

What *dique* and *zhende* do is to impose restrictions on the previous discourse, hence they are analyzed as presupposition triggers. Consequently, utterances containing *dique* and *zhende* express an at-issue content and a presupposition at the same time. For instance, (4) indicates that the speaker is asking whether Li went abroad and presupposes that 'Li went abroad' has been suggested:

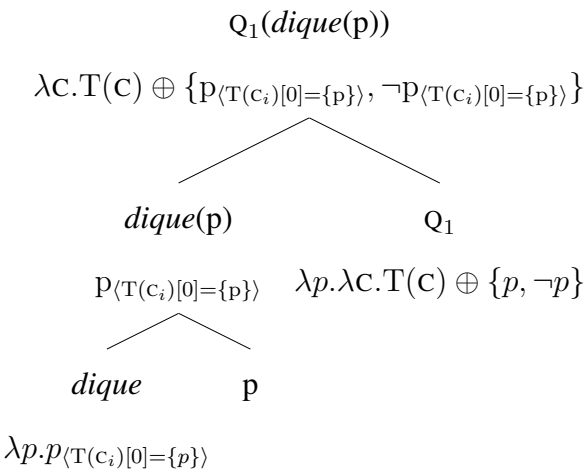
(5) Li *dique* chuguo le ma?
Li indeed go-abroad PERF Q_1
'Did Li indeed go abroad?'

At-issue content: The speaker is asking whether Li went abroad or not.

Presupposition: Someone has suggested 'Li went abroad'.

The concept of multi-dimensionality appears to be a simple idea, but it raises a fundamental question of how to deal with different meaning dimensions compositionally. As pointed out by Barker et al. (2010), expressions that contribute to side-issue dimension challenge traditional conception of composition. Traditionally, functors have the full power to modify semantic objects within their scope. However, side-issue meanings generally cannot be modified by other semantic elements. That is, they can always take widest semantic scope. As in (4), the presupposition triggered by the adverb *dique* is not semantically modified by the question operator Q_1. This behavior of side-issue content in composition is captured by the presupposition operator $\langle\rangle$ in the definition of *dique* (and *zhende*). In a two-dimensional formula $\varphi_{\langle\pi\rangle}$, the at-issue content φ composes with other semantic objects in normal fashion, whereas the presupposition π within the angle bracket remains intact. As shown in the composition of (4) in (6), the at-issue content p combines with the question operator Q_1 to yield a question CCP. The presupposition $\mathrm{T}(\mathrm{C}_i)[0] = \{p\}$, after saturated with the argument p, takes no part in the at-issue composition and remains semantically unmodified.

(6)



Another important question concerning multi-dimensionality is how different meaning dimensions interact with each other. The study of *dique* and *zhende* in the dissertation showed that the integration of the at-issue and side-issue content gives rise to a new layer of meaning. For instance, an assertion containing *dique* indicates the speaker's commitment to p and presupposes that p has been suggested by some individual x. The combination of the at-issue and side-issue content gives rise to an indication that the speaker is confirming the old information p and showing his agreement with x. A question containing *dique* (at VP-initial position) also presupposes that p has been suggested, but it expresses a different at-issue meaning, i.e., the speaker is seeking an answer to the question. In other words, the speaker is still seeking an answer to the question even though the positive answer p has been suggested. This results in an indication of the speaker's doubt towards the positive answer p and his request for more evidence for p. The interactions between *dique*/*zhende* and different sentential forces are summarized in Table 6.1.

	Assertion (Speaker is committed to p)	Question (Speaker is seeking an answer from {p, ¬p})	...
Dique (p is old)	Confirmation of p	Doubt towards p	...
Zhende (p is old and challenged)	Emphasize the truth of p to defend p	Doubt towards p	...

Table 6.1: Interactions between *dique*/*zhende* and sentential forces

Like *dique* and *zhende*, many discourse items in Mandarin Chinese contribute to side-issue meaning. For example, Like *dique*, the adverb *queshi* and the verb *shi* (when stressed) trigger a presupposition that their prejacents are old information, as in (7).

(7) A: Li shengbing le.
Li get-sick PERF
'Li got sick.'

B: Li *queshi* shengbing le. / Li *shi* shengbing le.
Li indeed get-sick PERF Li is get-sick PERF
'Li indeed got sick./Li DID get sick.'

Similarly, the adverbs like *daodi* and *jiujing* 'after all' contribute to the presuppositional content. As mentioned in Chapter 5, these adverbs require that the questions they attach to have been asked before but not solved.

Another example is the adverb *bing*, as exemplified in (8). This adverb always co-occurs with *bu*/*mei* 'not', and it is claimed to strengthen the negation (Lü, 1980). *Bing* also contributes nothing to the at-issue meaning. What *bing* does is to impose a restriction on the previous discourse that the negation of its prejacent is old information. For instance, (8) requires that p 'The speaker is strict to Li' is old information, as shown in (9). Here, A has suggested p, and B's assertion of *bing*(¬p) functions as a denial of

A's assertion. Without A's assertion, the use of *bing* would be infelicitous.

(8) Wo dui Li bing bu yange.
I to Li BING not strict
'I am not strict to Li.'

(9) A: Ni dui Li tai yange le.
you to Li too strict PERF
'You are too strict to Li.'

B: Wo dui ta bing bu yange. Ni zongshi guan ta.
I to him BING not strict you always spoil him
'I am not strict to him. You always spoil him.'

The concept and methodology of multi-dimensionality in studying *dique* and *zhende* can shed new light on the study of these discourse items and other *xüci* 'function/empty words' in Chinese.

6.2.2 Mandarin questions

Multi-dimensionality is also demonstrated in the analysis of Mandarin questions. As discussed in Chapter 5, a Group A question expresses a single dimension of meaning, i.e., it indicates an update of the Table. In contrast, a Group B question expresses two dimensions of meaning. First, a Group B question indicates an update of the Table. Second, it asserts a disjunction of all the possible answers to the question. This difference is summarized in Table 6.2. The side-issue meaning of Group B questions accounts for the neutrality requirement of Group B questions.

	Group A question	Group B question
At-issue	Update the Table	Update the Table
Side-issue	———	Asserting the disjunction of all answers

Table 6.2: Multi-dimensionality in Mandarin questions

Formally, the multi-dimensional meaning of Group B questions is introduced by the question operator Q_2, as shown in the definition of Q_2 in (10). The operator Q_2 combines with a set of propositions to yield two dimensions of meaning. One is the at-issue content $\lambda C.\ [T(C) \oplus Q]$, a CCP that indicates an update of the Table. The other is the side-issue content $r_1 \vee r_2 \vee ... \vee r_{|S|}$, a disjunction of all the possible answers to the question. This disjunction is later taken by the assertive morpheme (represented by the final low tone L%) to form an assertion.

(10) $[\![Q_2]\!] = \lambda Q.\lambda C.\ [T(C) \oplus Q] \ \times \ \lambda S.(r_1 \vee r_2 \vee ... \vee r_{|S|}), r_i \in S$ for all $1 < i \leqslant |S|$

As can be seen, the meaning of Group B question is compositionally derived from the syntactic structure and paratactic association of the L% tone with the structure. This is a fruitful exploration of how syntactic elements and intonational features collaborate to yield a multi-dimensional semantics. This study also demonstrated that multi-dimensionality plays an important role in distinguishing between different kinds of questions (See Lam (2014) and Hara (2014) for similar analyses of Cantonese questions).

6.3 Remaining issues

There are several remaining issues regarding *dique* and *zhende* that were not discussed in this dissertation. In the following sections, I address some interesting issues among them for further investigation.

6.3.1 *Dique* and *zhende* in commands

In Chapter 2 and Chapter 5, I have looked into the behaviors of *dique* and *zhende* in assertions and questions. It is shown that *dique* and *zhende* have constant semantic contribution in different sentential forces. *Dique* marks its prejacent as old information in both assertions and questions, while *zhende* marks its prejacent as old and challenged in these forces. If this semantic characterization of *dique* and *zhende* is correct, these two adverbs should make the same contribution in another sentential force, i.e., command, as they do in assertion and question. In this section, I will briefly explore the interaction between *dique*/*zhende* and the command force.

Like assertions and questions containing *dique*, commands containing *dique* indicate a confirmation of old information. Take (11) as an example. Here, the command 'Leave quickly!' has been made by A in the prior discourse, and now B is using *dique* to show his agreement with A in that this command should be made. In other words, B is confirming the old command 'Leave quickly!'.

(11) A (to C): Gankuai zou!
quickly leave
'Leave quickly!'

B (to C): *Dique*, gankuai zou ba!
indeed quickly leave COM
'Indeed, leave quickly!'

This shows that *dique* has the same semantic contribution in commands as in assertions and questions, that is, *dique* presupposes that its prejacent is old information. Since commands generally lack syntactic subjects, I assume that the prejacent of *dique* denotes a property P of type $\langle e, \langle s, t\rangle\rangle$. In illustrating the presupposition triggered by *dique*, I follow Han (1998), Portner (2004) and Davis (2011) and assume that each individual x is associated with his public intentions $\mathrm{PI}_x(\mathrm{C})$, which is a set of irrealis propositions that x intends to make true in the context C. A command of P, then, serves to update the speaker's public intentions with the proposition $P(\mathrm{ADDR})$, i.e., the speaker intends for the property P to be true of the addressee. Within this model of discourse, a command containing *dique*, represented as *dique*(P), presupposes that the proposition $P(\mathrm{ADDR})$ has been added onto the public intentions of some individual. As in (11), A added the proposition 'The addressee (i.e., C) leaves quickly' onto A's public intensions in the previous discourse. The presupposition triggered by *dique* is satisfied, and thus the use of *dique* is felicitous.

Let us turn to the behaviors of *zhende* in commands. Intuitively, commands containing *zhende* indicate an emphasis on truth, like assertions and questions containing *zhende*. To illustrate, B in (12) is emphasizing that C should truly be committed to the realization of p 'C leaves quickly'. B finds it necessary to emphasize this because C remains uncommitted to the realization of p even after recognizing that p has been intended by A.

(12) A (to C): Gankuai zou!
quickly leave
'Leave quickly!'

(C stands still and does nothing.)

B (to C): *Zhende*, gankuai zou ba!
really quickly leave COM
'Really, leave quickly!'

This shows that *zhende* has the same contribution in commands as in assertions and questions, i.e., *zhende* triggers a presupposition that its prejacent is old and challenged. A command containing *zhende*, i.e., *zhende*(P), imposes two requirements on the previous discourse. First, the proposition P(ADDR) has been added onto the public intentions of some individual. Second, some discourse participant remains uncommitted to the realization of P(ADDR). In (12), by using a command, A indicates that P(ADDR) 'C leaves quickly' is A's public intention. However, C stands still and does nothing after recognizing A's public intention. C remains uncommitted to the realization of 'C leaves quickly'. Since the two requirements are satisfied, the use of *zhende* is felicitous in (12).

If the addressee C committed himself to the realization of P(ADDR) by starting to pack up his luggage, it would be infelicitous for B to use *zhende*, as shown in (13). This is because every discourse participants are committed to the realization of P(ADDR), i.e., the requirement of *zhende* is not met.

(13) A (to C): Gankuai zou!
quickly leave
'Leave quickly!'

(C begins to pack up his luggage.)

B (to C): #*Zhende*, gankuai zou ba!
really quickly leave COM
'#Really, leave quickly!'

In summary, *dique* and *zhende* make constant semantic contribution in assertions, questions and commands.

Another issue is that sentence-initial *dique*/*zhende* can occur in commands but VP-initial *dique*/*zhende* cannot, as demonstrated in (14).

(14) a. *Dique*/*Zhende*, (ni) gankuai zou!
indeed/really you quickly leave
'Indeed/Really, (you) leave quickly!'

b. * (Ni) *dique*/*zhende* gankuai zou!
you indeed/really quickly leave
'You indeed/really leave quickly!'

This supports the analysis of sentence-initial and VP-initial adverbs presented in Chapter 4. As propositional modifiers, VP-initial adverbs take a single proposition as an argument, and thus only occur in assertions and MAQs. A command is made up of the force head COM and a property P. VP-initial adverbs cannot take a property of type $\langle e, \langle s, t\rangle\rangle$ as an argument, and thus cannot occur in commands.

This section made a preliminary investigation of the behaviors of *dique* and *zhende* in commands, and showed that the semantic analysis of *dique* and *zhende* can extend to command force. More careful investigations are required in studying the interaction between the adverbs and different types of commands.

6.3.2 *Zhende* in dream reports

As discussed in Chapter 2, *zhende* marks information as old and challenged by some discourse participant. Therefore, assertions containing *zhende* always function as a defense for old information against opposing beliefs. A typical example of an assertion containing *zhende* is like (15), where C emphasizes the truth of p 'Xiaoli failed the exam' and shows C's defense of p against B's belief of ¬p.

(15) A: Nimen tingshuo le ma? Xiaoli kaoshi mei jige.
you hear PERF Q Xiaoli exam not pass
'Have you heard? Xiaoli failed the exam.'

B: Bu keneng.
not possible
'Impossible.'

C: Ta *zhende* mei jige.
he really not pass
'He really failed.'

Nevertheless, not all assertions containing *zhende* function as a defense against opposing beliefs. Take the second clause in (16) as an example. The speaker is not defending p against any belief. The speaker is simply stating that p is true in the actual world (in addition to the dream world).

(16) Xiaoli mengjian ta kaoshi mei jige. Jieguo, ta *zhende* mei jige.
Xiaoli dream he exam not pass result he really not pass
'Xiaoli dreamed that he failed the exam. It turns out that he really failed. '

It appears that the assertion *Ta zhende mei jige* 'He really failed' have different functions in (15) and (16). A question arises as to whether *zhende* in (16) is the same as *zhende* in (15). My answer is that they are the same adverb. *Zhende* in (16), like *zhende* in (15), is a presupposition trigger and imposes the same requirements on the previous discourse as discussed in Chapter 2. The first requirement is that the proposition p 'Xiaoli failed the exam' is old information. This requirement is satisfied in (16), where p has been mentioned in the first clause. If p had never been mentioned, it would be infelicitous to use *zhende*, as shown in (17).

(17) #Xiaoli *zhende* mei jige.
Xiaoli really not pass
'Xiaoli really failed the exam.'

('#' indicates infelicitous as discourse initial.)

The second requirement of *zhende* is that at least one discourse participant is uncommitted to p. I speculate that the speaker of (16) was uncommitted to p after he knew about Xiaoli's dream, as a reasonable person cannot believe in the truth of a dream. In the end, the speaker finds out that p is true in the actual world and thus commits himself to p. As can be seen, both requirements of *zhende* are met in (16). The adverb *zhende* in (16) does not differ from *zhende* in (15). The only difference between (15) and (16) is that the participant who is uncommitted to p is the speaker in (16) but the addressee in (15).

Assuming that this analysis of *zhende* in dream reports is correct, we face another problem. As the reader might have already noticed, the formal analysis presented in Chapter 2 cannot fully capture the behaviors of *zhende* in examples like (16). The formal definition of *zhende* is repeated here in (18), which says that x who suggested p is a member of the individuals in the context C_i ($x \in \mathrm{I}(\mathrm{C}_i)$).

(18) a. If an individual x asserts $O(p)$ in a context C and $\mathrm{Cred}_{x,\mathrm{C}}(p) > 0.5$, then $\mathrm{T}(\mathrm{C})[0]= \{p\}$, where $x \in$ I(C) and I(C) is a set of individuals in the context C.

b. $[\![\textit{zhende}]\!] = \lambda p.p_{\langle(\mathrm{T}(\mathrm{C}_i)[0]=\{p\})\wedge(\exists y.p\notin \mathrm{PB}_y(\mathrm{C}_i))\rangle}$

Since *zhende* occurs in a matrix clause in (16), the context C_i refers to the utterance context, and therefore x must be one of the individuals in the utterance context. However, in (16), no individual in the utterance context is biased towards p. Xiaoli

dreamed that he failed the exam, but he knew that it was a dream and thus cannot be biased towards p at that time. The person who is biased towards p is not the individual Xiaoli who exists in the actual world, but rather 'Xiaoli' who exists in the dream world and failed the exam in the dream world.

In order to solve this problem, I will adopt Heim's (1998) theory of guises (or individual concepts). Heim (1998) provides an account for pronouns in an attempt to explain examples like (19). In the second clause *I kissed me*, both the pronouns *I* and *me* denote the speaker of (19), and *I* is local to *me*. That is, the pronoun *me* is locally bound, which violates Binding Condition B.

(19) I dreamed I was Brigitte Bardot and I kissed me. (Lakoff 1972: 639)

Following Reinhart (1983), Heim (1998) proposes that pronouns are interpreted as guises, which are construed as functions from worlds to individuals. For example, the interpretation of the pronoun *I* is determined by contextually salient variable assignments g as follows:

(20) $[\![\mathrm{I}_i]\!]^g = g(i) = f_i$

f_i is of type $\langle s, e \rangle$, function from worlds to individuals

Consequently, one individual in the actual world can be presented in other guises in other worlds. In (19), the pronoun *I* in the second clause refers to the guise of the speaker in the dream world, i.e., Brigitte Bardot (represented as f_1), and thus is not co-indexed with *me*, which refers to the guise of the speaker in the actual world (represented as f_2). Therefore, Binding Condition B is not violated.

Now, let us return to the *zhende* example in (16). Based on Heim's (1998) analysis, I will revise the formal definition of *zhende* so that the individual x who suggested p denotes an individual concept and thus can refer to the guise of Xiaoli in the dream world. In this way, the formal analysis will be able to capture the behaviors of *zhende* in dream reports. Although the idea is simple and straightforward, the formal details need to be worked out carefully in the future.

6.3.3 *Dique/zhende* and modality expressions

As discussed in Chapter 3, presupposition differs from other aspects of meaning in that presuppositions can project. In Chapter 3 and Chapter 5, I have shown that the presuppositions triggered by *dique* and *zhende* project up from conditional antecedents and questions. In fact, presuppositions also project up from modals. For example, *dique* and *zhende* can be embedded under the epistemic modal *keneng* 'may', as shown in (21).[1]

(21) Xiaoli keneng *dique* shengbing le.
Xiaoli may indeed sick PERF
'Xiaoli may indeed get sick.'

(21) requires that the proposition p 'Xiaoli got sick' has been suggested in the previous discourse. For instance, (21) is felicitous in the discourse in (22), where p has been suggested by A. This shows that the presupposition triggered by *dique* is projected up from the scope of *keneng* and inherited by the entire utterance. In (22), B's assertion expresses a multi-dimensional meaning. On the one hand, this assertion indicates B's

[1] I will use *dique* as a representative in this section.

commitment to ⋄p, that is, B believes that p is true in some possible world.[2] On the other hand, this assertion carries a presupposition that p has been suggested. B uses *dique* to connect his utterance with the previous utterance made by A, showing B's agreement with A's conjecture.

(22) A: Xiaoli you mei shangke. Wo cai ta shengbing le.
Xiaoli again not go-to-class I guess he sick PERF
'Xiaoli missed the class again. I guess he got sick.'

B: Xiaoli keneng *dique* shengbing le.
Xiaoli may indeed sick PERF
'Xiaoli may indeed got sick.'

Interestingly, *dique* cannot be embedded under another epistemic modal *yiding* 'must', as in (23).

(23) *Xiaoli yiding *dique* shengbing le.
Xiaoli must indeed sick PERF
'Xiaoli must indeed got sick.'

The puzzle is why (23) is ungrammatical. (23) asserts the p is true in all worlds compatible with what the speaker knows. According to the analysis given in this dissertation, (23) presupposes that p has been suggested by some individual. There is no contradiction between the at-issue assertion meaning and the presupposition. Thus, my analysis cannot predict the ungrammaticality of (23). I am optimistic, however, that my semantic analysis is on the right track, and I speculate that the ungrammaticality of (23) does not arise due to semantic reason. This can be shown from the fact that phrases or clauses expressing the meaning of necessity can co-occur with *dique*, as shown in (24).

[2]Following Kratzer (1991), I assume that possibility is defined as existential quantification over epistemic possible worlds, while necessity is construed as universal quantification over epistemic possible worlds.

That is to say, the necessity meaning does not contradict the presupposition triggered by *dique*.

(24) a. Haowuyiwen, Xiaoli *dique* shengbing le.
no-doubt Xiaoli indeed sick PERF
'Certainly, Xiaoli indeed got sick.'

b. Xiaoli *dique* shengbing le. Zhe shi kending de.
Xiaoli indeed sick PERF This is certain DE
Xiaoli indeed got sick. This is certain.

Currently, I speculate that (23) is ungrammatical because of a syntactic reason. One syntactic difference between *keneng* and *yiding* is that *keneng* can occur at sentence-initial position, whereas *yiding* cannot, as shown in (25).[3]

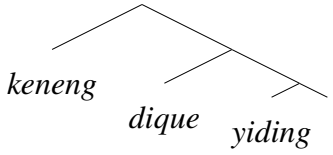
(25) a. Keneng Xiaoli shengbing le.
may Xiaoli sick PERF
'Maybe Xiaoli got sick.'

b. *Yiding Xiaoli shengbing le.
must Xiaoli sick PERF
'Certainly Xiaoli got sick.'

Motivated by this fact, I hypothesize that *keneng* and *dique* occupy a higher position than *yiding*, as depicted in (26). Such a syntactic hierarchy explains why *yiding* cannot scope over *dique*.

[3]The contrast in (25) has been discussed in the previous studies of Chinese modals. Traditionally, both *keneng* and *yiding* are classified as (modal) auxiliary verbs, as they have some core properties of auxiliary verbs. For example, *keneng* and *yiding* can co-occur with full verbs, which is a distinct property of auxiliary verbs. *Keneng* and *yiding* can be negated with *bu* 'not', demonstrating that they are not adverbs. Furthermore, *keneng* and *yiding* cannot be reduplicated and cannot take aspect markers, which distinguishes them from normal verbs. Nevertheless, because of the syntactic difference shown in (25), some researchers label *keneng* and *yiding* as different classes of words. For example, Hsieh (2005) and Tang (2010) both propose that *keneng* is an auxiliary verb scoping over the whole clause, while *yiding* is a modal adverb that takes a VP (or upper VP) scope.

(26)



This hypothesis has two other benefits. First, following this hypothesis, if a modal can occur at sentence-initial position, then it occupies the highest position in the hierarchy and thus can embed *dique*. This is indeed the case. Epistemic adverbs like *yexu* and *huoxu* 'probably' can occur at sentence-initial position, and they can embed *dique*:

(27) a. Yexu/Huoxu Xiaoli shengbing le.
probably Xiaoli sick PERF
'Probably Xiaoli got sick.'

b. Xiaoli yexu/huoxu *dique* shengbing le.
Xiaoli probably indeed sick PERF
'Xiaoli probably indeed got sick.'

This hypothesis also correctly predicts that modals forbidden from occupying sentence-initial position cannot embed *dique*. For instance, modals such as *hui* and *yinggai* cannot occur at sentence-initial position, and they cannot embed *dique*.

(28) a. *Hui/Yinggai Xiaoli shengbing le.
must Xiaoli indeed sick PERF
'Certainly Xiaoli got sick.'

b. *Xiaoli hui/yinggai *dique* shengbing le.
Xiaoli must indeed sick PERF
'Certainly Xiaoli indeed got sick.'

This hypothesis needs to be carefully examined in the future. If the hypothesis is verified, it can provide clues for the classification of Chinese modals. The majority of

modal expressions in Mandarin cannot occur at sentence-initial position. If we regard this syntactic property as a core feature of modal auxiliary verbs, *keneng*, *yexu* and *huoxu* will not be classified as typical modal auxiliaries. Furthermore, we can see that discourse markers occupy a relatively high position in the sentence, at least higher than typical modal auxiliary verbs. This seems to be reasonable, as modal auxiliaries contribute to the propositional content of an utterance (Kratzer, 1977; Papafragou, 2006, among others), and thus occupy a lower position than discourse items.

6.4 Chapter summary

At the beginning of this chapter, I summarized the work that has been done in this dissertation. First, this dissertation provided a semantic analysis of Mandarin discourse adverbs *dique* and *zhende* within the dynamic semantics framework. *Dique* and *zhende*, as presupposition triggers, modify assertions and questions by contributing to the presuppositional content. This semantic analysis accounts for the different behaviors of these two adverbs and makes correct prediction about their behaviors in embedded clauses. Second, this dissertation revealed the semantic distinction between two groups of Mandarin questions by investigating the interactions between the discourse adverbs and questions. Group A and Group B questions share the same question meaning, i.e., an update in the Table, while Group B questions have an additional assertion meaning that indicates the speaker's ignorance. This assertion meaning is not compatible with the semantics of the discourse adverbs. The analysis of the particle *ma* in Group A questions supports the view that sentential forces have syntactic representation.

The second section of this chapter introduced the concept of multi-dimensionality and showed how the studies of the discourse adverbs and questions in this dissertation

illustrate multi-dimensionality. Discourse adverbs *dique* and *zhende* contribute to the presuppositional content, and thus utterances containing the adverbs express two dimensions of meaning simultaneously. Multi-dimensionality also plays an important role in distinguishing between different kinds of questions in Mandarin.

The last part of this chapter discussed several remaining issues related to *dique* and *zhende*. First, I presented a preliminary investigation showing that *dique* and *zhende* have the same contributions in command force as in assertion and question force. This suggests that my semantic analysis of the discourse adverbs can extend to different sentential forces. The second issue concerns how to account for the behaviors of *zhende* in dream reports. A promising solution is to introduce 'individual concepts' (Heim, 1998) into the formal account of *zhende*. In this way, *zhende* can impose requirements on the commitments of individuals existing in worlds besides the actual world. The last issue is concerned with the behaviors of the discourse adverbs when embedded under modals. The interaction between discourse adverbs and modals can provide clues for the classification of Mandarin modality expressions and reveal some interesting syntactic and semantic properties of modals.

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Appendix A

Translated questionnaire for naturalness rating experiment on assertions containing *dique* and *zhende*

Please judge how natural the target sentences are in the contexts by ticking the numbers on a 5-point scale: completely natural, somewhat natural, undecidable, somewhat unnatural, completely unnatural.

Block 1

(1) Context: Mr. Lan arrives home and finds that his son Xiaolan is not at home. Mrs. Lan tells Mr. Lan:
Dique, Xiaolan qu paobu le. 'Indeed, Xiaolan went out for jogging.'

(2) Context: There is a table tennis game tonight. You tell you friend that the Chinese team will surely win the game. The next day your friend calls you and tells you:
Dique, Zhongguo dui ying le! 'Indeed, the Chinese team won the game!'

(3) Context: You haven't seen Xiaoming for a long time. One day you meet Xiaoming's friend and he tells to you:
Xiaoming zhende jiehun le. 'Xiaoming really got married.'

(4) Context: You tell your college that Xiaozhang quit the job. He says to you:
Xiaozhang zhende cizhi le. 'Xiaozhang really quit the job.'

(5) Context: You enter an Apple store to buy iPhone 5. The seller tells you that iPhone 5 is sold out in their store. You don't believe it, and the seller says:
Zhende, women dian de iphone5 mai wan le. 'Really, iPhone 5 is sold out in our store.'

(6) Context: Xiaoli tells Xiaoming about his hiking plan this weekend. Xiaoli asks Xiaoming:
Ni daodi qu bu qu? 'After all, will you go or not go?'

(7) Context: In the morning, Jane says to Helen and Anna: 'It rained heavily last night!'. Anna asks:
Zuowan daodi xia mei xia yu? 'After all, did it rain or not rain last night?'

(8) Context: The announcement at the first floor of the dorm says that the flushing water will be suspended tomorrow, but the email from the dorm office says that it will not. Xiaoli feels puzzled and calls the dorm office:
Mingtian daodi ting bu ting shui? 'After all, will the flushing water be suspended or not tomorrow?'

(9) Context: Your friend tells you that Xiaolei is a nice person. Xiaolei was once your classmate and you don't think he is nice. You ask your friend:
Xiaolei xingge hao ma? 'Is Xiaolei nice?'

(10) Context: Your friend tells you that the house rent at Mongkok is very expensive. You don't think so and you say to him:
Wangjiao de fangzu gui bu gui? 'Is the house rent at Mongkok expensive or not?'

Block 2

(11) Context: The result of the final exam came out. Your classmate tells you:
Xiaoli dique mei jiege. 'Xiaoli indeed failed.'

(12) Context: You haven't seen John for a long time. You remember that John plans to travel to the United States. So, you ask John's roommate: 'Is it the case that John went to the U.S.?' He tells you:
Dique, John qu meiguo le. 'Indeed, John went to the United States.'

(13) Context: You and your friend are talking about Beijing. Your friend says:
Wo zhende quguo beijing . 'I really have been to Beijing.'

(14) Context: Waking up in the morning, A tells his roommate: 'There was an earthquake last night.' A's roommate says to A:
Zuowan zhende dizhen le. 'There was really an earthquake last night.'

(15) Context: Your friend tells you that Xiaowang just left Hong Kong. You don't believe and says: 'But he said that he will stay in Hong Kong until next week.' Your friend

says to you:
Xiaowang zhende bu zai Xianggang. 'Xiaowang is really not in Hong Kong.'

(16) Context: This is the first time that your friend visited Hong Kong. Your friend asks you:
Haiyang Gongyuan daodi haowan bu haowan? 'After all, is Ocean Park interesting or not?'

(17) Context: Xiaohong asks Xiaoli if she would like to attend a dinner this weekend. Xiaoli answers: 'No. I have a date.' Xiaohong says:
Ni daodi can bu can jia wanyan? 'After all, will you attend the dinner or not?'

(18) Context: Girls are discussing about where to buy cheap clothes. Emily says: 'You can buy cheap clothes at Mongkok.' Alice says: 'No! You can only buy cheap clothes in Shenzhen.' Mary asks:
Daodi nali keyi maidao pianyi de yifu? 'Where on earth can we buy cheap clothes?'

(19) Context: You ask your friend:
Zuijin you mei you hao dianying? 'Is there any good movie recently?'

(20) Context: You are not sure if the class is canceled tomorrow evening, so you ask your classmate:
Mingwan ting ke ma? 'Is the class canceled tomorrow evening?'

Block 3

(21) Context: In a regular meeting, your supervisor tells you:
Dique, wo xiage xingqi yao qu kaihui. 'Indeed, I will attend a conference next week.'

(22) Context: Xiaomei went back to her hometown last month. You remember that she will be back to Hong Kong this week. You say to your friend: 'Xiaomei probably has come back.' She tells you:
Xiaomei dique hui Xianggang le. 'Xiaomei has indeed returned to Hong Kong.'

(23) Context: John's wallet was stolen in the office. Jack says to everyone:
Zhende shi Xiaowei tou de. It is really Xiaowei who stole it.

(24) Context: You know that your friend always buys lottery tickets. Today you find that he is quite happy. You say to him: 'You must have won the lottery.' He says to you:
Wo zhende zhongjiang le! 'I really won the lottery!'

(25) Context: You and your friend are talking about your old classmates. Your friend tells you that Xiaowei stopped smoking. You don't believe it and your friend says:
Xiaowei zhende jieyan le. 'Xiaowei really stopped smoking.'

(26) Context: You ask the library staff:
Tushuguan daodi jidian guanmen? 'After all, when does the library close?'

(27) Context: One friend tells you that John's new girlfriend is Lily. You ask him:
Daodi shui shi Yuehan de xin nupengyou? 'After all, who is John's new girlfriend?'

(28) Context: You ask your friend: 'Do you like Chinese food or Western food?' Your friend says: 'Neither.' You ask:
Ni daodi xihuan chi shenme? 'What on earth do you like eating?'

(29) Context: Your friends says that the food in the new canteen is delicious. You don't believe it and ask him:
Shitang de fan haochi ma? 'Is the food in the canteen good?'

(30) Context: Your friend rented a house at Mongkok. You ask him:
Wangjiao de fangzu gui bu gui? 'Is the house rent at Mongkok expensive or not?'

Block 4

(31) Context: Your mother calls you in the evening and says:
Mingtian dique hui xiayu. Dai zai jiali. 'It will indeed rain tomorrow. Stay at home.'

(32) Context: You and your friend attended a party last week. Before going, you told her that the party must be great since lots of interesting people would come. Today you meet your friend and she tells you:
Shangci de juhui dique bucuo. 'The party last time was indeed great!'

(33) Context: You are preparing a dinner for your friend and her boyfriend. You ask if there is any food they don't like. Your friend tells you:
Wo nanpengyou zhende bu chi rou. 'My boyfriend really doesn't eat meat.'

(34) Context: You haven't seen Xiaoming for a long time and you heard that he is married. One day you meet another friend and tell him that Xiaoming got married. Then he says to you:
Xiaoming zhende jiehun le. 'Xiaoming really got married.'

(35) Context: Your college tells you that Xiaozhang quit the job. You don't believe it and

say: 'No way! He likes the job.' He says to you:
Xiaozhang zhende cizhi le. 'Xiaozhang really quit the job.'

(36) Context: You enter a building and ask the security guard:
Zhensuo daodi zai na yi ceng? 'After all, which floor is the Medical Center on?'

(37) Context: Xiaoli asks if Xiaoming would like to go hiking this weekend. Xiaoming says: 'Ok, I will go'. Then Xiaoli asks:
Ni daodi qu bu qu? 'After all, will you go or not go?'

(38) Context: In the morning, Jane says to Helen and Anna: 'It rained heavily last night!'. Helen says: 'No way! I didn't hear anything last night.' Anna asks:
Zuowan daodi xia mei xia yu? 'After all, did it rain or not rain last night?'

(39) Context: Your friend tells you that Xiaolei is a nice person. Xiaolei was once your classmate and you don't think he is nice. You ask your friend:
Xiaolei xingge hao bu hao? 'Is Xiaolei nice or not?'

(40) Context: You ask your friend:
Zuijin you hao dianying ma? 'Is there any good movie recently?'

Block 5

(41) Context: You are eating a hamburger outside the classroom. A security guard approaches and tells you:
Dique, zhe li bu keyi chi dongxi. 'Indeed, you cannot eat food here.'

(42) Context: A and B were classmates in high school and they haven't seen each other for more than 10 years. A was told that B is very slim now. When meeting B at the reunion party, the first sentence A says to B is:
Dique, ni shou le hen duo. 'Indeed, you are much slimmer now.'

(43) Context: When you enter an Apple store, the seller approaches and says:
Zhende, women dian de iphone5 mai wan le. 'Really, iPhone 5 is sold out in our store.'

(44) Context: You and your friend are talking about Beijing. You say to your friend: 'I remember that you have been to Beijing.' Your friend says:
Wo zhende guguo beijing . 'I really have been to Beijing.'

(45) Context: Waking up in the morning, A's roommate tells A: 'There was an earthquake last night.' A doesn't believe it and says: 'Are you sure? I didn't feel anything.' A's

roommate says to A:
Zuowan zhende dizhen le! 'There was really an earthquake last night!'

(46) Context: Xiaoli calls the dorm office and asks:
Mingtian daodi ting bu ting shui? 'After all, will the flushing water be suspended or not tomorrow?'

(47) Context: This is the first time that your friend visited Hong Kong. You tell your friend that the Ocean park is very interesting and worth going. Your friend asks:
Haiyang Gongyuan daodi haowan bu haowan? 'After all, is Ocean Park interesting or not?'

(48) Context: Xiaohong asks Xiaoli if she would like to attend a dinner this weekend. Xiaoli says: 'Let me think for a while.' After five hours, Xiaohong asks:
Ni daodi can bu can jia wanyan? 'After all, will you attend the dinner or not?'

(49) Context: Your friend tells you that there is no class tomorrow evening. You don't believe and ask him:
Mingwan ting ke ma? 'Is the class canceled tomorrow evening?'

(50) Context: Your friend says that the food in the new canteen is delicious. You don't believe it and ask him:
Shitang de fan haochi bu haochi? 'Is the food in the canteen good or not?'

Block 6

(51) Context: Mr. Lan arrives home and finds that his son Xiaolan is not at home. He sees that Xiaolan's sneakers are not in the shoe cabinet, so he says to Mrs. Lan: 'I suppose Xiaolan went out for jogging?'. Mrs. Lan answers:
Dique, Xiaolan qu paobu le. 'Indeed, Xiaolan indeed went out for jogging.'

(52) Context: Your friend calls you in the morning and tells you:
Dique, Zhongguo dui ying le! 'Indeed, the Chinese team won the game!'

(53) Context: You and your friend are talking about Xiaowang. Your friend says to you:
Xiaowang zhende buzai Xianggang. 'Xiaowang is really not in Hong Kong.'

(54) Context: John's wallet was stolen in the office. Everyone believes that Xiaowei stole it since he was the only person staying in the office when the wallet was stolen. Jack says:
Zhende shi Xiaowei tou de. It is really Xiaowei who stole it.

(55) Context: You know that your friend always buys lottery tickets but never win. Today he tells you that he won the lottery. You say to him: 'Are you sure? Check the number again.' He says to you:
Wo zhende zhongjiang le! 'I really won the lottery!'

(56) Context: Girls are talking with each other. Mary asks:
Daodi nali keyi maidao pianyi de yifu? 'Where on earth can we buy cheap clothes?'

(57) Context: You ask the library staff when the library closes, and he says that it closes at 10 p.m. You ask him:
Tushuguan daodi jidian guanmen? 'After all, when does the library close?'

(58) Context: One friend tells you that John's new girlfriend is Lily, but another friend tells you that John's new girlfriend is Lucy. You ask:
Daodi shui shi John de xin nupengyou? 'After all, who is John's new girlfriend?'

(59) Context: Xiaolei is the roommate of your friend. You ask your friend:
Xiaolei xingge hao ma? 'Is Xiaolei nice?'

(60) Context: Your friend rented a house at Mongkok. You ask him:
Wangjiao de fangzu gui ma? 'Is the house rent at Mongkok expensive?'

Block 7

(61) Context: The result of the final exam came out. You tell your classmate that Xiaoli must have failed the exam since he looks quite low. Your classmate says to you:
Xiaoli dique mei jiege. 'Xiaoli indeed failed.'

(62) Context: You haven't seen John for a long time. One day you meet John's roommate and he tells you:
Dique, John qu meiguo le. 'Indeed, John went to the United States.'

(63) Context: You and your friend are talking about your old classmates. Your friend tells you:
Xiaowei zhende jieyan le. 'Xiaowei really stopped smoking.'

(64) Context: You are preparing a dinner for your friend and her boyfriend. You say to your friend: 'I remember that your boyfriend does not eat meat.' Your friend says:
Wo nanpengyou zhende bu chi rou. 'My boyfriend really does not eat meat.'

(65) Context: You met Xiaoming last month and knew that he was still single. But today

his friend tells you: 'Xiaoming got married.' You are surprised and say: 'Impossible!'. Then he says to you:
Xiaoming zhende jiehun le. 'Xiaoming really got married.'

(66) Context: You ask your friend:
Ni daodi xihuan chi shenme? 'What on earth do you like eating?'

(67) Context: You enter a building and ask the security guard where is the Medical Center. He tells you that it is on the 10th floor. You say to him:
Zhensuo daodi zai na yi ceng? 'After all, which floor is the Medical Center on?'

(68) Context: Xiaoli asks Xiaoming if he would like to go hiking this weekend. Xiaoming says: 'Sure, I will go...wait, I have a lot of homework this weekend'. Then Xiaoli asks:
Ni daodi qu bu qu? 'After all, will you go or not go?'

(69) Context: Your friend tells you that there are lots of good movies recently, but you don't think so. You ask him:
Zuijin you mei you hao dianying? 'Is there any good movie or not recently?'

(70) Context: Your friend tells you that there is no class tomorrow evening. You don't believe it and ask him:
Mingwan ting bu ting ke? 'Is the class canceled or not tomorrow evening?'

Block 8

(71) Context: You remember that your supervisor will attend a conference this month. You ask him: 'Is it the case that you will attend a conference soon?' He tells you:
Dique, wo xiage xingqi yao qu kaihui. 'Indeed, I will attend a conference next week.'

(72) Context: Everyone knows that Xiaomei has gone back to her hometown. One day you meet a friend and she tells you:
Xiaomei dique hui Xianggang le. 'Xiaomei has indeed returned to Hong Kong.'

(73) Context: You meet your college in the morning and he tells you:
Xiaozhang zhende cizhi le. 'Xiaozhang really quit the job.'

(74) Context: You find that iPhone5 has been sold out in many stores. You enter the last Apple store and say to the seller: 'Your iPhone5 must have been sold out.' The seller says to you:
Zhende, women dian de iphone5 mai wan le. 'Really, iPhone 5 is sold out in our store.'

(75) Context: You and your friend are talking about Beijing. Your friend says that he has been to Beijing but you don't believe it. Your friend says:
Wo zhende quguo beijing . 'I really have been to Beijing.'

(76) Context: In the morning, Anna asks Jane and Helen:
Zuowan daodi xia mei xia yu? 'After all, did it rain or not rain last night?'

(77) Context: The announcement at the first floor of the dorm says that the flushing water will be suspended tomorrow. Xiaoli calls the dorm office and asks:
Mingtian daodi ting bu ting shui? 'After all, will the flushing water be suspended or not tomorrow?'

(78) Context: This is the first time that your friend visited Hong Kong. You tell your friend that the Ocean park is very interesting and worth going, but the tour guide says that the Ocean park is not interesting at all. Your friend asks:
Haiyang Gongyuan daodi haowan bu haowan? 'After all, is Ocean Park interesting or not?'

(79) Context: Your friend just came back from the new canteen. You ask him:
Shitang de fan haochi bu haochi? 'Is the food in the canteen good or not?'

(80) Context: Xiaolei is the roommate of your friend. You ask your friend:
Xiaolei xingge hao bu hao? 'Is Xiaolei nice or not?'

Block 9

(81) Context: Your mother calls you in the evening. You tell her that you will not go hiking tomorrow since it will rain. Your mother says:
Mingtian dique hui xiayu. Dai zai jiali. 'It will indeed rain tomorrow. Stay at home.'

(82) Context: This is the first time that you met Kate. She shakes hands with you and says:
Shangci de juhui dique bucuo. 'The party last time was indeed great!'

(83) Context: Waking up in the morning, A's roommate says to A:
Zuowan zhende dizhen le! 'There was really an earthquake last night!'

(84) Context: You and your friend are talking about Xiaowang. You tell your friend that Xiaowang just left Hong Kong. Your friend says to you:
Xiaowang zhende buzai xianggang. 'Xiaowang is really not in Hong Kong.'

(85) Context: John's wallet was stolen in the office. Jack says to everyone that Xiaowei stole

it. Ben says to Jack: 'I don't think so. Xiaowei is a good person.' Jack says to Ben: *Zhende shi Xiaowei tou de.* It is really Xiaowei who stole it.

(86) Context: Xiaohong tells Xiaoli that there will be a dinner this weekend. Xiaohong asks Xiaoli:
Ni daodi can bu can jia wanyan? 'After all, will you attend the dinner or not?'

(87) Context: Girls are discussing about where to buy cheap clothes. Emily says: 'You can buy cheap clothes at Mongkok.' Mary asks:
Daodi nali keyi maidao pianyi de yifu? 'Where on earth can we buy cheap clothes?'

(88) Context: The website of the library says that the library closes at 10 p.m., but the library staff says that it closes at 11 p.m. You ask the staff:
Tushuguan daodi jidian guanmen? 'After all, when does the library close?'

(89) Context: Your friend tells you that the house rent at Mongkok is very expensive. You don't think so and you say to him:
Wangjiao de fangzu gui ma? 'Is the house rent at Mongkok expensive?'

(90) Context: Your friend tells you that there are lots of good movies recently, but you don't think so. You ask him:
Zuijin you hao dianying ma? 'Is there any good movie recently?'

Block 10

(91) Context: You are hungry but you remember that it is against the rule to eat foot outside the classroom. You ask a security guard nearby if it is the case, he says:
Dique, zhe li bu keyi chi dongxi. 'Indeed, you cannot eat food here.'

(92) Context: A and B were classmates in high school and they haven't seen each other for more than 10 years. When meeting B at the reunion party, A surprisingly finds that B is much slimmer than before. So A says to B:
Dique, ni shou le hen duo. 'Indeed, you are much slimmer now.'

(93) Context: You haven't seen your friend for a long time. One day you meet him and he tells you:
Wo zhende zhongjiang le! 'I really won the lottery!'

(94) Context: You and your friend are talking about your old classmates. You tell your friend that Xiaowei stopped smoking. He says to you:
Xiaowei zhende jieyan le. 'Xiaowei really stopped smoking.'

(95) Context: You are preparing a dinner for your friend and her boyfriend. She tells you that her boyfriend does not eat meat. You say to her: 'Really? He ate much meat last time.' She says to you:
Wo nanpengyou zhende bu chi rou. 'My boyfriend really does not eat meat.'

(96) Context: You and your friend are talking about John's new girlfriend. You ask:
Daodi shui shi Yuehan de xin nupengyou? 'After all, who is John's new girlfriend?'

(97) Context: Your friend tells you that he likes Chinese food. You ask him:
Ni daodi xihuan chi shenme? 'What on earth do you like eating?'

(98) Context: The website says that the Medical Center is on the 11th floor, but the security guard tells you that it is on the 10th floor. You ask him:
Zhensuo daodi zai na yi ceng? 'After all, which floor is the Medical Center on?'

(99) Context: You are not sure if the class is canceled tomorrow evening, so you ask your classmate:
Mingwan ting bu ting ke? 'Is the class canceled tomorrow evening or not?'

(100) Context: Your friend just came back from the new canteen. You ask him:
Shitang de fan haochi ma? 'Is the food in the canteen good?'

Appendix B

Translated Questionnaire for Naturalness Rating Experiment on Mandarin questions

Please judge how natural the target sentences are in the contexts by ticking the numbers on a 5-point scale: completely natural, somewhat natural, undecidable, somewhat unnatural, completely unnatural.

Block 1

(1) Context: Your friend just had supper in the new canteen. You ask him if the food is nice there. He hesitates for a long time and does not answer you. You feel impatient and ask him:
Shitang de fan haochi ma? 'Is the food in the canteen good?'

(2) Context: Your friend rented a house at Mongkok. You ask him:
Wangjiao de fangzu gui bu gui? 'Is the house rent at Mongkok expensive or not?'

(3) Context: Your friend tells you that there are lots of good movies recently, but you don't think so. You ask him:
Zuijin you mei you hao dianying? 'Is there any good movie recently?'

(4) Context: You ask a classmate if the new swimming pool in the university is good, but she looks quite impatient and does not want to answer you. You ask her:
Xuexiao de youyongchi hao bu hao? 'Is the swimming pool good or not?'

(5) Context: Your friend tells you that Xiaolei made yogurt for him. You ask your friend:
Xiaolei zuo de suannai haochi haishi bu haochi? 'Is the yogurt made by Xiaolei delicious or not?'

(6) Context: A friend tells you that the pink Hello Kitty is very cute. You don't like pink things and you ask her:

Fenhong de Hello Kitty keai haishi bu keai? 'Is the pink Hello Kitty cute or not?'

(7) Context: You ask one college if the concert last week was good. He hesitates for a long time and does not answer you. You are a bit upset and ask him:
Na chang yanchanghui jingcai haishi bu jingcai? 'Was that concert good or not?'

(8) Context: A friend comes back from Thailand in December. You ask him:
Taiguo leng ma? 'Is it cold in Thailand?'

(9) Context: Your friend tells you that Xiaolei is a nice person. Xiaolei was once your classmate and you don't think he is nice. You ask your friend:
Xiaolei xingge hao ma? 'Is Xiaolei nice?'

(10) Context: Mr. Lan arrives home and finds that his son Xiaolan is not at home. Mrs. Lan tells Mr. Lan:
Dique, Xiaolan qu paobu le.
'Indeed, Xiaolan went out for jogging.'

(11) Context: There is a table tennis game tonight. You tell you friend that the Chinese team will surely win the game. The next day your friend calls you and tells you:
Dique, Zhongguo dui ying le! 'Indeed, the Chinese team won the game!'

(12) Context: You enter an Apple store to buy iPhone 5. The seller tells you that iPhone 5 is sold out in their store. You don't believe it, and the seller says:
Dique, women dian de iphone5 mai wan le. 'Indeed, iPhone 5 is sold out in our store.'

(13) Context: You haven't seen Xiaoming for a long time. One day you meet Xiaoming's friend and he tells to you:
Xiaoming zhende jiehun le. 'Xiaoming really got married.'

(14) Context: You tell your college that Xiaozhang quit the job. He says to you:
Xiaozhang zhende cizhi le. 'Xiaozhang really quit the job.'

(15) Context: You enter an Apple store to buy iPhone 5. The seller tells you that iPhone 5 is sold out in their store. You don't believe it, and the seller says:
Zhende, women dian de iphone5 mai wan le. 'Really, iPhone 5 is sold out in our store.'

Block 2

(16) Context: You ask your classmate if the class is canceled tomorrow evening, but it seems that she does not want to tell you the answer. You feel impatient and ask her:

Mingwan ting ke ma? 'Is the class canceled tomorrow evening?'

(17) Context: Your friend just had supper in the new canteen. You ask him:
Shitang de fan haochi bu haochi? 'Is the food in the canteen good or not?'

(18) Context: Your friend tells you that the house rent at Mongkok is very expensive. You don't think so and you say to him:
Wangjiao de fangzu gui bu gui? 'Is the house rent at Mongkok expensive or not?'

(19) Context: You ask a friend if there are any good movies recently, but it seems that he does not want to tell you about it. You feel upset and ask him:
Zuijin you mei you hao dianying? 'Is there good movie or not recently?'

(20) Context: Your classmate just came back from the new swimming pool in the university. You ask her:
Xuexiao de youyongchi hao haishi bu hao? 'Is the swimming pool good or not?'

(21) Context: Your friend tells you that the yogurt made by Xiaolei is very delicious. You don't think Xiaolei is good at making food, so you ask your friend:
Xiaolei zuo de suannai haochi haishi bu haochi? 'Is the yogurt made by Xiaolei delicious or not?'

(22) Context: You ask your friend if the pink Hello Kitty is cute. She seems to be absent-minded and does not answer you. You ask her:
Fenhong de Hello Kitty keai haishi bu keai? 'Is the pink Hello Kitty cute or not?'

(23) Context: One college went to a concert last week. You ask him:
Na chang yanchanghui jingcai ma? 'Was that concert good?'

(24) Context: A friend comes back from Thailand in December and tells you that it is very cold in Thailand. You don't believe it and ask him:
Taiguo leng ma? 'Is it cold in Thailand?'

(25) Context: The result of the final exam came out. Your classmate tells you:
Xiaoli dique mei jiege. 'Xiaoli indeed failed.'

(26) Context: You haven't seen John for a long time. You remember that John plans to travel to the United States. So, you ask John's roommate: 'Is it the case that John went to the U.S.?' He tells you:
Dique, John qu meiguo le. 'Indeed, John went to the United States.'

(27) Context: Your friend tells you that Xiaowang just left Hong Kong. You don't believe and says: 'But he said that he will stay in Hong Kong until next week.' Your friend says to you:
Xiaowang dique bu zai Xianggang. 'Xiaowang is indeed not in Hong Kong.'

(28) Context: You and your friend are talking about Beijing. Your friend says:
Wo zhende quguo beijing . 'I really have been to Beijing.'

(29) Context: Waking up in the morning, A tells his roommate: 'There was an earthquake last night.' A's roommate says to A:
Zuowan zhende dizhen le. 'There was really an earthquake last night.'

(30) Context: Your friend tells you that Xiaowang just left Hong Kong. You don't believe and says: 'But he said that he will stay in Hong Kong until next week.' Your friend says to you:
Xiaowang zhende bu zai Xianggang. 'Xiaowang is really not in Hong Kong.'

Block 3

(31) Context: You ask your friend if Xiaolei is nice, but your friend hesitates for a long time and does not answer you. You feel upset and ask:
Xiaolei xingge hao ma? 'Is Xiaolei nice?'

(32) Context: You are not sure if the class is canceled tomorrow evening, so you ask your classmate:
Mingwan ting bu ting ke? 'Is the class canceled tomorrow evening or not?'

(33) Context: You know that the food in the canteen is very bad. However, your friend tells you that the food there is very delicious. You ask him:
Shitang de fan haochi bu haochi? 'Is the food in the canteen good or not?'

(34) Context: You ask your friend if the house rent at Mongkok is expensive, but she does not answer you. You wait for a while and ask:
Wangjiao de fangzu gui bu gui? 'Is the house rent at Mongkok expensive or not?'

(35) Context: You ask your friend:
Zuijin you haishi mei you hao dianying? 'Is there good movie or not recently?'

(36) Context: Your classmate tells you that the new swimming pool in the university is good. You don't quite believe it and ask him:
Xuexiao de youyongchi hao haishi bu hao? 'Is the swimming pool good or not?'

(37) Context: You ask your friend if the yogurt made by Xiaolei is delicious, but your friend does not want to tell you. You feel impatient and ask:
Xiaolei zuo de suannai haochi haishi bu haochi? 'Is the yogurt made by Xiaolei delicious or not?'

(38) Context: You ask your friend:
Fenhong de Hello Kitty keai ma? 'Is the pink Hello Kitty cute?'

(39) Context: Your college tells you that the concert last week was very good. You also went to this concert and you don't think it was good. You ask him:
Na chang yanchanghui jingcai ma? 'Was that concert good?'

(40) Context: In a regular meeting, your supervisor tells you:
Dique, wo xiage xingqi yao qu kaihui. 'Indeed, I will attend a conference next week.'

(41) Context: Xiaomei went back to her hometown last month. You remember that she will be back to Hong Kong this week. You say to your friend: 'Xiaomei probably has come back.' She tells you:
Xiaomei dique hui Xianggang le. 'Xiaomei has indeed returned to Hong Kong.'

(42) Context: You and your friend are talking about your old classmates. Your friend tells you that Xiaowei stopped smoking. You don't believe it and your friend says:
Xiaowei dique jieyan le. 'Xiaowei indeed stopped smoking.'

(43) Context: John's wallet was stolen in the office. Jack says to everyone:
Zhende shi Xiaowei tou de. It is really Xiaowei who stole it.

(44) Context: You know that your friend always buys lottery tickets. Today you find that he is quite happy. You say to him: 'You must have won the lottery.' He says to you:
Wo zhende zhongjiang le! 'I really won the lottery!'

(45) Context: You and your friend are talking about your old classmates. Your friend tells you that Xiaowei stopped smoking. You don't believe it and your friend says:
Xiaowei zhende jieyan le. 'Xiaowei really stopped smoking.'

Block 4

(46) Context: You ask your friend if it is cold in Thailand, but he hesitates for a long time and says nothing. You feel impatient and ask him:
Taiguo leng ma? 'Is it cold in Thailand?'

(47) Context: Xiaolei is the roommate of your friend. You ask your friend:
Xiaolei xingge hao bu hao? 'Is Xiaolei nice or not?'

(48) Context: Your friend tells you that there is no class tomorrow evening. You don't believe it and ask him:
Mingwan ting bu ting ke? 'Is the class canceled or not tomorrow evening?'

(49) Context: Your friend just had supper in the new canteen. You ask him if the food is nice there. He hesitates for a long time and does not answer you. You feel impatient and ask him:
Shitang de fan haochi bu haochi? 'Is the food in the canteen good or not?'

(50) Context: Your friend rented a house at Mongkok. You ask him:
Wangjiao de fangzu gui haishi bu gui? 'Is the house rent at Mongkok expensive or not?'

(51) Context: Your friend tells you that there are lots of good movies recently, but you don't think so. You ask him:
Zuijin you haishi mei you hao dianying? 'Is there any good movie or not recently?'

(52) Context: You ask your classmate if the new swimming pool in the university is good. She hesitates for a long time and does not answer you. You ask her:
Xuexiao de youyongchi hao haishi bu hao? 'Is the swimming pool good or not?'

(53) Context: Your friend tells you that Xiaolei made yogurt for him. You ask your friend:
Xiaolei zuo de suannai haochi ma? 'Is the yogurt made by Xiaolei delicious?'

(54) Context: A friend tells you that the pink Hello Kitty is very cute. You don't like pink things and you ask her:
Fenhong de Hello Kitty keai ma? 'Is the pink Hello Kitty cute?'

(55) Context: Your mother calls you in the evening and says:
Mingtian dique hui xiayu. Dai zai jiali. 'It will indeed rain tomorrow. Stay at home.'

(56) Context: You and your friend attended a party last week. Before going, you told her that the party must be great since lots of interesting people would come. Today you meet your friend and she tells you:
Shangci de juhui dique bucuo. 'The party last time was indeed great!'

(57) Context: Your college tells you that Xiaozhang quit the job. You don't believe it and say: 'No way! He likes the job.' He says to you:

Xiaozhang dique cizhi le. 'Xiaozhang indeed quit the job.'

(58) Context: You are preparing a dinner for your friend and her boyfriend. You ask if there is any food they don't like. Your friend tells you:
Wo nanpengyou zhende bu chi rou. 'My boyfriend really doesn't eat meat.'

(59) Context: You haven't seen Xiaoming for a long time and you heard that he is married. One day you meet another friend and tell him that Xiaoming got married. Then he says to you:
Xiaoming zhende jiehun le. 'Xiaoming really got married.'

(60) Context: Your college tells you that Xiaozhang quit the job. You don't believe it and say: 'No way! He likes the job.' He says to you:
Xiaozhang zhende cizhi le. 'Xiaozhang really quit the job.'

Block 5

(61) Context: You ask one college if the concert last week was good. He hesitates for a long time and does not answer you. You are a bit upset and ask him:
Na chang yanchanghui jingcai ma? 'Was that concert good?'

(62) Context: A friend comes back from Thailand in December. You ask him:
Taiguo leng bu leng? 'Is it cold or not in Thailand?'

(63) Context: Your friend tells you that Xiaolei is a nice person. Xiaolei was once your classmate and you don't think he is nice. You ask your friend:
Xiaolei xingge hao bu hao? 'Is Xiaolei nice or not?'

(64) Context: Your friend just had supper in the new canteen. You ask him:
Shitang de fan haochi haishi bu haochi? 'Is the food in the canteen good or not?'

(65) Context: You ask your classmate if the class is canceled tomorrow evening, but it seems that she does not want to tell you the answer. You feel impatient and ask her:
Mingwan ting bu ting ke? 'Is the class canceled or not tomorrow evening?'

(66) Context: Your friend tells you that the house rent at Mongkok is very expensive. You don't think so and you say to him:
Wangjiao de fangzu gui haishi bu gui? 'Is the house rent at Mongkok expensive or not?'

(67) Context: You ask a friend if there are any good movies recently, but it seems that he

does not want to tell you about it. You feel upset and ask him:
Zuijin you haishi mei you hao dianying? 'Is there good movie or not recently?'

(68) Context: Your classmate just came back from the new swimming pool in the university. You ask her:
Xuexiao de youyongchi hao ma? 'Is the swimming pool good?'

(69) Context: Your friend tells you that the yogurt made by Xiaolei is very delicious. You don't think Xiaolei is good at making food, so you ask your friend:
Xiaolei zuo de suannai haochi ma? 'Is the yogurt made by Xiaolei delicious?'

(70) Context: You are eating a hamburger outside the classroom. A security guard approaches and tells you:
Dique, zhe li bu keyi chi dongxi. 'Indeed, you cannot eat food here.'

(71) Context: A and B were classmates in high school and they haven't seen each other for more than 10 years. A was told that B is very slim now. When meeting B at the reunion party, the first sentence A says to B is:
Dique, ni shou le hen duo. 'Indeed, you are much slimmer now.'

(72) Context: Waking up in the morning, A's roommate tells A: 'There was an earthquake last night.' A doesn't believe it and says: 'Are you sure? I didn't feel anything.' A's roommate says to A:
Zuowan dique dizhen le! 'There was indeed an earthquake last night!'

(73) Context: When you enter an Apple store, the seller approaches and says:
Zhende, women dian de iphone5 mai wan le. 'Really, iPhone 5 is sold out in our store.'

(74) Context: You and your friend are talking about Beijing. You say to your friend: 'I remember that you have been to Beijing.' Your friend says:
Wo zhende quguo beijing . 'I really have been to Beijing.'

(75) Context: Waking up in the morning, A's roommate tells A: 'There was an earthquake last night.' A doesn't believe it and says: 'Are you sure? I didn't feel anything.' A's roommate says to A:
Zuowan zhende dizhen le! 'There was really an earthquake last night!'

Block 6

(76) Context: You ask your friend if the pink Hello Kitty is cute. She seems to be absent-minded and does not answer you. You ask her:

Fenhong de Hello Kitty keai ma? 'Is the pink Hello Kitty cute?'

(77) Context: One college went to a concert last week. You ask him:
Na chang yanchanghui jingcai bu jingcai? 'Was that concert good or not?'

(78) Context: A friend comes back from Thailand in December and tells you that it is very cold in Thailand. You don't believe it and ask him:
Taiguo leng bu leng? 'Is it cold in Thailand or not?'

(79) Context: You ask your friend if Xiaolei is nice, but your friend hesitates for a long time and does not answer you. You feel upset and ask:
Xiaolei xingge hao bu hao? 'Is Xiaolei nice or not?'

(80) Context: You are not sure if the class is canceled tomorrow evening, so you ask your classmate:
Mingwan ting ke haishi bu ting ke? 'Is the class canceled tomorrow evening or not?'

(81) Context: You know that the food in the canteen is very bad. However, your friend tells you that the food there is very delicious. You ask him:
Shitang de fan haochi haishi bu haochi? 'Is the food in the canteen good or not?'

(82) Context: You ask your friend if the house rent at Mongkok is expensive, but she does not answer you. You wait for a while and ask:
Wangjiao de fangzu gui haishi bu gui? 'Is the house rent at Mongkok expensive or not?'

(83) Context: You ask your friend:
Zuijin you hao dianying ma? 'Is there any good movie recently?'

(84) Context: Your classmate tells you that the new swimming pool in the university is good. You don't quite believe it and ask him:
Xuexiao de youyongchi hao ma? 'Is the swimming pool good?'

(85) Context: Mr. Lan arrives home and finds that his son Xiaolan is not at home. He sees that Xiaolan's sneakers are not in the shoe cabinet, so he says to Mrs. Lan: 'I suppose Xiaolan went out for jogging?'. Mrs. Lan answers:
Dique, Xiaolan qu paobu le. 'Indeed, Xiaolan indeed went out for jogging.'

(86) Context: Your friend calls you in the morning and tells you:
Dique, Zhongguo dui ying le! 'Indeed, the Chinese team won the game!'

(87) Context: You know that your friend always buys lottery tickets but never win. Today he tells you that he won the lottery. You say to him: 'Are you sure? Check the number again.' He says to you:
Wo dique zhongjiang le! 'I indeed won the lottery!'

(88) Context: You and your friend are talking about Xiaowang. Your friend says to you:
Xiaowang zhende buzai Xianggang. 'Xiaowang is really not in Hong Kong.'

(89) Context: John's wallet was stolen in the office. Everyone believes that Xiaowei stole it since he was the only person staying in the office when the wallet was stolen. Jack says:
Zhende shi Xiaowei tou de. It is really Xiaowei who stole it.

(90) Context: You know that your friend always buys lottery tickets but never win. Today he tells you that he won the lottery. You say to him: 'Are you sure? Check the number again.' He says to you:
Wo zhende zhongjiang le! 'I really won the lottery!'

Block 7

(91) Context: You ask your friend if the yogurt made by Xiaolei is delicious, but your friend does not want to tell you about it. You feel impatient and ask:
Xiaolei zuo de suannai haochi ma? 'Is the yogurt made by Xiaolei delicious?'

(92) Context: You ask your friend:
Fenhong de Hello Kitty keai bu keai? 'Is the pink Hello Kitty cute or not?'

(93) Context: Your college tells you that the concert last week was very good. You also went to this concert and you don't think it was good. You ask him:
Na chang yanchanghui jingcai bu jingcai? 'Was that concert good or not?'

(94) Context: You ask your friend if it is cold in Thailand, but he hesitates for a long time and says nothing. You feel impatient and ask him:
Taiguo leng bu leng? 'Is it cold in Thailand or not?'

(95) Context: Xiaolei is the roommate of your friend. You ask your friend:
Xiaolei xingge hao haishi bu hao? 'Is Xiaolei nice or not?'

(96) Context: Your friend just had supper in the new canteen. You ask him if the food is nice there. He hesitates for a long time and does not answer you. You feel impatient and ask him:

Shitang de fan haochi haishi bu haochi? 'Is the food in the canteen good or not?'

(97) Context: Your friend tells you that there is no class tomorrow evening. You don't believe it and ask him:
Mingwan ting ke haishi bu ting ke? 'Is the class canceled or not tomorrow evening?'

(98) Context: Your friend rented a house at Mongkok. You ask him:
Wangjiao de fangzu gui ma? 'Is the house rent at Mongkok expensive?'

(99) Context: Your friend tells you that there are lots of good movies recently, but you don't think so. You ask him:
Zuijin you hao dianying ma? 'Is there any good movie recently?'

(100) Context: The result of the final exam came out. You tell your classmate that Xiaoli must have failed the exam since he looks quite low. Your classmate says to you:
Xiaoli dique mei jiege. 'Xiaoli indeed failed.'

(101) Context: You haven't seen John for a long time. One day you meet John's roommate and he tells you:
Dique, John qu meiguo le. 'Indeed, John went to the United States.'

(102) Context: You met Xiaoming last month and knew that he was still single. But today his friend tells you: 'Xiaoming got married.' You are surprised and say: 'Impossible!'. Then he says to you:
Xiaoming dique jiehun le. 'Xiaoming indeed got married.'

(103) Context: You and your friend are talking about your old classmates. Your friend tells you:
Xiaowei zhende jieyan le. 'Xiaowei really stopped smoking.'

(104) Context: You are preparing a dinner for your friend and her boyfriend. You say to your friend: 'I remember that your boyfriend does not eat meat.' Your friend says:
Wo nanpengyou zhende bu chi rou. 'My boyfriend really does not eat meat.'

(105) Context: You met Xiaoming last month and knew that he was still single. But today his friend tells you: 'Xiaoming got married.' You are surprised and say: 'Impossible!'. Then he says to you:
Xiaoming zhende jiehun le. 'Xiaoming really got married.'

Block 8

(106) Context: You ask a classmate if the new swimming pool in the university is good, but she looks quite impatient and does not want to answer you. You ask her:
Xuexiao de youyongchi hao ma? 'Is the swimming pool good?'

(107) Context: Your friend tells you that Xiaolei made yogurt for him. You ask your friend:
Xiaolei zuo de suannai haochi bu haochi? 'Is the yogurt made by Xiaolei delicious or not?'

(108) Context: A friend tells you that the pink Hello Kitty is very cute. You don't like pink things and you ask her:
Fenhong de Hello Kitty keai bu keai? 'Is the pink Hello Kitty cute or not?'

(109) Context: You ask one college if the concert last week was good. He hesitates for a long time and does not answer you. You are a bit upset and ask him:
Na chang yanchanghui jingcai bu jingcai? 'Was that concert good or not?'

(110) Context: A friend comes back from Thailand in December. You ask him:
Taiguo leng haishi bu leng? 'Is it cold in Thailand or not?'

(111) Context: Your friend tells you that Xiaolei is a nice person. Xiaolei was once your classmate and you don't think he is nice. You ask your friend:
Xiaolei xingge hao haishi bu hao? 'Is Xiaolei nice or not?'

(112) Context: You ask your classmate if the class is canceled tomorrow evening, but it seems that she does not want to tell you the answer. You feel impatient and ask her:
Mingwan ting ke haishi bu ting ke? 'Is the class canceled or not tomorrow evening?'

(113) Context: Your friend just had supper in the new canteen. You ask him:
Shitang de fan haochi ma? 'Is the food in the canteen good?'

(114) Context: Your friend tells you that the house rent at Mongkok is very expensive. You don't think so and you say to him:
Wangjiao de fangzu gui ma? 'Is the house rent at Mongkok expensive?'

(115) Context: You remember that your supervisor will attend a conference this month. You ask him: 'Is it the case that you will attend a conference soon?' He tells you:
Dique, wo xiage xingqi yao qu kaihui. 'Indeed, I will attend a conference next week.'

(116) Context: Everyone knows that Xiaomei has gone back to her hometown. One day you meet a friend and she tells you:
Xiaomei dique hui Xianggang le. 'Xiaomei has indeed returned to Hong Kong.'

(117) Context: You and your friend are talking about Beijing. Your friend says that he has been to Beijing but you don't believe it. Your friend says:
Wo dique quguo beijing . 'I indeed have been to Beijing.'

(118) Context: You meet your college in the morning and he tells you:
Xiaozhang zhende cizhi le. 'Xiaozhang really quit the job.'

(119) Context: You find that iPhone5 has been sold out in many stores. You enter the last Apple store and say to the seller: 'Your iPhone5 must have been sold out.' The seller says to you:
Zhende, women dian de iphone5 mai wan le. 'Really, iPhone 5 is sold out in our store.'

(120) Context: You and your friend are talking about Beijing. Your friend says that he has been to Beijing but you don't believe it. Your friend says:
Wo zhende quguo beijing . 'I really have been to Beijing.'

Block 9

(121) Context: You ask a friend if there are any good movies recently, but it seems that he does not want to tell you about it. You feel upset and ask him:
Zuijin you hao dianying ma? 'Is there any good movie recently?'

(122) Context: Your classmate just came back from the new swimming pool in the university. You ask her:
Xuexiao de youyongchi hao bu hao? 'Is the swimming pool good or not?'

(123) Context: Your friend tells you that the yogurt made by Xiaolei is very delicious. You don't think Xiaolei is good at making food, so you ask your friend:
Xiaolei zuo de suannai haochi bu haochi? 'Is the yogurt made by Xiaolei delicious or not?'

(124) Context: You ask your friend if the pink Hello Kitty is cute. She seems to be absent-minded and does not answer you. You ask her:
Fenhong de Hello Kitty keai bu keai? 'Is the pink Hello Kitty cute or not?'

(125) Context: One college went to a concert last week. You ask him:
Na chang yanchanghui jingcai haishi bu jingcai? 'Was that concert good or not?'

(126) Context: A friend comes back from Thailand in December and tells you that it is very cold in Thailand. You don't believe it and ask him:
Taiguo leng haishi bu leng? 'Is it cold in Thailand or not?'

(127) Context: You ask your friend if Xiaolei is nice, but your friend hesitates for a long time and does not answer you. You feel upset and ask:
Xiaolei xingge hao haishi bu hao? 'Is Xiaolei nice or not?'

(128) Context: You are not sure if the class is canceled tomorrow evening, so you ask your classmate:
Mingwan ting ke ma? 'Is the class canceled tomorrow evening?'

(129) Context: Your friends says that the food in the new canteen is delicious. You don't believe it and ask him:
Shitang de fan haochi ma? 'Is the food in the canteen good?'

(130) Context: Your mother calls you in the evening. You tell her that you will not go hiking tomorrow since it will rain. Your mother says:
Mingtian dique hui xiayu. Dai zai jiali. 'It will indeed rain tomorrow. Stay at home.'

(131) Context: This is the first time that you met Kate. She shakes hands with you and says:
Shangci de juhui dique bucuo. 'The party last time was indeed great!'

(132) Context: John's wallet was stolen in the office. Jack says to everyone that Xiaowei stole it. Ben says to Jack: 'I don't think so. Xiaowei is a good person.' Jack says to Ben:
Dique shi Xiaowei tou de. It is indeed Xiaowei who stole it.

(133) Context: Waking up in the morning, A's roommate says to A:
Zuowan zhende dizhen le! 'There was really an earthquake last night!'

(134) Context: You and your friend are talking about Xiaowang. You tell your friend that Xiaowang just left Hong Kong. Your friend says to you:
Xiaowang zhende buzai xianggang. 'Xiaowang is really not in Hong Kong.'

(135) Context: John's wallet was stolen in the office. Jack says to everyone that Xiaowei stole it. Ben says to Jack: 'I don't think so. Xiaowei is a good person.' Jack says to Ben:
Zhende shi Xiaowei tou de. It is really Xiaowei who stole it.

Block 10

(136) Context: You ask your friend if the house rent at Mongkok is expensive, but she does not answer you. You wait for a while and ask:
Wangjiao de fangzu gui ma? 'Is the house rent at Mongkok expensive?'

(137) Context: You ask your friend:
Zuijin you mei you hao dianying? 'Is there good movie or not recently?'

(138) Context: Your classmate tells you that the new swimming pool in the university is good. You don't quite believe it and ask him:
Xuexiao de youyongchi hao bu hao? 'Is the swimming pool good or not?'

(139) Context: You ask your friend if the yogurt made by Xiaolei is delicious, but your friend does not want to tell you about it. You feel impatient and ask:
Xiaolei zuo de suannai haochi bu haochi? 'Is the yogurt made by Xiaolei delicious or not?'

(140) Context: You ask your friend:
Fenhong de Hello Kitty keai haishi bu keai? 'Is the pink Hello Kitty cute or not?'

(141) Context: Your college tells you that the concert last week was very good. You also went to this concert and you don't think it was good. You ask him:
Na chang yanchanghui jingcai haishi bu jingcai? 'Was that concert good or not?'

(142) Context: You ask your friend if it is cold in Thailand, but he hesitates for a long time and says nothing. You feel impatient and ask him:
Taiguo leng haishi bu leng? 'Is it cold or not in Thailand?'

(143) Context: Xiaolei is the roommate of your friend. You ask your friend:
Xiaolei xingge hao ma? 'Is Xiaolei nice?'

(144) Context: Your friend tells you that there is no class tomorrow evening. You don't believe it and ask him:
Mingwan ting ke ma? 'Is the class canceled tomorrow evening?'

(145) Context: You are hungry but you remember that it is against the rule to eat foot outside the classroom. You ask a security guard nearby if it is the case, he says:
Dique, zhe li bu keyi chi dongxi. 'Indeed, you cannot eat food here.'

(146) Context: A and B were classmates in high school and they haven't seen each other for more than 10 years. When meeting B at the reunion party, A surprisingly finds that B is much slimmer than before. So A says to B:
Dique, ni shou le hen duo. 'Indeed, you are much slimmer now.'

(147) Context: You are preparing a dinner for your friend and her boyfriend. She tells you that her boyfriend does not eat meat. You say to her: 'Really? He ate much meat last

time.' She says to you:
Wo nanpengyou dique bu chi rou. 'My boyfriend indeed does not eat meat.'

(148) Context: You haven't seen your friend for a long time. One day you meet him and he tells you:
Wo zhende zhongjiang le! 'I really won the lottery!'

(149) Context: You and your friend are talking about your old classmates. You tell your friend that Xiaowei stopped smoking. He says to you:
Xiaowei zhende jieyan le. 'Xiaowei really stopped smoking.'

(150) Context: You are preparing a dinner for your friend and her boyfriend. She tells you that her boyfriend does not eat meat. You say to her: 'Really? He ate much meat last time.' She says to you:
Wo nanpengyou zhende bu chi rou. 'My boyfriend really does not eat meat.'

Appendix C

The logic L

The primary descriptive tool of this dissertation is L, a higher-order type-theoretic language with a few extra operators to be defined below.

The syntax of L

1. Types for L:

(1) a. e is a type

b. t is a type

c. $\langle s, t\rangle$ is a type

d. n (for number) is a type

e. $\langle \mathrm{C}, \mathrm{C}\rangle$ is a type

f. If a and b are any types, then $\langle a, b\rangle$ is a type.

2. Syntactic rules for L:

Let ME_a denote the set of all meaningful expressions of type a for L.

(2) a. If c is a non-logical constant of type a, then c $\in ME_a$.

b. If x is a variable of type a, then $x \in ME_a$.

c. If $\alpha \in ME_{\langle a,b\rangle}$, $\beta \in ME_a$, then $\alpha(\beta) \in ME_b$.

d. If α and β are both in ME_a, then $[\alpha = \beta] \in ME_t$.

e. If φ and ψ are both in ME_t, then so are each of the following: $\neg\varphi$, $[\varphi \wedge \psi]$, $[\varphi \vee \psi]$, $[\varphi \rightarrow \psi]$, $[\varphi \leftrightarrow \psi]$.

f. If $\varphi \in ME_t$, and u is a variable (of any type), then $\forall u\varphi \in ME_t$.

g. If $\varphi \in ME_t$, and u is a variable (of any type), then $\exists u\varphi \in ME_t$.

h. If $\alpha \in ME_a$, and u is a variable of type b, then $\lambda u\alpha \in ME_{<b,a>}$.

i. If φ, ψ and γ are formulae, $\varphi_{\langle\psi\rangle}$, $\varphi \times \psi$, and $[(\varphi \times \psi) \bigotimes \gamma]$ are also formulae.

The Semantics of L

1. A model M for L is an ordered pair $\langle \mathrm{D}, F\rangle$ such that

- D is a set of domains defined below:
  - The domain of a type e is D_e, a set of entities
  - The domain of a type t is D_t = $\{1, 0\}$, a set of truth values
  - The domain of a type s is D_s, a set of entities called possible worlds, disjoint from D_e.
  - The domain of a type $\langle a, b\rangle$ is $D_{\langle a,b\rangle} = D_b^{D_a}$, the set of all functions from D_a to D_b.
- F assigns a denotation to each non-logical constant of type a from the set D_a.

2. Interpretation for L

The interpretation function for L is given by $[\![.]\!]^{M,g}$,[1] where M is the model defined above and g is a value assignment: if x is a variable of type a, then $g(x) \in D_a$.

(3) a. If α is a non-logical constant, then $[\![\alpha]\!]^{M,g} = F(\alpha)$

b. If α is a variable, then $[\![\alpha]\!]^{M,g} = g(\alpha)$.

c. Functional application:

If $\alpha \in ME_{\langle a,b\rangle}$ and $\beta \in ME_a$, then $[\![\alpha(\beta)]\!]^{M,g} = [\![\alpha]\!]^{M,g}([\![\beta]\!]^{M,g})$

d. Pointwise functional application:

If α is a branching node with daughters β and γ, and $\beta \in ME_{\langle\sigma\rangle}$ and $\gamma \in ME_{\langle\sigma,\tau\rangle}$, then $[\![\alpha]\!]^{M,g} = \{a \in ME_{\langle\tau\rangle}\colon\ \exists b.\exists c.[b \in [\![\beta]\!]^{M,g}$ & $c \in [\![\gamma]\!]^{M,g}$ & $a = c(b)]\}$

e. If α and β are in ME_a, then $[\![\alpha{=}\beta]\!]^{M,g}$ is 1 if and only if $[\![\alpha]\!]^{M,g}$ is the same as $[\![\beta]\!]^{M,g}$.

f. If $\varphi \in ME_t$, then $[\![\neg\varphi]\!]^{M,g}$ is 1 if and only if $[\![\varphi]\!]^{M,g}$ is 0, and $[\![\neg\varphi]\!]^{M,g}$ is 0 otherwise.

g. If φ and ψ are in ME_t, then $[\![\varphi \wedge \psi]\!]^{M,g}$ is 1 if and only if both $[\![\varphi]\!]^{M,g}$ and $[\![\psi]\!]^{M,g}$ are 1.

h. If φ and ψ are in ME_t, then $[\![\varphi \vee \psi]\!]^{M,g}$ is 1 if and only if either $[\![\varphi]\!]^{M,g}$ or $[\![\psi]\!]^{M,g}$ = 1.

i. If φ and ψ are in ME_t, then $[\![\varphi \rightarrow \psi]\!]^{M,g}$ is 1 if and only if either $[\![\varphi]\!]^{M,g}$ = 0 or $[\![\psi]\!]^{M,g}$ = 1.

j. If φ and ψ are in ME_t, then $[\![\varphi \leftrightarrow \psi]\!]^{M,g}$ is 1 if and only if either both $[\![\varphi]\!]^{M,g}$ and $[\![\psi]\!]^{M,g}$ = 1 or else both of them = 0.

k. If $\varphi \in ME_t$ and u is variable in ME_a, then $[\![\forall u\varphi]\!]^{M,g}$ = 1 iff for all e in D_a,

[1] $[\![.]\!]^{M,g}$ is often simplified as $[\![.]\!]$ in this dissertation.

$[\![\varphi]\!]^{M,g[e/u]} = 1$

l. If $\varphi \in ME_t$ and u is variable in ME_a, then $[\![\exists u\varphi]\!]^{M,g} = 1$ iff for some e in D_a, $[\![\varphi]\!]^{M,g[e/u]} = 1$

m. If $\alpha \in ME_a$ and u is a variable in ME_b, then $[\![\lambda u\alpha]\!]^{M,g}$ is that function h from D_b to D_a such that for any object k in D_b, $h(k) = [\![\alpha]\!]^{M,g[k/u]}$.

n. If $\varphi \in ME_{\langle a,b\rangle}$, $\psi \in ME_{\langle a,c\rangle}$, $\gamma \in ME_{\langle a\rangle}$, $[\![(\varphi \times \psi)(\gamma)]\!]^{M,g} = [\![\varphi(\gamma)]\!]^{M,g} \times [\![\psi(\gamma)]\!]^{M,g}$.

o. Paratactic association:

(i) If α is a sentence made up of a syntactic node β and an intonation that can be represented as a semantic feature γ, $[\![\alpha]\!]^{M,g} = [\![\beta]\!]^{M,g} \bigotimes [\![\gamma]\!]^{M,g} = [\![\beta \bigotimes \gamma]\!]^{M,g}$.

(ii) If $\varphi \in ME_c$, $\psi \in ME_a$, and $\gamma \in ME_{\langle a,b\rangle}$, $[\![(\varphi \times \psi) \bigotimes(\gamma)]\!]^{M,g} = [\![\varphi]\!]^{M,g} \times [\![\gamma(\psi)]\!]^{M,g}$. If $\varphi \in ME_a$, $\psi \in ME_c$, and $\gamma \in ME_{\langle a,b\rangle}$, $[\![(\varphi \times \psi) \bigotimes(\gamma)]\!]^{M,g} = [\![\gamma(\varphi)]\!]^{M,g} \times [\![\psi]\!]^{M,g}$.

3. The denotation of an expression of L relative to a model M is defined:

(4) a. For any expression φ in ME_t, $[\![\varphi]\!]^M = 1$ iff $[\![\varphi]\!]^{M,g} = 1$ for all value assignments g.

b. For any expression φ in ME_t, $[\![\varphi]\!]^M = 0$ iff $[\![\varphi]\!]^{M,g} = 0$ for all value assignments g.