Modal Concord in Mandarin

by

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Abstract

The aim of this thesis is to describe and analyze modal concord in Mandarin Chinese. Modal concord is a semantic phenomenon in which multiple modal words in a sentence are interpreted semantically as if there was only a single modal expression. The thesis provides a description of the Mandarin modal system (especially the necessity modals), following the formal analysis of Kratzer (1991) and von Fintel & Iatridou (2008). The generalization is established that a concord reading is available only when the modals agree in their modal type, ordering sources and quantificational force. This generalization cannot be accounted for by the current modal concord analyses: the modal logic approach and the type-shifting analysis from Huitink (2008). Inspired by global theories of negative concord such as de Swart & Sag (2002), a fusion analysis is proposed to account for modal concord, which treats the multiple modals in a concord reading as equal to each other in the sense that their combination is semantically equivalent to each modal alone, leading to a single modality interpretation.

Preface

This dissertation is original, unpublished, independent work by the author, Tianhan Liu.

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List of Abbreviations

EP = epistemic modal

MB = modal base

NEC = necessity modal

NONEP = non-epistemic modal

POS = primary ordering source

POSS = possibility modal

SN = strong necessity modal

SOS = secondary ordering source

UN = unspecified necessity modal

WN = weak necessity modal

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Chapter 1

Introduction

1.1 Introduction to modal concord

Sentences where two modals occur together sometimes allow a concord interpretation, in which the two modals somehow "fuse" to just a single modal meaning. This thesis will investigate when, why and how two Mandarin modal operators can merge into one semantic modal interpretation.

Both English and Mandarin allow two modal words[1] occurring together. This is illustrated by the English data in (1a) (cited from von Fintel & Heim 2011) and the Mandarin data in (1b).

(1) a. You **might** **have to** leave.   (von Fintel & Heim 2011, ex. (75))

    b. ni   **keneng** **bixu**   likai

       you   EP-POSS   NONEP-POSS   leave

       'You might have to leave.'

These structures are called double-modal constructions in this thesis. According to Huitink (2008, 2012), Halliday (1970) was the first to point out the two possible readings of English double-modal constructions. One is called a cumulative reading: the multiple modals are semantically independent of each other, with one appearing in the scope of the other, as illustrated in (2a), cited from von Fintel & Heim (2011). The other is a concord reading: the multiple modals somehow "fuse" to just a single modal meaning, as illustrated in (2b) from Halliday (1970). In this thesis, I will follow Halliday's terminology for naming these two readings.

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[1] The modal words here include not only modal auxiliaries but also other items that can express modality.

(2) a. You **might have to** leave.   (von Fintel & Heim 2011, ex. (75))

   [might [have to [you leave]]]

   'It might be the case that you have to leave.'

   b. This gazebo **may possibly** have been built by Sir Christopher Wren. [2]

   [may / possibly [this gazebo was built by Sir Christopher Wren]]

   'Maybe / Possibly this gazebo was built by Sir Christopher Wren.'

                                        (Halliday 1970, ex. (2.3))

Similarly, Mandarin double-modal constructions also have cumulative readings and concord readings. For example, a cumulative reading is available in (3a), while (3b) has a concord reading.

(3) a. ta **yexu**   **keyi**   jinlai

   he EP-POSS   NONEP-POSS   come in

   'Maybe he is allowed to come in.'

   b. ta   **yexu**   **keneng** zaijia

   he   EP-POSS   EP-POSS   at home

   'Maybe he is at home.'

It is mysterious why the two modal operators can merge into one semantic modal interpretation, or in other words, why the interpretation of one modal operator in the surface form seems to disappear. Inspired by Huitink (2008), since modal concord is relatively unexplored, I will compare it with negative concord, a more familiar phenomenon which might be helpful in developing an analysis for modal concord.

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[2] (2b) may also have a cumulative reading, but according to Halliday (1970), the concord reading is the most natural interpretation.

Negative concord is the phenomenon that a single semantic negation is encoded more than once in the syntax. Consider the Italian data in (4) and the Dutch data in (5), cited from Zanuttini (1991) and Huitink (2008) respectively.

(4) ***(Non)** ha detto   quasi   niente   (Zanuttini 1991, ex. (192))
       neg   has said   almost nothing
     'He said almost nothing.'

(5) a. Hij   heeft   **nergens**   **geen**   zin   in   (Huitink 2008, ex. (29))
       he   has   nowhere   no   desire   in
       'He doesn't feel like doing anything at all.'

   b. Hij   heeft   **nergens**   zin   in
       he   has   nowhere   desire   in
       'He doesn't feel like doing anything.'

As shown in both Italian (in 4) and Dutch (in 5a), a single semantic negation can be expressed by a combination of two negation words. As Huitink points out, the difference between them is that, in Italian, negative concord is obligatory in expressing negation, while in Dutch, it is optional. As shown in (4), the sentence becomes ungrammatical if *non* is left out; in (5b), however, negation can also be expressed by a single negative quantifier.

Therefore, Italian is a language with obligatory negative concord, while Dutch is a language with optional negative concord. In languages that have modal concord, however, this concord phenomenon seems always optional in expressing a single modal meaning. Consider the English data in (6).

(6) a. This gazebo **may possibly** have been built by Sir Christopher Wren.

'Maybe / Possibly this gazebo was built by Sir Christopher Wren.'

b. This gazebo **may** have been built by Sir Christopher Wren.

c. **Possibly** this gazebo has been built by Sir Christopher Wren.

(6a) is an example of modal concord, where the two modals *may* and *possibly* merge into a single modal interpretation. These two modals can also be used alone to express the same single modal meaning, as seen in (6b) and (6c). This shows that modal concord is optional in expressing a single modal interpretation. The same conclusion can also be drawn for Mandarin, as shown in (7).

(7) a. ta **yexu**   **keneng** zaijia
    he EP-POSS   EP-POSS   at home
    'Maybe he is at home.'

b. ta **yexu**   zaijia
   he EP-POSS   at home
   'Maybe he is at home.'

c. ta **keneng** zaijia
   he EP-POSS   at home
   'Maybe he is at home.'

In the modal concord example (7a), the two modals *yexu* and *keneng* merge into a single modal interpretation, while in (7b) and (7c), *yexu* and *keneng* can also be used on their own to express the same meaning.

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As discussed above, one of the differences between negative and modal concord is that the former can be obligatory while the latter can only be optional. This might lead to different analyses of these two concord phenomena, an issue which will be discussed in the next section.

1.2 How to account for modal concord

Except for the modal logic approach, most existing approaches to modal concord are inspired by approaches to negative concord (Huitink 2008). I will begin with the modal logic approach and very briefly discuss how it fails to account for modal concord. Then I will introduce the analyses of negative concord, and explain how they can help in analyzing modal concord.[3] Recently, Huitink (2012) has proposed a domain restriction analysis to account for modal concord, involving ordering sources of modals. More details on semantic approaches to modal concord will be provided in Chapter 5.

Recall the two possible readings of double-modal constructions, as shown in (8).

(8) a. You **might have to** leave.

[might [have to [you leave]]]

'It might be the case that you have to leave.'

b. This gazebo **may possibly** have been built by Sir Christopher Wren.

[may / possibly [this gazebo was built by Sir Christopher Wren]]

'Maybe / Possibly this gazebo was built by Sir Christopher Wren."

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[3] Note that all these approaches are logic-based or semantic analyses of modal concord. On the other hand, Zeijlstra (2004) proposes a syntactic approach. I will not discuss the syntactic approach to concord in this thesis, and will leave a detailed comparison between syntactic and semantic approaches for future research. One reason is that Mandarin modal concord does not appear to be sensitive to syntactic distinctions (for instance, modal verbs and adverbs are treated the same way), as will be shown in Section 3.4.

(8a) is called a cumulative reading, where the two modals are interpreted separately. (8b) is called a concord reading, where the two modals fuse into a single modal meaning. von Fintel & Heim (2011) analyze a cumulative reading as one modal embedded under a higher modal. Suppose M_1 and M_2 represent the modal operators in a double modal combination, then the availability of a cumulative reading can be illustrated by the formula in (9).

(9) Cumulative reading: $M_1M_2(p) = M_1(M_2(p))$

For the example *you might have to leave* in (8a) above, the speaker considers it possible that the addressee is under the obligation to leave. In a modal logic approach, suppose w is the world of evaluation for the whole sentence, then (8a) is true iff there is a world w' that is compatible with the speaker's knowledge in w such that the proposition "you leave" is true in every world w'' where the rules of w' are obeyed.

However, modal logic cannot easily account for the availability of a concord reading. When a concord reading is available, the combination of two modals would have to be logically equivalent to one modal, as illustrated by the formula in (10).

(10) Concord reading: $M_1M_2(p) = M_3(p)$

In a modal logic approach, if M_1 and M_2 have the same quantificational force, and their accessibility relations are both reflexive and transitive, then it is guaranteed that the equation in (10) holds (Gamut 1991, Portner 2009). See also Huitink (2008, 2012) for related discussion. In natural languages, however, a concord reading can be available between two modals with non-reflexive accessibility relations, which is at odds with the predictions by the modal logic approach (c.f. Huitink 2008). A more extensive discussion of the modal logic approach will be provided in Chapter 5. Here I will briefly present one example where the modal logic approach fails to account for the availability of a concord reading.

Reflexivity means a world is always accessible to itself. Deontic modality is about rules and laws which are not always obeyed in the actual world. Therefore, the actual world is not always accessible to itself with respect to rules and laws. Considering this, deontic modality is not always reflexive in natural languages. However, a concord reading is available between two deontic modals in Mandarin, as shown in (11).

(11) Context: A mom is talking with her son about when he is allowed to play soccer.

| zhiyao | ni | bazuoyexiewan | le, |
| if | you | finish assignment | PERF |

| ni | jiu | **neng** | **keyi** | qutiqiu |
| you | then | NONEP-POSS | NONEP-POSS | go play soccer |

'If you have finished your assignment, then you can go play soccer.'

As we can see in Mandarin, two modals can have a concord reading even though the accessibility relation is not reflexive. Therefore, the modal logic approach cannot fully account for the phenomenon of modal concord.

Except for modal logic, most other existing approaches to modal concord are derived from analyses of negative concord. In the rest of the section, I will briefly review theories of negative concord and how they inspire approaches to modal concord (Huitink 2008, 2012). I will discuss why the existing approaches to modal concord cannot fully account for the Mandarin data, and provide a preview of my final analysis of Mandarin modal concord, which is also inspired by one of the analyses of negative concord. A more detailed investigation of all these issues will be provided in Chapter 5.

As discussed in Huitink (2008), there are two major kinds of theories of negative concord: local theories and global theories. Local theories interpret one of the negation words as a

semantic negative quantifier, while the other one only as a morphological negation that is semantically vacuous. In contrast, global theories interpret both of the negation words equally as semantic negative operators.

Inspired by the local theories of negative concord, Huitink's (2008) type-shifting analysis of modal concord in Dutch and English interprets the modal verb as the only modal word, and treats the modal adverb as a semantically vacuous item. Consider the Dutch data in (12).

(12) Het **kan** **misschien** gaan regenen   (Huitink 2008, ex. (13))

    it   **can**   **perhaps**   go   rain

    'It might rain.'

In (12), *kan* is a modal verb and *misschien* is a modal adverb. Huitink proposes that when the verb and the adverb are of the same modal type (epistemic, deontic, etc.) and force (possibility, necessity), the modal adverb will shift into a semantically vacuous item, while the modal verb is the "real" modal. Therefore it results in a single modal interpretation.

This analysis only considers the combination of "modal verb + modal adverb". In Mandarin, however, modal concord is not sensitive to syntactic categories. A concord reading can be available for the combination of two modal verbs, or two modal adverbs, or a modal verb and a modal adverb. More importantly, the two modal words are semantically equal in modality. There is no obvious reason for treating one as the real modal word but the other as a semantically vacuous item. More discussion of Huitink's type-shifting analysis and her more recent analysis in terms of restriction (Huitink 2012) will be provided in Chapter 5.

Due to these considerations, I will propose a "fusion analysis" to account for Mandarin modal concord. This analysis is inspired by the global theories of negative concord.

In a given context, the combinations of two modals with a concord reading can be

semantically replaced by either of the two modal expressions individually. Recall the data in (7), repeated as in (13).

(13) a. ta **yexu** **keneng** zaijia

    he   EP-POSS EP-POSS at home

    'Maybe he is at home.'

  b. ta **yexu** zaijia

    he   EP-POSS at home

    'Maybe he is at home.'

  c. ta **keneng** zaijia

    he   EP-POSS   at home

    'Maybe he is at home.'

The concord reading combination *yexu keneng* in (13a) can be replaced by *yexu* in (13b) or *keneng* in (13c). They are semantically the same, although there might be some difference in emphasis. The fusion analysis treats the two modal words in a concord reading as equally important items. I will argue in this thesis that they fuse into a single modal interpretation when the two modals receive the same conversational backgrounds from the context and have the same quantificational force. A detailed analysis will be presented in Chapter 5.

1.3 Methodology

The Mandarin data in this thesis are mainly obtained from self-elicitation (I am a native speaker of Beijing-dialect Mandarin). Since different languages may have very different modal systems (see for instance Rullmann et al 2008), it might be misleading if a native speaker is asked to translate a target sentence into his or her language. Instead of direct translation, providing an appropriate context is important in elicitation of modality. Take the

data in (11) as an example, repeated in (14).

(14) Context: A mom is talking with her son about when he is allowed to play soccer.

zhiyao	ni	bazuoyexiewan	le,
if	you	finish assignment	PERF

ni	jiu	**neng**	**keyi**	qutiqiu
you	then	NONEP-POSS	NONEP-POSS	go play soccer

'If you have finished your assignment, then you can go play soccer.'

This context is designed to elicit a deontic possibility reading: since it is about rules (when to play soccer and when not), the modality elicited is deontic; since it is about what the son could do (play soccer) but doesn't have to do, it is a possibility (not necessity) modal interpretation.

In most cases, I design a context to elicit a certain single-modal reading or a certain cumulative-modal reading. Then I make two kinds of judgements: i) I judge whether a Mandarin sentence is felicitous in this context; ii) given two sentences, I judge which one is more felicitous in this context. In the example (14) above, I make a judgement that the Mandarin sentence is felicitous in this context.

In future research, I intend to elicit data from more Mandarin speakers, in order to make sure the data are stable and reliable. More discussion on future research will be presented in Chapter 6.

1.4 Structure of the thesis

The structure of the thesis is as follows: in Chapter 2, I will discuss the theoretical framework for modality that I will be working in. An overview of the Mandarin modal system will be presented in Chapter 3. Chapter 4 will provide data on Mandarin modal

concord and formulate generalizations about the conditions under which a concord reading is available. In Chapter 5, I will discuss three different approaches in which modal concord can be analyzed. Finally, I will conclude the whole thesis and point out the problems for future research in Chapter 6.

Chapter 2

The Formal Semantics of Modality

There exist various formal frameworks and analyses of modality. This chapter introduces some well-known theories that I will adopt for the following discussion on Mandarin modal concord. Section 2.1 will discuss the ordering semantics, mainly developed by Kratzer (1977, 1981, 1991). She argues that the interpretation of a modal depends on what she calls conversational backgrounds. There are two kinds of conversational background: the modal base, which determines the set of possible worlds that are accessible from the evaluation world, and the ordering source, which imposes an ordering on this set of accessible worlds. Section 2.2 will introduce an approach to weak necessity and strong necessity modal expressions, developed by von Fintel & Iatridou (2006, 2008) and Rubinstein (2012a, 2012b, 2013). They argue that, instead of a single ordering source, there are multiple ordering sources involved for the interpretation of weak necessity modals.

2.1 Ordering Semantics

In the theoretical framework developed by Kratzer (1977, 1981, 1991), the semantics of modal expressions is determined by two components: the conversational backgrounds and the quantificational force. The conversational backgrounds consist of the modal base, which determines the set of possible worlds that are accessible from the evaluation world, and the ordering source, which imposes an ordering on this set. The different types of modality are determined by the conversational backgrounds, namely, the modal base and the ordering source. Table 2.1 below presents the conversational backgrounds of the modal types that will be discussed in this thesis[4].

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[4] The conversational backgrounds listed in this table are directly related with the types of modality. Besides, a type of modality may also have other trivial conversational backgrounds. For example, both deontic and teleological modals usually take a second stereotypical ordering source which restrict the worlds to be ordinary worlds.

Table 2.1 The conversational backgrounds of different modal types

Modal type	Modal base	Ordering source
Deontic	Circumstantial	Deontic
Teleological	Circumstantial	Teleological
Epistemic	Epistemic	Stereotypical

The quantificational force is existential (for possibility modals, e.g., *may*) or universal (for necessity modals, e.g., *must*) quantification over the best worlds in the modal base, as determined by the ordering source. There might be intuitive force differences between modals that have the same quantificational force. For example, *should* and *must* are both necessity modals, but *should* intuitively has a weaker force than *must*. This intuitive force difference will be further discussed in Section 2.2. In the rest of this section, I will mainly discuss the different kinds of modal base and ordering source presented in Table 2.1 above.

According to Kratzer, there are two basic kinds of modal bases: circumstantial and epistemic. The difference between them can be illustrated by (15), cited from Kratzer (1991).

(15) Context A: I acquire a piece of land in a far away country, and discover that the soil and climate are very much like they are at home, where hydrangeas prosper everywhere. Then I conclude:

a. Hydrangeas **can** grow here.

Context B: I travel to a far away city for the first time, and see a flower shop selling hydrangea bouquets. Then I conclude:

b. There **might** be hydrangeas growing here.

(Kratzer 1991, ex. (21))

In Context A, (15a) is true regardless of whether there are already hydrangeas growing in that country. It only depends on the climate, soil, properties of hydrangeas and so on. In this case, the modal base is described as **circumstantial**. A circumstantial modal base picks out a set of possible worlds that are compatible with the relevant dispositions and potentials in the evaluation world. In some of these worlds, hydrangeas grow here.

In Context B, the conclusion (15b) is based on the evidence that a flower shop is selling hydrangeas. It is likely that these hydrangeas grow in the local area, but it is also possible that they are transported from other places. In this case, the modal base is described as **epistemic**. An epistemic modal base picks out a set of possible worlds where the evidence that is available in the evaluation world holds. In some of these worlds, hydrangeas are growing there.

In Kratzer's framework, the modal base is defined as a function *f* that assigns to any evaluation world a set of propositions which the relevant agent knows about that world (epistemic) or a set of propositions representing the relevant circumstances in that world (circumstantial); the set of possible worlds accessible from the evaluation world is the set of worlds where those propositions are all true. For instance, in (15b), given an evaluation world w and an epistemic modal base f, the set of propositions that we know in w is f(w)={there is a flower shop, the shop is selling hydrangeas, etc.}. The set of worlds epistemically accessible from w is the set of worlds where all the propositions in f(w) are true, namely, ∩f(w).

It seems that the modal base itself can already successfully account for the modal interpretations in (15) above. If the modal base is considered to be the only conversational background, however, there will be three major problems (Kratzer 1977, 1981, 1991). First, when there is an inconsistent background, the modals will quantify over an empty set of worlds, which will predict the wrong truth value for some sentences containing modal operators. Second, it can not account for the distinction between different grades of

possibility and necessity. Third, this analysis will lead to the Samaritan Paradox of deontic logic, where the prejacent of a conditional would also be considered a morally commanded proposition. For example, in "*if a murder occurs, the murderer will go to jail*", the morally dispreferred prejacent "*a murder occurs*" is also considered to be a proposition in the modal base. In order to solve these problems, Kratzer introduces the ordering source as a second kind of conversational background.

Kratzer defines the partial ordering of the propositions in the ordering source as a function g that assigns to an evaluation world a set of propositions. Following Kratzer's framework, von Fintel & Heim (2011) define the ordering induced by the ordering source as follows:

(16) Given a set of worlds X and a set of propositions P, define the strict partial order $<_P$ as follows:

$\forall w_1, w_2 \in X$: $w_1 <_p w_2$ iff $\{p \in P: p(w_2)=1\} \subset \{p \in P: p(w_1)=1\}$

<div align="right">(von Fintel & Heim 2011, ex. (107))</div>

For any pair of worlds w_1 and w_2 in the modal base worlds X, w_1 is ranked higher than w_2 with respect to a set of propositions P if and only if the set of propositions from P that are true in w_2 is a proper subset of the set of propositions from P that are true in w_1. They also define a *max* operator to determine the set of best worlds in the modal base with respect to an ordering source, as shown in (17).

(17) For a given partial order $<_p$ on worlds, define the selection function max_p that selects the set of $<_p$-best worlds from any set X of worlds:

$\forall X \subseteq W$: $max_p(X) = \{w \in X: \neg\exists w' \in X: w' <_p w\}$.

<div align="right">(von Fintel & Heim 2011, ex. (108))</div>

Given an ordering source P, for any set of worlds X that is a subset of worlds W, max_p is the set of all worlds w from X such that there doesn't exist a world w' in X that ranks higher than

w. As mentioned by von Fintel & Heim (2011), this definition assumes that there are finite sequences of propositions in the ordering source, and that there always are accessible worlds that come closest to the ideal. This is called the Limit Assumption by Lewis (1973). He argues against this assumption, while Stalnaker (1984) argues against Lewis by saying that this assumption is reasonable for the modality of actual natural language. Although Kratzer is following Lewis's proposal and does not make the limit assumption, I will adopt von Fintel & Heim's definition of the ordering source in order to make the analysis easier to follow.

There are three types of ordering sources that will be investigated in this thesis: deontic, teleological and stereotypical. A deontic ordering source contains propositions about obligations, laws or other social norms or rules; a teleological ordering source is about the goals to be achieved (which can be made explicit by means of an adjunct *in order to* clause); a stereotypical ordering source consists of propositions that describe the normal course of events. These ordering sources are illustrated by the examples in (18) below.

(18) a. You **have to** wash your hands after using the bathroom.

     b. In order to get to UBC, you **may** take a #14 bus.

     c. Since the ground is all wet, it **must** have rained before.

In (18a), the deontic ordering source contains propositions like "you always keep your hands clean". According to this ordering source, the *max* operator selects the best worlds from the modal base, while the proposition "you wash your hands after using the bathroom" happens to be true in all these best worlds. Therefore, the universal quantification *have to* can be used in (18a). In (18b), the teleological ordering source contains the proposition "you get to UBC". Since there might be other options to get to UBC other than taking a #14 bus, the proposition "you take a #14 bus" is true in some (not all) of the best worlds selected by the ordering source. Therefore (18b) is true in using an existential quantifier. In (18c), the epistemic modal base selects the worlds where the ground is all wet; the stereotypical

ordering source consists of propositions such as "only the rain makes the ground all wet". The proposition "it rained" is true in all the best worlds in the modal base selected by the *max* operator. This results in a necessity reading as in (18c).

The ordering source can also account for different grades of modality. Kratzer (1991) provides examples of graded epistemic modals as follows.

(19) Context: Girgl has been murdered on his way home. The police began an investigation. Certain conclusions may be drawn from what is known about the crime:

    a. Michl **must** be the murderer.
    b. Michl is **probably** the murder
    c. Michl **might** be the murderer.

<div align="right">(Kratzer 1991, ex. (19))</div>

In (19a), the modal expression *must* makes a claim about a larger set of worlds than *probably* in (19b), which in turn makes a claim about a larger set of worlds than *might* in (19c). These quantificational force differences can be accounted for by the notion *better possibility*, which is defined as follows:

(20) Better possibility:

A proposition p is a better possibility than a proposition q in a world w with respect to a modal base f and an ordering source g iff for all u such that $u \in \cap f(w)$ and $u \in q$, there is a $v \in \cap f(w)$ such that $v <_{g(w)} u$ and $v \in p$.

<div align="right">(Kratzer 1991, *Definition 10*)</div>

Given a modal base $f(w)$ and an ordering source $g(w)$, a proposition p is a better possibility than q if and only if for all worlds u in the modal base where q is true, there is always a world v in the modal base where p is true and v ranks higher than u with respect to the ordering source.

This section has summarized Kratzer's (1977, 1981, 1991) framework for ordering semantics. In the next section, I introduce an analysis of weak necessity and strong necessity modals developed by von Fintel & Iatridou (2008) and Rubinstein (2012a, 2012b, 2013).

2.2 Multiple Ordering Sources

Although the framework introduced in Section 2.1 captures the difference between possibility and necessity modals, it is difficult to explain the intuitive force difference between different necessity modals.[5] In English, necessity modals can be classified into weak necessity (WN, e.g., *ought to, should*) and strong necessity (SN, e.g., *must, have to*) modals, where the former have an intuitively weaker force than the latter. This intuitive force difference is rooted in scalar-like implications these modals give rise to. According to Horn (1972) and Levinson (2000), higher elements on a certain scale are more informative or stronger than lower elements on the same scale, so a higher element entails a lower element, and the negation of a higher element is compatible with a lower element. This pattern can be illustrated by <*some, all*> in (21a) and <*warm, hot*> in (21b).

(21) a. Harry ate **some** of the apples, but he didn't eat **all** of them.

b. The water is **warm** but not **hot**.

The same pattern can also be found between WN and SN modals, as illustrated in (22).

(22) a. You **ought to** do the dishes but you don't **have to**.

b. *You **have to** do the dishes but it is not the case that you **ought to**.

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[5] The weak necessity modals in Kratzer (1991) refer to words like *probably* and *likely*, which are usually treated as possibility modals but not necessity modals. The weak necessity modals that will be discussed below refer to words like *ought to* and *should*. Although Kratzer's analysis can account for the differences between *probably / likely* and *must / have to* (as discussed at the end of Section 2.1), it cannot account for the differences between *ought to / should* and *must / have to*.

Moreover, based on Grice's Cooperative Principle, speakers make their contribution as informative as required (Grice 1975). Therefore, a weaker or less informative element conversationally implicates the negation of a stronger or more informative element, but this implicature can be canceled, as illustrated by *<some, all>* and *<warm, hot>* in (23).

(23) a. Harry ate **some** of the apples — in fact, he ate **all** of them.

b. The water is **warm** — in fact, it is **hot**.

Again, the same pattern can be found between WN and SN modals, as shown in (24), cited from von Fintel & Iatridou (2008).

(24) a. You **ought to** wash your hands — in fact, you **have to**.

b. ??You **have to** wash your hands — in fact, you **ought to**.

(von Fintel & Iatridou 2008, ex. (5))

There is a debate in the literature about how to define the difference between WN and SN modals within the basic framework proposed by Kratzer (1981, 1991). One straightforward idea, inspired by Horn (1972), is that SN modals require the proposition to be true in all the accessible worlds favored by a certain ordering source, while WN modals require it to be true in most (not all or only some) favored accessible worlds. There are several arguments against this idea (von Fintel & Iatridou 2008, Portner 2009). First of all, it is not clear how to count possible worlds in order for them to be "most" possible worlds in a set, especially considering that the set of favored accessible worlds is usually infinite. More importantly, the "most" analysis cannot truly capture the meaning of a WN modal. To see this, consider the teleological context in (25), adapted from the "going to Ashfield" example from von Fintel & Iatridou (2008).

(25) You are considering how to drive from Alma St. to UBC. There are four routes on

Google Maps:

  i) Take 4th Ave., then take Marine Dr.

  ii) Take 4th Ave., then take Chancellor Blvd.

  iii) Take 10th Ave., then take University Blvd.

  iv) Take 16th Ave.

Among these four options, (iii) is not available because University Blvd. is closed for construction. Among the three remaining options, two involve 4th Ave, which has a more scenic view than the other routes. Consider the sentences in (26) below.

(26) a. *To drive to UBC, you **must** / **have to** take 4th Ave.

    b. ??To drive to UBC, you **ought to** / **should** take 4th Ave.

    c. To drive to UBC and have a good scenic view while driving, you **ought to** / **should** take 4th Ave.

Intuitively, (26a) is infelicitous. (26b) is questionable: it is not felicitous if there is no other implicit reason or requirement that rules out the option of taking 16th Ave.; however, it will become undoubtedly felicitous if we take into account other requirements such as having a good scenic view, as shown in (26c).

If we assume that "two out of three" can be regarded as "most", (26b) should be undoubtedly felicitous if the "most" analysis for WN modals were correct. However, this is not the case, because there exists another option to take 16th Ave. In order to make it undoubtedly felicitous, taking 4th Ave. should be true in all (not most) of the relevant accessible worlds. Therefore there should be some additional requirement to rule out taking 16th Ave., as illustrated in (26c).

Imagine that 16th Ave. is also closed for construction or some bike race, then i) and ii) become the only options to get to UBC. In this scenario, a SN modal expression in (27) is

felicitous and obligatory. No additional requirement is needed for (27) to be true.

(27) To drive to UBC, you **must** / **have to** take 4th Ave.

von Fintel & Iatridou (2008) conclude that a teleological SN modal requires the proposition to be true in all the accessible worlds where the goal is achieved, while a WN modal requires the proposition to be true in all the accessible worlds where the goal is achieved and which are optimal according to some additional requirement. This secondary requirement is used to make further distinctions among the accessible worlds where the primary goal is achieved.

In Kratzer's framework, a modal base decides the set of possible worlds that are accessible from the evaluation world, and an ordering source imposes an ordering on this set of accessible worlds. Instead of assuming a single ordering source, von Fintel & Iatridou (2008) propose using a pair of ordering sources to account for the difference between WN and SN modals: a) the primary ordering source, which is the only one that SN modals are sensitive to, and b) the secondary ordering source, which is used by WN modals to refine the ranking of the worlds favored by the primary ordering source. A formalized definition of WN and SN modals is provided in (28), adapted from von Fintel & Iatridou (2008)[6].

(28) a. *Have to* / *must p* is true in a world *w* with respect to a modal base *f* and a (primary) ordering source *g* iff the following conditions are satisfied:

For all $v \in max_{g(w)}(f(w))$, $[[p]]^v=1$.

b. *Should* / *Ought to p* is true in a world *w* with respect to a modal base *f*, a primary ordering source g_1 and a secondary ordering source g_2 iff the following conditions are satisfied:

For all $v \in max_{g2(w)}(max_{g1(w)}(f(w)))$, $[[p]]^v=1$.

---

[6] von Fintel & Iatridou (2008) state the analysis of weak necessity and strong necessity modals in prose, and they do not make the limit assumption. For simplicity, I adopt *max* operator in the definitions of weak necessity and strong necessity modals, which requires the limit assumption.

In other words, a SN modal makes a claim about all the worlds in the modal base (MB) that are favored by the primary or[dering] ... as a WN modal m[akes a claim] about the subset containing tho[se ...] y the secondary ordering source (SOS). This is illustrated ...

bixu

dei/yao

yinggai

Weak Force

POS

MB

W

Figure 2.1: Sch[ematic of WN] and SN modals

SN modals: *must / have to*   WN modals: *ought to / should*
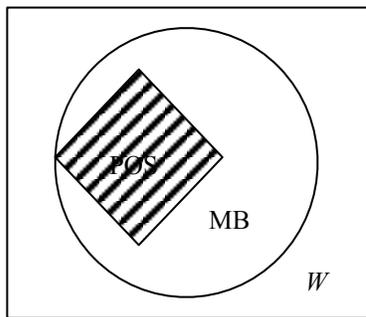
yinggai

Weak F[orce]

POS

MB

W

POS   SOS

MB   W
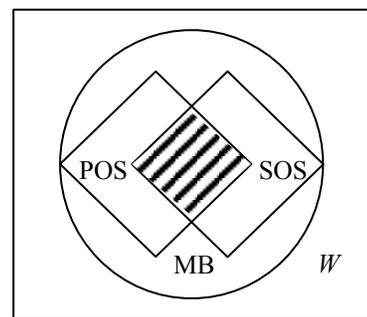
This analysis gives rise to the question of which ordering source from the context should be primary and which shou[ld be secondary. von Fintel] & Iatridou (2008) propose that in a teleological context such [as ..., the primary] ordering source is the goal proposition overtly stated by the spe[aker in an] *(in order) to*-adjunct (e.g., *to get to UBC*); the secondary orde[ring source contains consid]erations about the means for achieving the primary goal (e.g., *t[o ... ha]ve a good scenic view*). In a deontic context, the primary ordering source contains rules and laws that are required to be more strictly and coercively obeyed than the secondary ordering source. In an epistemic context, the stereotypical propositions in the primary ordering source more closely approximate the normal course of events than those in the secondary ordering source; in other words, the secondary ordering source is less certain than the primary.

Rubinstein (2012a, 2012b, 2013) further develops von Fintel & Iatridou's approach by proposing a more general principle differentiating the primary ordering source from the

POS   SOS

MB   W

secondary: the primary ordering source contains propositions that are collectively committed to by the interlocutors, while the secondary ordering source relies on information that is not collectively committed to. This proposal is illustrated by the teleological-bouletic scenarios in (29), cited from Rubinstein (2013).

(29) There are two trains going from Moscow to Vladivostok: a Russian train and a Chinese train. Of the two, only the Chinese train offers a comfortable ride.

Context A: Babushka is preparing to take the Trans-Siberian train from Moscow to visit her daughter in Vladivostok.
a. Babushka: I want the trip to be pleasant.
   Daughter: To get here comfortably, you **have to** take the Chinese train.

<div align="right">(Rubinstein 2013, ex. (15))</div>

Context B: At the train station, Babushka asks the clerk about the trains to Vladivostok.
b. Babushka: I want the trip to be pleasant.
   Clerk: To get there comfortably, you **ought to** take the Chinese train.

<div align="right">(Rubinstein 2013, ex. (16))</div>

Although judgements about these data may vary among different native English speakers, I will stick to the judgement provided by Rubinstein (2013) above. According to her research, a SN modal is intuitively appropriate for Context A while a WN modal is intuitively appropriate for Context B. She explains that in Context A, the daughter, who knows her mother well, may easily accept that her mother is indeed committed to paying for the more comfortable ride. The desire for a comfortable ride becomes the collective commitment between the interlocutors. In contrast, the clerk in Context B is not familiar with the woman. He cannot judge how strong her desire is and whether she will change her mind later, although she has already overtly stated her desire. Therefore, it would be too strong to use *have to* here.

In both scenarios, Babushka overtly states her wish for the trip to be pleasant. Therefore, according to von Fintel & Iatridou (2008), this desire should have been included in the primary ordering source, and a SN modal should have been preferred in both scenarios. However, according to the intuitive judgements provided above, this is not the case. It suggests that the difference between the primary and the secondary ordering source of teleological modality is not simply that the former is concerned with the overtly-stated main goal while the latter contains implicit considerations about how to achieve the goal.

Instead, Rubinstein (2012a, 2012b, 2013) argues that the primary ordering source relies on collectively committed information, while the secondary ordering source relies on non-collectively committed information.[7] Back to the example in (29), the proposition "Babushka gets to Vladivostok" is collectively-committed to by the interlocutors in both contexts A and B. In context A, since the daughter knows Babushka well, she thinks that according to Babushka's normal behavior, Babushka won't change her goal of getting to Vladivostok comfortably, even if it may cost more money or take more time. Therefore, the proposition "Babushka gets there comfortably" is committed to by the speaker, and is included in the primary ordering source. In context B, although Babushka overtly stated her desire to get there comfortably, the clerk is not committed to it because he is not sure how strong her

---

[7] The term "primary ordering source" and "secondary ordering source" is based on von Fintel & Iatridou's analysis on the primary goal (e.g., *to drive to UBC*) and the secondary goal (e.g., *to have a scenic view when driving to UBC*) of teleological modality. Although the difference between the two ordering sources proposed by Rubinstein is not the difference between the primary goal and the secondary goal anymore, I will keep the original terms to refer to the two kinds of ordering sources in this thesis. Therefore, the primary ordering source is the one that only relies on collectively committed information, and the secondary ordering source is the one that only relies on non-collectively committed information.

desire is and whether she will change her mind later.[8] Therefore, "Babushka gets there comfortably" is included in the secondary ordering source in context B. Since a WN modal can take a secondary ordering source but a SN modal cannot, the WN modal *ought to* is felicitous in context B while the SN modal *have to* is felicitous in context A.

In Rubinstein's analysis, a SN modal always takes a non-empty set of primary ordering source propositions and an empty[9] set of secondary ordering source propositions. A WN modal always takes a non-empty set of secondary ordering source propositions, but its primary ordering source can be either empty[10] or non-empty. The ordering sources of WN and SN modals are summarized as the table below.

Table 2.2 The ordering sources of WN and SN modals

Modals	Primary Ordering Source (collectively committed information)	Secondary Ordering Source (non-collectively committed information)
SN	non-empty	empty
WN	empty OR non-empty	non-empty

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[8] Based on my understanding of Rubinstein's example, the term "collective commitment" might be misleading. In (29), whether to use a WN modal or a SN modal is not related to whether both of the interlocutors are actually committed to the proposition "Babushka gets there comfortably". In my opinion, it is only related to whether the speaker is committed to the proposition, and one of the factors that can affect the speaker's commitment is that whether he/she thinks this proposition is committed to by the listener. If the speaker thinks this proposition is committed to by the listener, as in Context A, this will become one of the reasons supporting the speaker to be committed to the proposition. But whether the listener is actually committed to the proposition is not relevant here: in Context A, Babushka may change her mind if she knows taking the Chinese train costs a lot more money, although her daughter thinks she won't change her mind. If the speaker thinks the proposition is not committed to by the listener, as in Context B, this will become one of the reasons why the speaker is not fully committed to the proposition. But in this case it is possible that the listener is actually committed to the proposition, although the speaker doesn't think so. In this thesis, for simplicity, I will still use the term "collective commitment" to differentiate the primary and secondary ordering source: the primary ordering source relies on collectively committed information, while the secondary ordering source relies on non-collectively committed information. A WN modal always takes a secondary ordering source, but a SN modal never takes a secondary ordering source.

[9] There are always some trivial propositions from the common ground of the interlocutors. Therefore the primary and the secondary ordering source can never be really empty. For simplicity, this thesis will not take into account these trivial propositions. When a set of ordering source propositions is empty, it means that it does not have any propositions directly related to the topic of the sentence.

[10] Although Rubinstein does not explicitly state this point, the secondary ordering source is able to exist without the existence of the primary ordering source, because the former does not need to rely on the latter. Therefore, a WN modal can have an empty primary ordering source.

Chapter 3

The Mandarin modal system

3.1 Introduction to the Mandarin modal system

This chapter will investigate a list of modal words in Mandarin, as shown in Table 3.1 below. Their modal types, quantificational forces and syntactic categories are based on the existing literature on Mandarin modality (Tsang 1981, Bybee & Fleishman 1995, Hsieh 2005, Huang 2010, Wu 2010). I choose this list of modal words because it covers both epistemic and non-epistemic[11] modal types as well as possibility and necessity quantificational forces. Besides, the words in this list are among the most frequently used modal words in Mandarin.

Table 3.1 Mandarin modal words

Mandarin Modals	Modal Type	Quantificational Force	Syntactic Category
yinggai	epistemic non-epistemic	necessity	Verb
yiding	epistemic	necessity	Verb
biran	epistemic	necessity	Adverb
keneng	epistemic	possibility	Verb
yexu	epistemic	possibility	Adverb
dei	non-epistemic	necessity	Verb
yao	non-epistemic	necessity	Verb
bixu	non-epistemic	necessity	Verb
keyi	non-epistemic	possibility	Verb
neng	non-epistemic	possibility	Verb

---

[11] The modal type "non-epistemic" includes deontic, teleological, etc. For the Mandarin modals that are lexically specified to be non-epistemic, they are usually ambiguous between the sub-types of non-epistemic. For instance, *dei* and *yao* can be used in both deontic and teleological contexts.

Different modal systems may differ from each other in whether they specify for conversational background or quantificational force (Rullmann et al. 2008, Peterson 2010). Table 3.2 is a summary of this modal typology.

Table 3.2 Cross-linguistic modal typology

	Unspecified Conversational Background	Specified Conversational Background
Unspecified Quantificational Force		St'át'imcets
Specified Quantificational Force	English	Javanese

All the Mandarin modals in Table 3.1 are lexically specified for quantificational force. Except for *yinggai*, which is ambiguous between an epistemic and a non-epistemic interpretation, all the other modals are either unambiguously epistemic or unambiguously non-epistemic. Therefore, as for the modal typology, Mandarin should be put in the lower left-hand cell in Table 3.2, the same as English.[12]

In this chapter, Section 3.2 and 3.3 will introduce Mandarin possibility and necessity modals respectively, providing evidence for the type and force of each modal in Table 3. Section 3.4 will discuss the syntactic category of each modal and its effect on the investigation of modal concord.

3.2 Possibility Modals in Mandarin

These are the four possibility modals that will be investigated in this thesis, as summarized

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[12] The WALS website (see 76A on http://wals.info/languoid/lect/wals_code_mnd) mistakenly classifies Mandarin as a language that allows for variable conversational backgrounds for both possibility and necessity modals. Based on the references mentioned above, among the most frequently-used Mandarin modals, only the necessity modal *yinggai* is ambiguous between an epistemic and a non-epistemic interpretation.

in Table 3.3 below (Tsang 1981, Bybee & Fleishman 1995, Hsieh 2005). This section will present data to prove that this categorization of modal type and quantificational force is correct.

Table 3.3 Possibility Modals in Mandarin

Mandarin Modals	Modal Type	Quantificational Force
keneng	epistemic	possibility
yexu	epistemic	possibility
keyi	non-epistemic	possibility
neng	non-epistemic	possibility

All these four modals are lexically specified for their modal type and modal force. First, I will provide evidence that they are possibility (not necessity) modals. None of these four modals are felicitous in a context designed to elicit a necessity reading, no matter whether it is epistemic or non-epistemic. The context in (30) is designed to elicit an epistemic necessity reading. As shown in (30a), the epistemic necessity modal *yiding* (which will be further investigated in Section 3.2) is felicitous, while the four possibility modals are infelicitous.

(30) Context: Your roommate is very busy with his thesis these days. He studies either at home or in the library, and never goes anywhere else. Today he is not at home.

a.　ta　**yiding**　zai　　tushuguan

　　he　EP-NEC　at　　library

　　'He must be at the library.'

b. * ta　***keneng*** /　***yexu*** /　　***keyi*** /　　　***neng***　　　zai　tushuguan

　　he　EP-POSS /　　EP-POSS /　　NONEP-POSS / NONEP-POSS　at　library

The context in (31) is designed to elicit a deontic (non-epistemic) necessity reading. The non-epistemic necessity modal *bixu* is felicitous (as in 31a), but the four possibility modals

are still infelicitous here (as in 31b).

(31) Context: You are taking a course and you need to submit an assignment to the instructor. The instructor requires you to submit it before Sep. 28th. He is strict with deadlines and won't accept any late assignments.

a.   ni   ***bixu***   zai   jiuyueershibahao qian   jiaozuoye

      you NONEP-NEC   at   September 28th   before   hand in assignment

      'You must hand in your assignment before Sep. 28th.'

b. * ni   ***keneng*** /   ***yexu*** /   ***keyi*** /   ***neng***

      you   EP-POSS /   EP-POSS /   NONEP-POSS /   NONEP-POSS

      zai jiuyueershibahao   qian   jiaozuoye

      at   September 28th   before   hand in assignment

The context in (32) is designed to elicit a teleological (non-epistemic) necessity reading. The non-epistemic necessity modal *bixu* is still felicitous (as in 32a), but the four possibility modals in (32b) are not.

(32) Context: The homework this week is writing an essay about *Animal Farm.* In order to finish this homework, you…

a. ni   **bixu**   xian   du   dongwu nongchang.

   you   NONEP-NEC   first   read   animal   farm

   'You have to read *Animal Farm* first.'

b. * ni   ***keneng*** /   ***yexu*** /   ***keyi*** /   ***neng***

      you EP-POSS /   EP-POSS /   NONEP-POSS /   NONEP-POSS

      xian   du   dongwu nongchang

      first   read   animal   farm

The infelicity of these four modals in necessity contexts indicates that they are not necessity modals. Now consider the contexts in (33), (34) and (35).

The context in (33) is designed to elicit an epistemic possibility reading. Among the four possibility modals, *keneng* and *yexu* are felicitous (as in 33a), while *keyi* and *neng* are infelicitous (as in 33b).

(33) Context: Your friend and his wife live together. You pass by their house and notice that the light is on.

a. ta **keneng /** **yexu** zaijia

   he EP-POSS / EP-POSS at home

   'He may be at home.'

b.* ta **keyi /** **neng** zaijia

   he NONEP-POSS / NONEP-POSS at home

The context in (34) is designed to elicit a deontic possibility reading. *Keyi* and *neng* are felicitous here (as in 34b), but *keneng* and *yexu* are not (as in 34a).

(34) Context: You are waiting outside your boss's office in order to meet him. Now your boss opens the door and says...

a.* ni xianzai **keneng /** **yexu** jinlai

   you now EP-POSS / EP-POSS come in

b. ni xianzai **keyi /** **neng** jinlai

   you now nonep-poss / nonep-poss come in

   'You can come in now.'

The context in (35) is designed to elicit a teleological possibility reading. *Keneng* and *yexu* are infelicitous here (as in 35a), but *keyi* and *neng* are felicitous (as in 35b).

(35) Context: There are several flights from Vancouver to Beijing, including Air China. In order to go back to Beijing, you ...

a.* ni **keneng** / **yexu** cong zhongguo hangkong ding piao
      you EP-POSS / EP-POSS from China airline order ticket

b. ni **keyi** / **neng** cong zhongguo hangkong ding piao
     you NONEP-POSS / NONEP-POSS from China airline order ticket
     'You can order a flight ticket from Air China.'

The data in (33), (34) and (35) indicate that *keneng* and *yexu* are unambiguously epistemic modals, while *keyi* and *neng* are unambiguously non-epistemic. Note that besides a deontic interpretation in (34) and a teleological interpretation in (35), *keyi* and *neng* can also have other non-epistemic possibility interpretations, such as desire and ability. For example, *keyi* and *neng* in (36) below express a person's ability.

(36) A: ni **keyi** / **neng** zuo naxie shuishang yundong?
        you NONEP-POSS / NONEP-POSS do what water-on sports
        'What water sports can you do?'

   B: wo **keyi** / **neng** youyong he qianshui
      I NONEP-POSS / NONEP-POSS swim and dive
      'I can swim and dive.'

The last point in this section is that Mandarin also has graded possibility modal expressions. Some possibility modals can be modified by an intensifier *hen* or *ji* to make a claim about a restricted set of worlds, which is defined as a better possibility by Kratzer. For example, *hen-keneng* and *ji-keneng* are better epistemic possibility modals than *keneng*. This can be shown

by two pieces of evidence. The first evidence is the implicature tests in (37) and (38) below. In (37), the weaker modal *keneng* is compatible with the negation of the stronger modal *henkeneng* / *jikeneng* (as in 37a), but not vice versa (as in 37b).

(37) a. **keneng**   shi ta tou   le diannao,

     EP-POSS   BE he steal   PRF computer,

     dan   bingbushi   **henkeneng** /   **jikeneng**

     but   not   very-EP-POSS /   extremely-EP-POSS

     'It is possible that he stole the computer, but not very / extremely possible.'

    b. * **henkeneng** /   **jikeneng**   shi ta tou   le diannao,

       very-EP-POSS /   extremely-EP-POSS   BE he steal   PRF computer,

       dan   bingbushi   **keneng**

       but   not   EP-POSS

In (38), although the weaker modal *keneng* implicates the negation of the stronger modal *henkeneng* / *jikeneng*, this implicature can be canceled (as in 38a), but not vice versa (as in 38b).

(38) a. **keneng**   shi ta tou   le diannao,

     EP-POSS   BE he steal   PRF computer,

     shijishang,   **henkeneng** /   **jikeneng**

     actually,   very-EP-POSS /   extremely-EP-POSS

     'It is possible that he stole the computer; in fact, very / extremely possible.'

    b.* shijishang,   **henkeneng** /   **jikeneng**   shi ta tou   le diannao,

       actually,   very-EP-POSS /   extremely-EP-POSS BE he steal   PRF computer,

       shijishang,   **keneng**

       actually,   EP-POSS

The second piece of evidence regarding the force difference between *henkeneng* / *jikeneng* and *keneng* can be shown by elicitation in context. The context in (40) below is designed to elicit a stronger epistemic possibility reading than the context in (39). As seen below, *keneng* is appropriate in (39) but questionable in (40), while *henkeneng* / *jikeneng* patterns in the opposite way.

(39) Context: You find a notebook in the study room. There are several people who just left the room, and John is one of them.

a. zhege	bijiben	**keneng**	shi	John	de
this	notebook	EP-POSS	BE	John	POSSESSIVE

'This note book may be John's.'

b. ?? zhege	bijiben	**henkeneng** /	**jikeneng**	shi John	de
this	notebook	very-EP-POSS /	extremely-EP-POSS BE John		POSSESSIVE

(40) Context: You find a notebook in the study room, and the hand writing in it looks like John's, who just left the room when you came in.

a. ?? zhege	bijiben	**keneng** shi John	de
this	notebook	EP-POSS BE John	POSSESSIVE

b. zhege	bijiben	**henkeneng** /	**jikeneng**	shi John de
this	notebook	very-EP-POSS /	extremely-EP-POSS BE John POSSESSIVE	

'This notebook is extremely possible to be John's.'

To sum up, among the four possibility modals under investigation in this thesis, *keneng* and *yexu* are lexically specified to be epistemic possibility modals, while *keyi* and *neng* are lexically specified to be non-epistemic possibility modals. Some possibility modals can be

modified by intensifiers, forming better possibility modals that have a stronger quantificational force.

3.3 Necessity modals in Mandarin

These are the six necessity modals that will be investigated in this thesis, as shown in Table 3.4 below (Tsang 1981, Bybee & Fleischman 1995, Hsieh 2005).

Table 3.4 A list of necessity modals in Mandarin

Mandarin Modals	Modal Type	Quantificational Force
yinggai	epistemic, non-epistemic	necessity
yiding	epistemic	necessity
biran	epistemic	necessity
dei	non-epistemic	necessity
yao	non-epistemic	necessity
bixu	non-epistemic	necessity

The existing literature divides them into epistemic and non-epistemic modals. In this section, I will provide evidence for this modal type categorization. As for quantificational force, they are all necessity modals (Tsang 1981, Hsieh 2005). However, not much investigation has been done on the intuitive force differences among these Mandarin necessity modals. The intuitive force, rather than the quantificational force, of Mandarin necessity modals, is closely related to Mandarin modal concord (refer to Chapter 4 for details). In this section, therefore, I will also provide evidence on the intuitive force differences between these modals, which will further categorize them into weak necessity (WN), strong necessity (SN) and unspecified necessity (UN) modals, as shown in Table 3.5 below. I will also propose a definition of Mandarin necessity modals by the end of this section.

Table 3.5 The intuitive force of necessity modals in Mandarin

Mandarin Modals	Modal Type	Intuitive Force
yinggai	epistemic, non-epistemic	WN
yiding	epistemic	SN
biran	epistemic	SN
dei	non-epistemic	UN
yao	non-epistemic	UN
bixu	non-epistemic	SN

In Table 3.5, UN is a new category of Mandarin modals that refers to unspecified necessity modals, which are not specified for a WN or SN interpretation. The intuitive force of each necessity modals will be discussed in detail later in this section, but I will include it in glossing from now on, which makes it easier for readers to identify different Mandarin necessity modals.

I will first provide evidence on the modal type of each necessity modal. The context in (41) is designed to elicit an epistemic necessity reading. *Yinggai*, *yiding*, and *biran* are felicitous in it (as in 41a), while *dei*, *yao*, and *bixu* are not (as in 41b). This indicates that the former have epistemic interpretations but the latter don't.

(41) Context: Your friend lives by himself. You pass by his house and find the light is on.

 a. ta   **yinggai** /   **yiding** /   **biran**   zai jia

  he   WN[13] /   EP-SN /   EP-SN   at home

  'He should / must be at home.'

 b. * ta   **dei** /   **yao** /   **bixu**   zai jia

   he   NONEP-UN /   NONEP-UN /   NONEP-SN   at home.

---

[13] Since *yinggai* is unspecified for epistemic or non-epistemic conversational backgrounds, I will only include its force (weak necessity, written as WN for short) in glossing.

The context in (42) is designed to elicit a deontic (non-epistemic) necessity reading. Since *yiding* and *biran* are infelicitous (as in 42a) while *yinggai*, *dei*, *yao*, and *bixu* are felicitous (as in 42b), it can be concluded that only the latter have deontic interpretations.

(42) Context: In class, the instructor is talking about the rule for handing in assignments.

    a. * nimen   **yiding /**   **biran**   anshi   jiao   zuoye

        you   EP-SN /   EP-SN   on time hand in assignment

    b. nimen   **yinggai /**   **dei /**   **yao /**   **bixu**

       you   WN /   NONEP-UN / NONEP-UN /   NONEP-SN

       anshi   jiao   zuoye

       on time   hand in assignment

       'You should / have to / must hand in the assignment on time.'

The context in (43) is designed to elicit a teleological (non-epistemic) necessity reading. Similar to (42) above, *yiding* and *biran* are infelicitous here (as in 43a) while *yinggai*, *dei*, *yao*, and *bixu* are felicitous (as in 43b). Therefore, only the latter have teleological interpretations.

(43) Context: The homework for this week is writing an essay about *Animal Farm.* In order to finish this assignment, you ...

    a. * ni **yiding / biran**   xian   du   dongwu nongchang.

       you EP-SN /   EP-SN   first   read   animal farm

    b. ni   **yinggai /**   **dei /**   **yao /**   **bixu**

      you   WN /   NONEP-UN / NONEP-UN / NONEP-SN

      xian du   dongwu nongchang.

      first read   animal farm

      'You should / have to read *Animal Farm* first.'

Some conclusions can be drawn from the data above: *yinggai* is ambiguous between an epistemic and a non-epistemic modal interpretation; *yiding* and *biran* are unambiguously epistemic, while *dei*, *yao* and *bixu* are unambiguously non-epistemic.[14] A summary of the modal types of Mandarin necessity modals is shown in Table 3.6 below.

Table 3.6 The modal types of Mandarin necessity modals

Mandarin Modals	Modal Type
yinggai	epistemic
	non-epistemic
yiding	epistemic
biran	
dei	non-epistemic
yao	
bixu	

Now let's look at the intuitive force of these necessity modals. As discussed in Section 2.2, there are two ways of comparing the force differences among necessity modals. One is to apply scalar implicature tests (Horn 1972, Grice 1975, von Fintel & Iatridou 2008), and the other is to compare modals in contexts that are designed to elicit different force interpretations (von Fintel & Iatridou 2008, Rubinstein 2012). Both of these methods will be used in the following discussion.

First of all, the scalar implicature tests show that, among the three modals that can have epistemic interpretations, *yinggai* is weaker than *yiding* and *biran*. In (44), *yinggai* is compatible with the negation of *yiding*/*biran* (as in 44a), and the implicature of *yinggai* can be canceled by *yiding*/*biran* (as in 44c), but not vice versa (as in 44b and 44d). This indicates that *yinggai* has a weaker force than *yiding*/*biran.* This is comparable with the force

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[14] For unambiguous non-epistemic modals, they are usually ambiguous between deontic, teleological and other non-epistemic interpretations. For example, *dei*, *yao* and *bixu* are felicitous in both a deontic context (as in 42) and a teleological context (as in 43).

difference between *should* and *must* in English as discussed in Section 2.2.

(44) a. ta **yinggai** zaijia   dan ye bushi   **yiding / biran**   zaijia

  he WN   at home but also no   EP-SN / EP-SN   at home

  'He should be at home, but is not necessarily at home.'

  b. * ta **yiding / biran**   zaijia,   dan bingbu **yinggai** zaijia

  he EP-SN / EP-SN   at home but not   WN   at home

  c. ta   **yinggai** zaijia,   shijishang,   ta **yiding / biran**   zaijia

  he WN   at home in fact   he EP-SN / EP-SN   at home

  'He should be at home, in fact, he must be at home.'

  d. * ta **yiding / biran**   zaijia,   shijishang,   ta **yinggai** zaijia.

  he EP-SN / EP-SN   at home in fact   he WN   at home

In (45), *yiding* and *biran* are not compatible with the negation of each other (as in 45a, b), and they cannot cancel the implicature of each other (as in 45c, d). This indicates that *yiding* and *biran* probably have the same intuitive force.

(45) a. * ta **yiding** zaijia   dan ye bushi   **biran**   zaijia

  he EP-SN   at home but also no   EP-SN   at home

  b. * ta **biran**   zaijia,   dan bingbu **yiding** zaijia

  he EP-SN   at home but not   EP-SN   at home

  c. * ta **yiding** zaijia,   shijishang,   ta **biran**   zaijia

  he EP-SN   at home in fact   he EP-SN   at home

d. * ta **biran** zaijia, shijishang, ta **yiding** zaijia.

     he EP-SN   at home in fact   he EP-SN   at home

Also, *yinggai* is felicitous in a context designed to elicit a WN reading, as in (46), while *yiding*/*biran* is felicitous in a context for a SN reading (as in 47).

(46) Context: My friend John lives next door to me. His mom (who lives in another city) somehow cannot reach him by phone, so she calls me asking whether John is at home. Since the light in his apartment is on, I think he is at home, but I am not familiar with his mom and not sure whether his mom will agree with this inference. So I say:

    a. ta   **yinggai** zaijia

       he   WN   at home

       'He should be at home.'

    b. * ta   **yiding / biran**   zaijia

       he EP-SN /   EP-SN   at home

(47) Context: My friend John lives next door to me. Our common friend Mary who hangs out a lot with us calls me and ask whether John is at home. Since his car is in the driveway and the light of his house is on, I think he is at home. And I think that if Mary were me, she would make the same inference. So I say:

    a. * ta   **yinggai** zaijia

       he WN   at home

    b. ta   **yiding / biran**   zaijia

       he EP-SN /   EP-SN   at home

       'He must be at home.'

The context in (46) is designed to elicit a WN reading. It involves a stereotypical conditional proposition "if the light is on, then he is at home" in the **secondary** ordering source, which is not committed to (at least) by the speaker because the speaker is not sure whether this stereotypical proposition is accepted by the listener. In contrast, the context in (47) elicits a SN reading. In this context, the proposition "if the light is on and the car is in the driveway, then he is at home" is in the **primary** ordering source, which is fully committed to by the speaker because he thinks that this is reasonable and he is sure that the listener will also accept this proposition.

Based on the evidence provided above, it can be concluded that *yinggai* has a weaker intuitive modal force than *yiding/biran*, which is similar to the force difference between *should* and *must* in English. Therefore, based on the theories of WN and SN modals discussed in Section 2.2, *yiding* and *biran* can be categorized as SN modals, which only take a primary ordering source that relies on collectively committed information, while *yinggai* can be categorized as a WN modal, which takes an additional secondary ordering source that relies on non-collectively committed information.

For the four Mandarin modals that can have non-epistemic interpretations (namely, *yinggai, dei, yao* and *bixu*), however, the force differences between them are more complicated. First of all, the scalar implicature test shows an obvious force difference between *yinggai* and *bixu*, as illustrated in (48).

(48) a. ni   **yinggai** xipanzi,   dan bingbushi   **bixu**   zhemezuo

you WN   wash dish   but no   NONEP-SN   do so

'You should do the dishes, but you don't have to.'

b. * ni   **bixu**   xipanzi,   dan ye bushi   **yinggai** zhemezuo

you   NONEP-SN   wash dish   but also no   WN   do so

c. ni **yinggai** xipanzi, shijishang ni **bixu** zhemezuo

you WN wash dish in fact you NONEP-SN do so

'You should do the dishes, in fact you have to.'

d. * ni **bixu** xipanzi, shijishang ni **yinggai** zhemezuo

you NONEP-SN wash dish in fact you WN do so

As shown in (48), *yinggai* clearly has a weaker force than *bixu*, but not vice versa. This is similar to the force difference between *yinggai* and *yiding*/*biran*, which indicates that *yinggai* is a WN modal while *bixu* is a SN modal.

However, this scalar implicature test cannot show a clear force difference between *yinggai* and *dei*/*yao*. The unacceptability of (49b) and (49d) below indicates that the force of *dei*/*yao* is not weaker than *yinggai*. However, since the acceptability of (49a) and (49c) is questionable, it is not clear whether *yinggai* is weaker than *dei*/*yao*. At this point, it can only be concluded that *dei*/*yao* is at least as strong as *yinggai*.

(49) a. ?? ni **yinggai** xipanzi, dan bingbushi **dei** / **yao** zhemezuo

you WN wash dish but no NONEP-UN / NONEP-UN do so

'You should do the dishes, but you don't have to.'

b. * ni **dei** / **yao** xipanzi, dan ye bushi **yinggai** zhemezuo

you NONEP-UN / NONEP-UN wash dish but also no WN do so

c. ?? ni **yinggai** xipanzi, shijishang ni **dei** / **yao** zhemezuo

you WN wash dish in fact you NONEP-UN / NONEP-UN do so

'You should do the dishes, in fact you have to.'

d. * ni **dei** / **yao** xipanzi, shijishang ni **yinggai** zhemezuo

    you NONEP-UN / NONEP-UN wash dish in fact you WN do so

Similarly, the force difference between *dei*/*yao* and *bixu* is not very clear based on the scalar implicature test. Since (50a) and (50c) below are unacceptable, it can be concluded that the force of *dei*/*yao* is not stronger than *bixu*. However, it is not clear whether *bixu* is stronger than *dei*/*yao* because (50b) and (50d) are questionable. This implicature test only shows that *dei*/*yao* is at most as strong as *bixu*.

(50) a. * ni **bixu** xipanzi, dan bingbushi **dei** / **yao** zhemezuo

    you NONEP-SN wash dish but no NONEP-UN / NONEP-UN do so

b. ?? ni **dei** / **yao** xipanzi, dan ye bushi **bixu** zhemezuo

    you NONEP-UN / NONEP-UN wash dish but also no NONEP-SN do so

    'You have to do the dishes, but not necessary.'

c. * ni **bixu** xipanzi, shijishang ni **dei** / **yao** zhemezuo

    you NONEP-SN wash dish in fact you NONEP-UN / NONEP-UN do so

d. ?? ni **dei** / **yao** xipanzi, shijishang ni **bixu** zhemezuo

    you NONEP-UN / NONEP-UN wash dish in fact you NONEP-SN do so

    'You have to do the dishes, in fact, you must do so.'

In (51), *dei* and *yao* are not compatible with the negation of each other (as in 51a, b), and they cannot cancel the implicature of each other (as in 51c, d). This indicates that *dei* and *yao* may have the same intuitive force.

(51) a. * ni **dei** xipanzi, dan bingbushi **yao** zhemezuo

you NONEP-UN wash dish but no NONEP-UN do so

b. * ni **yao** xipanzi, dan ye bushi **dei** zhemezuo

you NONEP-UN wash dish but also no NONEP-UN do so

c. * ni **dei** xipanzi, shijishang ni **yao** zhemezuo

you NONEP-UN wash dish in fact you NONEP-UN do so

d. * ni **yao** xipanzi, shijishang ni **dei** zhemezuo

you NONEP-UN wash dish in fact you NONEP-UN do so

According to the scalar implicature tests applied above, *yinggai* is weaker than *bixu*, while *dei*/*yao* is not weaker than *yinggai* and not stronger than *bixu*. More evidence about their force differences will be provided by applying the context elicitation tests. Consider the WN context in (52).

(52) You are a member of the staff in a theatre. There are three doors to that theatre: the front door, the back door, and the side door. During a show, only the back door and the side door are open. A customer is late for the show, and asks you how to get into the theatre. You two are closer to the side door than to the back door. You think it is better to take the shorter route, although you are not sure whether the customer agrees with this. So you answer

a. ni **yinggai** zou cemen

you WN go side door

'You should go to the side door.'

b. ni **dei** / **yao** zou cemen

you NONEP-UN / NONEP-UN go side door

'You have to go to the side door.'

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c. * ni **bixu** zou cemen

   you NONEP-SN go side door

The context in (52) above is designed to elicit a teleological WN reading. In this context, "the customer gets into the theatre" is included in the primary ordering source and "the customer takes the shorter route" is included in the secondary ordering source, because the former is fully committed to by the speaker while the latter is not. As shown above, the WN modal *yinggai* in (52a) and the UN modals *dei* and *yao* in (52b) are felicitous, while the SN modal *bixu* is too strong for the context. Although both *yinggai* and *dei/yao* are felicitous, the former is more acceptable than the latter.

Now consider the SN context in (53).

(53) Your family has a history of diabetes. Since you are a bit over-weight, losing weight is the first step to prevent this disease. Your mom is sure that you would do anything to prevent from being sick, so she says: in order to prevent diabetes, you...

   a. * ni **yinggai** jianfei

      you WN lose weight

   b. ni **dei** / **yao** jianfei

      you NONEP-UN / NONEP-UN lose weight

      'You have to lose weight.'

   c. ni **bixu** jianfei

      you NONEP-UN lose weight

      'You must lose weight.'

The context in (53) is designed for a teleological SN reading, where "you prevent diabetes"

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is collectively committed to, and therefore included in the primary ordering source. The UN modals *dei/yao* in (53b) and the SN modal *bixu* in (53c) are felicitous, but the WN modal *yinggai* in (53a) is too weak here. Similarly, the UN modals *dei/yao* are less acceptable than the SN modal *bixu*, although they are both felicitous.

In conclusion, among the four Mandarin necessity modals that can have non-epistemic interpretations, *yinggai* can be treated as a WN modal while *bixu* is a SN modal. The intuitive force of *dei/yao* is not weaker than *yinggai* and not stronger than *bixu*. Also, *dei* and *yao* are felicitous in the context where either *yinggai* or *bixu* is felicitous, but they are less acceptable than them in such a context.

In this thesis, I will assume that there is no gap between the intuitive force of the WN modal *yinggai* and the SN modal *bixu* on the force scale of necessity modals, as shown in Figure 3.1 below. There are two reasons why I make this assumption: i) although it is theoretically plausible, there is no existing literature mentioning that there might be a force gap between a SN modal and a WN modal in a certain language; ii) this assumption could simplify the analysis of unspecified modals later in this section and the analysis of Mandarin modal concord discussed in Chapter 4 and 5.

Figure 3.1: The force scale of Mandarin necessity modals.
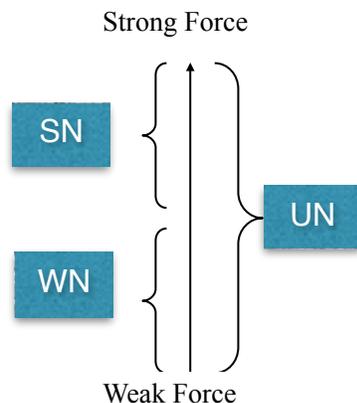
According to the observations above, I propose that the force of *dei/yao* is unspecified between the WN modal *yinggai* and the SN modal *bixu*. In a WN context, it will be interpreted as a WN modal; in a SN context, it will have a SN interpretation.

This explains that the force of *dei* and *yao* are not weaker than *yinggai* and not stronger than *bixu*, and that *dei* and *yao* are felicitous in the contexts where either *yinggai* or *bixu* is felicitous. This also explains why *dei* and *yao* are less acceptable than the WN modal *yinggai* in a WN context and less acceptable than the SN modal *bixu* in a SN context, because plausibly native speakers tend to use a specified modal rather than an unspecified one in a context designed for a certain reading.

Following this proposal, we need to further investigate the function of *dei/yao* in Mandarin. If Mandarin already has the WN modal *yinggai* and the SN modal *bixu*, why does it need the UN modal *dei* and *yao*? Is there a context where only *dei/yao* is felicitous? Based on some preliminary observations, I conjecture that *dei/yao* might have some pragmatic significance in Mandarin. In this thesis, these problems won't be discussed in detail, and I will leave this issue for future research.

According to Rubinstein's theory of WN and SN modals discussed in Section 2.2, a primary ordering source relies on information that is collectively committed to by the interlocutors, and a secondary ordering source relies on information that is not collectively committed to. A SN modal always takes a non-empty primary ordering source and an empty secondary ordering source, while a WN modal always takes a non-empty secondary ordering source and an optionally-empty primary ordering source. This is repeated in Table 3.7 below. Since the UN modal *dei* and *yao* are unspecified between a WN and a SN interpretation, they can be defined as modals that take an optionally-empty primary ordering source and an optionally-empty secondary ordering source, but those two ordering sources cannot be both

empty at the same time.[15] When its secondary ordering source is empty, *dei/yao* resembles the SN modal *bixu* in that it only includes collectively committed information in its ordering source; when its secondary ordering source is not empty, *dei/yao* resembles the WN modal *yinggai* in that it can include only non-collectively committed information, or both collectively committed and non-collectively committed information in its ordering source. A summary of the ordering sources taken by these four modals is given in Table 3.7 below.

Table 3.7 The ordering sources of Mandarin non-epistemic necessity modals

Modals	Primary Ordering Source (collectively committed information)	Secondary Ordering Source (non-collectively committed information)
WN *yinggai*	empty OR non-empty	non-empty
UN *dei/yao*	empty OR non-empty	empty OR non-empty
SN *bixu*	non-empty	empty

Table 3.8 below summarizes the modal type and the modal force of each Mandarin necessity modal. Note that there is no frequently-used epistemic UN modal in Mandarin, which may also relate to the function of UN modals in Mandarin. I will leave this for future research.

Table 3.8 The type and force of Mandarin necessity modals

Mandarin Modals	Modal Type	Intuitive Force
yinggai	epistemic	WN
	non-epistemic	
yiding	epistemic	SN
biran		
dei	non-epistemic	UN
yao		
bixu		SN

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[15] Since a UN modal is unspecified between a WN and a SN modal interpretation, it doesn't allow for both ordering sources to be empty, because this option will lead to neither a WN nor a SN modal interpretation.

Detailed formal definitions of the semantics of Mandarin necessity modals are provided in (54), adapted from the definitions of WN and SN modals in von Fintel & Iatridou (2008).

(54) **Definition of Mandarin necessity modals**

   a. For the SN modals, *yiding* / *biran* / *bixu p* is true in a world *w* with respect to a modal base *f* and a (primary) ordering source *g* iff the following conditions are satisfied:

     For all $v \in max_{g(w)}(f(w))$, $[[p]]^v = 1$.

   b. For the WN modal, *yinggai p* is true in a world *w* with respect to a modal base *f*, a primary ordering source g_1 and a secondary ordering source g_2 iff the following conditions are satisfied:

     For all $v \in max_{g2(w)}(max_{g1(w)}(f(w)))$, $[[p]]^v = 1$.

   c. For the UN modals, *dei* / *yao p* is true in a world *w* with respect to a modal base *f*, a primary ordering source g_1 and a secondary ordering source g_2 iff the following conditions are satisfied:

     if $g_1(w)=\varnothing$, for all $v \in max_{g2(w)}(f(w))$, $[[p]]^v = 1$;

     if $g_2(w)=\varnothing$, for all $v \in max_{g1(w)}(f(w))$, $[[p]]^v = 1$;

     otherwise, for all $v \in max_{g2(w)}(max_{g1(w)}(f(w)))$, $[[p]]^v = 1$ [16]

3.4 Syntactic Categories of Mandarin Modals

According to Huitink's (2008) approach, the syntactic categories of modals might be related with the analysis of modal concord: in a double-modal combination where a concord reading is available, the role each modal plays may depend on its syntactic category. For example, the modal adverb *possibly* and the modal verb *may* in (55) merge into a single possibility

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[16] $g_1(w)$ and $g_2(w)$ cannot both be empty set at the same time.

reading.

(55) **Possibly** this gazebo **may** have been built by Sir Christopher Wren.

Concord reading: "Maybe this gazebo was built by Sir Christopher Wren."

Huitink (2008) analyses the modal verb *may* as a real modal but the modal adverb *possibly* as a semantically vacuous item. Therefore, the possibility concord reading is only derived from the modal verb. Further details of this approach will be discussed in Section 5.2.

Since syntactic categories might be relevant for the phenomenon of modal concord, in this section, I will provide evidence on the syntactic categories of Mandarin modals under investigation (repeated as in Table 3.9 below). Also, I will give a preview of some data showing that syntactic categories are actually irrelevant in Mandarin modal concord.

Table 3.9: Mandarin Modal Words

Mandarin Modals	Modal Type	Quantificational Force	Syntactic Category
yinggai	epistemic non-epistemic	necessity	Verb
yiding	epistemic	necessity	Verb
biran	epistemic	necessity	Adverb
keneng	epistemic	possibility	Verb
yexu	epistemic	possibility	Adverb
dei	non-epistemic	necessity	Verb
yao	non-epistemic	necessity	Verb
bixu	non-epistemic	necessity	Verb
keyi	non-epistemic	possibility	Verb
neng	non-epistemic	possibility	Verb

Unlike English, where a modal adverb usually has a *–ly* suffix while a modal verb doesn't, there is no obvious morphological cue differentiating a modal adverb from a modal verb in Mandarin. Huang (2010) and Wu (2010) propose three major criteria regarding the

differences between them.

The first criterion is that a modal verb can be directly negated by the negative adverb *bu* ("not") or *fei* ("improperly"), but a modal adverb cannot. Consider the examples in (56).

(56) a. ta **bu keneng** / ***yexu** xiazhou   lai   Beijing

      He not EP-POSS / EP-POSS next week   come   Beijing

      'It is not possible that he will come to Beijing next week.'

   b. ta **bu yiding** / ***biran** xiazhou   lai   Beijing

      He not EP-NEC / EP-NEC next week   come   Beijing

      'It is not necessary that he will come to Beijing next week.'

Both *keneng* and *yexu* are epistemic possibility modals, as shown in (56a). *Keneng* can be negated by the negative adverb *bu*, while *yexu* cannot. The same applies to epistemic necessity modals *yiding* and *biran* in (56b). This indicates that *keneng* and *yiding are* modal verbs, while *yexu* and *biran* are modal adverbs.

Secondly, modal verbs can be modified by degree words such as *hen* ("very"), *geng* ("even more") and *feichang* ("very"), but modal adverbs cannot. For instance, in (57), the modal verb *keneng* can be modified by the intensifier *hen*, while the modal adverb *yexu* cannot.

(57) ta **hen**   **keneng** /   ***yexu** xiazhou   lai   Beijing

   he very   EP-POSS /   EP-POSS next week   come   Beijing

   'It is very possible that he will come to Beijing next week.'

For this criterion, Huang (2010) and Wu (2010) didn't provide data demonstrating the epistemic necessity modal *biran* is a modal adverb, probably because it is semantically impossible to modify a necessity modal with a degree word.

The last criterion proposed by Huang (2010) and Wu (2010) is that a modal verb can appear alone as a reply to a question, while a modal adverb cannot. The data they provide is shown in (58).

(58) A: wo **keyi** / **neng** jinlai ma?

       I   NONEP-POSS / NONEP-POSS   come in Q-particle

       'Can I come in?'

   B: **keyi** / **neng**

       NONEP-POSS / NONEP-POSS

       'Yes, you can.'

For this criterion, the authors didn't provide negative data showing that a modal adverb cannot be used alone as a reply. To summarize these three criteria differentiating a modal verb from a modal adverb, the first one is the major criterion, while the other two are relatively minor.

Now I will provide a preview of data showing that syntactic categories are irrelevant in Mandarin modal concord, which is different from Huitink's proposal. More detail will be provided in Chapter 5.

Huitink (2008) shows that in Dutch and English, a concord reading is available between a modal verb and a modal adverb when they have the same modal base and the same quantificational force, as cited in (59).

(59) a. Het **kan** **misschien** gaan regenen

       it   EP-POSS EP-POSS go   rain

       'It might rain.'

b. **Possibly** this gazebo **may** have been built by Sir Christopher Wren.

   'Maybe this gazebo was built by Sir Christopher Wren.'

In (59a), *kan* is a modal verb and *misschien* a modal adverb. A epistemic possibility reading is available between them. The same applies to the English modal verb *may* and the modal adverb *possibly* in (59b). Therefore, Huitink concludes that a concord reading can be available between a modal verb and a modal adverb. She analyzes the modal verb as the real modal word, while the modal adverb is just a semantically vacuous item. But Huitink didn't provide any data on whether a concord reading is available between two modal verbs or between two modal adverbs. In Mandarin, syntactic categories are not crucial in modal concord. A concord reading is available between two modal verbs (in 60a), between two modal adverbs (in 60b), or between a modal verb and a modal adverb (in 60c).

(60) a. ta   **bixu**   **dei**   anshi   huijia

   he   NONEP-NEC   NONEP-NEC   on time   return home

   'He has to return home on time.'

b. ta   **yexu**   **meizhuner**   zaijia

   he   EP-POSS   EP-POSS   at home

   'He is possibly at home.'

c. ta   **yexu**   **keneng**   zaijia

   he   EP-POSS   EP-POSS   at home

   'He is possibly at home.'

In (60a), both *bixu* and *dei* are modal verbs, and a non-epistemic necessity concord reading is available between them. In (60b), *yexu* is a modal adverb and *keneng* is a modal verb. An epistemic possibility concord reading is available here. In (60c), both the two modal words are adverbs, and an epistemic possibility concord reading is available between them. We can

see that in Mandarin, a concord reading is available, regardless of the syntactic categories of modals. Therefore, I propose that syntactic category is not relevant for Mandarin modal concord.

Chapter 4

Modal Concord in Mandarin

Recall from Chapter 1 the definition of a cumulative reading and a concord reading. A cumulative reading means that the two modals are semantically independent of each other, as illustrated in (61a). The other is a concord reading: the two modals somehow "fuse" to just a single modal meaning, as illustrated in (61b).

(61) a. ta   **yexu**   **keyi**   jinlai

       he   EP-POSS   NONEP-POSS   come in

       'Maybe he is allowed to come in.'

    b. ta   **yexu**   **keneng**   zaijia

       he   EP-POSS   EP-POSS   at home

       'Maybe he is at home.'

This chapter will investigate when a concord reading is available and when a cumulative reading is available in a Mandarin double-modal combination. Section 4.2 will look at combinations of a possibility modal and a necessity modal. Section 4.3 investigate combinations of two possibility modals and combinations of two necessity modals respectively. Before showing data on Mandarin modal concord, it is important to define what is a Mandarin double modal combination and discuss the restrictions of modal ordering in Section 4.1.

4.1 Double modal combinations in Mandarin

Mandarin allows two or more modal words stacking in a row, as shown in (62) below (Lin 2006). Lin (2006) observes that sentences with two modals are very common, while sentences with three or more modals are much rarer. Basically, the acceptability of multiple-

modal structure decreases as the number of modals increases.

(62) a. Zhangsan   **keneng**   lai.   (1 modal)

    Zhangsan   EP-POSS   come

    'Zhangsan is likely to come.'

  b. Zhangsan   **keneng hui**   lai.   (2 modals)

    Zhangsan   EP-POSS   FUT[17]   come

    'Zhangsan is likely to come.'

  c. Zhangsan   **keneng hui nenggou**   lai.   (3 modals)

    Zhangsan   EP-POSS   FUT   NONEP-POSS   come

    'It is likely that Zhangsan will be able to come.'

  d. Zhangsan   **yinggai keneng hui nenggou**   lai.   (4 modals)

    Zhangsan   WN   EP-POSS   FUT   NONEP-POSS   come

    'It should be the case that Zhangsan will be able to come.'

Since sentences with three or more modals are rare, for simplicity, this thesis will only investigate the situations where there are only two modal words stacking in a sentence, which are defined as double-modal combinations.

Heish (2005), Lin (2006) and Huang (2010) formulate two basic ordering restrictions on Mandarin modal stacking. One is that an epistemic modal usually precedes a non-epistemic modal. This is illustrated in (63), where the epistemic modal *keneng* precedes the non-epistemic modal *keyi*, but not vice versa.

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[17] According to Lin (2006), *hui* is used as a modal expressing the future tense in Mandarin.

(63) a. Zhangsan   **keneng keyi**   lai.

     Zhangsan   EP-POSS   NONEP-POSS   come

     'It is likely that Zhangsan is permitted to come.'

     b.* Zhangsan   **keyi**   **keneng**   lai.

       Zhangsan   NONEP-POSS   EP-POSS   come

The second restriction is that a necessity modal usually precedes a possibility modal. In (64), the necessity modal y*iding* precedes the possibility modal *keneng*, but not vice versa.

(64) a. Zhangsan   **yiding**   **keneng**   lai.

     Zhangsan   EP-NEC   EP-POSS   come

     'It must be the case that Zhangsan is likely to come.'

     b.# Zhangsan   **keneng**   **yiding**   lai.

     Zhangsan   EP-POSS   EP-NEC   come

In Mandarin, except for the above two restrictions, there are no other obvious restrictions on modal ordering, no matter whether the sentence has a cumulative reading or a concord reading. Both (63) and (64) have a cumulative reading. Now consider the examples of a concord reading in (65).

(65) a.   ta   **keneng**   **yexu**   zaijia

     he   EP-POSS   EP-POSS   at home

     'Maybe he is at home.'

b. ta **yexu** **keneng** zaijia

   he EP-POSS   EP-POSS   at home

   'Maybe he is at home.'

Since both *keneng* and *yexu* are epistemic possibility modals, the two orderings in (65) are both grammatical, and they have the same concord reading. It will be shown in the rest of this chapter that a concord reading is only available when the two modals are of the same modal type and the same quantificational force. If that is the case, then the modal ordering in a concord reading will never violate the above two restrictions. Therefore, to avoid repetition, I will provide the concord data in only one modal order. The readers may assume that the reverse order is also grammatical and semantically the same.

4.2 The combination of a possibility modal and a necessity modal

In this section, I will look at the available readings for the combination of a necessity modal and a possibility modal, and conclude that only a cumulative reading is available in such cases. Table 4.1 below is a list of the most frequently used necessity and possibility modals of both epistemic and non-epistemic modal types. This section will investigate the combination between a necessity modal and a possibility modal.

Table 4.1 A list of necessity and possibility modals

	Modal Type	Quantificational Force
yiding	epistemic	Necessity
bixu	non-epistemic	Necessity
keneng	epistemic	Possibility
keyi	non-epistemic	Possibility

First consider the necessity-possibility modal combination of two epistemic modals: *yiding*

keneng.[18] It is felicitous in a context designed to elicit a cumulative reading, as illustrated in (66) below.

(66) Context: Your friend is a detective. These days he is working on a murder case, and after a very close investigation, he says that it is possible that Zhangsan is the murderer. Based on what I know about my friend, he won't say anything until he is 100% sure about it. What he said must be true. Therefore, it must be true that Zhangsan is possibly the murderer.

    Zhangsan   **yiding** **keneng** shi xiongshou

    Zhangsan   EP-NEC   EP-POSS be murder

    'It must be the case that Zhangsan is possibly the murderer.'

In (66), *yiding* is an epistemic necessity modal, and its evidence is based on what I know about my friend; *keneng* is an epistemic possibility modal, and its evidence is based on my friend's investigation. This shows that a cumulative reading is available in the combination of a necessity modal and a possibility modal.

However, the *yiding keneng* combination is not felicitous in a context designed to elicit a modal concord reading. Consider the data in (67) and (68).

(67) Context: Your roommate just came back from outside and his coat is all wet. So you think it must be raining outside.

  a. waimian **yiding** zai   xiayu

     outside   EP-NEC PROG   rain

     'It must be raining outside.'

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[18] As mentioned in Chapter 3, a necessity modal usually precedes a possibility modal. In this case, therefore, I will only investigate the combination *yiding keneng*, but not the reverse order. The same applies to other necessity-possibility modal combination below.

b. * waimian   **yiding** **keneng** zai   xiayu

   outside   EP-NEC   EP-POSS   PROG   rain

(68) Context: You pass by your friend's house and notice the light is on. You know that both he and his wife live there. If the light is on, then it is possible (not certain) that he is at home.

   a. ta   **keneng** zaijia

      he   EP-POSS   at home

      'He may be at home.'

   b. * ta   **yiding** **keneng** zaijia

      he   EP-NEC   EP-POSS   at home

The contexts in (67) and (68) are designed to elicit an epistemic necessity reading and an epistemic possibility reading respectively. The epistemic necessity modal *yiding* is felicitous in (67) and the epistemic possibility modal *keneng* is felicitous in (68). However, the combination *yiding keneng* is infelicitous in both of these contexts. This indicates that no necessity or possibility concord reading is available in *yiding keneng*.

The necessity-possibility modal combination above only involves epistemic modals. Now consider the combination of two non-epistemic modals: *bixu keyi*. This combination is felicitous in a context designed for a cumulative reading, as shown in (69).

(69) Context: You are working in the administration office of a company. According to the rules of your office, you are allowed to leave before 5pm if you have finished your work. According to the rules of the company, the rules of each office must be obeyed. Therefore, it must be the case that you can leave before 5pm.

   ni **bixu**   **keyi**   zai wudian   qian   likai

   you NONEP-NEC   NONEP-POSS   at 5 o'clock   before   leave

   'It must be the case that you can leave before 5 o'clock.'

In (69), *bixu* is a deontic necessity modal, whose ordering source is based on the rules of the company; *keyi* is a deontic possibility modal, whose ordering source is based on the rules of the office. This piece of data shows that a cumulative reading is available in the combination of a non-epistemic necessity modal and a non-epistemic possibility modal.

Similar to y*iding keneng*, the *bixu keyi* combination is not felicitous in a context designed for a single modal reading, as illustrated in (70) and (71) below.

(70) Context: The instructor is talking about the course policy of handing in assignments on time.

    a.   meigeren   **bixu**   anshi   jiaozuoye

        everyone   NONEP-NEC   on time hand in assignment

        'Everyone must hand in their assignments on time.'

    b. * meigeren   **bixu**   **keyi**   anshi   jiaozuoye

        everyone   NONEP-NEC   NONEP-POSS   on time hand in assignment

(71) Context: Your roommate is knocking on your door and you are giving him permission to come in.

    a.   ni **keyi**   jinlai

        you NONEP-POSS   come in

        'You can come in.'

    b. * ni **bixu**   **keyi**   jinlai

        you NONEP-NEC   NONEP-POSS   come in

The contexts in (70) and (71) are designed to elicit a deontic necessity reading and a deontic possibility reading respectively. The deontic necessity modal *bixu* is felicitous in (70a) and

the deontic possibility modal *keyi* is felicitous in (71a), while the combination *bixu keyi* is infelicitous in both of them. This indicates that no necessity or possibility concord reading is available in *bixu keyi*.

Last but not the least, we will look at a necessity-possibility modal combination of an epistemic modal and a non-epistemic modal: *yiding keyi*. This combination is felicitous in a context for a cumulative reading, as shown in (72).

(72) Context: Your friend is working hard on a final exam. Based on your observation, you are commenting on whether he can pass the exam.

    ta **yiding** **keyi**   tongguo   kaoshi

    he <small>EP-NEC</small>   <small>NONEP-POSS</small> pass   exam

    'It is for sure that he can pass the exam.'

In this case, *yiding* is an epistemic necessity modal, and its evidence is based on your observation that he is working hard. *Keyi* is a non-epistemic possibility modal expressing the ability of doing something. This data shows that a cumulative reading is available in *yiding keyi*.

However, no modal concord reading is available in this combination. Consider the context in (73) and (74), repeated from (67) and (71) above.

(73) Context: Your roommate just came back from outside and his coat is all wet. So you think it must be raining outside.

    a. waimian **yiding** zai   xiayu

       outside   <small>EP-NEC</small> <small>PROG</small>   rain

       'It must be raining outside.'

b. * waimian   **yiding keyi**   zai   xiayu

    outside   EP-NEC   NONEP-POSS   PROG   rain

(74) Context: Your roommate is knocking on your door and you are giving him permission to come in.

a.   ni   **keyi**   jinlai

     you NONEP-POSS   come in

     'You can come in.'

b. * ni   **yiding keyi**   jinlai

     you EP-NEC   NONEP-POSS   come in

The contexts in (73) and (74) are designed to elicit an epistemic necessity reading and a non-epistemic possibility reading respectively. The epistemic necessity modal *yiding* is felicitous in (73) and the non-epistemic possibility modal *keyi* is felicitous in (74). However, the combination *yiding keyi* is infelicitous in both of these contexts. This indicates that no concord reading is available for *yiding keneng*.

In conclusion, this section has investigated the available readings of necessity-possibility modal combinations: when a double-modal combination consists of a necessity modal and a possibility modal, it is not felicitous in a context designed for a modal concord interpretation, even if the two modals are of the same modal type (both epistemic or both non-epistemic). These combinations, however, are felicitous in a context designed for a cumulative interpretation. Therefore, we can make the generalization that a cumulative reading but no concord reading is available when the two modals differ in quantificational force.

4.3 The combination of two possibility modals

In this section, I will look at combinations of two possibility modals, and conclude that a concord reading is available and preferred when the two possibility modals are of the same modal type. Table 4.2 is a list of the most frequently used possibility modals under investigation in this section.

Table 4.2 A list of possibility modals

Mandarin Modals	Modal Type	Quantificational Force
keneng	epistemic	possibility
yexu	epistemic	possibility
keyi	non-epistemic	possibility
neng	non-epistemic	possibility

First we will look at the combination of two possibility modals that have different modal types, for example, the combination *keneng keyi*[19]. This combination is felicitous in a context designed to elicit a cumulative reading, as illustrated in (75) below.

(75) Context: After submitting a term paper, some instructors still allow further revision but some don't. It is possible for an instructor to allow further revision.

ni	**keneng**	**keyi**	jixu	xiugai	lunwen
you	EP-POSS	NONEP-POSS	continue	revise	paper

'It is possible that you can continue to revise the paper.'

In (75), the epistemic modal *keneng* is based on the knowledge that some instructors allow revision but some don't, while the non-epistemic modal *keyi* expresses whether revision is allowed under certain circumstances. This example shows that the combination *keneng keyi* has a cumulative reading.

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[19] As mentioned in Chapter 3, an epistemic modal usually precedes a non-epistemic modal. In this case, therefore, I will only investigate the combination *keneng keyi*, but not the reverse order.

This combination, however, is not felicitous in a context designed for a single modal reading. Consider the data in (76) and (77).

(76) Context: You pass by your friend's house and notice that the light is on. You know that both he and his wife live there. If the light is on, then it is possible that he is at home.

    a.   ta   **keneng**   zaijia

        he   EP-POSS   at home

        'He may be at home.'

    b.* ta   **keneng keyi**   zaijia

        he   EP-POSS   NONEP-POSS   at home

(77) Context: A mom is talking with her son about when he is allowed to play soccer.

    a.   zhiyao ni bazuoyexiewan   le, ni jiu **keyi**   tiqiu

        if   you finish assignment   PERF you then NONEP-POSS play soccer

        'If you have finished your assignment, then you can play soccer.'

    b.* zhiyao ni bazuoyexiewan le, ni   jiu **keneng keyi**   tiqiu

        if   you finish assignment PERF you then EP-POSS NONEP-POSS play soccer

The context in (76) is designed to elicit an epistemic possibility interpretation. The epistemic possibility modal *keneng* is felicitous, as illustrated in (76a), but the combination *keneng keyi* is infelicitous, as illustrated in (76b). This indicates that no epistemic concord reading is available for this modal combination. Similarly, the context in (77) is designed for a non-epistemic possibility reading. The non-epistemic possibility modal *keyi* is felicitous, while the combination *keneng keyi* is infelicitous. This indicates that no non-epistemic concord reading is available. Based on the data from (75) to (77), it can be concluded that with two possibility modals which differ in modal type, only a cumulative reading but no concord

reading is available.

Now let's turn to the combination of two possibility modals that both have an epistemic modal type, for example, the combination *yexu keneng*. Consider the context in (78) below, repeated from (76).

(78) Context: You pass by your friend's house and notice that the light is on. You know that both he and his wife live there. If the light is on, then it is possible that he is at home.

    a.   ta **yexu**   /   **keneng** zaijia

        he EP-POSS /   EP-POSS at home

        'He may be at home.'

    b.   ta **yexu**   **keneng** zaijia

        he EP-POSS EP-POSS at home

        'He may be at home.'

In this case, the context is designed for a single epistemic possibility reading. The epistemic possibility modal *yexu* and *keneng* are felicitous, as shown in (78a). In (78b), the combination *yexu keneng* is also felicitous, which indicates an epistemic possibility concord reading is available here. This combination may still have a cumulative reading in certain context, but it is marginal. As mentioned in Section 4.1, when a concord reading is available, the order of modals doesn't affect the availability of the concord reading. To avoid repetition, I won't provide data of the reverse order.

Last but not the least, we will look at the combination of two possibility modals that both have a non-epistemic modal type, for example, the combination *neng keyi*. Consider the data in (79) below, repeated from (77).

(79) Context: A mom is talking with her son about when he is allowed to play soccer.

  a. zhiyao ni   bazuoyexiewan le,   ni   jiu **neng**   / **keyi**   tiqiu

      if   you   finish assignment PERF you then NONEP-POSS/ NONEP-POSS play soccer

      'If you have finished your assignment, then you can play soccer.'

  b. zhiyao ni   bazuoyexiewan le,   ni   jiu **neng**   **keyi**   tiqiu

      if   you   finish assignment PERF you then NONEP-POSS NONEP-POSS play soccer

      'If you have finished your assignment, then you can play soccer.'

The context in (79) is designed to elicit a deontic possibility interpretation. The deontic possibility modals *keyi* and *neng* are both felicitous in this context, as illustrated in (79a). Their combination *neng keyi* is also felicitous, shown in (79b). This shows that *neng keyi* has a deontic possibility concord interpretation. Similar as *yexu keneng* in (78b), the cumulative reading of *neng keyi* is also marginal, and the concord reading is generally preferred.


Based on the data above, it can be concluded that for a combination of two possibility modals, only a cumulative reading but no concord reading is available when they differ in modal types (as in 75, 76 and 77). A concord reading is available when the two possibility modals are of the same modal type (both epistemic or both non-epistemic), as shown in (78) and (79). Recall the conclusion in Section 4.1 that a cumulative reading but no concord reading is available when the two modals differ in quantificational force. At this point, we can state the generalization that a concord reading is only available when the two modals have the same modal type (both epistemic or non-epistemic) and the same quantificational force (both possibility). In the next section, we will see whether this generalization also applies to the combination of two necessity modals.

4.4 The combination of two necessity modals

In this section, I will investigate the double modal combination of two necessity modals, and make a final generalization about the availability of concord readings.

Recall from Section 3.3 that there are three types of necessity modals: WN (weak necessity) modals, SN (strong necessity) modals and UN (unspecified necessity) modals. A WN modal has a weaker intuitive force than a SN modal, although they are both necessity modals. A UN modal is not lexically-specified between WN and SN intuitive force: it could be felicitous under both WN and SN contexts. This is indicated by Figure 4.1 below, adapted from Figure 3.1 in Chapter 3.

Figure 4.1 The force scale of Mandarin necessity modals.
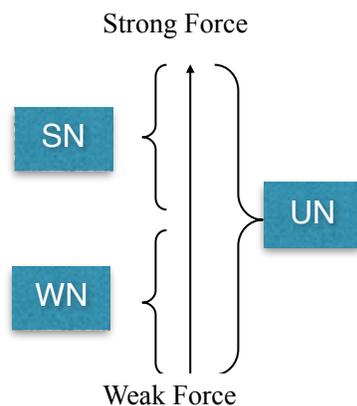
intel & Iatridou (2008) and Rubinstein (2012), I have proposed an analysis N, SN and UN modals, as shown in Table 4.3, adapted from Table 3.7 in Chapter 3.

Table 4.3 The ordering sources of Mandarin necessity modals

Modals	Primary Ordering Source (collectively committed information)	Secondary Ordering Source (non-collectively committed information)
WN	empty OR non-empty	non-empty
UN	empty OR non-empty	empty OR non-empty
SN	non-empty	empty

Table 4.4 is a list of the most frequently used Mandarin necessity modals (adapted from Table 3.8). Among these modals, *yinggai* is the only WN modal in Mandarin, and it is not specified between an epistemic and a non-epistemic interpretation. *Dei* and *yao* are the only UN modals I found in Mandarin. They are both non-epistemic modals. At this point, I assume there are no epistemic UN modals in Mandarin.

Table 4.4 The type and force of Mandarin necessity modals

Mandarin Modals	Modal Type	Intuitive Force	Quantificational Force
yinggai	epistemic	WN	Necessity
	non-epistemic		
yiding	epistemic	SN	
biran			
dei	non-epistemic	UN	
yao			
wubi		SN	
bixu			

After reviewing the necessity modal system in Mandarin, let's look at data involving necessity modal combinations. First consider the combinations of two necessity modals that both have SN intuitive force: *biran yiding* (two epistemic modals), *bixu wubi* (two non-epistemic modals) and *yiding bixu* (an epistemic modal and a non-epistemic modal).

(80) Context: My friend lives next door to me. His mom (who lives in another city)

somehow cannot reach him by phone, so she calls me asking whether he is at home. I see the light in my friend's apartment is on, and I hear his voice. So I say:

a. ta **biran** / **yiding** / ***bixu*** / ***wubi*** zaijia

    he EP-SN / EP-SN / NONEP-SN / NONEP-SN at home

    'He must be at home.'

b. ta **biran** **yiding** zaijia

    he EP-SN EP-SN at home

    'He must be at home.'

c.* ta **bixu** *wubi* zaijia

    he NONEP-SN NONEP-SN at home

d.* ta **yiding** ***bixu*** zaijia

    he EP-SN NONEP-SN at home

The context in (80) is designed for an epistemic SN reading: the speaker thinks the evidence is enough to convince the mom that her son is at home. In other words, the evidence is based on collectively committed information. As predicted, the epistemic SN modals *yiding* and *biran* are both felicitous, while the non-epistemic SN modals *bixu* and *wubi* are not, as illustrated in (80a). The combination *biran yiding* is also felicitous (as in 80b), indicating an epistemic SN concord reading is available here. The other two combinations *bixu wubi* and *yiding bixu* are not felicitous, as in (80c) and (80d). This shows that no SN epistemic concord reading is available for these two combinations.

(81) Context: Your family has a history of diabetes. Since you are a bit over-weight, losing weight is the first step to prevent this disease. Your mom is sure that you would do anything to prevent being sick, so she says: in order to prevent diabetes, you...

a. ni ***biran / *yiding / *bixu* / *wubi* jianfei

you EP-SN / EP-SN / NONEP-SN / NONEP-SN lose weight

'You must lose weight.'

b.* ni **biran yiding** jianfei

you EP-SN EP-SN lose weight

c. ni *bixu wubi* jianfei

you NONEP-SN NONEP-SN lose weight

'You must lose weight.'

d.* ni **yiding** *bixu* jianfei

you EP-SN NONEP-SN lose weight

The context in (81) is designed for a teleological SN reading, where "you prevent diabetes" is collectively committed to, and therefore included in the primary ordering source. The non-epistemic SN modals *bixu* and *wubi* are felicitous while the epistemic SN modals *biran* and *yiding* are not, as shown in (81a). The non-epistemic SN modal combination *bixu wubi* is also felicitous (81c), indicating a concord reading is available here. The other two combinations *biran yiding* and *yiding bixu* are not felicitous, as in (81b) and (81c). This shows that no non-epistemic SN concord reading is available.

From the data in (80) and (81), we can see that the epistemic SN modal combination *biran yiding* has an epistemic SN concord reading, and the non-epistemic SN modal combination *bixu wubi* has a non-epistemic SN concord reading. For the SN modal combination that has modals of different types (e.g., *yiding bixu*), no concord reading is available. Instead, it has a cumulative reading, as shown in (82).

(82) Context: Your boss told you that your colleague Zhangsan must attend the meeting

because he needs to know about the work plan that will be discussed. Now Zhangsan is asking you about the meeting. You are pretty sure he must attend it, since your boss said so. So you answer:

ni	**yiding**	**bixu**	canjia	zhege	huiyi
you	EP-SN	NONEP-SN	attend	this	meeting

'It is for sure that you must attend this meeting.'

The context in (82) is designed for a cumulative reading. In this case, the epistemic SN modal *yiding* is based on the evidence of the boss's words, while the non-epistemic SN modal *bixu* is based on the goal that Zhangsan knows about the work plan. This piece of data shows that a cumulative reading is available for the combination *yiding bixu*.

Now consider combinations of two necessity modals that both have WN intuitive force. Unfortunately, in Mandarin there is only one WN modal: *yinggai*. Due to this lexical restriction, it is impossible to construct the relevant data. For this reason, we will skip this part.

Next let's look at combinations of two necessity modals that both have UN intuitive force. In Mandarin, the only two UN modals are both non-epistemic: *dei* and *yao*. Due to this lexical restriction, we can only investigate the available reading of this particular combination. Consider the contexts in (83) and (84).

(83) Context: You are a member of the staff in a theatre. There are three doors to that theatre: the front door, the back door, and the side door. During a show, only the side door is open. A customer is late for the show, and asks you how to get into the theatre. So you answer:

a.	ni	**dei**	/	**yao**	zou	cemen
	you	NONEP-UN	/	NONEP-UN	go	side door

'You have to go to the side door.'

b. ni **dei** **yao** zou cemen

you NONEP-UN NONEP-UN go side door

'You have to go to the side door.'

(84) Context: You are a member of the staff in a theatre. There are three doors to that theatre: the front door, the back door, and the side door. During a show, only the back door and the side door are open. A customer is late for the show, and asks you how to get into the theatre. You two are closer to the side door than to the back door. You think it is better to take the shorter route, although you are not sure whether the customer agrees with this. So you answer:

a. ni **dei** / **yao** zou cemen

you NONEP-UN / NONEP-UN go side door

'You should go to the side door.'

b. ni **dei** **yao** zou cemen

you NONEP-UN NONEP-UN go side door

'You should go to the side door.'

The context in (83) is designed for a non-epistemic SN reading, and the context in (84) is designed for a non-epistemic WN reading. In these contexts, the non-epistemic UN modals *dei* and *yao* are also felicitous, since they are not specified between a SN and a WN interpretation. Their combination *dei yao* is also felicitous in both contexts. This indicates that a non-epistemic UN concord reading is available here.

From the data in (80)-(84), it can be concluded that with two necessity modals that have the same intuitive force, a concord reading is available when they are of the same modal type. Recall the generalization in Section 4.3 that a concord reading is only available when the two modals have the same modal type (both epistemic or non-epistemic) and the same quantificational force (both possibility or both necessity). At this point, this generalization

still holds.

Now let's turn to combinations of two necessity modals that differ in intuitive force. Notice that even if the intuitive force is different, they have the same quantificational force (necessity). First consider the combination of a WN modal and a SN modal. *Yinggai* is the only WN modal in Mandarin, unspecified between an epistemic and a non-epistemic interpretation. We will investigate the available readings when *yinggai* combines with the epistemic SN modal *yiding* or with the non-epistemic SN modal *bixu*, namely, the combinations *yinggai yiding* and *yinggai bixu*. Consider the contexts in (85).

(85) Context: I visit a friend's home, and notice that he has a good collection of Hitchcock movies. So I guess he is a huge a fan of Hitchcock. Based on what I know about fans of Hitchcock, they all remember the famous scene in *Psycho* where the actress screams in horror.

ta	**yinggai yiding**	jide	zhege	changing
he	WN	EP-SN	remember	this	scene

'It should be the case that he must remember this scene.'

In (85), the WN modal *yinggai* is based on my observation that there are Hitchcock's movies at my friend's home, while the SN epistemic modal *yiding* is based on what I know about fans of Hitchcock. These are two separate modal expressions that receive different conversational backgrounds from the context, leading to a cumulative interpretation. From this example, we can see that a cumulative reading is available in this modal combination.

(86) Context: You are working in the administration office of a company. According to the rules of your office, you have to arrive at work before 9am. According to the rules of the company, the rules of each office should be obeyed, unless they conflict with the company's rules.

ni	**yinggai bixu**		zai	jiudian	qian	daoda
you WN	NONEP-SN		at	9 o'clock	before	arrive

'It should be the case that you must arrive before 9 o'clock.'

In (86), the WN modal *yinggai* is based on the rules of the company, while the SN deontic modal *bixu* is based on the rules of the office. Since they receive different conversational backgrounds from the context, a cumulative reading is available in this modal combination.

As we can see in (85) and (86), the WN and SN modal combinations *yinggai yiding* and *yinggai bixu* both have a cumulative reading. However, no concord reading is available for these two combinations. Consider the data in (87) and (88).

(87) Context: My friend lives next door to me. His mom (who lives in another city) somehow cannot reach him by phone, so she calls me asking whether he is at home. I see the light in my friend's apartment is on, so I think he is at home. But I am not sure whether his mom will agree with my judgement. So I say:

a. ta **yinggai** / ***yiding** / ***bixu**   zaijia

    he WN   / EP-SN / NONP-SN   at home

    'He should be at home.'

b.* ta **yinggai yiding** zaijia

    he WN   EP-SN   at home

c.* ta **yinggai bixu**   zaijia

    he WN   NONEP-SN   at home

(88) You are a member of the staff in a theatre. There are three doors to that theatre: the front door, the back door, and the side door. During a show, only the back door and the side door are open. A customer is late for the show, and asks you how to get into the theatre. You two

are closer to the side door than to the back door. You think it is better to take the shorter route, although you are not sure whether the customer agrees with this. So you answer:

a. ni   **yinggai** /   ***yiding** /   ***bixu**   zou cemen

    you   WN   /   EP-SN   /   NONP-SN   go side door

    'He should go through the side door.'

b.* ni   **yinggai yiding**   zou cemen

    you   WN   EP-SN   go side door

c.* ni   **yinggai bixu**   zou cemen

    you   WN   NONEP-SN   go   side door

The context in (87) is designed for an epistemic WN reading, and the context in (88) is for an non-epistemic WN reading. As predicted, the WN modal *yinggai* is felicitous in the both contexts (as in 87a and 88a). However, the WN and SN modal combinations *yinggai yiding* and *yinggai bixu* are not felicitous in either of these contexts, indicating that no WN concord reading is available in a WN and SN modal combination. Now consider the data below to see whether a SN concord reading is available in such a combination.

(89) Context: My friend lives next door to me. His mom (who lives in another city) somehow cannot reach him by phone, so she calls me asking whether he is at home. I see the light in my friend's apartment is on, and I hear his voice. so I think he is at home. And I am sure his mom will agree with my judgement. So I say:

a. ta   ***yinggai** /   **yiding** /   ***bixu**   zaijia

    he   WN   /   EP-SN   /   NONEP-SN   at home

    'He must be at home.'

b.* ta   **yinggai yiding**   zaijia

    he   WN   EP-SN   at home

75

c.* ta   **yinggai bixu**   zaijia

    he   WN   NONEP-SN   at home

(90) Context: You are a member of the staff in a theatre. There are three doors to that theatre: the front door, the back door, and the side door. During a show, only the side door is open. A customer is late for the show, and asks you how to get into the theatre. So you answer:

a.   ni   ***yinggai** /   ***yiding** /   **bixu**   zou cemen

    you   WN   /   EP-SN   /   NONEP-SN   go   side door

    'You must go through the side door.'

b.* ni   **yinggai yiding**   zou cemen

    you   WN   EP-SN   go   side door

c.* ni   **yinggai bixu**   zou cemen

    you   WN   NONEP-SN   go   side door

The context in (89) is designed for an epistemic SN reading, and the context in (90) is for an non-epistemic SN reading. The epistemic SN modal *yiding* is felicitous in (89), while the non-epistemic SN modal *bixu* is felicitous in (90). Similar to (87) and (88) above, the WN and SN modal combinations *yinggai yiding* and *yinggai bixu* are not felicitous in either of these contexts, indicating that no SN concord reading is available in a WN and SN modal combination.

Recall the generalization that a concord reading is available when two modals have the same modal type and the same quantificational force. However, summarized from the data (85) to (90), only a cumulative reading but no concord reading is available in a WN and SN modal combination, although they have the same modal type (both epistemic or both non-epistemic) and the same quantificational force (both necessity). This is a counterexample to

the generalization above. Moreover, something interesting will also show up when a UN modal combines with a SN or a WN modal, which will be discussed next.

First look at the combination of a SN modal and a UN modal. The only UN modals in Mandarin are the non-epistemic modals *dei* and *yao*. Since these two modals are semantically similar, I will only investigate one of them: *dei*. I will look at the available readings when *dei* combines with the epistemic SN modal *yiding* or the non-epistemic SN modal *bixu*, namely, the combination *yiding dei* and *bixu dei*. Consider the context in (91), repeated from (81) above.

(91) Context: Your family has a history of diabetes. Since you are a bit over-weight, losing weight is the first step to prevent this disease. Your mom is sure that you would do anything to prevent being sick, so she says: in order to prevent diabetes, you...

a. ni   ***yiding* /   *bixu* /   *dei*   jianfei

    you   EP-SN /   NONEP-SN /   NONEP-UN   lose weight

    'You must lose weight.'

b.??ni   **yiding *dei*   jianfei

    you   EP-SN   NONEP-UN   lose weight

c. ni   *bixu*   *dei*   jianfei

    you   NONEP-SN   NONEP-UN   lose weight

    'You must lose weight.'

The context in (91) is designed for a teleological SN reading. As predicted, the epistemic SN modal *yiding* is infelicitous, while the non-epistemic SN modal *bixu* and the non-epistemic UN modal *dei* are felicitous, as in (91a). The combination *bixu dei* is also felicitous (as in 91c), indicating that a non-epistemic SN concord reading is available. Whether the

combination *yiding dei* is felicitous in this context is still questionable (as in 91b). This combination is more acceptable in the context in (92), repeated from (82) above.

(92) Context: Your boss told you that your colleague Zhangsan must attend the meeting because he need to know about the work plan that will be discussed. Now Zhangsan is asking you about the meeting. You are pretty sure he must attend it, since your boss said so. So you answer:

ni	**yiding**	**dei**	canjia	zhege	huiyi
you	EP-SN	NONEP-UN	attend	this	meeting

'It is for sure that you have to attend this meeting.'

The context in (92) is designed for a cumulative reading. In this case, the epistemic SN modal *yiding* is based on the evidence of the boss's words, while the non-epistemic UN modal *dei* is based on the goal that Zhangsan knows about the work plan. This example shows that a cumulative reading is available for the combination *yiding dei*. Comparing (92) to (91b), for this modal combination, the cumulative reading is more preferred than the concord reading. It might be the case that in (91b), the epistemic SN modal *yiding* is interpreted as a pragmatic emphasis but not a modal word, which leaves *dei* the only modal in that sentence. This pseudo-concord phenomenon will be further discussed in Chapter 6.

From (91) and (92), we can conclude that in a SN and UN modal combination, a SN concord reading is available when the two modals are of the same modal type.

In the last piece of data, we will investigate the combinations of a WN modal and a UN modal. The only WN modal in Mandarin is *yinggai*, not specified between an epistemic and a non-epistemic interpretation. The only UN modals in Mandarin are the non-epistemic modals *dei* and *yao*. Just as before, since these two modals are semantically similar, I will only investigate one of them: *dei*. Therefore, I will look at the available readings of the WN and UN combination: *yinggai dei*. Consider the contexts in (93) and (94), repeated from (87)

and (88) above.

(93) Context: My friend lives next door to me. His mom (who lives in another city) somehow cannot reach him by phone, so she calls me asking whether he is at home. I see the light in my friend's apartment is on, so I think he is at home. But I am not sure whether his mom will agree with my judgement. So I say:

    a.   ta   **yinggai** /   ***dei**   zaijia

        he   WN   /   NONP-UN at home

        'He should be at home.'

    b.* ta   **yinggai dei**   zaijia

        he   WN   NONEP-UN   at home

(94) You are a member of the staff in a theatre. There are three doors to that theatre: the front door, the back door, and the side door. During a show, only the back door and the side door are open. A customer is late for the show, and asks you how to get into the theatre. You two are closer to the side door than to the back door. You think it is better to take the shorter route, although you are not sure whether the customer agrees with this. So you answer:

    a.   ni   **yinggai** /   **dei**   zou cemen

        you   WN   /   NONEP-UN go side door

        'You should go through the side door.'

    b.   ni   **yinggai dei**   zou cemen

        you   WN   NONEP-UN   go side door

        'You should go through the side door.'

The context in (93) is designed for an epistemic WN reading, and the context in (94) is for an non-epistemic WN reading. As predicted, the WN modal *yinggai* is felicitous in both contexts, and the non-epistemic UN modal *dei* is felicitous in (94) but infelicitous in (93).

Their combination *yinggai dei* is only felicitous in (94). This indicates that a WN reading is available for a WN modal and a UN modal when they can have the same modal type in a certain context.

So far, we have looked at all the possible combinations of necessity modals. Table 4.4 is a summary of the available readings they have when the two necessity modals are of the same modal type.

Table 4.4. Available readings of Mandarin necessity modal combinations

Concord Reading	UN+UN=UN
	SN+SN=SN
	WN+UN=WN
	SN+UN=SN
Cumulative Reading	WN+SN

Recall the generalization in Section 4.3 that a concord reading is available when the two modals can have the same modal type and the same quantificational force. This generalization would incorrectly predict a concord reading is also available between a WN and a SN modal, since they are of the same necessity quantificational force. Therefore the original generalization is not enough to cover the data involving necessity modal concord that we have seen in this section.

Let's have a closer investigation of what is going on with the necessity modal concord. Recall the analysis of WN, SN and UN modals in Mandarin, as repeated in Table 4.5.

Table 4.5 The ordering sources of Mandarin necessity modals

Modals	Primary Ordering Source (collectively committed information)	Secondary Ordering Source (non-collectively committed information)
WN	empty OR non-empty	non-empty
UN	empty OR non-empty	empty OR non-empty
SN	non-empty	empty

The primary ordering source is based on collectively committed information between the speaker and the listener, and the secondary ordering source is based on non-collectively committed information. A SN modal has an empty secondary ordering source, while a WN modal has a non-empty secondary ordering source. As for a UN modal, it is unspecified between a WN and a SN interpretation, depending on the ordering sources it receives from the context. When the secondary ordering source is empty, it has a SN interpretation. Otherwise it has a WN reading.

When a WN modal combines with a SN modal, it is impossible for them to receive the same ordering sources from the context, because the former requires a non-empty secondary ordering source but the latter requires it to be empty. When a UN modal combines with a WN modal or with a SN modal, it is possible for them to have the same ordering sources. Take the data in (91) as an example, repeated as in (95).

(95) Context: Your family has a history of diabetes. Since you are a bit over-weight, losing weight is the first step to prevent this disease. Your mom is sure that you would do anything to prevent being sick, so she says: in order to prevent diabetes, you...

a.   ni   ***bixu* /   *dei*   jianfei

     you   NONEP-SN /   NONEP-UN   lose weight

     'You must lose weight.'

b. ni   ***bixu***   ***dei***   jianfei

you   <small>NONEP-SN</small>   <small>NONEP-UN</small>   lose weight

'You must lose weight.'

This context is designed for a teleological SN reading. The goal "to prevent diabetes" is collectively committed information between the speaker and the listener, thus the primary ordering source is not empty while the secondary ordering source is empty. The non-epistemic SN modal *bixu* and the non-epistemic UN modal *dei* can both receive a non-empty primary ordering source and an empty secondary ordering source. So they are both felicitous, as in (95a). Their combination also has the same non-epistemic SN concord reading, as in (95b). This indicates that for a concord reading to be available, the two modals must also receive the same ordering sources from the context.

In summary, based on the observations of Mandarin necessity modal combinations, a revised generalization is provided below on the availability of a concord reading.

(96) Generalization on Mandarin modal concord:

    A concord reading is available between two modals when they can

    i) have the same modal type, and

    ii) have the same ordering sources, and

    iii) have the same quantificational force.

Chapter 5

Theoretical approaches to Mandarin modal concord

This chapter will look at three theoretical approaches to account for modal concord: the modal logic approach (5.1), the type-shifting approach (5.2) and the fusion analysis (5.3). I argue that the fusion analysis can best account for Mandarin modal concord.

5.1 The modal logic approach

In modal logic, a modal operator is defined with respect to its quantificational force and its accessibility relation. There are two kinds of quantificational force, universal and existential, represented by □p and ◊p respectively. The accessibility relation can be defined as a property of a modal frame, which is a pair $<W, R>$ consisting of W, a set of possible worlds, and R, an accessibility relation on W. Portner (2009) discusses three common properties of modal frames, as shown in (97).

(97) a. **Reflexivity**: $<W, R>$ is reflexive iff for every $w \in W$, $R(w, w)$.

　　b. **Transitivity**: $<W, R>$ is transitive iff for every w, w' and $w'' \in W$, if $R(w, w')$ and $R(w', w'')$, then $R(w, w'')$.

　　c. **Seriality**: $<W, R>$ is serial iff for every $w \in W$, there is a $w' \in W$, such that $R(w, w')$.

Each accessibility relation can be characterized by a logical schema in (98) (Gamut 1991, Portner 2009).

(98)　　a. **T**: $\Box p \rightarrow p$

　　　Schema **T** is valid iff the modal frame is reflexive.

　　　　b. **4**: $\Box p \rightarrow \Box \Box p$

　　　Schema **4** is valid iff the modal frame is transitive.

　　　　c. **D**: $\Box p \rightarrow \Diamond p$

Schema **D** is valid iff the frame is serial.

Necessity and possibility concord could be represented in modal logic as the equivalences $\square\square p = \square p$ and $\lozenge\lozenge p = \lozenge p$ respectively. If the modal frame is both reflexive and transitive, then it is guaranteed that necessity concord is available ($\square\square p = \square p$). Furthermore, if the modal frame is transitive, it can also be proved that $\lozenge\lozenge p = \lozenge p$ is valid (Portner 2009). Therefore, a reflexive and transitive accessibility relation could potentially account for modal concord (see also Huitink 2008, 2012). Now let's look at whether the accessibility relations of modality in natural languages could be both reflexive and transitive.[20]

For epistemic modality, it is usually assumed that reflexivity and transitivity are plausible (Portner 2009). For deontic modality, it is usually assumed that this type of modality is serial: if something is obligatory, then it must also be allowed. Although there is a debate about whether deontic modality is transitive or not (Huitink 2008), it is generally agreed that it is not reflexive, because rules and laws are not always followed in the actual world. Therefore, the modal logic approach may be able to cover the modal concord for epistemic modals, but not the deontic modal concord, since reflexivity is not a property of deontic modality in natural languages.

However, as mentioned in Chapter 1, a concord reading is available between two deontic modals in Mandarin, repeated in (99). This is an example that cannot be covered by the modal logic approach, as was shown by Huitink (2008) for Dutch.

(99) Context: A mom is talking with her son about when he is allowed to play soccer.

> zhiyao   ni   bazuoyexiewan   le,
>
> if   you   finish assignment   PERF

---

[20] Huitink (2008, 2012) discusses the issue in term of transitivity and density, instead of reflexivity. Density corresponds to the schema $\square\square p \rightarrow \square p$, and is a weaker property than reflexivity. Huitink argues that deontic modality does not obey density. Because reflexivity is stronger than density, it follows from her argument that deontic modality is not reflexive either. My argument based on the non-reflexivity of deontic modality is very similar to Huitink's.

ni	jiu	**neng**	**keyi**	qutiqiu
you	then	NONEP-POSS	NONEP-POSS	go play soccer

'If you have finished your assignment, then you can go play soccer.'

To sum up, in the modal logic analysis, a reflexive and transitive accessibility relation could account for modal concord. But deontic modality in natural languages is usually assumed to be non-reflexive. Therefore, the modal logic approach cannot account for deontic modal concord in Mandarin.

5.2 The Type-shifting Analysis

Huitink (2008, 2012) investigates the "modal verb + modal adverb" constructions in Dutch and English, and proposes the generalization that a concord reading is available only when the modal verb and adverb can have the same modal type (epistemic, deontic, etc.) and the same quantificational force (possibility, necessity). She presents data on possibility concord (as in 100) and necessity concord (as in 101) in both Dutch and English.

(100) a. Het **kan** **misschien** gaan regenen   (Huitink 2008, ex. (13))

it POSS EP-POSS go rain

'It might rain.'

b. **Possibly** this gazebo **may** have been built by Sir Christopher Wren.

'Maybe this gazebo was built by Sir Christopher Wren.'

(Huitink 2008, ex. (2))

In (100a), *kan* is a modal verb that is ambiguous between an epistemic and non-epistemic possibility interpretation, while *misschien* is a modal adverb that unambiguously has an epistemic possibility interpretation. When they are combined, an epistemic possibility concord reading is strongly preferred. The same applies to the modal verb *may* and the

modal adverb *possibly* in English in (100b).

(101) a. Dat **moet** **ongetwijfeld**   zijn vrouw zijn   (Huitink 2008, ex. (7))

that NEC   EP-NEC   his wife   be

'That has to be his wife.'

b. Hermione **must**   **certainly**   be clever.   (Huitink 2008, ex. (3))

'Hermione is certainly clever.'

The data in (101) are examples of epistemic necessity concord in Dutch (101a) and English (101b). In (101a), *moet* is a modal verb ambiguous between an epistemic and non-epistemic necessity interpretation, while *ongetwijfeld* is a modal adverb with an epistemic necessity interpretation. An epistemic necessity concord is available between them. Although the modal verb *moet* is ambiguous, when a concord reading is available as in (101a), that concord reading can only be epistemic. This is to say, the unambiguous epistemic modal adverb *ongetwijfeld* is restricting the modal verb *moet* to be interpreted as epistemic. Similarly, in the English data in (101b), *must* is ambiguous between an epistemic and a non-epistemic modal base, while *certainly* is unambiguously epistemic. When they are combined, we can get an epistemic concord reading.

In the double-modal combinations in (100) and (101) above, a concord reading is available and preferred. However, Huitink claims that given an appropriate context, these modal combinations can also have cumulative readings, as illustrated in (102), cited from Huitink (2008).

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(102) Context: Marie is in charge of the household, assigning chores, and she doesn't like Jane very much. So Marie will definitely give Jane the toilet-cleaning job.

Jane	**moet**	**ongetwijfeld**	het toilet	schoonmaken
Jane	NEC	EP-NEC	the toilet	clean

'There is no doubt that Jane has to clean the toilet.'

(Huitink 2008, ex. (10))

Although the Dutch double-modal combination *moet ongetwijfeld* is the same as in (101a) above, it is also felicitous in a context designed for a cumulative interpretation in (102). In this case, the context forces the ambiguous modal verb *moet* to be interpreted as a deontic modal, which is different from the unambiguously epistemic modal adverb *ongetwijfeld*. Therefore, a cumulative reading is available in this context.

Huitink proposes a type-shifting analysis to account for modal concord in Dutch and English: in a "modal verb + modal adverb" combination, the adverb will check whether the verb is of the same modal type and the same quantificational force as itself. If yes, the adverb will shift into a semantically vacuous item, while the verb will be the only modal word in this construction. Therefore, a concord reading is available. If the modal verb is of a different type or quantificational force as the modal adverb, then no shifting takes place, and both the verb and the adverb will be interpreted as modal words. In this case, a cumulative reading is available. If the modal verb is ambiguous in its modal type, then both a concord and a cumulative reading are available according to whether the modal verb is interpreted as of the same type as the modal adverb.

However, this type-shifting analysis could not explain why a modal adverb will shift into a semantically vacuous item when the modal verb has the same type and force. Also, there might be two problems if Huitink's analysis is applied to Mandarin modal concord. First of all, recall the generalization on Mandarin modal concord: a concord reading is available between two modals when they can have the same modal type, the same ordering sources

and the same quantificational force. This type-shifting analysis doesn't involve ordering sources, and thus couldn't account for Mandarin modal concord without some modification. Secondly, this type-shifting analysis only looks at "modal verb + modal adverb" combinations, where the modal verb is analyzed as the real modal when a concord reading is available, while the modal adverb is semantically vacuous. In Mandarin, however, modal concord is available in the combination of two modal verbs, or two modal adverbs, or a modal verb and a modal adverb. More importantly, the two modal words are semantically equal in modality. Take the Mandarin data in (103) for example, repeated from (59) above.

(103)   a.   ta   **yexu / meizhuner**   zaijia

he   EP-POSS / EP-POSS   at home

'He is possibly at home.'

b.   ta   **yexu   meizhuner**   zaijia

he   EP-POSS   EP-POSS   at home

'He is possibly at home.'

The two epistemic possibility modals *yucca* and *meizhuner* are both adverbs, and a concord reading is available between them, as in (103b). These two modals are semantically the same, and there is no obvious reason to treat one as the real modal word but the other as a semantically vacuous item.

In summary, Huitink (2008) claims that in the "modal verb + modal adverb" combinations in Dutch and English, a concord reading is available only when the verb and the adverb can have the same modal type (epistemic, deontic, etc.) and the same quantificational force (possibility, necessity). She also proposes that, when a concord reading is available, the verb is the real modal word, while the adverb is shifted into a semantically vacuous item. However, Mandarin modal concord also involves requirements on ordering sources. Moreover, in Mandarin there is no obvious motivation for treating one modal as the real

modal word but the other modal as a semantically vacuous item. Based on these considerations, I think the type-shifting analysis is not the right approach for modal concord in Mandarin.

Based on the type-shifting approach, recently Huitink (2012) proposes a domain restriction analysis, including ordering sources in it. This analysis could account for the concord reading of modals that have different force, as shown in (104), cited from Huitink (2012).

(104)   Dat **moet**   **waarschijnlijk**   in   1943   zijn   geweest.

       that NEC   EP-NEC   in   1943   be   been

       'That was probably in 1943.'

                                               (Huitink 2008, ex. (85))

Basically, the domain restriction analysis treats *waarschijnlijk* (usually translated as "probably" in English) as denoting an ordering source that is an argument of the modal *moet*. The ordering sources of *waarschijnlijk* restricts the domain of *moet*, leading to the weak concord reading in (104). But Huitink (2012) doesn't analyze *waarschijnlijk* as a WN modal, and doesn't apply the formal analysis of primary and secondary ordering sources by von Fintel & Iatridou (2008) and Rubinstein (2012a, b). Moreover, the domain restriction analysis is similar to the type-shifting approach in that it treats the modal verb as the real modal word while the modal adverb as the domain restrictor. As discussed above, this might be problematic when applying to Mandarin modal concord, where the two modals are equal in a concord reading. For these reasons, I believe that Huitink's (2012) approach faces some of the same problems as her analysis from (2008) when applied to Mandarin. I will leave a more detailed comparison between my analysis and that of Huitink (2012) for future research.

5.3 The Fusion Analysis

As discussed in Huitink (2008), since modal concord is relatively unexplored, comparing it with negative concord, a more familiar phenomenon, might be helpful in developing an analysis for modal concord. In this section, I will first briefly review the analysis of negative concord, and then propose a fusion analysis inspired by negative concord to account for Mandarin modal concord.

Negative concord is the phenomenon that a single semantic negation can be expressed by a combination of two negative quantifiers. Recall the Italian and Dutch negative concord data in Chapter 1, repeated in (105) and (106) respectively.

(105) ***(Non)** ha detto   quasi   niente   (Zanuttini 1991, ex. (192))
       neg   has said   almost   nothing
       'He said almost nothing.'

(106)   a. Hij heeft   **nergens**   **geen**   zin   in   (Huitink 2008, ex. (29))
            he has   nowhere   no   desire in
            'He doesn't feel like doing anything at all.'

        b. Hij   heeft   **nergens**   zin   in
            he   has   nowhere   desire   in
            'He doesn't feel like doing anything.'

As Huitink discusses, in both Italian (105) and Dutch (106a), a single semantic negation is encoded by two negation words. The difference between them is that, in Italian, negative concord is obligatory in expressing negation, while in Dutch, it is optional. As shown in (105), the sentence becomes ungrammatical if *non* is left out; in (106b), however, negation can also be expressed by a single negative quantifier.

As mentioned in Chapter 1, following de Swart & Sag's (2002), Huitink (2008) divides the theories of negative concord into two major groups: local theories and global theories. Local theories analyze one of the negation words as a real semantic negation, while the other as a morphological negation that doesn't have a semantic interpretation. In contrast, global theories treat both of the negation words equally as semantic negative quantifiers. One of the well-known global theories is de Swart & Sag's (2002) quantifier resumption. For example, on one of the available readings, the two negation words in (107) are interpreted as one semantic negative quantifier that binds two variables. This example is from de Swart & Sag (2002), as cited in Huitink (2008).

(107) No one loves no one.   (Huitink 2008, ex. (27))

$\neg \exists x \exists y$ Love(x, y)

'There doesn't exist a person who likes a person.'

In (107), the negative quantifier binds pairs of human beings, which results in the reading that there doesn't exist a situation where a person likes a person.

Inspired by the local theories of negative concord, the type-shifting analysis interprets the modal verb as the only modal word and treats the modal adverb as a semantically vacuous item. This is mainly designed to account for the data in Dutch and English, where modal concord usually occurs in a combination of a modal verb and a modal adverb (Huitink 2008). As discussed in Section 5.2, since Mandarin modal concord is not sensitive to syntactic categories and there is no obvious reason for treating the two modals differently from each other, this analysis is much less plausible when applied to Mandarin. Instead, global theories may be better able to capture the properties of Mandarin modal concord, because they interpret the two concord items as equal.

However, as noted by Zeijlstra (2004) and Huitink (2008), it is almost impossible to directly apply well-developed global theories such as resumptive quantification to modal concord,

since a modal concord reading does not involve a quantifier that binds pairs of possible worlds. To develop an analysis for Mandarin modal concord, I will borrow from global theories the basic idea of treating the two concord items equally, but depart from the specific way in which this idea is implemented .

Mandarin modal concord resembles emphatic negation in that it is not obligatory in expressing one semantic modality. The repetition of modal expressions mainly functions to emphasize a modal. For example, *keneng* and *yexu* are both epistemic possibility modals (as in 108a below), and their combination *yexu keneng* can have an epistemic possibility concord reading (as in 108b). The difference between (108a) and (108b) is mainly pragmatic: the latter emphasizes that the proposition *he is at home* is a possibility, not a necessity.

(108)   a.   ta   **keneng** /   **yexu**   zaijia

             he   EP-POSS /   EP-POSS   at home

             'Maybe he is at home.'

        b.   ta   **keneng**   **yexu**   zaijia

             he   EP-POSS   EP-POSS   at home

             'Maybe he is at home.'

This is to say, in a given context, the combinations of two modals with a concord reading can be semantically replaced by either of the two modal expressions individually, although there might be a pragmatic difference in emphasis. Recall the generalization in (96) about Mandarin modal concord from Chapter 4: a concord reading is available and preferred between two modals when they have the same modal type, the same ordering sources and the same quantificational force. If these requirements are satisfied, there exists some contexts where both of the modals are felicitous. Then modal concord can be analyzed as repetition of a single modal expression, and it can be semantically replaced by either of them

individually. Therefore, I propose a fusion analysis to account for modal concord in Mandarin, where the two modals are treated equally and merge into a single modal interpretation when they satisfy the requirements for modal concord.

(109) Fusion Analysis:

Suppose that M_1 and M_2 are modal expressions and p is a proposition.

M_1p is defined in a world w with respect to a modal base f_1 and a primary ordering source g_1 and a secondary ordering source g'_1;

M_2p is defined in a world w with respect to a modal base f_2 and a primary ordering source g_2 and a secondary ordering source g'_2;

If a) $f_1(w) = f_2(w)$, $g_1(w) = g_2(w)$, $g'_1(w) = g'_2(w)$, and

   b) M_1 and M_2 are of the same quantificational force,

then $[[M_1M_2p]] = [[M_1\,p]] = [[M_2\,p]]$ (a concord reading is available);

Otherwise, $[[M_1M_2p]] = [[M_1([[\,M_2\,p]])]]$ (a cumulative reading is available).

This is to say, when two modals receive the same conversational backgrounds from the context and have the same quantificational force, their combination can be semantically replaced by either of the two modals. I will discuss an example to explain how this analysis accounts for Mandarin modal concord. Consider the data in (110) and (111), repeated from (94) and (85) above.

(110) Context: Your family has a history of diabetes. Since you are a bit over-weight, losing weight is the first step to prevent this disease. Your mom is sure that you would do anything to prevent from being sick, so she says: in order to prevent diabetes, you...

   a. ni   ***bixu*** /   ***dei***   jianfei

       you   NONEP-SN / NONEP-UN   lose weight

       'You must lose weight.'

b.   ni   ***bixu***   ***dei***   jianfei

   you   NONEP-SN   NONEP-UN   lose weight

   'You must lose weight.'

This context is designed for a teleological SN reading. The goal "to prevent diabetes" is collectively committed information between the speaker and the listener, and therefore included in the primary ordering source. The secondary ordering source is empty in this context. The SN modal *bixu* and the UN modal *dei* both receive a non-epistemic modal base from the context, and they both receive a non-empty primary ordering source and an empty secondary ordering source. Also, they have the same universal quantificational force. The modal combination *bixu dei* satisfies all the requirements for modal concord. As predicted, this modal combination has a concord reading, as shown in (110b). Namely, *bixu dei* is semantically equal to *bixu* or *dei* alone.

(111) Context: You are working in the administration office of a company. According to the rules of your office, you have to arrive at work before 9am. According to the rules of the company, the rules of each office should be obeyed, unless they conflict with the company's rules.

   ni   **yinggai bixu**   zai jiudian   qian   daoda

   you WN   NONEP-SN   at   9 o'clock   before   arrive

   'It should be the case that you must arrive before 9 o'clock.'

In (111), the WN modal *yinggai* and the SN modal both receive a non-epistemic modal base from the context. The WN modal is based on the rules of the company saying that the rules of each office needs to be obeyed. This is non-collectively committed information because the speaker and the listener may disagree about whether the office rules conflict with the company rules. Therefore it is included in the secondary ordering source, and the WN modal *yinggai* is able to take a non-empty secondary ordering source, but the SN modal can't. The SN modal is based on the rules of the office that you arrive before 9 o'clock. This is

collectively committed information, and thus included in the primary ordering source. So the SN modal *bixu* takes a non-empty primary ordering source but an empty secondary source. Although *yinggai* and *bixu* both receive a non-epistemic modal base from the context and they are of the same universal quantificational force, they differ in their ordering sources. Therefore, only a cumulative reading is available in this combination, as predicted by the fusion analysis.

Chapter 6

Conclusion

In this thesis, I have given a full analysis of the Mandarin modal system, provided data on Mandarin modal concord and proposed a fusion analysis to account for it. There are two original contributions of my analysis that I want to highlight here.

The first one is the analysis of Mandarin necessity modals. Based on the analysis of WN (weak necessity) and SN (strong necessity) modals by von Fintel & Iatridou (2008) and Rubinstein (2012a, 2012b, 2013), I have proposed a new Mandarin necessity modal category: UN (unspecified necessity) modals. A UN modal it not specified between a weak necessity and a strong necessity interpretation. The reading depends on the ordering sources it receives from the context: when the secondary ordering source is empty, it has a SN reading; otherwise it has a WN reading. This is a new category of necessity modals that hasn't been observed before.

The second contribution is my fusion analysis of Mandarin modal concord. The modal logic and the type-shifting analyses cannot fully capture the properties of Mandarin modal concord. Inspired by global theories of negative concord, I have proposed the fusion analysis, where the two modal words are treated equally the same when a concord reading is available. In principle, this analysis can not only account for Mandarin modal concord, but may also for the concord phenomena in other languages like Dutch and English.

As mentioned in the above chapters, there are at least four problems left for future research. One is that the Mandarin data in this thesis are mainly obtained through self-elicitation. I intend to elicit with other Mandarin speakers in order to obtain more stable and reliable data. I will do a questionnaire study with native speakers on the acceptability of Mandarin data under certain contexts, in order to have more precise quantitive results on whether a sentence is felicitous, questionable or infelicitous in a context.

Secondly, this thesis is mainly about double-modal combinations in Mandarin, because sentences with two modals are much more common than sentences with three or more modals. In future research, I will extend my approach to modal combinations with three or more modals, in order to see whether the fusion analysis could also account for these combinations.

The third question I will continue to think about is UN modals. First of all, there might be a different analysis for Mandarin UN modals. Recall the force scale of Mandarin necessity modals, repeated as in Figure 6.1.

Figure 6.1 The force scale of Mandarin necessity modals.
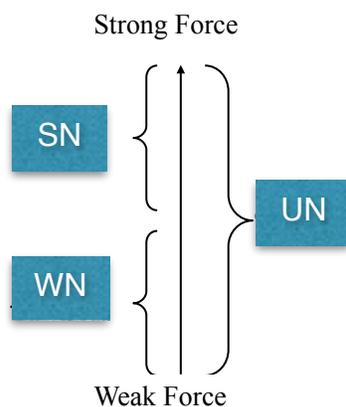
...d on the assumption that there is no force gap between a SN modal and a ...re was a gap, then it would be possible for a UN modal to fit in it. In that case, a UN modal would have a weaker intuitive force than a SN modal, and a stronger intuitive force than a WN modal. To solve this problem, I need to elicit more carefully-controlled data ...ng necessity modals.

Besides, there ...other languages. I will investigate whether this is a universal cate... only a category that is specific to Mandarin. If it

is universal, what kind of analysis should we adopt to account for it? At this point, these are open questions that we need to consider in future research.

Last but not the least, there is a "pseudo-concord" phenomenon that is still mysterious at this point. Recall the data involving the combination of the epistemic SN modal *yiding* and the non-epistemic UN modal *dei*, as repeated in (112).

(112) Context: Your family has a history of diabetes. Since you are a bit over-weight, losing weight is the first step to prevent this disease. Your mom is sure that you would do anything to prevent from being sick, so she says: in order to prevent diabetes, you...

    a.   ni   **** yiding* / *dei***   jianfei

       you   EP-SN / NONEP-UN   lose weight

       'You must lose weight.'

    b.?? ni   **yiding** ***dei***   jianfei

       you   EP-SN   NONEP-UN   lose weight

(113) Context: Your boss told you that your colleague Zhangsan must attend the meeting because he need to know about the work plan that will be discussed in the meeting. Now Zhangsan is asking you about the meeting. You are pretty sure he must attend it, since your boss said so. So you answer:

    ni **yiding dei**   canjia   zhege   huiyi

    you EP-SN   NONEP-UN   attend   this   meeting

    'It is for sure that you have to attend this meeting.'

The context in (112) is designed for a teleological SN reading. As predicted, the epistemic SN modal *yiding* is infelicitous, while the non-epistemic UN modal *dei* is felicitous, as in (112a). Whether the combination *yiding dei* is felicitous in this context is still an open question (as in 112b), but this combination is more acceptable in a context for a cumulative

reading, as shown in (113). In this case, the epistemic SN modal *yiding* is based on the evidence of the boss's words, while the non-epistemic UN modal *dei* is based on the goal that Zhangsan knows about the working plan.

Yiding is an epistemic modal, while *dei* is a non-epistemic modal. They always differ in the modal base received from the context. Therefore, the fusion analysis would predict no concord reading is available between them. However, the status of (112b) is questionable, indicating that a non-epistemic SN reading might be available in this modal combination, although they differ in modal types. This is called "pseudo-concord" in this thesis.

One possible analysis for pseudo-concord is to treat *yiding* as a speech-act particle. According to Brown & Levinson (1987), if a speaker decides to make a suggestion, he or she might try to soften the speech act through the use of specific politeness strategies in order to minimize the chances of the hearer's being offended. This is illustrated in (114), adapted from Brown & Levinson (1987).

(114)   a.   I am afraid you have to leave.
         b.   Maybe you have to leave.

When giving an order or suggestion as in (114), *I am afraid* and *maybe* can behave as a speech-act particle to soften the speech act, which will result in a weakening in the intuitive force of the modal *have to*. Usually, *maybe* is interpreted as an epistemic possibility modal. In (112b), however, *maybe* is not behaving as a real modal word but as a speech-act modifier comparable to *I am afraid*.

Back to Mandarin, since *dei* is unspecified for intuitive modal force, the SN epistemic modal *yiding* may behave as a speech-act modifier to strengthen the force of *dei/yao* to be specifically strong necessity. If this is the case, in (112b), *yiding* is not interpreted as a modal word, leaving *dei* the only modal in the sentence. This may explain why a single modality

reading could be available in (112b). Further research is needed to completely solve this pseudo-concord problem.

References

Brown, Penelope, and Stephen Levinson. 1987. *Politeness: Some Universals in Language Usage.* Cambridge: Cambridge University Press.

Bybee, Joan, and Suzanne Fleischman. 1995. *Modality in Grammar and Discourse.* Amsterdam and Philadelphia: John Benjamins.

von Fintel, Kai, and Irene Heim. 2011. Intensional semantics. *Lecture notes for "Advanced Semantics", MIT.* (http://web.mit.edu/fintel/fintel-heim-intensional.pdf, retrieved on Aug. 12, 2015)

von Fintel, Kai, and Sabine Iatridou. 2006. What to do if you want to go to Harlem: notes on anankastic conditionals and related matters (presentation slides). Linguistics Colloquium. University of Tübingen. (http://web.mit.edu/fintel/fintel-2006-harlem-tubingen.pdf, retrieved on Aug. 12, 2015)

von Fintel Kai, and Sabine Iatridou. 2008. How to say 'ought' in foreign: the composition of weak necessity modals. In Jacqueline Guéron & Jacqueline Lecarme (eds.), *Time and Modality*, p. 115–141. Berlin: Springer.

Gamut, L.T.F. 1991. *Logic, Language, and Meaning.* Chicago: The University of Chicago Press.

Grice, Herbert Paul. 1975. *Logic and Conversation.* Cambridge, MA: Harvard University Press.

Halliday, M.A.K. 1970. Functional diversity in language as seen from a consideration of

modality and mood in English. *Foundations of Language* 6: 322–361.

Horn, Laurence R. 1972. *On the Semantic Properties of the Logical Operators in English.* Ph.D. thesis, UCLA.

Hsieh, Chia-Ling. 2005. Modal verbs and modal adverbs in Chinese: an investigation into the semantics source. *University System of Taiwan Working Papers in Linguistics* 1: 31-58.

Huang, Xiaoyou. 2010. *Multiple-modal Constructions in Mandarin Chines: A View from Cartography and MP*. Master's thesis, National Tsing Hua University.

Huitink, Janneke. 2008. *Modals, Conditionals and Compositionality.* Ph.D. thesis, Radboud University.

Huitink, Janneke. 2012. Modal concord: a case study of Dutch. *Journal of Semantics* 29: 403-437.

Kratzer, Angelika. 1977. What "must" and "can" must and can mean. *Linguistics and Philosophy* 1: 337-355.

Kratzer, Angelika. 1981. The notional category of modality. In H.-J. Eikemeyer and H. Rieser (eds.), *Words, Worlds and Contexts*, p. 38-74. Berlin: de Gruyter.

Kratzer, Angelika. 1991. Modality. In Arnim von Stechow and Dieter Wunderlich (eds.), *Semantics: An International Handbook of Contemporary Research*, p. 639-656. Berlin: de Gruyter.

Levinson, Stephen C. 2000. *Presumptive Meanings: the Theory of Generalized*

Conversational Implicature. Cambridge, MA: MIT Press.

Lewis, David. 1973. *Counterfactuals*. Oxford: Basil Blackwell.

Lin, T. H. Jonah. 2006. *Multiple-Modal Constructions in Mandarin Chinese and Their Fititeness Properties.* Master's thesis, National Tsing Hua University.

Peterson, Tyler. 2010. *Epistemic Modality and Evidentiality in Gitksan at the Semantics-Pragmatics Interface.* Ph.D. thesis, University of British Columbia.

Portner, Paul Howard. 2009. *Modality*. Oxford: Oxford University Press.

Rubinstein, Aynat. 2012a. Ordering combination for modal comparison. *Proceedings of SALT* 22: 448-507.

Rubinstein, Aynat. 2012b. *Roots of Modality*. Ph.D. thesis, University of Massachusetts, Amherst.

Rubinstein, Aynat. 2013. Figuring out what we ought to do: the challenge of delineating priorities. *University of Pennsylvania Working Papers in Linguistics* 2013: 169-178.

Rullmann, Hotze, Lisa Matthewson, and Henry Davis. 2008. Modals as distributive indefinites. *Natural Language Semantics* 16: 317-357.

Stalnaker, Robert. 1984. *Inquiry*. Cambridge, MA: MIT Press.

de Swart, Henriette, and Ivan Sag. 2002. Negation and negative concord in Romance. *Linguistics and Philosophy* 25: 373–417.

Tsang, Chui Lim. 1981. *A Semantic Study of Modal Auxiliary Verbs in Chinese.* Ph.D. thesis, Stanford University.

World Atlas of Language Structures (retrieved on Aug. 12, 2015): http://wals.info/languoid/lect/wals_code_mnd

Wu, Guang-zhong, 2010. *On the Construction of Multiple Polysemous Modal Verbs in Mandarin Chinese: the Semantics-pragmatics Interface.* Master's thesis, Taiwan National Chengchi University.

Zanuttini, Raffaella. 1991. *Syntactic Properties of Sentential Negation*. Ph.D. thesis, University of Pennsylvania.

Zeijlstra, Hedde. 2004. *Sentential Negation and Negative Concord*. Ph.D. thesis, University of Amsterdam.