

The temporal interpretation of modals in Mandarin Chinese*

Sihwei Chen
University of British Columbia

This paper investigates how modals anchor the temporal perspective and the temporal orientation in Mandarin. Mandarin exhibits distinct temporal orientations between modals with different types of conversational background (Kratzer 1991), epistemic vs. circumstantial modal base (Condoravdi 2002, Stowell 2004, Werner 2006, van de Vate 2010, Matthewson to appear, among others). Moreover, both types of modals are found to allow shifting of temporal perspective from the speech time. Based on (in)compatibility of the modal base and aspectual/temporal marking, I propose that epistemic modals don't contribute to any temporal orientation, which instead relies on aspectual and temporal marking on the prejacent, whereas circumstantial modals consistently encode futurity in their semantics (Enç 1996, van de Vate 2010, Abusch to appear, among others).

1 Introduction

The interaction of modals and time has been elaborated in many recent crosslinguistic studies (e.g. Enç 1996, Condoravdi 2002, Stowell 2004, Werner 2006, Borgonovo and Cummins 2007, Demirdache et al. 2008, Laca 2008, Matthewson to appear, among others). In the sense of Condoravdi (2002), the temporal interpretation of modals involves two notions, *temporal perspective* and *temporal orientation*. *Temporal perspective* is the time at which the modal background, the evidence available or the laws in effect, is accessed, whereas *temporal orientation* is the relation between the temporal perspective and the time of a prejacent, a proposition embedded under modals. For example, the English epistemic modal *might* in (1) concerns the possibility in view of speaker's knowledge at speech time as to a state of various affairs located in the future, present, and or past: it has a present T.P. and allows an eventive prejacent to have a future T.O. (1a) and a stative prejacent a present or future T.O. (1b); with help of the perfect *have*, both prejacent show a past T.O. (1c-d).

- (1) a. He might get sick tomorrow/??now/*yesterday.
b. He might be sick tomorrow/now/*yesterday.
c. He might have gotten sick *tomorrow/*now/yesterday.
d. He might have been sick *tomorrow/*now/yesterday. (Condoravdi 2002: 60)

This paper investigates how modals anchor the temporal perspective and the temporal orientation in Mandarin. Mandarin has a very rich aspectual system, which is argued to be the resource of temporal reference (Smith and Erbaugh 2005, Lin 2006), in which the viewpoint aspect is sporadically indicated in the literature to relate with types of modal. Ren (2008) argues that circumstantial modals (her deontic and dynamic modals) in Mandarin encode futurity, whereas epistemic modals diverge as to whether they expand forward the topic time of the eventuality to the future. However, the modals she classifies as epistemic modals actually include both circumstantial modals and future modals, and the eventuality types, which are a factor influencing temporal interpretation, are not kept uniform under the modals. Considering these drawbacks, I modify Ren's (2008) study by controlling both modality types and eventuality types with respect to overt temporal or aspectual marking within the prejacent clause.

The methods of eliciting sentences follow Matthewson (2004). The judgments for the

* I gratefully thank Lisa Matthewson, Hotze Rullmann, my QP committee, and the LING 530C class at UBC. Thanks also to the audience at the QP mini-conference on April 17th, 2012 and the modality workshop at Ottawa on April 20-21th, 2012. This research was supported by SSHRC grant #410-2011-0431. Any remaining errors are mine.

temporal interpretations are obtained by offering the sentences containing modals to consultants in different discourse contexts. For instance, a sentence which is accepted in a modal context with a future T.O. is judged to be true in that context. If a sentence is rejected in a particular situation, follow-up elicitation including direct translation and grammatical judgments is supplemented to inquire if the sentence is false or infelicitous in that situation. The meta-language used to elicit the sentences in question is Mandarin.

This paper is organized as follows. Section 2 presents classification of Mandarin modals based on Kratzer (1991) and Rullmann et al. (2008). Section 3 introduces Mandarin temporal system by reviewing Lin's (2006) analysis. Section 4 discusses temporal orientation possibilities of the modals and how they shift temporal perspective. A split analysis of the different temporal orientation between circumstantial and epistemic modals is given in Section 5. Section 6 discusses consequences of the analysis and concludes this paper.

2 Classification of modals in Mandarin

Kratzer (1991) argues that uses of modals are decided by an implicit conversational background in context, which consists of two sets of propositions: the modal base and the ordering source. The modal base maps each world onto a set of accessible worlds, over which the modal quantifies, and the ordering source ranks and restricts the domain of the accessible worlds. In terms of Kratzer, epistemic modals have an epistemic modal base and can come with a stereotypical or doxastic ordering source. Circumstantial modal base can also combine with different ordering sources depending on the context, such as a deontic, bouletic, teleological or empty ordering source. Rullmann et al. (2008) adopt Kratzer's (1991) conversational backgrounds but propose that languages might vary in whether they have a contextually given or lexicalized conversational background.¹ For instance, the St'át'imcets (Lilloet Salish) modals lexically specifies quantificational strength but allow variable conversational backgrounds. The Pesisiran Javanese modals have specified quantificational strength as well as a selective modal base (Vander Kloek 2008). I follow the emerging theoretical typology and give a Kratzer-style's analysis of Mandarin modals. There's an identifiable class of auxiliary verbs that express modality in nature, despite the imperfect criteria for distinguishing auxiliaries, verbs, and adverbs (cf. Chao 1968, Li and Thompson 1981, Tsang 1981, Lin and Tang 1995, Li 2004, Ren 2008 etc.). I classify five frequently discussed modals in this paper: *yīdìng*, *kěnéng*, *bìxū*, *kěyǐ*, and *yīnggāi*.² The five modals can be analyzed as lexically encoding both of the two main types of modal bases, epistemic vs. circumstantial, and the quantificational strength, necessity or possibility:

- (2) a. Context: *He looks for his dog all over the house, but cannot find it.*

xiǎogǒu yīdìng/*kěnéng pǎodiào le.³
 small.dog EPIS.NEC/EPIS.POS run.away PRF
 'The dog must have escaped.'

- b. Context: *He was playing with a dog. When he just turned, he couldn't find the dog.*

xiǎogǒu *yīdìng/kěnéng pǎodiào le.
 small.dog EPIS.NEC/EPIS.POS run.away PRF
 'The dog may have escaped.'

- (3) a. Context: *My meeting with the student isn't done but he has to attend a class.*

wǒ bìxū/*kěyǐ rang tā líkāi.

¹ They also differ from Kratzer in adopting choice function but not the ordering source to restrict the domain of the accessible worlds universally quantified over.

² There are two more modals which often overlap with *bìxū* and *kěyǐ* respectively: *dé* and *néng(gòu)*. Like *bìxū* and *kěyǐ*, they lexically encode a circumstantial modal base but may differ from *bìxū* and *kěyǐ* in allowing different ordering sources. The reader who is interested in their use can refer to Tsang (1981) and Li (2004).

³ Abbreviations used in morpheme glosses are as follows: ABIL = ability, CIRC = circumstantial, CL = classifier, EPIS = epistemic, EXP = experiential, FUT = future, LOC = locative, NEC = necessity, NEG = negative, PFV = perfective, PL = plural, POS = possibility, PRF = perfect, PROG = progressive, PRT = particle, REL = relative clause, W = weak.

I CIRC.NEC/CIRC.POS let he leave
 ‘I have to let him go.’

- b. Context: *Only family members are allowed to enter the patient’s room during visiting hours, but you’re exceptional since you are a really close friend.*
 nǐ *bìxū/kěyǐ jìnlái.
 you CIRC.NEC/CIRC.POS come.in
 ‘You may come in.’

The only exception to this generalization is the weak necessity modal *yīnggāi*, which is ambiguous between both types of modal bases (4). The Mandarin modal system is summarized in Table 1.

- (4) a. Context: *It looks like my friend has left the party; her bag is gone, but she might have just taken it into the bathroom.*
 wǒ péngyǒu yīnggāi yǐjīng huíqù le. EPISTEMIC
 my friend W.NEC already return PRF
 ‘My friend must have left.’
- b. Context: *We rotate to do chores and today’s your turn.*
 nǐ yīnggāi xǐ pánzi. DEONTIC
 you should wash dishes
 ‘You ought to do the dishes.’

Table 1. The Mandarin modals system

QF \ CB	epistemic	circumstantial			
	stereotypical	bouletic	deontic	teleological	empty
necessity	<i>yīdìng</i>	<i>bìxū(?)</i>	<i>bìxū</i>		
weak necessity	<i>yīnggāi</i>				
possibility	<i>kěnéng</i>	<i>kěyǐ</i>			

3 Viewpoint aspect and temporal reference in Mandarin

Before assessing the temporal reference in modality, how modal-less sentences express their temporal reference has to be considered. This section introduces the Mandarin temporal system by reviewing Lin’s (2006) analysis. Mandarin Chinese lacks tense morphology but utilizes many other factors such as lexical and viewpoint aspectual morphemes, temporal adverbs and pragmatic reasoning and so forth to determine the temporal reference of sentences (Smith and Erbaugh 2005, Lin 2003, 2006).⁴ Lin (2006) argues that viewpoint aspect in Mandarin give both aspect and tense: Sentences with an imperfective aspectual morpheme, like the progressive maker *zài* in (5a), have a present interpretation, whereas sentences with a perfective aspectual morpheme, such as the marker *-le* in (5b), have a past interpretation.

- (5) a. tāmen zài chàng gē. IMPERFECTIVE: PRESENT
 they PROG sing song
 ‘They are singing songs.’
- b. tāmen chàng-le yī-shǒu gē. PERFECTIVE: PAST
 they sing-PFV one-CL song
 ‘They sang a song.’

However, not every sentence can carry an overt viewpoint aspect; for instance, stative verbs and achievement verbs are interpreted as present and past respectively, without any aspectual marker:

⁴ It has been a debate whether null tense exists in Mandarin but such discussion is beyond the topic of this paper; the interested reader can refer to Hu, Pan & Xu (2001), Sybesma (2007), and Lin (2011).

- (6) a. tāmen hěn cōngmíng. STATIVE: PRESENT
 they very smart
 ‘They are very smart.’
- b. tā dǎ-pò yī-gè bēizǐ. ACHIEVEMENT: PAST
 he hit-break one-CL cup
 ‘He broke a cup.’

Lin incorporates into his analysis Bohnemeyer and Swift’s (2004) theory that default aspectual interpretations depend on the telicity of the relevant eventuality, so a stative verb like (6a), which is atelic, has a covert imperfective aspect by default, whereas a telic event realized by a resultative verb compound in (6b), has a covert perfective aspect. The semantics of imperfective and perfective aspect Lin proposes is listed in (7). While both aspects specify the inclusive relationship between the topic time and the event time, the perfective aspect additionally encodes the evaluation time t_0 , which is preceded by the topic time.

- (7) a. Imperfective aspect =: $\lambda P_{\langle i, t \rangle} \lambda t_{\text{Top}} \exists t [t_{\text{Top}} \subseteq t \wedge P(t)]$ (Lin 2006: 4)
- b. Perfective aspect =: $\lambda P_{\langle i, t \rangle} \lambda t_{\text{Top}} \lambda t_0 \exists t [t \subseteq t_{\text{Top}} \wedge P(t) \wedge t_{\text{Top}} < t_0]$ (Lin 2006: 6)

With a default rule which assigns the speech time as the value of the evaluation time or the topic time at the root level, (7) correctly accounts for sentences with an overt or covert aspect. For instance, (7a) applies to (6a) and the default speech time is included within the situation: $\exists t [t_{\text{Speech}} \subseteq t \wedge \text{smart}(\text{they})(t)]$, thus giving a present interpretation. (7a) also correctly explains a shifting effect brought about by a past temporal adverb: In (8), the past time adverb gives the value of the topic time, $\exists t [\text{before} \subseteq t \wedge \text{smart}(\text{they})(t)]$, giving a past interpretation.

- (8) tāmen yǐqián hěn cōngmíng. STATIVE: PAST
 they before very smart
 ‘They were very smart before.’

In contrast, a past time adverb always agrees with the perfective aspect, (6) vs. (9), as the perfective aspect already encodes a past meaning as part of its semantics via the precedence relation $t_{\text{Top}} < t_0$.

- (9) tā zuótiān dǎ-pò yī-gè bēizǐ. ACHIEVEMENT: PAST
 he yesterday hit-break one-CL cup
 ‘He broke a cup yesterday.’

Future is lexically marked by an auxiliary/modal *huì* ‘will/would’ regardless of whether the following verb is eventive or stative (10). Without *huì*, (10a) with the activity verb only has a habitual reading, and (10b) with the stative verb can only be present tense (cf. (6a)).

- (10) a. tāmen *(*huì*) chàng gē.⁵
 they FUT sing song
 ‘They will sing songs.’
- b. tāmen *(*huì*) hěn máng.
 they FUT very busy
 ‘They will be very busy.’

In Lin’s analysis, the function of *huì* is to locate the topic time after the evaluation time, as in (11), where the evaluation time t_0 can be the speech time (10) or the matrix event time if *huì* is embedded in a subordinate clause (12).

⁵ (10a) is grammatical if *huì* is interpreted as an ability modal (‘they can sing songs’), cf. fn. 8.

(11) $[[hui]] = \lambda P_{\langle i, t \rangle} \lambda t_{Top} \lambda t_0 [P(t) \wedge t_0 < t_{Top}]$ (Lin 2006: 18)

(12) tā shuō tā huì hěn máng.
 he say he FUT very busy
 ‘He said that he would be very busy.’

Lin argues that (11) can explain why *huì* is incompatible with a perfective aspect under its scope (13a) but is compatible with an imperfective marker (13b): The function denoted by *huì* requires an argument of type $\langle i, t \rangle$. This condition is only met by the output of the imperfective aspect, but not by the output of the perfective marker, which is of type $\langle i, \langle i, t \rangle \rangle$.

(13) a. tāmen huì chàng(*-le) gē.
 they FUT sing-PFV song
 ‘They will sing songs.’
 b. tāmen huì zài chàng gē.
 they FUT PROG sing song
 ‘They will be singing songs.’

The Mandarin temporal system can be summarized in Table 2. Future reference is marked by *huì*, which is compatible with the imperfective aspect. If *huì* is absent in sentences, an (overt or covert) imperfective aspect gives a present interpretation by default and can be shifted to the past by a past time adverb if the verb is stative, whereas a perfective aspect always yields a past time.

Table 2. The Mandarin temporal system

	Past	Present	Future
State	<i>past time adverb</i>	<i>(covert) imperfective</i>	<i>huì</i>
Event	<i>perfective</i>	<i>imperfective</i>	

4 Temporal interpretation of modals in Mandarin

Having reviewed the temporal interpretations of modal-less sentences, I now examine both the temporal orientation (T.O.) and temporal perspective (T.P.) of epistemic and circumstantial modals in combination with prejacent of different eventuality types. I will show that both epistemic and circumstantial modals in Mandarin allow shifting of T.P. from the speech time but they differ in whether they allow a past T.O.

4.1 Epistemic modals

A stative event under an epistemic modal can happen at the same time as the time at which the modal base is calculated, giving a present T.O. (14), or have happened before the evaluation time of the modal, giving a past T.O. (15). The past T.O. is rendered possible by a past time adverb.

(14) Context: *You can't find your friend anywhere and the last place you have not checked is Mahony's. You're now at Mahony's and see your friend's umbrella outside the door.*
 tā yīdìng zài zhèlǐ.
 he EPIS.NEC LOC here
 ‘He must be here.’

(15) Context: *You can't find your friend anywhere and the last place you have not checked is Mahony's. You're now at Mahony's and find your friend's umbrella but don't see him around. The bartender says that there was a guy looking like what you describe.*
 tā gānggāng yīdìng zài zhèlǐ.
 he just.before EPIS.NEC LOC here
 ‘He must have been here just before.’

To express a future T.O., the stative preajacent has to take the future marker *huì*:

- (16) Context: *You would like to visit your friend tomorrow but you are not sure whether he will be at home. You get information from his sister that their family will have a get-together tomorrow which requires every member to be there.*

tā yīdìng *(huì) zài jiā.
he EPIS.NEC FUT LOC home
'He will be at home.'⁶

On the other hand, an eventive verb embedded under an epistemic modal requires the imperfective aspect for a present T.O. (17) and the perfective aspect for a past T.O. (18). For a future T.O., again *huì* is obligatory (19). These sentences are ungrammatical without the aspectual or future marking.

- (17) Context: *You hear the uproar and clink of bottles from the living room.*

tāmen kěnéng *(zài) hē jiǔ.
they EPIS.POS PROG drink wine
'They may be drinking.'

- (18) Context: *Your brothers come very late, uttering ravings and stinking of wine.*

tāmen yīdìng hē*(-le) jiǔ.
they EPIS.NEC drink-PFV wine
'They must have drunk wine.'

- (19) Context: *You don't see your brother at dinner time. Your mother tells you that he just had a quarrel with his girlfriend before you came back and said he was going for a walk alone. You know he always likes to drink when he's in bad mood.*

tā yīdìng *(huì) qù hē jiǔ.
he EPIS.NEC FUT go drink wine
'He will go drinking.'

The temporal orientations of the epistemic modals exhibit exactly the same patterns as the temporal interpretations of unembedded sentences, in which a non-future T.O. heavily relies on the interaction of viewpoint aspect and eventuality type, whereas a future T.O. is acquired only when *huì* is present. The fact is not surprising as T.O. of a modal is essentially a relation between an evaluation time at which modal background is accessed and an event time of preajacent, and thus has the same function as a perfective viewpoint aspect and the future auxiliary *huì* (cf. Section 3). In other words, past T.O. for epistemic modals is the semantics of a perfective aspect and future T.O. the semantics of the future auxiliary.

In the contexts presented so far, the temporal perspective is always located at the speech time. The speaker makes an inference as to the truth of the preajacent based on his knowledge at the time at which he speaks. Logically, the speaker can also evaluate the preajacent based on his knowledge prior to the speech time, giving a past temporal perspective, but a past T.P. for epistemic modals is not commonly acknowledged in the literature (e.g. Condoravdi 2002, Stowell 2004, Hacquard 2009, Demirdache and Uribe-Etxebarria 2008, Laca 2008 etc.) due to the fact that the epistemic state of speakers is in general accessed at the speech time. However, with a rich context, epistemic modals in various languages are found to allow a past T.P. without involving indirect speech or an elided attitude verb (Eide 2003, Matthewson to appear, Matthewson and Rullmann 2012). Interestingly, Mandarin demonstrates that shifting of the T.P. to the past is possible for epistemic modals without extra lexical or morphosyntactic resources. Below are examples of the past T.P. with a present (20), past (21) and future T.O. (22):

- (20) Context: *Pat is going on a long trip and Stacey promises to feed his pet for him while he's gone.*

⁶ (16) and (19) can only be translated with 'will' as the English epistemic necessity modal 'must' can't be future-oriented (Portner 2009: 230).

When Stacey headed to the pet store, she found she actually didn't know what kind of animal Pat has. She remembered Pat likes dogs so she bought a bone. However, 'it's a snake!' she realizes when she comes to Pat's house. Pat asks her, 'Why did you buy a bone?' Stacey says, 'Well, you might have had a dog.' (Feeding Fluffy, from Totem Field Storyboards <http://totemfieldstoryboards.org>)

nǐ kěnéng yǒu yī-zhī gǒu.
 you EPIS.POS have one-CL dog
 'You might have had a dog.'

- (21) Context: *You and your friend agreed to meet at 41 St.'s 7-11, but you didn't see him at the appointed time. The 7-11 clerk told you there's another 7-11 on 41 St. so you hastened to go there but still didn't find him. When you came home, you got his call. He says, 'Why didn't you wait for me? I was only 15 minutes late!' You reply:*

nǐ kěnéng qù-le lìngwài yī-jiā 7-11.
 you EPIS.POS go-PFV another one-CL 7-11
 'You might have gone to another 7-11.'

- (22) Context: *You thought you were going to meet your friend at 41 St.'s 7-11, but you didn't see him at the appointed time. You didn't have a cell with you so you only waited there but never find him. Later when you came home, you got his call, saying 'Why didn't you go find a booth and call me? I was waiting for you at 44 St.'s 7-11 for 1 hour!' You reply:*

nǐ kěnéng huì zhǎo-bú-dào wǒ.
 you EPIS.POS FUT find-NEG-out me
 'You might not have found me' (if I left the 7-11 and you arrived while I was gone).

A future T.P. is also possible for the epistemic modals. The context in (23) says that according to our knowledge at the speech time, it's impossible for human being to go up to the outer space by elevator, but it will become possible later once the Japanese company develops the technology. The future T.P. requires the future morpheme *jiāng* to precede the epistemic modal, which forms a contrast with the future T.O., which requires *huì* to follow the modal, as in (16), (19), and (22).⁷

- (23) Context: *Japanese construction company Obayashi wants to build an elevator to space and transport passengers to a station about a tenth the distance to the moon. The elevator would use super-strong carbon nanotubes in its cables and could be ready as early as 2050, according to Tokyo-based Obayashi. (<http://news.cnet.com>, Feb. 23, 2012)*

2050-nián jiāng/*huì kěnéng dǎ diàntī shàng wàitàikōng.
 2050-year FUT EPIS.POS take elevator go.up outer.space
 '(Human being) will be likely to go up to the outer space by elevator by 2050.'

We have seen that the Mandarin epistemic modals allow a present, past and future T.O. via the aspectual or temporal marking, and can involve a past T.P. without any particular grammatical element and a future T.P. with the future morpheme *jiāng* above the modal. The temporal interpretation possibilities for epistemic modals are summarized in Table 3.

Table 3. T.P. and T.O. for epistemic modals

	T.P.		Temporal Orientation		
	Past/Present	Future	Past	Present	Future
State	---	<i>jiāng</i>	<i>past adverb</i>	<i>(covert) imperfective</i>	<i>huì</i>
Event			<i>perfective</i>	<i>imperfective</i>	

⁷ The morphemes *jiāng* and *huì* are sometimes exchangeable without changing the future meaning, or even coexist as a disyllabic morpheme, as in (i). I leave the difference between them for future research.

(i) tā jiāng/huì/jiānghuì chéngwèi yōuxiù de lǎoshī.
 he FUT become excellent POSS teacher
 'He will become an excellent teacher.'

4.2 Circumstantial modals

Circumstantial modals differ from the epistemic modals in being incompatible with the future auxiliary *huì* in a context of future T.O., irrespective of whether their ordering source is deontic (24), teleological (25), or empty (26), and of whether their prejacent is stative or eventive, (24a) vs. (24b).

- (24) a. Context: *You plan to go on a short trip in the coming weekend but your mother rejects your plan because this weekend is your grandfather's 60th birthday and everyone should be there.*
 nǐ bìxū (*huì) zài jiā.
 you CIRC.NEC FUT LOC home
 'You must be at home.'
- b. Context: *We are playing a game and agree that the loser will sing a song for our entertainment. It comes out that John is the loser.*
 tā bìxū (*huì) chàng gē.⁸
 he CIRC.NEC FUT sing song
 'He must sing.'
- (25) Context: *Your friend asks you to taste her new recipe and give her advice.*
 nǐ kěyǐ (*huì) jiā duō yīdiǎn yánbā.
 you CIRC.POS FUT add more a.little salt
 'You can add some more salt.'
- (26) Context: *You acquire a piece of land in a far away country and discover that the soil and climate are very much like at home, where hydrangeas prosper everywhere. Since hydrangeas are your favorite plants, you wonder whether they would grow in this place and inquire about it.* (Kratzer 1991: 646)
 xiùqiúhuā kěyǐ (*huì) shēngzhǎng zài zhèlǐ.
 hydrangea CIRC.POS FUT grow LOC here
 'Hydrangeas can grow here.'

In addition, the circumstantial modals cannot embed a prejacent taking a perfective marker, which is the source of a past T.O. in the epistemic modals, as in (27). What if the circumstantial modal embed an achievement verb, which is assumed to have a covert perfective aspect in Lin (2006) (cf. Section 3), as in (28)? If there were a covert perfective, it would enforce a past T.O., but the sentence only allows a future T.O.

- (27) *tāmen bìxū chàng-*le/guò* gē.
 they CIRC.NEC sing-PFV/EXP song
 'They had to sing songs.'
- (28) tāmen bìxū dǎ-yíng bǐsài.
 they CIRC.NEC play-win game
 'They must win the game.'
 #'They had to win the game.'

A past time adverb can't lead to a past T.O. but instead triggers a counterfactual reading. For instance, (29) conveys that at the mentioned time yesterday, in view of their goal, that they win the game is true in all accessible worlds, but this was not realized in the actual world, thus involving past obligation, a past T.P. Therefore, the unavailability of a past T.O. in the circumstantial modals is evidenced by the absence of a perfective aspect with the prejacent as well as the fact that a past time adverb only shifts

⁸ *huì* is grammatical here if it's interpreted as an ability modal and the sentence will have multiple modals:

(i) tā bìxū *huì* chàng gē.
 he CIRC.NEC ABIL sing song
 'He must be able to sing songs.'

the temporal perspective.

- (29) Context: *In order to reach the final champion match, they had to win the game yesterday (but they lost in the end).*

tāmen zuótiān bìxū dǎ-yíng bǐsài.⁹
they yesterday CIRC.NEC play-win game
'They had to win the game yesterday' (but they didn't).

The imperfective markers are the only viewpoint aspects allowed under circumstantial modals. When an imperfective aspect is attached to an eventive prejacnt, we see either a future or a present T.O. is available (30), depending on the context. A stative prjacnt, which is argued to only take a covert imperfective marker (Lin 2006, cf. (5a) vs. (6a)), can also allow a present T.O. (31), in addition to the future T.O. (24a).

- (30) a. Context: *Our music class has been converted into an additional mathematics class when the midterm approaches. However, the school inspector will make his rounds in our music class today. Our teacher asks us:*

nǐ-men dǐngyǐxià bìxū (*hui) zài chàng gē. FUTURE T.O.
you-PL later CIRC.NEC FUT PROG sing song
'You guys must be singing later.'

- b. Context: *The school inspector arrives at the school and knows from the students' course schedule that now is their music class. He thinks:*

tāmen xiànzài bìxū zài chàng gē. PRESENT T.O.
they now CIRC.NEC PROG sing song
(According to the educational policy,) 'They must be singing now.'

- (31) xiànzài shì wǔxiū, tóngxué-men dōu bìxū zài jiàoshì.
now be lunch.break class-PL all CIRC.NEC LOC classroom
'Now is lunch break so all students have to be in the classroom.'

With regards to T.P., the circumstantial modals are parallel to the epistemic modals. We have seen above that the circumstantial modals allow both a present T.P. (24-26), and (30-31), and a past T.P. (29). They also allow a future T.P. if they are preceded by the future maker *jiāng* (32).

- (32) Context: *According to current law, foods containing more than 0.5g of trans fat must say so. But if a snack contains, for example, 0.49 g of trans fat, it can be labeled to indicate that it contains none at all. Considering the daily maximum 1.11 g of trans fat, you could exceed that amount by eating just three servings of "zero trans fat" snack food. The researcher and medical student at Case Western Reserve University School of Medicine is calling for a change in that policy. (<http://www.cbsnews.com>, Jan. 4, 2011)*

shípin suǒ hán fǎnshìzhī jiāng bìxū biāozhù.
food REL contain trans.fats FUT CIRC.NEC label
'Food which contains trans fats will have to be labeled.'

The temporal interpretation possibilities for the circumstantial modals are summarized in Table 4. The circumstantial modals have been shown to allow a future and present T.O. but not a past T.O. In this they contrast with the epistemic modals, which allow all the three kinds of T.O., as illustrated by the presence vs. absence of a perfective aspect under the two types of modals. Moreover, unlike the epistemic modals, a future T.O. for the circumstantial modals doesn't permit any overt

⁹ The counterfactual reading can be facilitated with a contrastive adverb *běnlái* or a sentence-final particle/mood *de*:

(i) tāmen zuótiān běnlái bìxū/kéyǐ dǎ-yíng bǐsài de.
they yesterday originally CIRC.NEC/CIRC.POS play-win game PRT
'They had to have won a game yesterday' (but they didn't).

marker on both stative and eventive prejacent. A stative prejacent can additionally have a present T.O. by itself, while an eventive prejacent can be present-oriented if an imperfective aspect is present.

Table 4. T.P. and T.O. for circumstantial modals

	T.P.		Temporal Orientation		
	Past/Present	Future	Past	Present	Future
State	---	<i>jiāng</i>	*	<i>(covert) imperfective</i>	<i>null</i>
Event				<i>imperfective</i>	

4.3 The ambiguous weak necessity modal

We have shown that the aspectual and future marking under both types of modals exhibit contrastive occurrence restriction: The epistemic modals co-occur with a perfective marker and the future marker *huì*, while the circumstantial modals don't. This generalization will predict that the weak necessity modal *yīnggāi*, which is ambiguous between an epistemic and circumstantial modal base, will be interpreted differently in terms of these markings. The prediction is upheld. When *yīnggāi* co-occurs with a perfective marker (33) or the future marker (34), it can only be epistemic.

(33) Context: *You were watching the Canucks and in the second period, they were up 4-1, but you fell asleep so didn't know the exact result.*

tāmen yīnggāi dǎ-yíng-le bǐsài. EPISTEMIC/*DEONTIC: PAST
 they W.NEC play-win-PFV game
 'They should have won the game.'

(34) Context: *They have been practicing very hard this season; their competitors haven't received intensive training; they are also the host team...*

tāmen yīnggāi huì dǎ-yíng bǐsài. EPISTEMIC/*DEONTIC: FUTURE
 they W.NEC FUT play-win game
 'They should win the game.'

On the contrary, if *yīnggāi* combines with a bare prejacent, it can only be used as circumstantial, with possibly varied ordering sources (35).

(35) tāmen yīnggāi dǎ-yíng bǐsài .
 they W.NEC play-win game
 'They should win the game.'

DEONTIC: *Their team is the best in the country. Given the convention that the best team always wins the international championship, they should win the game.*

TELEOLOGICAL: *Given their goal of being recognized by people worldwide, they should win the game.*

BOULETIC: *In view of the high value prizes they want, they should win the game.*

As for the imperfective aspects, since they are able to attach to prejacent of both types of modals, yielding a present T.O for the epistemic modals, and a present or future T.O. for the circumstantial modals, we predict that *yīnggāi* can co-occur with an eventive prejacent with the progressive marker *zài* and a stative one with a covert imperfective aspect, and the sentences can be used in types of modal contexts. This is upheld (36-37).

(36) tāmen yīnggāi zài chàng gē.
 they W.NEC PROG sing song
 'According to the schedule, they should be singing.' EPISTEMIC: PRESENT
 'According to the regulation, they should be singing.' DEONTIC: PRESENT/FUTURE

(37) tāmen yīnggāi zài jiā.
 they W.NEC LOC home
 'According to the schedule, they should be at home.' EPISTEMIC: PRESENT

The weak necessity modal *yīnggāi* thus reinforces the generalizations we have made: The two types of modals differ in whether they allow a past T.O., as evidenced by the presence vs. absence of a perfective aspect under the modals. A future T.O. for the two types of modals is derived differently: via *huì* under the epistemic modals, whereas via the null morpheme under the circumstantial ones. A present T.O. for both types of modals is possible only with a stative verb, and an imperfective aspect. The findings give empirical evidence for the correlation between the types of modal bases, epistemic vs. non-epistemic, and T.O. argued for in the literature (Condoravdi 2002¹⁰, Stowell 2004, Werner 2006, van de Vate 2010, Matthewson to appear, among others).

5 A split analysis

What kind of modal semantics can best account for the temporal difference based on the facts discussed so far? Since the future marker *huì* is obligatorily absent under the circumstantial modals, I argue that the future T.O. is encoded in the semantics of the circumstantial modals. On the other hand, the varied T.O. of the epistemic modals is determined by the presence of the aspectual/future marking.

There are reasons for not adopting a uniform analysis which either attributes the temporal semantics to both modals or to a separate future/prospective morpheme. The former can be represented by Condoravdi’s (2002) analysis, which argues that modals in English are all inherently forward-shifting and different interpretations other than future are conditioned by eventuality and the presence vs. absence of the perfect. This proposal cannot account for the fact that the epistemic modals in Mandarin must rely on the presence of the future marker to have a future T.O. The Mandarin epistemic modals thus differ from the English ones with respect to how to express futurity in a simple modal sentence. However, the Mandarin fact is not very surprising. In Gitksan, a Tsimshian language spoken in north-western British Columbia of Canada, it’s also found that a future T.O. for epistemic modals always needs a prospective aspect morpheme *dim* on the prejacent (Matthewson to appear).

Although Mandarin and Gitksan are parallel with the epistemic modals, they are different particularly with respect to the presence of the future marker under circumstantial modals: Gitksan obligatorily require the prospective aspect marker *dim* whereas Mandarin doesn’t permit the future marker *huì*. To account for the obligatory presence of a prospective aspect marker under all modals with a future T.O. in Gitksan, Matthewson (to appear) argues that Gitksan modals have no inherent future orientation, and it’s *dim* which appears under a modal that gives a future orientation. If applying the similar uniform analysis to the Mandarin modals, it will require the future marker *huì* be responsible for a future T.O. of both types of modals. However, it wrongly predicts that the future marker is obligatorily present under the circumstantial modals. Crucially, the split condition of the future marker in each modal class suggests the future semantics is lexically encoded only in circumstantial modals (Enç 1996, van de Vate 2010, Abusch to appear, among others).

Due to the difficulties of applying a uniform analysis, I suggest that Condoravdi’s (2002) analysis of English modals can only be extended to the Mandarin circumstantial modals, while Matthewson’s (to appear) analysis of Gitksan modals can only be applied to the Mandarin epistemic modals. Adopting a split analysis, I propose that in Mandarin, circumstantial modals encode futurity in their semantics, whereas epistemic modals only introduce a time variable but don’t specify its reference, which is derived from semantic composition with the viewpoint aspects and the future marker *huì*. Following Rullmann et al. (2008), the modals are defined as lexically restricted to either circumstantial or epistemic modal bases from the very first in the lexicon. I start with the analysis of the circumstantial modals.

Lexical entries for the Mandarin circumstantial necessity and possibility modals are given in (38-39). According to Abusch (1998), $[t, _)$ designates an interval with t as an initial subinterval and extending to the end of time, which gives forward-shifting semantics. Condoravdi’s AT relation (40),

¹⁰ Condoravdi (2002) actually proposes that the temporal asymmetry is between epistemic and metaphysical modal bases, but Abusch (to appear) argues that the modals which are always future-oriented use a circumstantial but not metaphysical modal base because not all facts about the base world are taken into account. Since Mandarin lexically distinguishes epistemic and circumstantial bases, the temporal asymmetry between the two provides evidence for Abusch’s (to appear) argument.

how property P is instantiated in world w at time t, is also assumed here because in Mandarin, the eventuality type makes a difference with respect to whether the temporal orientation can be present or not.

(38) [[*bìxū*_{MB}]] is defined only if MB is circumstantial. If defined,
[[*bìxū*_{MB}]] = $\lambda P_{\langle i, st \rangle} \lambda w \lambda t \forall w' [w' \in MB(w, t) \rightarrow AT([t, _], w', P)]$

(39) [[*kěyǐ*_{MB}]] is defined only if MB is circumstantial. If defined,
[[*kěyǐ*_{MB}]] = $\lambda P_{\langle i, st \rangle} \lambda w \lambda t \exists w' [w' \in MB(w, t) \& AT([t, _], w', P)]$ (Condoravdi 2002:71)

(40) $AT(t, w, P) = \begin{cases} \exists e [P(w)(e) \& \tau(e, w) \subseteq t] & \text{if P is eventive} \\ \exists e [P(w)(e) \& \tau(e, w) \circ t] & \text{if P is stative} \\ P(w)(t) & \text{if P is temporal (Condoravdi 2002:70)} \end{cases}$

(41-42) are results of applying the analysis to the deontic necessity modal with a stative and eventive preajacent respectively: (41) states that for all accessible worlds compatible with what the rules require at the time t, the time of the stative preajacent ‘you are at home’ overlaps the interval between the time t and the end of time. The overlapping relation gives either a present T.O. if the state starts at some point in the past of the time t, or a future T.O. if it is totally included in the interval [t, _). (42) shows that the time of the eventive preajacent is fully included in the interval [t, _) due to the semantics of AT, thus yielding a future T.O. alone. The time variable t can be the speech time or a past topic time if the sentence has a past T.P.

(41) nǐ bìxū zài jiā. PRESENT/FUTURE T.O.
you CIRC.NEC LOC home
‘You must be at home.’
[[*nǐ bìxū*_{MB} zài jiā]]
= $\lambda t \lambda w \forall w' [w' \in MB(w, t) \rightarrow \exists e [[\text{you are at home}](w', e) \& \tau(e, w') \circ [t, _]]]$

(42) tā bìxū chàng gē. FUTURE T.O.
he CIRC.NEC sing song
‘He must sing songs.’
[[*tā bìxū*_{MB} chàng gē]]
= $\lambda t \lambda w \forall w' [w' \in MB(w, t) \rightarrow \exists e [[\text{he sings songs}](w', e) \& \tau(e, w') \subseteq [t, _]]]$

Note that an eventive preajacent only acquires a present T.O. if it takes an imperfective aspect (43) (repeated from (30) above):

(43) nǐmen bìxū zài chàng gē. PRESENT/FUTURE T.O.
you CIRC.NEC PROG sing song
‘You guys must be singing.’

The effect of eventuality is also observed in English epistemic modals, where a progressive preajacent behaves like a stative one with respect to allowing a present T.O. I assume the temporal property of the imperfective aspect and an eventive predicate follows the third sub-relation of AT in (40). Applying Lin’s (2006) semantics of the imperfective aspect (44) (repeated from (7a) above),¹¹ and the lexical entry of the modal (38), the computation of (43) is shown in (45). The time t can be instantiated by a present or past T.P. and the relation that the event time t’ includes the interval [t, _) gives a present or future T.O.

(44) [[IMPRF]] = $\lambda P_{\langle i, st \rangle} \lambda t \lambda w \exists t' [t \subseteq t' \& \exists e [P(w)(e) \& \tau(e, w) = t']]$

(45) nǐmen bìxū zài chàng gē. PRESENT/FUTURE T.O.

¹¹ Since the semantics of imperfective/perfective viewpoint aspect and the future morpheme *huì* given in Lin (2006) (cf. (7) and (11) above) doesn’t have a world and event variable, I convert them into (44), (49), and (51).

you CIRC.NEC PROG sing song
 ‘You guys must be singing songs.’
 [[*nǐmen bìxū*_{MB} *zài chàng gē*]]
 = $\lambda t \lambda w \forall w' [w' \in \text{MB}(w, t) \rightarrow \exists t' [[t, _] \subseteq t' \& \exists e [[\text{you guys sing songs}](w', e) \& \tau(e, w') = t']]]$

Next, lexical entries for the epistemic necessity and possibility modals can be spelled out in (46-47). Unlike the circumstantial modals, no AT relation and specified interval $[t, _]$ is encoded in the epistemic modals.

(46) [[*yīdìng*_{MB}]] is defined only if MB is epistemic. If defined,
 [[*yīdìng*_{MB}]] = $\lambda P_{\langle i, st \rangle} \lambda w \lambda t \forall w' [w' \in \text{MB}(w, t) \rightarrow P(t)(w') = 1]$

(47) [[*kěnéng*_{MB}]] is defined only if MB is epistemic. If defined,
 [[*kěnéng*_{MB}]] = $\lambda P_{\langle i, st \rangle} \lambda w \lambda t \exists w' [w' \in \text{MB}(w, t) \& P(t)(w') = 1]$ (Matthewson to appear: 7)

I demonstrate the analysis applying to the epistemic possibility modal with a present T.P. (48) is repeated from (17) above, in which semantics is composed of an epistemic possibility modal base (47) and the imperfective aspect *zài* (44). (48) asserts that there’s a world w' which is accessible from w at the speech time, in which ‘they drink wine’ which includes the speech time, thus giving a present T.O.

(48) *tāmen kěnéng zài hē jiǔ.* PRESENT T.O.
 they EPIS.POS PROG drink wine
 ‘They may be drinking wine.’
 [[*tāmen kěnéng*_{MB} *zài hē jiǔ*]]
 = $\lambda w \exists w' [w' \in \text{MB}(w, \text{now}) \& \exists t' [\mathbf{now} \subseteq t' \& [\exists e [[\text{they drink wine}](w')(e) \& \tau(e, w') = t']]]]$

When the epistemic possibility modal embeds a predicate taking the perfective aspect (49) (repeated from (7b) above), it asserts that there’s a world w' which is accessible from w at the speech time, in which ‘they drink wine’ at a time t' which is included in a past topic time t (50). The precedence relation $t < \text{now}$ combining with the inclusion relation $t' \subseteq t$ gives the past T.O. and such relations exclusively arise from the semantics of the perfective aspect.

(49) [[PRF]] = $\lambda P_{\langle i, st \rangle} \lambda t \lambda t' \lambda w \exists t'' [t'' \subseteq t \& \exists e [P(w)(e) \& \tau(e, w) = t''] \& t < t']$

(50) *tāmen kěnéng hē-le jiǔ.* PAST T.O.
 they EPIS.POS drink-PFV wine
 ‘They may have drunk wine.’
 [[*tāmen kěnéng*_{MB} *hē le jiǔ*]]
 = $[[[kěnéng_{MB}]]](\lambda t' \lambda w \exists t \exists t'' [t'' \subseteq t \& \exists e [P(w)(e) \& \tau(e, w) = t''] \& t < t'])^{12}$
 = $\lambda w \exists w' [w' \in \text{MB}(w, \text{now}) \& \exists t \exists t'' [t'' \subseteq t \& [\exists e [[\text{they drink wine}](w')(e) \& \tau(e, w') = t''] \& t < \mathbf{now}]]]$

A future T.O. with the epistemic modal is derived from the future marker *huì* which encodes a precedence relation between the speech time and event time. The semantics of *huì* is repeated in (51) from (11) above. Applying (47) and (51), (52) asserts that there’s a world w' which is accessible from w at the speech time, such that ‘they drink wine’ at a time t' which follows the speech time.

(51) [[*huì*]] = $\lambda P_{\langle i, st \rangle} \lambda t \lambda t' \lambda w [\exists e [P(w)(e) \& \tau(e, w) = t] \& t' < t]$

¹² Lin (2006) assumes a rule applies at the IP level to an output translation of type $\langle i, \langle i, t \rangle \rangle$, closing an unfilled topic time variable, because “IP is the level where a topic time should be found” (Lin 2006: 5). Here I assume that such a rule in modal sentences applies at the ModP level, as in both (50) and (53), because T.O. is parallel to the semantics of the perfective aspect/future marker, cf. Section 4.1.

- (52) tāmen kěnéng huì hē jiǔ. FUTURE T.O.
 they EPIS.POS FUT drink wine
 ‘They may drink wine.’
 [[tāmen kěnéng_{MB} huì hē jiǔ]]
 = [[kěnéng_{MB}](λt' λw ∃t [∃e [P(w)(e) & τ(e, w) = t] & t' < t])
 = λw ∃w' [w' ∈ MB(w, now) & ∃t [∃e [[they drink wine](w')(e) & τ(e, w') = t] & **now** < t]]

In contrary to the epistemic modals, the incompatible co-occurrence of a circumstantial modal and the future marker is explained by the inherent semantics of the circumstantial modal. As demonstrated in (53) (repeated from (24b)), since the circumstantial modal already encodes in its lexical entry an interval [t', _), the composition of the modal and the future marker *huì*, which denotes the precedence of a topic time over the evaluation time t' < t, gives [t', _) < t and causes a conflict: a topic time can't precede an interval extended to the end of time.

- (53) *tā bìxū huì chàng gē.
 he CIRC.NEC FUT sing song
 ‘He must sing songs.’
 [[tā bìxū_{MB} huì chàng gē]]
 = [[bìxū_{MB}](λt' λw ∃t [∃e [[he sings songs](w)(e) & τ(e, w) = t] & t' < t])
 = λt' λw ∀w' [w' ∈ MB(w, t') → ∃t [∃e [[they drink wine](w')(e) & τ(e, w') = t] & [t', _) < t]
 = λw ∀w' [w' ∈ MB(w, now) → ∃t [∃e [[they drink wine](w')(e) & τ(e, w') = t] & [**now**, _) < t]]

The split analysis thus correctly accounts for the correct temporal interpretations of Mandarin modals. It captures the distinct occurrence of the future marker under each modal.¹³ To recapitulate, the interval [t', _) encoded in the lexical entry of circumstantial modals makes it incompatible with attaching to the future marker, while lacking such interval in epistemic modals explains the presence of the future marker for a future T.O.

6 Conclusion and remaining issues

The temporal orientation of modals in Mandarin relates to the types of modal bases: Circumstantial modals allow a present or future orientation, while epistemic modals allow a past, present and future T.O. The hypothesis is proved by the co-occurrence restriction between the perfective/future markers and the modals, and correctly predicts uses of the ambiguous weak necessity modal. Past time adverbs also exhibit a contrast between the two types of modals: while they are able to bring about a past T.O. for epistemic modals, they agree with a past T.P. of circumstantial modals. I propose that the obligatory absence and presence of the future marker *huì* under the circumstantial and epistemic modals in Mandarin need a split analysis of future semantics for each modal.

A remaining question is why the languages vary in the ways of expressing the future tendency for circumstantial modals. Specifically, Mandarin and Gitksan differ from English in the presence of a

¹³ This analysis can't explain why the perfective aspect is incompatible with circumstantial modals (Matthewson, p.c.); actually, it instead predicts that the perfective aspect can appear under a circumstantial modal (i) (repeated from (27)):

- (i) *tāmen bìxū chàng-le gē.
 they CIRC.NEC sing-PFV song
 ‘They had to sing songs.’
 = [[tāmen bìxū_{MB} chàng-le gē]]
 = [[bìxū_{MB}](λt' λw ∃t ∃t' [t'' ⊆ t & ∃e [[they sing songs](w)(e) & τ(e, w) = t''] & t < t'])
 = λt' λw ∀w' [w' ∈ MB(w, t') → ∃t ∃t'' [t'' ⊆ t & ∃e [[they sing songs](w')(e) & τ(e, w') = t''] & t < [t', _)]]

An alternative is to adopt Matthewson's (to appear) proposal that the futurity of modals comes from a separate prospective aspect marker, which in Mandarin is covert. This would ideally explain why the perfective aspect is incompatible with the circumstantial modals in Mandarin, as they already have a viewpoint aspect. However, the challenge to the prospective aspect analysis is to explain why Mandarin possess both a null prospective with circumstantial modals and an overt one with epistemic modals.

separate future morpheme in epistemic modals, while yet Mandarin deviates from Gitksan in the absence of a future morpheme in circumstantial modals, as summarized in Table 5.

Table 5. A comparison of futurity for the English, Gitksan, and Mandarin modals

	Epistemic: Future T.O.	Circumstantial
English	<i>null</i>	
Gitksan	<i>dim</i>	<i>dim</i>
Mandarin	<i>hui</i>	<i>null</i>

I suggest that the variations might relate to syntactic properties of modals in individual languages. In Mandarin, multiple modals exhibit an ordering restriction, which indicates a hierarchy of modals in the syntactic structure; particularly, epistemic modals precede deontic and ability modals (J.-H. Lin 2012). The hierarchical difference could explain why only epistemic modals, which are projected higher than circumstantial modals, can co-occur with the perfective aspect and future *hui*. A crucial support comes from a parallel property between the circumstantial modal and *hui*. J.-H. Lin (2011) argues that epistemic modals in Mandarin take a finite TP complement, and circumstantial modals take a nonfinite TP complement; Lin also shows that the future modal/auxiliary *hui* patterns with circumstantial modals in taking a nonfinite TP complement. If they are the same syntactic head, they are not able to co-occur. Multiple-modal constructions in Mandarin and a specific investigation of the future morpheme *hui* will have a direct bearing on the (in)compatibility of the types of modals and aspectual/future marking.

References

- Abusch, Dorit. 1998. Generalizing tense semantics for future contexts. In S. Rothstein (ed.), *Events and Grammar*, pp. 13-33. Dordrecht: Kluwer.
- Abusch, Dorit. To appear. Circumstantial and temporal dependence in counterfactual modals. *Natural Language Semantics*.
- Bohnenmeyer, J. and M. Swift. 2004. Event realization and default aspect. *Linguistics and Philosophy* 27: 263-296.
- Borgonovo, Claudia and Sarah Cummins. 2007. Tensed modals. In Luis Eguren et al. (eds.), *Coreference, Modality, and Focus: Studies on the Syntax-Semantics Interface*, pp. 1-18. John Benjamins.
- Chao, Y-R. 1968. *A grammar of spoken Chinese*. University of California Press.
- Condoravdi, Cleo. 2002. Temporal interpretation of modals: Modals for the present and for the past. David Beaver et al. (eds.), *The Construction of Meaning*, pp. 59-88. CSLI Publications.
- Demirdache, Hamida, and Myriam Uribe-Etxebarria. 2008. On the temporal syntax of non-root modals, In Jacqueline Lecarme et al. (eds.), *Time and Modality*, pp. 79-114. Dordrecht: Springer.
- Eide, Kristin M. 2003. Modals and tense. In M. Weisgerber (ed.), *Proceedings of Sinn und Bedeutung* 7, pp. 120-135. The University of Konstanz, Germany.
- Enç, Mürvet. 1996. Tense and modality. In S. Lappin (ed.), *The Handbook of Contemporary Semantic Theory*, pp. 345-358. Oxford: Blackwell.
- Kratzer, Angelika. 1991. Modality. In Dieter Wunderlich et al. (eds.), *Semantics: An International Handbook of Contemporary Research*, pp. 639-650. Berlin: de Gruyter.
- Hacquard, Valentine 2009. On the interaction of aspect and modal auxiliaries. *Linguistics and Philosophy* 32: 279-315.
- Hu, Jianhua, Pan, Haihua, and Xu, Liejiong. 2001. Is there a finite-nonfinite distinction in Chinese? *Linguistics* 39: 1117-1148.
- Laca, Brenda. 2008. On modal tenses and tensed modals. In Chiyo Nishida et al. (eds.), *Proceedings of CHRONOS 2008*.
- Li, Charles N. and Thompson, Sandra A. 1981. *Mandarin Chinese: A functional reference grammar*. Berkeley: University of California Press.
- Li, Ren-Zhi. 2004. *Modality in English and Chinese: A typological perspective*. Doctoral Dissertation, University of Antwerp.

- Lin, T.-H. 2011. Finiteness of clauses and raising of arguments in Mandarin Chinese. *Syntax* 14: 48-73.
- Lin, T.-H. 2012. Multiple-modal constructions in Mandarin Chinese and their finiteness properties. *Journal of Linguistics*: 1-36.
- Lin, J. W. and J. C. C. Tang. 1995. Modals as verbs in Chinese: a GB perspective. *Collection of Sinica Academia* 66: 53-105. (in Chinese)
- Lin, Jo-wang. 2003. Temporal reference in Mandarin Chinese. *Journal of East Asian Linguistics* 12: 259-311.
- Lin Jo-wang. 2006. Time in a language without tense: The case of Chinese. *Journal of Semantics* 23:1-56.
- Matthewson, Lisa and Hotze Rullmann. 2012. Epistemic modals can scope under past tense. Paper presented at the Workshop on Modality, April 20-21, Ottawa, Canada.
- Matthewson, Lisa. 2004. Methodology of semantic fieldwork. *International Journal of American Linguistics* 70: 369-415.
- Matthewson, Lisa. To appear. On the (non-)future orientation of modals. In A. Aguilar-Guevara et al. (eds.), *Proceedings of Sinn und Bedeutung 16*. Cambridge, MA: MIT Working Papers in Linguistics.
- Portner, Paul. 2009. *Modality*. Oxford University Press.
- Ren, F. 2008. *Futurity in Mandarin Chinese*. Doctoral dissertation, University of Texas at Austin.
- Rullmann, Hotze, Lisa Matthewson, and Henry Davis. 2008. Modals as distributive indefinites. *Natural Language Semantics* 16: 317-357.
- Smith, S. Carlota, and Erbaugh Mary S. 2005. Temporal interpretation in Mandarin Chinese. *Linguistics* 42: 713-756.
- Stowell, Tim. 2004. Tense and modals. In Jacqueline Gueron et al. (eds.), *The Syntax of Time*, pp. 621-636. Cambridge: MIT Press.
- Sybesma, Rint. 2007. Whether we tense-agree overtly or not. *Linguistic Inquiry* 38: 580-587.
- Tsang, Chui-Lim. 1981. *A semantic study of modal auxiliary verbs in Chinese*. Doctoral dissertation: Stanford University.
- Vander Klok, Jozina. 2008. Javanese modals: In between auxiliaries and verbs. Paper presented at the annual conference of the Canadian Linguistics Association, May 31-June 2, UBC, Vancouver.
- van de Vate, Marleen. 2010. Possibility Modality in Saamaka. In Lima, Suzi (ed.), *UMOP 41: Proceedings of SULA V*.
- Werner, Tom 2006. Future and non-future modal sentences. *Natural Language Semantics* 14: 35-255.

Sihwei Chen
Sihwei@interchange.ubc.ca