Dynamic Semantics for Intensification and Epistemic Necessity: 
The Case of Yìdīng and Shìbì in Mandarin Chinese

Wu, Jiun-Shiung
Chung Cheng University,
168, University Road,
Minshiung, Chiayi County,
Taiwan, 621
Lngwujs@ccu.edu.tw

Abstract
Functioning as adverbials, yìdīng and shìbì in Mandarin Chinese can either express intensification or (strong) epistemic necessity. In addition, context influences their semantics. Hence, dynamic semantics are proposed for them. An information state σ is a pair <Ą, s>, where s is a proposition and Ą is an affirmative ordering. Yìdīng(ϕ) performs update on an information state: Ą is updated with ϕ and s is specified to be a subset of or equal of ϕ, as long as ϕ is true in one of the absolutely affirmative worlds. Otherwise, uttering yìdīng(ϕ) leads to an absurd state. This is how a strong epistemic necessity reading is derived. To yield an intensification reading, yìdīng(ϕ) performs a test on the information state. Yìdīng(ϕ) gives back the original information state as long as ϕ is true in all of the absolutely affirmative worlds. Otherwise, an absurd state is produced. As for shìbì, its semantics is identical to that of yìdīng, except for that the s in an information state σ for shìbì is underspecified and needs resolving before a proposition gets an appropriate interpretation. The information needed to resolve the underspecified s for shìbì must be inferred from the context.

1 Introduction
In Mandarin Chinese (henceforth, Chinese), intensification and modal necessity can be expressed by the same lexical item. Adverbial yìdīng is one of such lexical items. Please refer to the following examples.

(1) A: Zhāngsān xīhuān Xiàoméi ma? 
Zhangsan like Xiaomei Q
‘Does Zhangsan like Xiaomei?’
B: Zhāngsān yìdīng xīhuān Xiàoméi 
Zhangsan Yìdīng like Xiaomei
Tā hěn zhǔyì Xiàoméi-de
He very pay.attention.to Xiaomei-ASSO
yìjūyídòng. Zhè shí hěn hélǐde
move this be very reasonable
tuǐcè.
conjecture
‘It must be the case that Zhangsan likes
Xiaomei. He pays much attention
to every move of Xiaomei. This is a reason-
able conjecture.’
B’: Zhāngsān yìdīng xīhuān Xiàoméi. 
Zhangsan Yìdīng like Xiaomei
Zhè shí zhōngsuǒzhōzhīde shìshí. 
This be widely-known fact
‘Zhangsan definitely likes Xiaomei. This is
a widely-known fact.’

1 Please note that yìdīng can function either as a nominal modifier or a propositional modifier. The former is referred to as adjectival yìdīng and the latter adverbial yìdīng. This paper discusses adverbial yìdīng only because the semantics of adjectival yìdīng is simple and not as rich as adverbial yìdīng.
2 The abbreviations used in this paper include: ASSO for an associative marker, DEON for a deontic modal expression, DYN for a dynamic modal expression, EPI for an epistemic modal expression, Prc for a sentence-final particle, Prg for a progressive marker, Q for an interrogative particle.
(1) contains two conversations: one between A and B, and the other between A and B’. In the two conversations, A asks whether Zhangsan likes Xiaomei. Although the same sentence Zhāngsān yídīng xīhuān Xiàomèi ‘Zhangsan YIDING like Xiaomei’ is uttered as a response to A’s question, yídīng has different semantic functions. In the utterance of B, yídīng expresses epistemic necessity because B says that the proposition Zhāngsān yídīng xīhuān Xiàomèi ‘Zhangsan YIDING like Xiaomei’ is a reasonable conjecture. Yídīng of this usage is translated as it must be the case that...

Moreover, when expressing epistemic necessity, yídīng expresses ‘strong’ epistemic necessity. The following examples demonstrate the difference between epistemic necessity and ‘strong’ epistemic necessity.

(2) a. Ruòguǒ zài kǎo bù jígě, nǐ
If again take exam not pass you
māmā yídīng hěn shēngqì.
Mom YIDING very angry
‘If you fail the exam again, it must be the case that you mom will be very angry.’
b. Ruòguǒ zài kǎo bù jígě, nǐ
If again take exam not pass you
māmā huì hěn shēngqì.
Mom will very angry
‘If you fail the exam again, you mom will be very angry.’

The difference between (2a) and (2b) lies in that (2a) contains yídīng, while (2b) uses huì. Huì has several meanings and one of them is inference, e.g. Chang (2000), Liu (1997), etc. In (2b), huì is used express an inference about a future situation based the antecedent led by ruòguǒ ‘if’. Although yídīng in (2a) has a similar function, (2a) and (2b) have a subtle semantic difference: (2a) shows a stronger certainty of the speaker’s regarding the truth of the proposition your Mom will be angry, compared to (2b). Hence, when used to indicate an inference, yídīng is said to express ‘strong’ epistemic necessity.

On the other hand, yídīng in the utterance of B’ has a different semantic function. In this utterance, yídīng is used to intensify the speaker’s affirmativeness toward the proposition your Mom will be angry, instead of expressing the proposition as an inference. The intensification function of yídīng in this example is made explicit because of B’ claims that the proposition (=Zhāngsān yídīng xīhuān Xiàomèi ‘Zhangsan YIDING like Xiaomei’) is a widely-known fact. This usage of yídīng is translated as definitely in English and is referred to as an intensification reading.

Shíbì has a semantic function similar to yídīng and they are interchangeable in some examples, but not in others. See below.

(3) a. Yīnwèi zhúzǐ tài xí, yòng zhè zhòng
Because pillar too thin, use this kind
wūdīng yídīng/shíbì yǒu kěnèng
roof YIDING/SHIBI have possibility
tāxiàlái.
collapse
‘Because the pillars are too thin, if this type of roof is used, it is definitely possible that the roof will collapse.’
b. Rúguǒ nǐ chuān hòu yǐfū, nide
if you wear thick clothes your
shāng yídīng/shíbì jiào qīng.
wound YIDING/SHIBI relatively minor
‘If you wear thick clothes, it must be the case that your wound is relatively minor.’

(4) a. Zhè-ge shìhòu, Xiáomíng yídīng/*shíbì
This-CL time Xiaoming YIDING/*SHIBI
zài jiā.
at home
‘At this moment, it must be the case that Xiaoming is at home.’
b. Hūn hòu, rúguǒ zhù Yínní, wǒ
married after if live Indonesia I
*yídīng/shíbì cídào gōngzuò.
*yIDING/SHIBI resign job
‘After getting married, if we live in Indonesia, I definitely have to quit my job.’

In (3a, b), yídīng and shíbì are interchangeable and these two sentences are pretty much synonymous. However, in (4a, b), they are not interchangeable. In (4a), only yídīng is allowed, whereas in (4b) only shíbì is permissible.

In this paper, I would like to address the following questions. First, is it possible to provide a unified semantics for yídīng and shíbì? Second, how can the unified semantics account for the semantic similarity and difference between yídīng and shíbì as demonstrated in (3) and (4)? Finally, how can the unified semantics take care of contextual influence on the semantics of yídīng and shíbì illustrated by the utterances of B and B’ in (1)?
This paper is organized as follows. In Section Two, I critically review literature on yíding and shìbì. In Section Three, I present more data and provide dynamic semantics for yíding and shìbì. Section Four concludes this paper.

2 Review of Previous Studies

The literature on yíding and/or shìbì include Chen (2011), Ding (2008a, b), C. Li (2005), S. Li (2009), Wang (2007), Xu (1995), Zhou (2014), etc. Xu (1995) is on the English translations of yíding and two other adverbs and is not reviewed here. I critically review the other seven studies.

I start with the literature on yídiing and conduct the review in chronological order. Li (2005) distinguishes two variants of yídiing, labeled as yídiing₁ and yídiing₂. He suggests that the former expresses strong volition, either the subject’s or the speaker’s strong volition (for another person) to do something, while the latter denotes stipulation or judgment. He further claims that yídiing₁ often goes with yào, which expresses a deontic reading here, or with děi, which also has a deontic reading, and that yídiing₂ often goes with shì ‘be’ or huì, which denotes epistemic necessity.

A major problem with Li (2005) is that he does not take the intensification reading into consideration, such as the utterance of B’ in (1). Another problem is that the semantic contribution of yídiing is blurred when it goes with another modal expression. For example, he suggests that yídiing děi ‘YIDING DEON’ expresses a deontic reading. Then, a reasonable question to ask is what semantic contribution yídiing has here. The same problem occurs to yídiing huì ‘YIDING EPI’.

Ding (2008a, b) also discusses the semantics of yídiing. These two studies distinguish yídiing₁ from yídiing₂ as well. Similar to Li (2005), Ding (2008a, b) claims that yídiing₁ expresses strong volition and yídiing₂ denotes emphasis on the truth of an inference/judgment. Ding’s (2008a, b) conclusion is similar to Li (2005) and hence suffers from the same problems.

Chen (2011) is mostly on the grammaticalization of yídiing. As for the semantics of yídiing, he claims that yídiing expresses strong volition or stipulation/inference. Since Chen’s (2011) conclusion is identical to Li (2005) and Ding (2008a, b), and therefore is vulnerable to the same problems.

Two major problems shared by Chen (2011), Ding (2008a, b) and Li (2005) are the following. First, they do not discuss whether it is possible to provide a unified semantics for yídiing, and second, they do not discuss how the contextual influence on the semantics of yídiing as demonstrated in the two conversations in (1) should be dealt with.

S. Li (2009), Wang (2007) and Zhou (2014) focus on shìbì. These three studies are also reviewed in chronological order. Wang (2007) is on the lexicalization of shìbì. This paper suggests that shìbì describes an inference made based on a current situation. S. Li (2009) is about the historical development of shìbì. This study states that shìbì expresses an inference that some situation is certain to take place in the future, based on the current status of some other situation. Zhou (2014) provides a relatively detailed discussion on the semantic features of shìbì, but basically says the same thing as S. Li (2009) and Wang (2007). While epistemic necessity is one of the readings expressed by shìbì, these studies cannot explain why shìbì is not good in (4a), which also has an epistemic necessity reading, and neither do they take the intensification reading, such as (3a), into consideration.

Since the above reviewed papers do not provide a comprehensive picture for the semantics of yídiing and shìbì, further study is called for so that the unanswered questions can be addressed.

3 Semantics of Yídiing and Shìbì

3.1 The Data

Yídiing can either present a proposition without a modal expression or one with a modal expression. The utterances of B and of B’ in (1), and the sentence (2a) are typical examples where yídiing presents a proposition not containing a modal expression. (3a) is an example where yídiing presents a modal containing a modal expression. Either case, yídiing is ambiguous between a strong epistemic reading and an intensification reading. Let’s look at a few more examples.

(5) a. Lǐsī yídiing zài jiā.
   Lǐsī YIDING at home
   ‘It must be the case that Lisi is at home.’
   Or, ‘Lisi is definite at home.’
b. Wángwú yìdīng yījīng xièwán  
   Wangwu YIDING already write.finish gōngkè le. 
   homework Prc  
   ‘It must be the case that Wangwu has already finished his homework.’ Or,  
   ‘Wangwau definitely has finished his homework.’

c. Zài xià jī tiān dà yǔ,  
   Again rain several day heavy rain zhēlǐ yìdīng fānsēng tūshīliū.  
   here YIDING happen mud.slide  
   ‘If it rains heavily a few more days, it must be the case that mud slide will happen here.’ Or,  
   ‘If it rains heavily a few more days, mud slide definitely will happen here.’

(6) a. Zhàoliū yìdīng huǐ qí jiāotàchē.  
   Zhaoliu YIDING DYN ride bike  
   ‘It must be the case that Zhaoliu can ride a bike.’ Or,  
   ‘Zhaoliu definitely can ride a bike.’  

b. Sūnqi yìdīng děi dāsāo fāngjiān le.  
   Sunqi YIDING DEON clean room Prc  
   ‘It must be the case that Sunqi has to clean his room.’ Or,  
   ‘Sunqi definitely has to clean his room.’

Some native speakers I consult point out to me that, standing alone, (6b) preferably has an intensification reading, rather than a strong epistemic necessity reading. However, if we provide a context for the sentence, the strong epistemic necessity reading can be brought out. For example,

(7) Sūnqi yìdīng děi dāsāo fāngjiān le.  
   Sunqi YIDING DEON clean room Prc  
   Zhè shí wǒ-de tūcí. Tā-de fùmù  
   this be my conjecture his parents yījīng shòubúliǎo le.  
   already tolerate.not Prc  
   ‘It must be the case that Sunqi has to clean his room. This is my guess. His parents cannot tolerate it anymore.’

So, can a unified semantics be proposed for yìdīng? I believe so. The examples presented in this section and previous sections tell us that the semantics of yìdīng contains two parts. The first part provides an epistemic necessity reading, just like must in English. The other part provides an intensification reading.

If we put aside the contextual influence on the semantics of yìdīng for the moment, the semantics of yìdīng can be modeled using Kratzer’s (2012[1981], 1991) semantics of modal expressions. See (8).

(8) Modal semantics for yìdīng  
   Modal base: Epistemic  
   Modal force: Necessity  
   Ordering sources: (a) doxastic or stereotypical, (b) affirmative

In (8), the modal base, modal force and one of the ordering sources in (a) together are actually the typical semantics for an epistemic necessary modal expression. The new idea here is the second ordering source, the affirmative ordering source. von Fintel and Iatridou (2008) propose that weak necessity modals such as should in English need two ordering sources for their semantics. The idea of two ordering sources is adopted here.

What is an affirmative ordering source? An affirmative ordering source orders possible worlds in terms of the speaker’s affirmativeness toward a proposition. ≤ represents an affirmative ordering source. Then, the ordering of two possible worlds based on an affirmative ordering source is defined as below.

(9) v, w are possible worlds. p is a proposition.  
   w ≤ A v iff {p; p is affirmed in v} ⊆ {p; p is affirmed in w}  
   (cf. Kratzer 2012[1981]: 39)

How about shībì? I show that yìdīng and shībì are interchangeable in some cases, but not in others. For the purpose of discussion, I repeat the relevant examples in (10).

(10) a. Zhè-ge shīhòu, Xiāomíng yìdīng/  
   This-CL time Xiaoming YIDING/  
   *shībì zài jiā.  
   *stūbī at home  
   ‘At this moment, it must be the case that Xiaoming is at home.’
b. Hūn hòu, rúgū zhù Yīnní, wǒ married after if live Indonesia I *yídīng/shībì cidiao gōngzuò. *YĪDĪNG/SHĪBĪ resign job ‘After getting married, if we live in Indonesia, I definitely have to quit my job.’

(11) a. Rúguǒ wǒ bù néng chōngfèn If I not can sufficient gōngyìng shichāng dehuà, wǒ-de provide market Prc my gūkè shībì/yídīng hui cóng other place purchase goods ‘If I cannot provide sufficiently in the market, my customers definitely purchase goods from somewhere else.’

b. Yào jiàngdī chéngbèn, zhōngyǒu want decrease cost CPC yídīng/shībì yào zēng YĪDĪNG/SHĪBĪ DEON increase chán production ‘If it wants to decrease cost, CPC definitely has to increase production.’

In (10a), yídīng is good, but shībì is not. 331 examples of shībì are retrieved from the online version of the Sinica Corpus. Examining these examples carefully, I find that, whenever shībì is used, additional information must be present so that the sentence with shībì can be inferred. For example, in (10b), moving to Indonesia after getting married leads to the event that the speaker has to quit his/her current job. The same reasoning applies to (11a, b).

Therefore, the first difference between yídīng and shībì is that the former does not need the context to explicitly provide information based on which the proposition presented by yídīng can be inferred, whereas the latter does. In (10a), shībì is not good because of lack of such information.

What happens if another modal expression, other than yídīng and shībì, occurs in the sentences, such as (11a, b)? In these cases, yídīng and shībì are interchangeable, and they are ambiguous as discussed above.

So, what is the semantics of shībì and how is it related to that of yídīng? (10) sheds some light on this question. Again, putting contextual influence aside, I propose that the modal base of shībì and the ordering source related to the modal base are both underspecified, while the affirmative ordering source is always there for shībì. Shībì cannot be used in (10a) because information required to infer the proposition presented by shībì does not exist. The lack of such information makes it impossible to resolve the underspecified modal base (and the underspecified ordering source) of shībì.

On the other hand, in (10b), if one moves out of town, then it is most likely required for him/her to quit his/her current job in town. That is, the relation between the two clauses in (10b) indicates a deontic reading and the underspecified modal base of shībì is resolved to circumstantial and the ordering source is related to a physical law: if one is not at a place, he cannot hold a job at that place.3

In sum, putting contextual influence aside, I propose the following. Yídīng has an epistemic modal base and two ordering sources. One is doxastic or stereotypical and the other is affirmative. An affirmative ordering source orders possible worlds in terms of the degree of speaker’s affirmativeness concerning a proposition. Shībì has an underspecified modal base and two ordering sources. One of the ordering sources is underspecified as well because it needs to be compatible with the modal base. The other is an affirmative one.

3.2 Dynamic Semantics for Yídīng and Shībì

Although, in Section 3.1, semantics are proposed, along the lines of Kratzer (2012[1981], 1991), for yídīng and shībì, Kratzer’s semantics of modality cannot take care of contextual influence, which is demonstrated in the two conversations in (1). There is no mechanism in Kratzer’s semantics of modality (and in truth-conditional semantics as well) to deal with contextual effects.

Instead, I would like to propose dynamic semantics (Groenendijk and Stokhof 1991, Chierchia 1995, etc.)4 for yídīng and shībì so that contextual effects can be taken care of. Yalcin (2007) discusses why sentences such as suppose that it is raining but it might not be is infelicitous. In order to take care of embedded epistemic modals, a clause embedded under suppose must be interpreted accord-

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3 Let’s not consider, for the moment, work at home through internet or other special situations.
4 For an excellent introduction to dynamic (modal) logic, please refer to Sectioin 3.2, Portner (2008).
ing to what the subject supposes. Hence, one version of Yalcin’s (2007) proposal is as follows:

(12) a. \( S_{w, x} \) is defined as \( \{ w' : w' \) is compatible with what \( x \) supposes in \( w \} \)

b. \[ \| x \supset \phi \|^w_e = \{ w : S^w_{w, x} \subseteq \| \phi \|^w_{S^w_{w, x} w'} \} \]

c. \[ \| \phi \|^w_{S^w_{w, x} w'} \text{ is true} \]

(12c) is a contradiction because it is not plausible that \( S_{w, x} \) contains a possible world where \( \phi \) and \( \neg \phi \) are both true at the same time. Yalcin’s (2007) idea applies to \textit{yídīng} and \textit{shíbì} as well because of the infelicity of the following example:

(13) **tiān zhème hēi, xiànzài yídīng/shíbì**

sky so dark now **yídīng/shībì**

zài xiáyǔ. #dānshì , yě yǒu kěnéng

Próg rain  #but also have possibility

mēiyǒu

‘It is so dark. Now, it must be the case that it is raining, #but it may not be.’

But, Yalcin’s (2007) idea alone is not adequate for \textit{yídīng} and \textit{shíbì} because they denote a ‘strong’ epistemic necessity reading, rather than simple epistemic necessity. Is it possible to incorporate the affirmative ordering source as defined in Section 3.1 into an information state, i.e. what Yalcin (2007) refers to as \( s \)? Veltman’s (1996) proposal can help us here.

In order to account for the semantics of normally and presumably, Veltman (1996) propose that an information state is a pair \( \sigma = \langle e, s \rangle \). \( s \) is a proposition and Yalcin’s (2007) \( s \) or \( S_{w, x} \) is one type of Veltman’s (1996) \( s \). \( e \) is an expectation pattern, i.e. an ordering of possible worlds, where \( w \) \( \leq_e v \) iff every expectation which is met by \( v \) is also met by \( w \) (Veltman 1996: 13).

Combining Veltman (1996) and Yalcin (2007), I propose that for \textit{yídīng} and \textit{shíbì} the information state \( \sigma \) is also a pair and that \( \sigma = \langle A, s \rangle \). \( s \) is a proposition, as in Veltman (1996) and Yalcin (2007). \( A \) is an affirmative ordering, where \( w \leq_s v \) if and only if every proposition which is affirmed to be true in \( v \) is also affirmed to be true in \( w \).

In addition, in order to account for the high degree of affirmativeness in the semantics of \textit{yídīng} and \textit{shíbì}, we define absolutely affirmative words as (14a). We also need to update the affirmative ordering with a proposition, so that the proposition is true in the worlds where more propositions are affirmed to be true, as defined in (14b):

(14) a. Absolutely affirmative worlds (cf. n.\textit{cc}, s).

\[
\text{Aff.} = \{ w \in W : \forall v \in W, w \leq_s v \}
\]

b. Updating an affirmative ordering

\[
A \bullet \phi = \{ \langle w, v \rangle : w \leq_s v \text{ if } v \in \phi, \text{ then } w \in \phi \}
\]

(14a) says the following: \( \text{Aff.} \) is a set of possible worlds each of whose members has more propositions affirmed to be true than one of the other possible worlds in \( W \). \( \text{Aff.} \) is referred to as the absolutely affirmative worlds because all the worlds in this set contain only propositions affirmed to be true.

(14b) is the definition of updating \( A \) with \( \phi \): \( A \bullet \phi \) is a pair \( \langle w, v \rangle \), where, if \( \phi \) is true in \( v \), then \( \phi \) is also true in \( w \), that is, the affirmative ordering takes \( \phi \) into consideration. In this way, we can relate a proposition \( \phi \) to an affirmative ordering \( A \).

(15) a. strong epistemic necessity reading

\[
\sigma \| yídīng(\phi) \|^M
\]

= \( \langle A \bullet \phi, s \subset \phi \rangle \) if \( \text{Aff.} \cap \{ w : \| \phi \|^w \M = 1 \} \neq \emptyset \) and \( s \) represents the speaker’s knowledge in \( w \); or

= absurd state, otherwise

b. intensification reading

\[
\sigma \| yídīng(\phi) \|^M
\]

= \( \sigma \) if \( \text{Aff.} \cap \{ w : \| \phi \|^w \M = 1 \} = \text{Aff.} \) and \( s \neq \) the speaker’s knowledge in \( w \); or

= absurd state, otherwise.

(15a) accounts for the strong epistemic necessity reading \textit{yídīng} can denote. The ordering source \( A \) is updated with the proposition \( \phi \). This update relates \( \phi \) to the order \( A \) so that the affirmative ordering takes \( \phi \) into consideration. Just like Yalcin (2007), \( s \subset \phi \) says that \( \phi \) is interpreted with respect to \( s \), the speaker’s knowledge. There is a condition for the new information state \( \langle A \bullet \phi, s \subset \phi \rangle \) to hold:
\(\phi\) must be true in one of the absolutely affirmative worlds. This condition is stated as \(\text{Aff.} \cap \{w: \|\phi\|^w, M = 1\} \neq \emptyset\). If the condition does not hold, then \(A*\phi\) fails and uttering the \(\|\text{yiding}(\phi)\|^M\) produces an absurd state.

As for the intensification reading, since this is not an inference or judgment, \(s\) does not equal to the speaker’s knowledge in \(w\). Instead of updating the information state, an intensification reading simply performs a test, as stated in (15b). As long as \(\phi\) is true in all of the absolutely affirmative worlds, then \(\|\text{yiding}(\phi)\|^M\) gives back the original information state. If the condition does not hold, then an absurd state is yielded.

How about \(\text{shibi}\)? As pointed out in Section 3.1, the difference between \(\text{yiding}\) and \(\text{shibi}\) lies in that the modal base of \(\text{shibi}\) is underspecified. If we examine the information state \(\sigma\) carefully, we can find that \(s\) in \(\sigma\) functions in a way similar to a modal base. Hence, I propose that the \(s\) in the information state for \(\text{shibi}\) is underspecified and must be resolved before a sentence containing \(\text{shibi}\) can get an appropriate interpretation. I formalize the idea as follows:

\[
\text{(16) a. } <A, s = ?> \|\text{shibi}(\phi)\|^M \\
\text{b. Suppose that } \alpha, \phi \text{ forms a } (\text{mini}) \text{ discourse. } \alpha, \phi \text{ are propositions} \\
\text{If } <A, s = ?>, \|\text{shibi}(\phi)\|^M \text{ and } R(\alpha, \phi), \text{then } s = R.
\]

In (16a), \(s = ?>\) stands for an underspecified \(s\). In (16b), \(R(\alpha, \phi)\) means that \(\alpha\) and \(\phi\) have a certain relation \(R\). This \(R\) resolves the underspecified \(s\). For example, in (10b), the two clauses are related because of a physical law, which says that one needs to live in a reasonable distance from where his job is. For this example, this physical law resolves \(s\) and hence (10b) can get an appropriate interpretation. Except for (16a, b), the semantics of \(\text{shibi}\) is identical to that of \(\text{yiding}\), as in (15).

Now, with the dynamic semantics (15) and (16), we can successfully explain the two conversations in (1). For the conversation between \(A\) and \(B\), since \(B\) says that this is a reasonable conjecture, \(s\) must represent the speaker’s knowledge. Therefore, (15b) is ruled out. The information state is updated and we get a strong epistemic necessity reading.

On the other hand, for the conversation between \(A\) and \(B'\), since \(B'\) says that this is a widely-known fact, \(s\) cannot be equal to the speaker’s knowledge. Hence, (15b) kicks in and we get an intensification reading.

In this section, I propose dynamic semantics for \(\text{yiding}\) and \(\text{shibi}\). Both of these adverbials have an information state \(<A, s, >\), where \(s\) is a proposition and \(A\) is an affirmative ordering. To derive a strong epistemic necessity reading, \(\text{yiding}\) and \(\text{shibi}\) update \(A\) with a proposition they present and specify that the proposition is a subset of or equal to \(s\). This update holds if \(\phi\) is true in one of the absolutely affirmative worlds. To produce an intensification reading, a check is performed on an information state: if \(\phi\) is true in all of the absolutely affirmative worlds, the original information state is returned. If the condition is not satisfied, neither strong epistemic necessity reading nor intensification reading can be produced. This is the unified semantics for \(\text{yiding}\) and \(\text{shibi}\).

Their difference is that the \(s\) in an information state \(<A, s, >\) for \(\text{shibi}\) is underspecified, and needs to be contextually resolved so that a proposition presented by \(\text{shibi}\) can get a proper reading.

4 Conclusion

In this paper, I propose dynamic semantics for \(\text{yiding}\) and \(\text{shibi}\) because truth-conditional semantics cannot deal with contextual effects in the semantics of \(\text{yiding}\) and \(\text{shibi}\). Following Veltman (1996), I propose an information state \(\sigma\) is a pair \(<A, s, >\), where \(s\) is a proposition and \(A\) is an affirmative ordering. \(\text{Yiding}(\phi)\) performs update on an information state: \(A\) is update with \(\phi\) and \(s\) is specified to be a subset or equal of \(\phi\), as long as \(\phi\) is true in one of the absolutely affirmative worlds. Otherwise, uttering \(\text{yiding}(\phi)\) leads to an absurd state. This is how a strong epistemic necessity reading is derived.

On the other hand, to yield an intensification reading, \(\text{yiding}(\phi)\) performs a test on an information state. \(\text{Yiding}(\phi)\) gives back the original information state as long as \(\phi\) is true in all of the absolutely affirmative worlds. Otherwise, an absurd state is produced.

As for \(\text{shibi}\), its semantics is identical to that of \(\text{yiding}\), except for the following: the \(s\) in an information state \(\sigma\) for \(\text{shibi}\) is underspecified and needs to be resolved before a proposition presented by \(\text{shibi}\) can get an appropriate interpretation. The
information needed to resolve the underspecified $s$
for $shibì$ must be inferred from the context.

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