

# Strict Comparison and Weak Necessity: The Case of Epistemic *Yào* in Mandarin Chinese

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**Abstract.** The epistemic use of *yào* in Mandarin Chinese, often translated as ‘should’ in English, shows certain interesting peculiarities. In this paper, I first describe the empirical properties of epistemic *yào*. The occurrence of epistemic *yào* is restricted only to certain comparative constructions, but forbidden in other degree constructions or non-degree constructions. It cannot appear above or below negation. It has a quantificational force stronger than that of existential modals, yet weaker than that of strong necessity modals. It can appear with another epistemic modal *yīnggāi*, which has a very similar modal flavor and an identical quantificational force. When co-occurring, however, the two epistemic modals have to follow a strict word order. Next, I examine whether the above empirical properties of epistemic *yào* arise as lexical idiosyncrasies, from syntax, semantics, or their interface. Wherever relevant in the discussion, I compare epistemic *yào* to the (near-)synonymous *yīnggāi*. The epistemic use of *yào* in Mandarin Chinese may constitute an interesting case of inter- and cross-linguistic variation in natural language modality.

## 1 Introduction

Modals in natural language often come with “peculiar” properties. To better understand the possible range of such peculiarities, it is an important and meaningful enterprise to provide both an empirical description and a theoretical analysis of interesting restrictions on the distribution and interpretation of modal elements across different languages. Certain peculiarities associated with a modal may receive a systematic explanation in syntax, semantics, and/or syntax-semantics interface, while certain other peculiarities may have to be wired in as lexical idiosyncrasies.

In this paper, I provide an empirical description as well as a theoretical analysis of the epistemic use of the modal *yào* ‘should’ in Mandarin Chinese. In Sect. 2, I discuss empirical characteristics regarding the use and meaning of epistemic *yào*. I pay particular attention to its distribution, quantificational force, and interaction with negation. I compare *yào* to the more commonly-used epistemic modal *yīnggāi* ‘should’. In Sect. 3, I provide a formal analysis of the properties observed with epistemic *yào*. I show that certain properties of the modal arise from its syntax, semantics, and syntax-semantics interface, while certain other properties are best treated as lexical idiosyncrasies. Section 4 concludes the paper.

## 2 Empirical Properties of Epistemic *yào* in Mandarin Chinese

Like many other languages, Mandarin Chinese has a variety of modal elements. Among them, *yào*, which also can be used as a regular main verb meaning ‘want, desire’, is one of the most productive and versatile. For instance, it can be used as a deontic modal to express obligations, as a dynamic modal to express volitional future, or as a predictive modal (following Ren 2008). These several uses of *yào* have been studied from many different perspectives.

In addition, *yào* has an epistemic use which is, to my knowledge, typologically rare in that it carries several unique restrictions. Though this use has been mentioned by Chinese grammarians and linguists over the years, researchers have yet to provide a detailed empirical description, let alone a convincing theoretical treatise, of the properties of epistemic *yào*. My main goal in this section is to discuss empirical properties of epistemic *yào*. In my discussion, where relevant I compare epistemic *yào* to another modal *yīnggāi* ‘should’, which is often used to paraphrase the former modal.

### 2.1 Pattern of Distribution

First, the epistemic reading of *yào* is available only when it appears in certain comparative constructions. When *yào* appears in a non-comparative sentence, it cannot receive an epistemic reading. (1) is an example of the *bǐ*-comparative construction in Mandarin Chinese (e.g., Xiang 2005, Lin 2009).<sup>1</sup> It allows epistemic *yào* to appear in it. The speaker can use (1) to express, with high certainty, her belief that the house price in Beijing is higher than in Shanghai. The speaker also can use the modal *yīnggāi* ‘should’ in place of *yào* to express (roughly) the same proposition. The sentence (2), by contrast, does not involve any comparative construction, and is not compatible with epistemic *yào*. To express the intended meaning of (2) with epistemic *yào*, *yīnggāi* can be used.

- (1) Běijīng fángjià yào/yīnggāi bǐ Shànghǎi gāo.  
 Beijing house price should BI Shanghai high  
 ‘The (average) house price in Beijing should be higher than in Shanghai.’
- (2) huángjīn jiàgé \*yào/√yīnggāi zài 1500 yuán shàngxià fú dòng.  
 gold price should at 1500 dollar around fluctuate  
 ‘The price of gold should be fluctuating around 1500 dollars (per ounce).’

Second, though previous literature has discussed the appearance of epistemic *yào* in the *bǐ*-comparative construction, few (if any) researchers have considered how epistemic *yào* fares with other comparative constructions. Like in many other languages, comparative constructions in Mandarin Chinese involve explicit

<sup>1</sup> The following abbreviations are used in this paper: CL = classifier, MOD = modifier marker, PERF = perfective marker, POS = positive morpheme, DIST = distributive marker.

or implicit comparison, depending on whether the ordering between two objects with respect to a gradable property is established by using special morphology of comparison or using the positive form of the gradable predicate (Kennedy 2007). Implicit comparative constructions are not compatible with epistemic *yào*. The *gēn x bǐ qílái* “compared to *x*” comparative is an implicit comparison strategy used in Mandarin Chinese (Erlewine 2007). It does not allow epistemic *yào* to appear in it. The sentence in (3), for instance, is only acceptable without the epistemically intended *yào*.

- (3) *gēn tā dìdì bǐ-qílai, xiǎomíng (\*yào) suànshì hěn gāo.*  
 with his brother compare-*qilai* Xiaoming should considered POS tall  
 Intended: ‘Compared to his brother, Xiaoming should be considered tall.’

By contrast, many explicit comparative constructions are compatible with epistemic *yào*. The sentence in (1) already demonstrated the compatibility of epistemic *yào* with the *bǐ* comparative. Several other explicit comparative constructions in Mandarin Chinese have been discussed in the literature. The so-called transitive comparative construction, in which the standard of comparison appears right after the gradable predicate, allows epistemic *yào* to appear in it (4). Similarly for the closely-related *chū* comparative, in which the degree morpheme *chū* intervenes between the standard of comparison and the gradable predicate. Some other comparative constructions that “licenses” epistemic *yào* include the *gèng* comparative (5) and the *yu* comparative (6). Moreover, *yào* in such constructions can be changed to *yīnggāi* without any significant effect on the grammaticality judgment or intuitive meaning of the sentences.

- (4) *Wángjūn yào gāo (chū) Zhèngzhāng yī ge tóu.*  
 Wangjun should tall exceed Zhengzhang one CL head  
 ‘Wangjun should be a head taller than Zhengzhang.’
- (5) (?) *zhè kē méiguī, huā hóng, yèzi yào gèng lǜ.*  
 this CL rose flower red leaf should GENG green  
 ‘This rose, its flowers are red; its leaves should be even greener (than its flowers are red).’
- (6) *hòuniǎo de shòumìng yào cháng yu qítā niǎo lèi.*  
 migratory bird MOD life span should long YU other bird kind.  
 ‘The life span of migratory birds should be longer than that of other kinds.’

Third, though many degree constructions in Mandarin Chinese allow epistemic *yào*, not all of them do. For example, Mandarin Chinese has a degree construction which involves the possessive/existential verb *yǒu* and appears very similar to the *bǐ* comparative in the surface structure. It typically takes the form of “*X + yǒu + Y + G*,” with *X* and *Y* being determiner phrases and *G* being a gradable predicate or a dimension noun (Xie 2014a). Epistemic *yào* cannot appear in this construction (7). Instead, *yīnggāi* can be used to express the meaning intended with *yào*.

- (7) zhāngsān de chéngjì \*yào/√yīnggāi yǒu tā gēge hǎo.  
 Zhangsan MOD grade should have his brother good  
 ‘Zhangsan’s grade should be as good as his brother’s’

Another degree construction in Mandarin Chinese is the so-called comparative correlative, which involves explicit comparison of the same or different individuals’ degrees associated with a property (Lin 2007). The construction does not allow epistemic *yào*. The sentence in (8) is ungrammatical with *yào* appearing in it. Again, *yīnggāi* can be used before the first *yuè* to express (roughly) the same meaning as intended with epistemic *yào*.

- (8) nà ge háizi (\*yào/√yīnggāi) yuè zhǎng yuè hǎokàn.  
 that CL child should YUE grow YUE good-looking  
 ‘It should be the case that the more the child grows, the prettier she becomes.’

Fourth, the equative construction, marked with *hé/gēn/xiàng x yīyàng g* ‘equally as *g* as *x*’, does not allow epistemic *yào* to appear in it, either. However, it allows epistemic *yīnggāi*. This claim is illustrated by the sentence in (9), which is minimally different from (1) just in that it establishes an identity relation between the average house prices in Beijing and in Shanghai.

- (9) Běijīng de fángjià \*yào/√yīnggāi gēn Shànghai yīyàng gāo.  
 Beijing MOD house price should with Shanghai same high  
 ‘The (average) house price in Beijing should be as high as in Shanghai.’

## 2.2 *Yào* Co-occurring with *yīnggāi*

Fifth, I have shown above that when epistemic *yào* appears grammatically in a comparative sentence, it can be replaced with *yīnggāi*, and no significant change of grammaticality judgment or meaning is observed between the two choices. In addition, *yào* and *yīnggāi* can occur together as epistemic modals in certain explicit comparative sentences, a phenomenon that has escaped observation in previous research. The sentence in (10) illustrates the co-occurrence of the two modals, both with an epistemic reading. The subject, *jiāoqū de kōngqì*, is inanimate and non-volitional. This property of the subject rules out the deontic reading for *yīnggāi*, as well as the deontic and volitional future readings for *yào*. The sentence can be understood as describing the speaker’s judgment about the *current*, not future, air quality in the suburb in relation to the city, thus ruling out the “predictive modal” reading for *yào* discussed in Ren (2008). Hence, it is safe to claim that both *yīnggāi* and *yào* in the sentence receive an epistemic reading.

- (10) jīntiān jiāoqū kōngqì yīnggāi yào bǐ shìqū hǎo.  
 today suburb air should should BI city good  
 ‘Air in the suburb today should be better than in the city.’

For the co-occurrence of epistemic *yīnggāi* and *yào* to be grammatical, all the restrictions regarding epistemic *yào* must be observed. The co-occurrence of

epistemic *yīnggāi* can never “coerce” epistemic *yào* to be acceptable in a sentence that does not allow the latter in the first place. In addition, in acceptable cases of *yào* co-occurring with *yīnggāi*, *yīnggāi* must precede *yào*; switching the order of the two epistemic modals would yield an ungrammatical sentence. This is illustrated by the acceptability contrast between (10) (see above) and (11).

- (11) \*jīntiān jiāoqū kōngqì yào yīnggāi bǐ shìqū hǎo.  
 today suburb air should should BI city good

Co-occurrences of multiple modals are nothing rare in Mandarin Chinese. The interested reader can refer to Lin and Tang (1995) and Lin (2012), among several others, for related discussion. However, two epistemic modals of the same quantificational force are generally forbidden from occurring together. The sentence in (12), for example, involves epistemic modals *yídìng* and *bìrán* ‘must’ with the same universal quantificational force. It is not acceptable regardless how the two modals are ordered relative to each other. Epistemic *yào* and *yīnggāi*, as will be discussed shortly, have the same weak necessity quantificational force. In this sense, co-occurrence of epistemic *yào* and *yīnggāi* in a comparative sentence is an interesting exception that requires some independent explanation.

- (12) \*tā yídìng bìrán xǐhuān nà jiā fàndiàn.  
 he must/definitely must/definitely like that CL restaurant  
 Intended: ‘He must like the restaurant.’

### 2.3 Lack of Scope Relation with Negation

Sixth, epistemic *yào* cannot enter into scope relation with negation in any way (Peng 2007). For instance, without occurrence of *bù* ‘not’, (13) would be grammatical. Adding *bù*, either before whether after *yào*, makes the sentence ungrammatical. In addition, epistemic *yào* cannot appear in a negative context in any other fashion. For example, it cannot participate in the A-not-A question, either, as illustrated in (14).

- (13) diànzǐ chǎnpǐn zhōngguó (\*bù) yào (\*bù) bǐ měiguó piányi.  
 electronic product China NEG should NEG BI USA cheap

- (14) \*hēi zhīmá jiàzhí yào bù yào gāo yu bái zhīmá.  
 black sesame value should NEG should high YU white sesame

In terms of interaction with negation, epistemic *yīnggāi* does not behave exactly the same as epistemic *yào*. Though epistemic *yīnggāi* cannot appear after negation or participate in the A-not-A question, it can appear before negation, whether in a comparative sentence (15) or elsewhere.

- (15) diànzǐ chǎnpǐn zhōngguó (\*bù) yīnggāi (bù) bǐ měiguó piányi.  
 electronic product China NEG should NEG BI US cheap  
 ‘For many electronic products, it should be the case that they are not cheaper in China than in US.’

## 2.4 Weak Necessity Quantificational Force

Seventh, different modals have different quantificational strengths. There is evidence to suggest that epistemic *yào* is a weak necessity modal that is comparable to the modals *should* and *ought to* in English. First, different from *kěnéng* ‘possible’, epistemic *yào* is not an existential modal that expresses the mere existence of relevant possibilities. For example, in the conversation in (16) between two speakers A and B, the first clause in B’s responses indicates that B agrees with A’s judgment about the reliability of diaries as compared to memoirs. The second clause in B’s response is intended to be further elaboration of how she agrees. However, by using *kěnéng* ‘possible’, the second clause weakens, and as such, contradicts, the expressed agreement in the first clause. The weakening and contradiction is comparable to what is responsible for the infelicity of (17), which involves nominal quantificational phrases (cf., Copley 2006 and von Stechow and Iatridou 2006). Hence, epistemic *yào* has a stronger quantificational force than *kěnéng*.

- (16) A: wǒ juéde rìjì yào bǐ huíyìlù kěkào.  
 I feel diary should BI memoir reliable  
 ‘I think that diaries should be more reliable than memoirs.’  
 B: #wǒ yě zhème juéde, rìjì kěnéng bǐ huíyìlù kěkào.  
 I also so feel diary possible BI memoir reliable  
 ‘I think so, too. Diaries are possibly more reliable than memoirs.’
- (17) A: jué dàduōshù rén dōu lái le.  
 outright majority people DIST come PERF  
 ‘The by far majority of people have come.’  
 B: #duì, yǒuxie rén lái le.  
 right some people come PERF  
 ‘Right, some people have come.’

On the other hand, epistemic *yào* is somewhat weaker than canonical strong necessity modals like *yídìng* and *kěndìng* ‘must, certainly.’ This claim is evident from the fact that an epistemic modal statement expressed by *yào* can be ensued by a strong necessity epistemic statement, and reversing the order of the two statements would lead to infelicity (18). The pattern, again, is comparable to a statement involving a weaker quantifier followed by another statement involving a stronger quantifier (19). This similarity suggests that epistemic *yào* is not a strong necessity modal. Rather, it is similar to English *should* and *ought to* – as already argued by Copley (2006) and von Stechow and Iatridou 2006 – in being a weak necessity modal. Moreover, epistemic *yīnggāi* has the same quantificational force as epistemic *yào*: if *yào* in (16) and (18) is changed to *yīnggāi*, the acceptability judgment remains the same.

- (18) a. *tā yào bǐ línju yǒuqián,*  
 he should BI neighbor rich  
*shìshíshàng tā kěndìng bǐ línju yǒuqián.*  
 in fact he certainly BI neighbor rich  
 ‘He should be richer than his neighbors; in fact, he is certainly richer than his neighbors.’  
 b. #*tā kěndìng bǐ línju yǒuqián, shìshíshàng tā yào bǐ línju yǒuqián.*
- (19) a. He finished most of the tasks, in fact, he finished all of them.  
 b. #He finished all of the tasks, in fact, he finished most of them.

To summarize, in this section I discussed several important properties of the epistemic use of *yào*. In my discussion, I compared epistemic *yào* to another epistemic modal *yīnggāi*. Epistemic *yào* is acceptable only in certain comparative constructions, and hence has a narrower distribution than the (near-)synonymous epistemic *yīnggāi*. The two epistemic modals can be used together, in which case *yīnggāi* must precede *yào*. Epistemic *yào* cannot appear above or under negation, while epistemic *yīnggāi* can appear above, though not under, negation. In terms of quantificational force, epistemic *yào* and *yīnggāi* both express weak necessity, comparable to English *should* and *ought to*.

### 3 Explaining Empirical Properties of Epistemic *yào*

In this section, I will address the question of where the above properties of epistemic *yào* each come from: whether they are lexical idiosyncrasies, or arise from syntax, semantics, or the interaction thereof.

#### 3.1 Incompatibility with the Comparative Correlative

First, I posit that the incompatibility of epistemic *yào* with the comparative correlative construction, as illustrated by the sentence in (8), is most likely a lexical idiosyncrasy. It has been proposed by Lin (2007) that the comparative correlative construction involves a causation relation between degrees. This means that the construction involves a change of state, and is dynamic in nature. The unacceptability of (8) is due to the requirement that epistemic *yào* cannot be combined with a dynamic prejacent. Confirming this explanation is yet another observation that the degree achievement construction, which is dynamic as well (Kennedy and Levin 2008), is not compatible with epistemic *yào*. By contrast, *yīnggāi* is (at least marginally) compatible with a dynamic prejacent and can be used an epistemic modal in both comparative correlative and degree achievement constructions (20).

- (20) *nà ge háizi (\*yào/?yīnggāi) měi nián zhǎng gāo liǎng lími.*  
 that CL child should every year grow tall two centimeter  
 Intended: ‘It should be the case that the child grows 2 cm taller each year.’

Some modals in other languages manifest a similar distinction regarding whether the epistemic reading is allowed with an eventive prejacent or not. For example, *must* and *cannot* in English are allowed to receive an epistemic reading only when it has a stative prejacent (21), but *may* and *might* can have an epistemic reading no matter whether it combines with a stative or eventive prejacent (22). To the best of my knowledge, the only attempt to address the distinction so far is Ramchand (2014). The basic idea of her analysis is to attribute the distinction to how (indexically vs. anaphorically) an epistemic modal anchors the denotation of the prejacent in terms of time and world. The distinction, therefore, is treated as a lexical property in her analysis. I assume that Ramchand’s discussion applies to epistemic modals in Mandarin Chinese, as well. It is a lexical idiosyncrasy of epistemic *yào* that it cannot combine with dynamic comparative constructions.

- (21) a. John must/cannot be in his office. (epistemic or deontic)  
       b. John must/cannot go to his office. (deontic, ability (*cannot*))
- (22) a. John may/might be in his office. (epistemic)  
       b. John may/might go to his office. (epistemic)

### 3.2 Compatibility only with Certain Comparative Constructions

Epistemic *yào* is compatible only with certain explicit comparative constructions, viz. the *bǐ* comparative, the transitive comparative, the *chū* comparative, the *gèng* comparative, and the *yu* comparative. By contrast, it is not compatible with the *yào* degree construction, the equative construction marked with *hé/gén/xiàng x yīyàng g* ‘equally as *g* as *x*’, or any non-degree construction.

A common characteristic among the comparative constructions in which epistemic *yào* can occur is that they all involve strict comparative morphology. For the *bǐ* comparative, different proposals have been entertained, but all of them include a strict comparative morpheme. Here, “strict comparison” means “greater/less than”. Lin (2009), for instance, took a “direct” analysis of the *bǐ* comparative, and treated *bǐ* as an overt strict comparative morpheme. Xiang (2005) proposed a so-called “DegP-shell” analysis of the *bǐ* comparative. There are two degree heads in the syntactic structure, with the higher one occupied by *bǐ*, and the lower one by a covert strict comparative morpheme *exceed* that introduces an optional differential phrase. Liu (2011) posited that *bǐ* comparative contains either a strict comparative morpheme *gèng* ‘even-more’ or its covert counterpart. It is sufficient to conclude that whatever form the currently available proposals for the syntax and semantics of the *bǐ* comparative take, they all include postulating some strict comparative morpheme, whether overtly or covertly.

The transitive comparative, along with the closely-related *chū* comparative construction, has been most extensively studied by Grano and Kennedy (2012). The transitive comparative requires the presence of a differential measure phrase. A differential measure phrase, in turn, “requires and is required by the presence of the degree morpheme” (p. 244). For the transitive comparative, the degree



morpheme contributes a strict comparative meaning. The preposition *chū* is analyzed by Grano and Kennedy (2012) to be an overt counterpart of such a strict comparative morpheme. As for the *yu* comparative, Xie (2014b) showed that it does not allow differential measure phrases. By capitalizing on this observation, Xie showed *yu* in the *yu* comparative to be in complimentary distribution with the comparative morpheme in the transitive comparative construction. Hence, it is reasonable to claim that *yu* itself is a strict comparative morpheme. For the *gèng* comparative, Liu (2010) has argued that *gèng* itself is a strict comparative morpheme (cf., Liu 2011).

By contrast, the *yǒu* degree construction has been shown by Xie (2011, 2014b) to be an equative construction comparable to the *as...as* construction in English. According to Xie's idea, its LF structure of the *yǒu* degree construction involves a covert degree morpheme, which encodes a "greater than or equal to" relation. It does not have a strict comparative morpheme. The equative construction marked by *hé/gēn/xiàng x yīyàng g* specifies a strict identity relation between two entities, and does not involve a strict comparative morpheme. As for the implicit comparative construction marked by *gēn x bǐ qǐlái* "compared with *x*", it makes use of "the inherent context sensitivity of the positive (unmarked) form" of gradable predicates (Kennedy 2007: p. 143). Its structure does not involve a comparative morpheme at all.

Based on the above discussion, it is reasonable to posit that the presence of a strict comparative morpheme (whether overt or covert) in the syntactic structure of a degree construction is responsible for the acceptability of epistemic *yào* in the construction. Those constructions without a strict comparative morpheme do not allow epistemic *yào*. There may be more than one way to represent the restriction in syntax. One option, within the Minimalist Program, is to say that in its epistemic use, *yào* somehow bears an uninterpretable *Comp*(arative) feature which has to be checked by a matching *Comp* feature. Comparative constructions like the *bǐ* and transitive comparative constructions provide such a matching feature, while the equative constructions and implicit comparison do not.

Obviously, I have taken a syntactic approach to explaining the distribution restriction of epistemic *yào*. The reader might ask whether a semantically-oriented approach, say within Kratzer's (1981) possible-world semantics framework of modality, will work. As far as I can see, the answer is negative. If we include in the semantic definition of epistemic *yào* the "strict comparison" contexts in which the modal *can* appear, a most likely component to encode the information is in the domain of quantification, by claiming that the worlds accessible from the speaker's epistemic state in her base world all involve strict comparison. However, this restriction is at best vacuous, because any world can, in principle, support strict comparison of any sort.

A second semantically-oriented option is to require, or presuppose, that the prejacent of epistemic *yào* express a strict comparative relation. Then, the question comes down to how to take an intensional proposition, which is potentially an indefinite set of possible worlds, and check whether the proposition expresses

a strict comparative relation. Though this option might be plausible, it is not clear to me how to represent it in a model-theoretic fashion.

### 3.3 Co-occurrence of *yào* and *yīnggāi*

It has been observed above that when epistemic *yīnggāi* and *yào* occur together, the former must appear before the latter. I argue that this property has to do with a very fine semantic distinction within epistemic modals as well as a structural constraint that reflects the semantic distinction. Lyons (1977) classified epistemic modals into subjective and objective sub-types. Subjective epistemic modals express the speaker's judgment based on what (she thinks) she knows. Objective epistemic modals, by contrast, express the speaker's judgment based on observable evidence often available to the speaker, the hearer, and possibly other people in the local speech community (Papafragou 2006). Despite the subjective vs. objective distinction, epistemic modals in general contribute semantic content and may have syntactic reflection thereof (Hacquard and Wellwood 2012).

Though *yào* and *yīnggāi* are both epistemic modals, the former is an objective epistemic modal, and the latter is used subjectively (Peng 2007, Peng and Liu 2012). Since they bear different sub-flavors of epistemic modality, it is not surprising that they can co-occur, in spite of the fact that they have the same quantificational force (a point to be discussed shortly). The two stacked modals express the speaker's judgment based on her private perception of relevant objective evidence available to her (and possibly to her local speech community, as well). Compared to its counterpart without *yīnggāi*, the sentence in (10) (repeated below) has an extra layer of uncertainty which arises from the speaker's indeterminacy typically associated with doxastic beliefs. By contrast, compared to its counterpart without *yào*, (10) does not express a mere guess on the part of the speaker, but conveys that the speaker actually bases her judgment on some objective evidence (e.g., the facts that there is a larger area of forest-covered hills in the suburb area, that it has just rained in the suburb but not in the city, etc.).

- (10) jīntiān jiāoqū kōngqì yīnggāi yào bǐ shìqū hao.  
 today suburb air should should BI city good  
 'Air in the suburb today should be better than in the city.'

In addition, Peng (2007) and Peng and Liu (2012) posited that in Mandarin Chinese, a subjective (interpretation of an) epistemic modal should always appear before an objective (interpretation of an) epistemic modal. How to represent this structural restriction is not very material to the current paper. Presumably, the restriction arises from the syntax-semantics interface of epistemic modals. For our purpose, the most important thing to note is that Peng's (2007) and Peng and Liu's (2012) generalization is what lies behind the ordering constraint of *yīnggāi* and *yào* occurring together as epistemic modals: the former, a subjective epistemic modal, should appear before the latter, an objective epistemic modal.

### 3.4 Semantic Meaning of Epistemic *Yào*

I have shown above that the distribution restriction of epistemic *yào* is due to lexical and syntactic reasons. The semantic definition of the modal does not need to, and in fact cannot, encode the restriction. In Sect. 2, I also indicated that epistemic *yào* is semantically identical to epistemic *yīnggāi*, modulo the distinctions with regard to objectivity/subjectivity and scope relation with respect to negation (viz., epistemic *yào* cannot form scope relation with negation at all, whereas epistemic *yīnggāi* can scope above, but not under, negation). The objectivity/subjectivity distinction is clearly semantic in nature; it will be encoded in the modal base in the semantic definitions of the two modals. The distinction with regard to scopal relation with negation presumably has to do with the polarity properties of the two modals, and will be addressed in the next sub-section.

Copley (2006) and von Stechow and Iatridou (2006) addressed several important semantic properties, especially the weak necessity quantificational force, of English modals *should* and *ought to*. Epistemic *yīnggāi* and *yào* – ignoring the distinctions mentioned above for the moment – manifest properties that are comparable to *should* and *ought to*. In this paper, I primarily draw on Copley (2006) to define the semantics of epistemic *yào* and *yīnggāi*. The intuition is that a weak necessity epistemic modal requires: (i) the prejacent proposition of the modal be true in every world that is accessible from the speaker’s knowledge/belief status in her base world and that is ranked as most highly plausible according to some ideal, and (ii) the prejacent proposition would be *allowed* (but not required) to be false if the speaker found herself in a different knowledge/belief status. The first requirement specifies that a weak necessity modal universally quantifies over a “most relevant” set of possible worlds – most relevant in the sense that the worlds are directly accessible from the speaker’s base world. The second requirement keys in the possibility of the prejacent proposition being false in a world that is (potentially) only compatible with a world in which the speaker finds herself dislocated from her current being (so to speak). It is the secondary possibility – which exists only in a “stretched” domain of quantification – that contributes the perceived “weakness” in the quantificational force of weak necessity modals.

Regarding the objectivity/subjectivity distinction between epistemic *yào* and *yīnggāi*, I assume that it arises from the choice of modal base. For epistemic *yào*, the speaker’s knowledge/belief is required to be based on objective evidence that is available to her, thus making the modal base objectively-oriented. By contrast, the modal base for epistemic *yīnggāi* is concerned with the speaker’s subjective perception of evidence or probably even arbitrary judgment.

The semantics of epistemic *yào* (time variable ignored) is defined in (23), where  $MB_{obj}$  indicates that the modal base for epistemic *yào* is objective in nature.  $ALT$  is a function that takes an element and returns a set of alternatives to the element. The semantics of epistemic *yīnggāi* is the same as that of epistemic *yào*, except for the modal base being  $MB_{sub}$ .

$$(23) [[y\grave{a}o_{\text{epistemic}}]] = \lambda w \lambda p. \forall w'(w' \in \text{HIGH-PLAUSIBILITY}(MB_{\text{obj}}(w)) \rightarrow p(w') = 1) \wedge \exists M(M \in \text{ALT}(MB_{\text{obj}}(w)) \wedge \exists w''(w'' \in \text{HIGH-PLAUSIBILITY}(M) \wedge p(w'') = 0))$$

### 3.5 Negation and *yào*

It has been noted above that negation is not allowed to occur in an epistemic *yào* sentence, regardless of the relative position between negation and *yào*. As I will argue below, actually there are two separate yet related stories behind this restriction. One has to do with why epistemic *yào* (and epistemic *yīnggāi*, for that matter) cannot appear under negation. The other has to do with why the reverse order is not allowed, either.

Let us first address the former question. The idea that I would like to pursue is that when epistemic *yào* or *yīnggāi* appears under negation (often marked by *bù* ‘not’), semantically it is equivalent to the existential epistemic modal *kěnéng* appearing above negation. It is lexical competition between *bù yào/bù yīnggāi* (epistemically intended) and *kěnéng bù*, I hypothesize, that leads to the unacceptable status of the former two phrases. The semantic definition of *bù yào* (epistemically intended) is given in (24). Among the two conjuncts linked by “ $\vee$ ,” the second one basically states that all modal bases that are alternative to the one accessible from the speaker’s base world can verify the prejacent proposition of epistemic *yào*. However, this requirement cannot hold in general, as it amounts to saying that the modal base accessible from the speaker’s base world ranks the least ideal among all possible modal bases. Nothing a priori renders such an “ugly” status for the modal base accessible from the speaker’s base world. Hence, the second conjunct is constantly false. The semantics of *bù yào<sub>epistemic</sub>* is just equivalent to the first conjunct, which in turn is equivalent to the semantics of *kěnéng bù*. Due to the semantic equivalence, *bù yào<sub>epistemic</sub>* competes with *kěnéng bù*. The former loses to the former, presumably because *yào* carries more morpho-syntactic restrictions and such restrictions do not have any semantic import or reflection.

$$(24) [[bù yào_{\text{epistemic}}]] = \lambda w \lambda p. \exists w'(w' \in \text{HIGH-PLAUSIBILITY}(MB_{\text{obj}}(w)) \wedge p(w') = 0) \vee \forall M(M \in \text{ALT}(MB_{\text{obj}}(w)) \rightarrow \forall w''(w'' \in \text{HIGH-PLAUSIBILITY}(M) \rightarrow p(w'') = 1)).$$

Regarding the fact that epistemic *yào* cannot appear above negation, I propose, albeit rather tentatively, that it has to do with the polarity property of the modal. Iatridou and Zeijlstra (2013) showed that deontic and epistemic modals can be grouped as positive-polarity items (PPIs), negative polarity items (NPIs), and polarity-neutral items. The classification does not only apply to English modals, but to modals in many other languages. The three types of modals manifest rather distinguished behaviors with respect to their scope relation with respect to negation. For the purpose of this paper, it suffices to note that “all neutral and NPI modals scope under negation” (Iatridou and Zeijlstra 2013: p. 564).

Assuming that modals in Mandarin Chinese also carry polarity distinctions, epistemic *yào* cannot be an NPI, because it can occur in positive sentences.

It is very likely not a PPI, either, for it does not pass PPI-hood tests (Szabolcsi 2004). For instance, PPIs (like ‘someone’ and ‘must’) are acceptable in the scope of clause-external negation (25). However, epistemic *yào* cannot appear in such a context, as suggested by the unacceptability of the sentence in (26).

- (25) a. No one says that the president found someone.  
 b. I do not think that he must come home tonight.

- (26) wǒ bú rènwéi tā (\*/?yào) bǐ tā dìdì gāo.  
 I not believe he should BI his brother tall

Intended: ‘I do not think that he should be taller than his younger brother.’

Hence, epistemic *yào* patterns with such English (semi-)modals as *have to* and *need to* in being a polarity-neutral item. An interesting characteristic of polarity-neutral modals is that they scope under negation for semantic interpretation. Therefore, even when epistemic *yào* appears above negation on the surface, it has to end up scoping under negation semantically. It has been just established above, however, that epistemic *yào* does not allow for such a semantic scope relation.

## 4 Conclusions

Modals can carry all sorts of peculiarities, in terms of distribution and interpretation. In this paper, I provided both empirical description and theoretical investigation of the rarely-discussed epistemic use of *yào* in Mandarin Chinese. Epistemic *yào* can only occur in certain comparative constructions. It cannot enter into any scope relation with negation. Its quantificational force is stronger than that of existential modals, yet at the same time weaker than that of strong necessity modals. Epistemic *yào* can appear with another epistemic modal *yīnggāi*, which has the same modal flavor (broadly speaking) and quantificational force. When the two epistemic modals co-occur, however, *yīnggāi* must precede *yào*. In the theoretical analysis component, I examined where each property of *yào* comes from: lexical idiosyncrasies, syntax, semantics, or the interface between syntax and semantics. I think that the epistemic use of *yào* constitutes an interesting case in studying intra- and cross-linguistic variation in natural language modality.

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