

## The epistemic use of *yào* in Mandarin Chinese and its theoretical implications

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### Abstract

The epistemic use of the Mandarin Chinese modal *yào* comes with typologically interesting properties. In this paper, the distribution and meaning of the epistemic use of *yào* will be described first. This use of *yào* is restricted to certain explicit strict comparative constructions, but forbidden in many other degree and non-degree constructions. Second, epistemic *yào* cannot appear above or below negation. Third, epistemic *yào* has a quantificational force stronger than that of existential modals, yet weaker than that of strong necessity modals. In the theoretical component of the paper, I argue that epistemic *yào* is a modifier for strict comparative morphemes, a syntactic/semantic function that sets it apart from many other epistemic modals that take propositions as direct argument. The weak necessity quantificational force of epistemic *yào* is encoded in its semantics by making recourse to alternative modal bases. Epistemic *yào*'s inability to form scopal relation with negation arises from two factors: (i) its status as a strict comparative morpheme modifier, and (ii) competition between lexical items with identical semantics. Through investigating the epistemic use of *yào*, some hitherto unnoticed interesting modal properties in natural language are brought to the forefront, and new intra- and inter-linguistic variations in the distribution and meaning of modals are revealed.

## 1. Introduction

Modals in natural language are famously associated with a wide range of “idiosyncrasies.” To better understand the extent to which modal elements vary, it is a meaningful and important enterprise to describe modal elements that demonstrate typologically “peculiar” properties, and then examine these properties against contemporary linguistic theory. Research along these lines often can reveal interesting cross-linguistic universality and variations in natural language modality. Along this line of research, in this paper I put under scrutiny the epistemic use of modal *yào* in Mandarin Chinese. My objectives in doing so are two-fold. First, I bring to the forefront some hitherto unnoticed empirical properties of modal elements existing in natural language. Second, I provide a theoretical analysis of these properties and locate which components of grammar contribute the variations observed with epistemic *yào*. More specifically, the epistemic use of *yào* is restricted to occur in certain strict comparative constructions. My analysis suggests that epistemic *yào* modifies a strict comparative morpheme. Thus, different from many other epistemic modal elements, the epistemic use of *yào* does not take propositions as its direct semantic arguments. Rather, it demonstrates an epistemic effect on the “prejacent” sentence indirectly, by modifying a constituent in the sentence.

As a modal element, *yào* in Mandarin Chinese has several distinctive readings, some of which will be discussed in Section 2.3. Although the epistemic use of *yào*, which is intuitively translatable as English *should* and *ought to* in their epistemic reading, has been mentioned by Chinese grammarians and linguists such as Lü (1980), Li (2003), Peng (2007), and Ren (2008), researchers have yet to provide a detailed empirical description, let alone a convincing theoretical analysis, of the empirical properties observed with this particular use of *yào*.

In the epistemic use, *yào* manifests several properties that to the best of my knowledge, have not been reported with any other modal element in Mandarin Chinese or in other languages. Two properties are worth mentioning upfront before more detailed descriptions are given in the next section. The first one is the distributive restriction of epistemic *yào*: it can only appear in certain explicit comparative constructions that express strict comparison (i.e., a “>” or “<” relation). One such construction is the relatively well studied *bǐ* comparative, of the form “X + *bǐ* + Y + G(radable predicate),” as illustrated in (1). The second interesting restriction of epistemic *yào* is that it is not acceptable to co-occur with negation, as in (2), no matter whether it appears above or below negation on the surface form.<sup>1</sup>

- (1) Dàiyù yào bǐ Bǎochāi piàoliàng.  
 Daiyu YAO BI Baochai beautiful  
 ‘Daiyu should be more beautiful than Baochai.’
- (2) Dàiyù (\*bù) yào (\*bù) bǐ Bǎochāi ǎi yìxiē  
 Daiyu NEG YAO NEG BI Baochai short a bit  
 Intended: ‘It should not be the case that Daiyu is a little shorter than Baochai.’

The rest of the paper is devoted to describing and explaining the empirical properties of epistemic *yào*. In Section 2, I will focus on describing the empirical properties of epistemic *yào*, with particular reference to its rather restrictive distribution, weak necessity quantificational force, and lack of scopal interaction with negation. In Section 3, I will show that the observed “peculiarities” with epistemic *yào* actually follow from its unique syntactic behaviors and the

<sup>1</sup> Abbreviations used in this paper are as follows: ASP = aspectual marker, CL = classifier, COP = copular, DIST = distributive marker, EXT = extent marker, INT = interjection, MOD = modifier marker, NEG = negative marker.

accompanying semantics. In Section 4, by way of concluding the paper, I will briefly discuss some theoretical implications of my analysis of epistemic *yào* and point out several remaining open issues.

## 2. Empirical properties of epistemic *yào*

In this section, I will first show that the epistemic use of *yào* is restricted to comparative constructions that explicitly express strict comparison. This restriction makes epistemic *yào* a cross-linguistically rare modal phenomenon. Then, I will discuss two other interesting properties of epistemic *yào*: its weak necessity quantificational force and lack of scopal interaction with negation. For the sake of completeness, toward the end of this section I will also mention some non-epistemic uses of *yào*.

### 2.1 The basic distribution of epistemic *yào*

An important empirical generalization regarding the distribution of epistemic *yào* is that it only occurs in degree constructions that *explicitly* encode a *strict* comparative relation. Strict comparison is defined as involving either a “greater-than” (i.e., “>”) or a “less-than” (“<”) relation. “Greater-than-or-equal-to” (“≥”), “less-than-or-equal-to” (“≤”), and strict identity (“=”) relations are not strict comparison.

First, epistemic *yào* cannot appear in non-comparative constructions. The sentence in (3) does not express a comparative relation. It is acceptable only under the deontic reading of *yào*, about Baoyu’s obligation of staying at home tomorrow morning. It is unacceptable under the epistemic reading of *yào*, whereby the speaker makes a judgment, or reveals her belief/knowledge, regarding the possibility of Baoyu staying at home tomorrow morning.<sup>2</sup> The sentence in (4), which involves the progressive marker (*zhèng*) *zài* under *yào*, is ungrammatical, and thus does not have any reading, not to mention an epistemic one.

- (3) \*Bǎoyù míngtiān zǎoshàng yào zài jiā.  
 Baoyu tomorrow morning YAO at home  
 Intended: ‘It should be the case that Baoyu will be at home tomorrow morning.’
- (4) \*wǒmen xiàozhǎng yào zhèng zài jiēdài kèrén.  
 our principal YAO right now ASP meet guest  
 Intended: ‘Our principal should be meeting with the guests right now.’

It is worth pointing out that I am taking a narrow definition of comparative construction. Although equative constructions show certain semantic similarities to comparative constructions, they are not considered comparative constructions in this paper. They behave just like other non-comparative constructions in not being able to “license” the epistemic use of *yào*. The observation is manifest from the ungrammatical sentences in (5-6), both of which involve *hé/gēn/xiàng x yíyàng G* roughly translatable as “(exactly) as G as x” (Eckardt 2009). The ungrammaticality of the two sentences is attributable to the presence of epistemically intended *yào*, for they would become grammatical if *yào* was removed, or received a deontic interpretation.

<sup>2</sup> Most (but not all, cf., the sentence in (4)) of the ungrammatical/marginal *yào* sentences in this paper receives such a judgment only when *yào* is intended for the epistemic reading. They may be acceptable under non-epistemic readings of *yào*. In this paper, unless otherwise noted, I am only concerned with the grammaticality status of *yào* sentences under the epistemic reading.

- (5) \*Dàiyù yào gēn Bǎochāi yíyàng cōngmíng.  
 Daiyu YAO with Baochai the same smart  
 Intended: ‘Daiyu should be (exactly) as smart as Baochai.’  
 (Without yào): ‘Daiyu is (exactly) as smart as Baochai.’
- (6) \*Běijīng de fángjià yào gēn Shànghǎi yíyàng gāo/guì.  
 Beijing MOD house price should with Shanghai same high/expensive  
 Intended: ‘The house price in Beijing should be (exactly) as expensive as in Shanghai.’  
 (Without yào): ‘The house price in Beijing is (exactly) as expensive as in Shanghai.’

At first blush, my claim seems too strong that epistemic *yào* cannot be “licensed” in non-comparative constructions, especially in face of the observation that *yào* can appear in a non-comparative sentence with a dynamic predicate and a future-oriented interpretation, as illustrated in the following two sentences:

- (7) lǎo tàitai yào fāhuǒ le.  
 old madam YAO become angry ASP  
 ‘The old grandmother will become angry.’
- (8) nà ge mǎxìtuán xià ge xīngqī yào lái běijīng yǎnchū.  
 that CL circus next CL week YAO come Beijing show  
 ‘The circus will come to play in Beijing next week.’

Most crucially, *yào* in such non-comparative sentences is not used as an epistemic modal, contrary to what descriptive linguists such as Peng (2007), Zhang (2007), and Guo and Yi (2008) assumed.<sup>3</sup> As a piece of empirical evidence, true epistemic modals – like the epistemic use of English *must* and Chinese *yīnggāi* ‘should’ – are disallowed in the complement of factive predicates (Papafragou 1998, Lyons 1977). For instance, the whole sentence in (9) is unacceptable (or very marginal for some Mandarin Chinese native speakers) under the epistemic reading of *yīnggāi*, in spite of the fact that the clause embedded under the factive predicate *ràng rén jīng yà de shì* ‘what is surprising is’ is acceptable under the same reading for *yīnggāi*. Non-comparative sentences containing *yào* that are (mistakenly) taken by some descriptive linguists to involve epistemic modality indeed can occur in the complement of factive predicates (10a), thus standing in stark contrast to the behavior of epistemic *yào* in comparative sentences (10b).<sup>4</sup> This contrast suggests that *yào* in non-comparative sentences does not receive a (true) epistemic interpretation.

<sup>3</sup> It is a cross-linguistically robust observation that certain modals ambiguous between epistemic and other modal readings cannot receive an epistemic interpretation when they appear in a dynamic sentence. For example, such modals as *must* and *cannot* in English are allowed to receive an epistemic reading only when it occurs in a stative sentence, as in (i). Ramchand (2014) attributed the restriction to how (i.e., whether indexically or anaphorically) an epistemic modal anchors the denotation of the prejacent in terms of time and possible world. Whether Ramchand’s analysis, which is based on English modals like *must*, can be extended to epistemic *yào* remains an open question that I will leave to future research. Minimally, her analysis needs to be changed to accommodate my analysis (anticipating details to be provided later in the paper) of epistemic *yào* as a modifier for strict comparative morphemes, rather than taking prejacent propositions as its direct argument.

- (i) a. John must be in his office. (√epistemic, √deontic)  
 b. John must go to his office. (\*epistemic, √deontic)

<sup>4</sup> The embedded clause in (10a) is adapted from Zhang (2007: p.68).

- (9) \*/??ràng rén jīng yà de shì tā xiànzài yīng gāi zài shuì jiào.  
surprising MOD COP he now should ASP sleep  
Intended: \*/?? ‘It is surprising that he should be sleeping now.’
- (10) a. ràng rén jīng yà de shì běi jīng jīn wǎn yào dì zhèn  
surprising MOD COP Beijing tonight YAO earthquake  
‘It is surprising that there will be an earthquake in Beijing tonight.’  
b. \*/??ràng rén jīng yà de shì mèi mei yào bǐ gē ge gāo.  
surprising MOD COP younger sister YAO BI elder brother tall  
Intended: \*/?? ‘It is surprising that the younger sister should be taller than the elder brother.’

Moreover, if *yào* that appears in a non-comparative sentence with a dynamic verb and a future-oriented interpretation is a (true) epistemic modal, one would expect that it cannot be used to make a judgment in such contexts that involve no subjective uncertainty whatsoever on the part of the speaker. However, this prediction does not hold. The sentence in (11), for instance, can be uttered by a most authoritative and confident NASA expert who, based on highly sophisticated and precise calculations as well as the transpired trajectory of the rocket, knows *without the least doubt* regarding whether, how, and when the rocket will land on Mars.

- (11) huǒ jiàn yī fēn zhōng hòu yào jiàng luò dào huǒ xīng jī dì le  
rocket one minute after YAO descend arrive Mars base ASP  
‘The rocket will descend on the base on Mars in one minute.’

Nevertheless, *yào* in such non-comparative sentences as in (7-8) has been often perceived and claimed to have an epistemic flavor which indicates subjective uncertainty on the part of the speaker. I postulate that the epistemic uncertainty in fact arises from the future-oriented interpretation of *yào* in such sentences. Generally speaking, future events are unsettled metaphysical possibilities with respect to a reference time (usually the speaker’s utterance time). Metaphysical uncertainty, in turn, can lead to epistemic uncertainty (Condoravdi 2002). It is this resulting, secondary epistemic uncertainty, I think, that makes *yào* in non-comparative sentences with dynamic verbs *appear* to be an epistemic modal.

The next observation is that epistemic *yào* is only allowed to appear in explicit comparative constructions, but not in implicit comparative constructions. Explicit comparison establishes ordering between two objects *x* and *y* with respect to a gradable property *g* through employing conventional, specialized degree morphology (whether overt or covert) which specifies *x*’s degree of being *g* to exceed *y*’s degree of being *g*. By contrast, implicit comparison establishes ordering between *x* and *y* with respect to *g* by “taking advantage of the inherent context sensitivity of the positive (unmarked) form” (Kennedy 2007). The *bǐ* comparative is a commonplace instance of explicit comparison in Mandarin Chinese. It has been analyzed by many scholars such as Erlewine (2007), J. Lin (2009), and Liu (2011). The *bǐ* sentence in (1) has demonstrated its compatibility with epistemic *yào*. The sentence in (12) is yet another example of the *bǐ* comparative, which can be used to express, with a high degree of subjective certainty, the speaker’s belief that the (average) house price in Beijing is more expensive than in Shanghai. The *guò* comparative morpheme in ‘X G *guò* Y (D)’ – where *G* is a gradable adjective and *D* an optional differential phrase – is another strategy of marking explicit comparison in Mandarin Chinese (Liu 2007). *Yào* appearing in this comparative construction can also receive an epistemic reading, as illustrated in (13). More explicit comparative constructions will be discussed shortly.

- (12) Běijīng de fáng jià yào bǐ Shànghǎi gāo/guì.  
Beijing MOD house price YAO BI Shanghai high/expensive  
'The house price in Beijing should be more expensive than in Shanghai.'
- (13) (wǒ gǎnjué) nánfāngrén de chuàngyèrèqíng yào gāo guò běifāngrén  
I feel southerner MOD entrepreneurship spirit YAO high exceed northerner  
'(I feel) that southerners have a higher level of entrepreneurship spirit than do northerners.'

There are several different ways to express implicit comparison in Mandarin Chinese, but crucially, none of them is compatible with the epistemic reading of *yào*. Contrastive focus sentences, for instance, can specify two entities under contrast such that one entity is associated with a quality (e.g., being tall) absent in, different from, or opposite to (that of) the other entity (Liu 2010). Such sentences express comparison implicitly, and do not allow *yào* that appears in them to have an epistemic reading (14).

- (14) \* Běijīng yào lěng, xiānggǎng yào rè.  
Beijing YAO cold, Hong Kong YAO hot  
Intended: "It should be the case that Beijing is cold, and Hong Kong is hot."

Another strategy of making implicit comparison in Mandarin Chinese is to use the *gēn x bǐ qǐlai* "compared with *x*" construction. When the construction does not occur with any other comparative morpheme, it is generally taken to express implicit comparison (Liu 2014, Erlewine 2007).<sup>5</sup> When the construction expresses implicit comparison, it does not allow epistemic *yào* to appear in it. By contrast, other epistemic elements can (at least marginally) appear in implicit comparative constructions, as illustrated by the sentence in (15).<sup>6</sup>

- (15) gēn bālìdǎo bǐqǐlái, xiàwēiyí \*yào/yīdìng/?yīnggāi/?kěnéng hěn guì.<sup>7</sup>  
with Bali island compare Hawaii YAO/certainly/should/possibly very expensive  
'Compared with Bali, Hawaii \*YAO is/definitely is/possibly is/should be very expensive.'  
(Without *yào*): 'Compared with Bali island, Hawaii is very expensive.'

Thirdly, not all explicit comparative constructions allow the epistemic use of *yào*. Epistemic *yào* can only occur in comparative sentences that explicitly express a *strict* comparative relation; it is not attested in comparative sentences that express "≥" or "≤" relations, viz., comparative relations including an equative component. The sentences in (1), (12) and (13) have indicated the compatibility of epistemic *yào* with two Mandarin Chinese explicit comparative

<sup>5</sup>Erlewine (2007) and J. Lin (2007) are among the first researchers to observe that in Mandarin Chinese *gēn x bǐ qǐlai* "compared with *x*" construction can express implicit comparison. In his recent work, Liu (2014) further noted that the construction can be "divided into two subtypes," depending on whether other explicit comparative morpheme occurs within it. Thus, Liu (2014) also appeared to suggest that *gēn x bǐ qǐlai* – when used on its own – is a strategy of making implicit comparison.

<sup>6</sup> A native speaker of Mandarin Chinese suggested to me that adding the verb *suan* 'count, consider' and the sentence-final particle *le* to *gēn x bǐ qǐlai* implicit comparative sentences would improve the acceptability of *yào* in such sentences. All other native speakers of Mandarin Chinese I consulted, however, did not share the judgment. In addition, Mandarin Chinese native speakers' judgment about other epistemic elements appearing in implicit comparative constructions shows inter-speaker variation. In this paper, I will leave aside issues that may lie behind the above inter-speaker variations of judgment.

<sup>7</sup> This sentence is adapted from <http://zhidao.baidu.com/question/66487595.html>, retrieved on October 18, 2015.

constructions -- the *bǐ* and *guò* comparatives. At least three other explicit strict comparative constructions in Mandarin Chinese have been discussed in the literature, and they are all compatible with epistemic *yào*.<sup>8</sup> The so-called transitive comparative, in which the standard-of-comparison phrase appears right after the gradable predicate, allows epistemic *yào* to appear in it (16-17). Similarly for the closely-related *chū* comparative construction, which differs from the transitive comparative just in that an overt degree morpheme *chū* ‘exit, exceed’ intervenes between the standard-of-comparison phrase and the gradable predicate (also, (16-17)).

- (16) Wángjùn yào gāo (chū) Zhèngzhāng zhěngzhěng yī ge tóu.  
Wangjun should tall exceed Zhengzhang whole one CL head  
‘Wangjun should be a whole head taller than Zhengzhang.’
- (17) ?shìqū de lājī liàng yào duō (chū) jiāoqū liǎngbèi.  
city MOD trash amount YAO many/much exceed suburban twice  
‘The amount of trash in the city should be twice more than that in the suburban area.’

Still another explicit strict comparative construction, the *gèng* comparative construction, also allows the occurrence of epistemic *yào*, as illustrated in (18). Interestingly, the *gèng* comparative can be embedded in the *bǐ* comparative. When such embedding occurs, epistemic *yào* can appear before either, and even both, of *bǐ* and *gèng*. The sentence in (19) are grammatical with one *yào* before *bǐ/gèng* or with two *yào*'s.

- (18) tāde méiguī, huā hóng, yèzi yào gèng lǜ.  
his rose flower red leaf should GENG green  
‘His rose, its flowers are red; its leaves should be even greener (than its flowers are red).’
- (19) mántóu (yào) bǐ mǐfàn (yào) gèng yǒuyì yu shòushēn.<sup>9</sup>  
mun YAO BI rice YAO GENG benefit to lose weight  
‘Eating muns should be more beneficial for losing weight.’

Like in many other languages, an explicit comparative sentence in Mandarin Chinese does not have to have a standard-of-comparison phrase overtly specified in the sentence. Rather, the standard can be supplied from the extra-linguistic context. Such explicit comparative sentences, if they express strict comparison, are still compatible with epistemic *yào*. This claim is illustrated by the sentence in (20) (taken from Lü 1980: p.593), in which the clarity of the photo in the back is implicated to serve as the standard of comparison for clarity of the photo in the front.<sup>10</sup>

- (20) zhè liǎng zhāng zhàopiàn, qián yī zhāng yào qīngchu xiē.  
this two CL photo front one CL should clear a bit  
‘Between these two photos, the front one should be a bit clearer.’

<sup>8</sup> Important relevant works include Xiang (2005), Erlewine (2007), Liu (2007), and Grano and Kennedy (2012) on the transitive and *chū* comparative constructions, and Liu (2010, 2014) on the *gèng* comparative construction.

<sup>9</sup> This example was retrieved and adapted from <http://wx.shenchuang.com/article/2015-09-05/1176405.html> (accessed on Nov. 14, 2015)

<sup>10</sup> The degree modifier *xiē* ‘a bit’ only can be used with the comparative reading of certain adjectives, but not with the positive reading. Thus, *qīngchu* ‘clear’ in (20) only have a comparative reading, giving rise to an explicit comparative sentence. Deleting *xiē* would make *qīngchu* receive a positive reading and (20) an implicit comparative sentence. Then, *yào* would be unacceptable in the resulting sentence.

In contrast to explicit strict comparatives, an explicit comparative construction which specifies a “ $\geq$ ” or “ $\leq$ ” relation cannot license the epistemic use of *yào*. In Mandarin Chinese, the comparative construction “ $X + yǒu + Y + G$ ,” where  $X$  and  $Y$  are determiner phrases and  $G$  a gradable predicate or a dimension noun, specifies a “ $\geq$ ” relation between the referents of  $X$  and  $Y$  with respect to the property specified by  $G$  (Xie 2011, 2014). Despite its surface similarity with the *bǐ* comparative (of the form “ $X + bǐ + Y + G$ ”), the *yǒu* comparative construction does not express a strict comparative relation.<sup>11</sup> Consequently, it does not allow epistemic *yào* to occur in it, no matter whether  $G$  is a gradable predicate or a dimension noun (21-22).

- (21) \*Zhāngsān de chéngjì yào yǒu tā gēge hǎo.  
 Zhangsan MOD grade YAO have his elder brother good  
 Intended: ‘Zhangsan’s grades should be as good as his elder brother’s’
- (22) \*nà ge lízi yào yǒu quántou yībān dàxiǎo.  
 that CL pear YAO have fist like size  
 Intended: ‘The pear should be as big as a fist.’

To summarize, in this sub-section it has been shown that *yào* is allowed to have an epistemic reading when it occurs in explicit strict comparative constructions. Non-comparative constructions, implicit comparative construction, and (explicit) comparative constructions that do not express a strict comparative relation can’t “license” the epistemic use of *yào*. No modal with such a restricted distribution has been reported in the literature. Thus, epistemic *yào* constitutes a cross-linguistic rarity of modal element that has the potential to reveal important variations in natural language modality.

## 2.2 Some further properties of epistemic *yào*

In addition to the distribution pattern discussed above, epistemic *yào* shows interesting properties with regard to: (i) lack of scopal relation with negation, and (ii) weak necessity quantificational force. First, it is a robust cross-linguistic generalization that epistemic modals can scope over negation (Cinque 1999, Hacquard 2006). This generalization presupposes that epistemic modals can scopally interact with negation. Epistemic *yào*, however, constitutes an interesting exception to the generalization, in that it cannot interact with negation in any way (Peng 2007, Ni 2008). For instance, if without the negation marker *bù*, (23) would be grammatical. Adding *bù* – whether before or after *yào*, would make the resulting sentence ungrammatical.<sup>12</sup>

<sup>11</sup> The *yǒu* comparative in Mandarin Chinese was taken by Xie (2014) to be translational equivalent of the “as...as” construction in English, which specifies a “ $\geq$ ” relation (e.g., see Schwarzschild 2008 for a recent review).

<sup>12</sup> There is an idiomatic expression *yàobu* (with the tone on *bù* being neutralized) in Mandarin Chinese, which means “either ... or” when *yàobu* is used in pairs or “otherwise” when it is used alone. It cannot be decomposed into an epistemic *yào* followed by the negative marker *bù*. Thus, even when used in a strict comparative sentence (e.g., (i)), *yàobu* should not be confused with our discussion of scopal relation between epistemic *yào* and negation.

- (i) riběn huò yàobu bǐ hánguó huò guì, yàobu bǐ měiguó huò guì  
 Japan product either BI Korean product expensive or BI American product expensive  
 ‘Japanese products are more expensive either than Korean products or than American products.’



The same holds for another negative marker *méi*, which is typically used to negate completed actions (24) (Li and Thompson 1981).<sup>13</sup>

- (23) hěnduō diànzǐ chǎnpǐn zhōngguó (\*bù) yào (\*bù) bǐ měiguó guì.  
 many electronic product China NEG should NEG BI USA expensive  
 Intended: ‘It should not be the case that many electronic products are more expensive in China than in USA.’
- (24) yóu jià qùnián (\*méi) yào (\*méi) bǐ qiánnián gāo chū 33%  
 oil price last year NEG YAO NEG BI the year before last high exceed 33%  
 Intended: ‘It should not be the case that gas price was 33% higher last year than the year before.’

Next, there exists empirical evidence to suggest that epistemic *yào* is a weak necessity modal comparable to *should* and *ought to* in English. First, epistemic *yào* is not a pure existential modal that expresses the mere existence of certain relevant possibilities. In the conversation given in (25), for example, the first clause in Speaker B’s responses indicates that B agrees with Speaker A’s judgment about the reliability of diaries as opposed to memoirs. The second clause in Speaker B’s response is intended to further elaborate on how the speaker agrees. By using the pure existential modal element *kěnéng* ‘possible’, however, the second clause in Speaker B’s response weakens, and as a result contradicts with, the expressed agreement in the first clause.<sup>14</sup> The weakening/contradiction is comparable to what is responsible for the infelicity observed with (26), which involves canonical nominal quantification phrases. Hence, epistemic *yào* has a stronger quantificational force than the canonical pure existential modal *kěnéng* ‘possible’.

- (25) A: wǒ juéde rìjì yào bǐ huíyìlù kěkào.  
 I feel diary YAO BI memoir reliable  
 ‘I think diaries should be more reliable than memoirs.’  
 B: #wǒ yě zhème juéde, rìjì quèshí kěnéng bǐ huíyìlù kěkào.  
 I also so think diary indeed possible BI memoir reliable  
 ‘I think so, too. It is indeed possible that diaries are more reliable than memoirs.’
- (26) A: jué dàduōshù rén dōu lái le.  
 outright majority people DIST come ASP  
 ‘The by far majority of people have come.’  
 B: #duì a, yǒude rén lái le.  
 right INT some people come ASP  
 ‘Right, some people have come.’

<sup>13</sup> *Yào* has a bouletic use that expresses the speaker’s desire and that may be confused with the epistemic use. The bouletic use of *yào* is compatible with negative contexts, as illustrated in (i) below. Still another important distinction between the bouletic and epistemic uses of *yào* is that only the former use can be embedded under desire predicates like *xīwàng* ‘hope’:

- (i) (wǒ xīwàng) nán péngyǒu bú yào bǐ wǒ ǎi.  
 I hope boyfriend NEG YAO BI I short  
 ‘(I hope that) my boyfriend should not be shorter than me.’

<sup>14</sup> In this paper, the “\*” symbol is used to indicate ungrammaticality, and “#” to indicate pragmatic infelicity.

At the same time, the quantificational force of epistemic *yào* is weaker than that of strong necessity modals like *yíding* ‘definitely’ and *kěndìng* ‘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, while reversing the order of the two statements would lead to pragmatic infelicity (27). Again, the empirical pattern is comparable to a statement involving a weaker nominal quantifier followed by another statement involving a stronger nominal quantifier, such as in (28). This parallelism suggests that epistemic *yào* cannot be a strong necessity modal, either.

- (27) a. tā yào bǐ línjū yǒuqián, shìshíshàng tā kěndìng bǐ línjū yǒuqián.  
 he should BI neighbor rich 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 línjū yǒuqián, shìshíshàng tā yào bǐ línjū yǒuqián.
- (28) 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.

The above empirical pattern of epistemic *yào*, with respect to quantificational force, is strongly reminiscent of *should* and *ought to* in English, both of which have been shown by Copley (2006) and von Stechow and Iatridou (2008) to be weak necessity modals. In this paper I follow their suit to conclude that epistemic *yào* in Mandarin Chinese are weak necessity modals, as well.

To sum up, in this sub-section I described two more important properties of epistemic *yào*: its weak necessity quantificational force and inability to co-occur with negation. Although the former property is familiar from Copley’s (2006) and von Stechow and Iatridou’s (2008) research on English *should* and *ought to*, the latter property constitutes an interesting exception to the widely observed propensity of epistemic modals to form scopal relation with negation.

### 2.3 Non-epistemic uses of *yào*

Before I conclude this section, I would like to briefly mention some other uses of *yào*, by drawing on recent advances of classifying modality (e.g., Portner 2009) and descriptive Chinese linguistic research (e.g., Lü 1980 and Peng 2007). The discussion is by no means intended to offer an exhaustive list of interpretations for *yào*, as doing so would require much more space than available in this paper. First, *yào* can be used as a “regular” transitive verb taking a nominal argument and meaning ‘want’, ‘request’ and ‘require’ depending on the context of use (29).

- (29) a. wǒ yào yī gēn xiāngjiāo. (want reading)  
 I want one CL banana  
 ‘I want a banana.’
- b. tā zuótiān xiàng bàba yào le wǔ kuài qián. (request reading)  
 he yesterday toward father request ASP five dollar money  
 ‘He requested five dollars yesterday from his dad.’
- c. bān zhè zhāng zhuōzi yào sì ge rén. (require reading)  
 move this CL table require four CL people.  
 ‘It requires four people to move this table.’

Second, when used as a modal element, *yào* have at least the following non-epistemic readings: a deontic reading to express requirements and obligations (30), as a “volitional” modal

to express a future action available to an agent (31), as a teleological modal to express means of achieving a goal (31), as well as a bouletic modal to express desires ((33), repeated from fn. 13). The deontic and volitional readings of *yào* have been relatively well-studied from many different perspectives by such scholars as Chao (1968), Tsang (1981), Li (2003), Peng (2007), Ren (2008), Ni (2008), Wu and Kuo (2010), and T. Lin (2012). The teleological and bouletic uses, however, have received as little attention as the epistemic use. Out of practical reasons, I will leave these uses for future research.

- (30) měi ge fùmǔ dōu yào bāng hái zi fāzhǎn qíngshāng (deontic)  
 every CL parent DIST should help child develop emotional quotient  
 ‘Every parent should help their children to develop emotional maturity.’
- (31) wǒ jīntiān xiàwǔ yào qù yóuyǒng. (volitional)  
 I today afternoon will go swim  
 ‘I will go swimming this afternoon.’
- (32) xiǎng jiǎnféi jiù yào shǎo chī duō dòng. (teleological)  
 want lose weight then YAO little eat much exercise  
 ‘In order to lose weight, one should eat little/less and exercise much/more.’
- (33) (wǒ xīwàng) nán péngyǒu bú yào bǐ wǒ ǎi. (bouletic)  
 I hope boyfriend NEG YAO BI I short  
 ‘(I hope that) my boyfriend should not be shorter than me.’

To summarize, in this section I described several key empirical properties of epistemic *yào*. Two restrictions set *yào* apart from many familiar modal elements. The first is the restrictive distribution that epistemic *yào* can only appear in explicit strict comparative constructions, and the second is its inability to form any scopal relation with negation. Still another interesting fact is that epistemic *yào* manifests weak necessity quantificational force, a property that makes it comparable to *should* and *ought to* in English. The next task that I would like to take up in this paper is to provide a theoretical analysis of the three empirical properties of epistemic *yào*. In particular, I will address the question of which properties come from which components of grammar (e.g., syntax, semantics, their interface) for epistemic *yào*.

### 3. Explaining the empirical properties of epistemic *yào*

In this section, I will provide a theoretical analysis of the following three properties of epistemic *yào*, in that order: (i) the epistemic reading of *yào* is allowed only when it occurs in explicit strict comparative sentences, (ii) epistemic *yào* is a weak universal modal, and (iii) epistemic *yào* cannot form any scopal relation with negation.

#### 3.1 epistemic *yào* “licensed” only in explicit strict comparative sentences

The highly restrictive distribution of epistemic *yào* makes it distinguished not only from non-epistemic uses of *yào*, but also from many familiar modals in languages such as Mandarin Chinese and English. Explaining its distribution restriction has the potential to reveal interesting parameters of variation in the syntax and semantics of natural language modality. The primary point of departure for my analysis of the restrictive distribution of epistemic *yào* is the rather underappreciated observation of epistemic *yào* showing considerable flexibility regarding where it can appear in explicit strict comparative constructions, especially in the *bǐ* comparative. Lü (1980) noted that when *yào* takes an epistemic reading in a *bǐ* comparative sentence, it can appear right

before *bǐ*, right after the standard-of-comparison phrase, or even right after the extent marker *de* – provided the extent marker is present, of course. Where it appears does not (significantly) affect the acceptability or meaning of the sentence<sup>15</sup>. The sentence in (34), taken from Lü (1980: p.593), allows *yào* to have an epistemic reading in any one of the three indicated positions.

- (34) tā (yào) bǐ wǒ (yào) zǒu de (yào) kuài xiē.  
 he YAO BI me YAO walk EXT YAO fast a bit  
 ‘It should be the case that he walks faster than I do.’

Given the multiple possible positions for epistemic *yào* in a *bǐ* comparative sentence, a natural question to ask is whether it can occur simultaneously in more than one position. Generally speaking, such co-occurrence sounds rather degraded. However, I think the unnaturalness arises from the general dis-preference of stylistic redundancy, rather than from any deep grammatical constraint. When circumstances permit or call for such repetition, it actually can be used as a useful emphasis strategy. Indeed, epistemic *yào* is not categorically banned from occurring multiple times in the same *bǐ* comparative sentence. The *bǐ* sentences in (35) and (36), both containing two instances of epistemic *yào*, are adapted from the Internet and judged “somewhat acceptable” or “fully acceptable” by all three native speakers of Mandarin Chinese who I consulted. The sentence in (19) (repeated in (37a), with minimum stylistic modifications) illustrates multiple occurrences of epistemic *yào* in a sentence combining the *bǐ* comparative with the *gèng* comparative. In addition, the second epistemic *yào* can occur right before *yǒuyì* ‘benefit’ (37b).<sup>16</sup>

- (35) (?) dōngzhī de chuántǒng jiādiàn yèwù yào bǐ rìlì yào quán.<sup>17</sup>  
 Toshiba MOD traditional appliance business YAO BI Hitachi YAO whole  
 ‘Toshiba should have more comprehensive traditional appliance business than Hitachi.’
- (36) (?) Jiāngwǔ yào bǐ tā zhǎng de yào kěài yīxiē.<sup>18</sup>  
 Jiangwu YAO BI he grow EXT YAO loveable a bit  
 ‘Jiangwu should be more loveable in appearance than him.’
- (37) a. (?) mántóu yào bǐ mǐfàn yào gèng yǒuyì yu shòushēn.  
 mun YAO BI rice YAO GENG benefit to lose weight  
 ‘Eating muns should be more beneficial for losing weight.’
- b. (?) mántóu yào bǐ mǐfàn gèng yào yǒuyì yu shòushēn.  
 mun YAO BI rice GENG YAO benefit to lose weight

<sup>15</sup> To the best of my knowledge, among the rather limited descriptive literature on epistemic *yào*, Lü (1980) is the only work where this observation of positional flexibility is made.

<sup>16</sup> To give a fair and complete picture, I did not find naturally-occurring sentences that contain three *theoretically possible* slots for epistemic *yào* and that *in reality* involve epistemic *yào* in the second slot occurring together with another slot (i.e., the first and/or third slots). According to judgments by the three Mandarin Chinese native speakers that I consulted, sentences containing epistemic *yào* in the second slot and an additional slot strongly oriented toward the “unacceptable” end. Three instances of epistemic *yào* occurring together was constantly judged by these native speakers to be “unacceptable.” Unfortunately, at this point I do not know why this is the case, and will have to leave the question open for future research.

<sup>17</sup> This example was retrieved and adapted from [http://news.xinhuanet.com/world/2015-08/13/c\\_128123437\\_2.htm](http://news.xinhuanet.com/world/2015-08/13/c_128123437_2.htm) (accessed on Nov. 12, 2015)

<sup>18</sup> This sentence was retrieved and adapted from <http://tieba.baidu.com/p/7424295> (accessed on Nov. 12, 2015).

The positional flexibility of epistemic *yào* in *bǐ* and *gèng* comparative constructions, combined with the possibility of simultaneous multiple occurrences of epistemic *yào*, renders it to stand in stark contrast to other (epistemic) modals in Mandarin Chinese. Take the epistemic use of *yīnggāi* ‘should’ and *kěndìng* ‘must’ for example. They can occur immediately before *bǐ*, but are not acceptable in any other position: replacing the first possible occurrence of *yào* with *yīnggāi* in (34) would yield a grammatical sentence with roughly the same interpretation, but making the same replacement in the second possible position of *yào* would yield an unacceptable (or marginal for some native speakers) sentence, and replacement in the third position would yield an outright unacceptable sentence (38). Replacing *yào* with propositional modifiers like *xiǎnrán* ‘obviously’ and *wúyí* ‘certainly, with no doubt’ would yield exactly the same grammaticality pattern, as illustrated in (39). In addition, these modal elements and propositional modifiers can never occur multiple times in a *bǐ* or *gèng* comparative sentence, an observation that further sets them apart from epistemic *yào*.

- (38) tā (yīnggāi)      bǐ      wǒ      (??/\*yīnggāi)      zǒu      de      (\*yīnggāi)      kuài      xiē.  
 he should      BI      me      should      walk      EXT      should      fast      a bit  
 ‘It should/must be the case that he walks faster than I do.’
- (39) tā (xiǎnrán)      bǐ      wǒ      (??/\*xiǎnrán)      zǒu      de      (\*xiǎnrán)      kuài      xiē.  
 he obviously      BI      me      obviously      walk      EXT      obviously      fast      a bit  
 ‘It is obviously the case that he walks faster than I do.’

My analysis of the distributive restriction of epistemic *yào* precisely capitalizes on the above distinction. In the epistemic use, *yīnggāi* and *kěndìng* behave on a par with *xiǎnrán* and *wúyí* in taking a proposition as their argument (Cinque 1999, Tsai 2001, Hacquard 2006, among others)<sup>19</sup>. This property explains why these elements are categorically barred from occurring in an extent *de*-phrase in a *bǐ* comparative sentence. Specifically, an extent *de*-phrase forms an island, as is evident from the unacceptability of *zěnmè* ‘how (manner)’ in (40). Thus, it does not allow any element in it to undergo LF movement (Huang 1982), including those elements that have to raise to take the whole proposition expressed by the sentence as its argument. The fact that epistemic *yào* is allowed to appear in a *de* extent phrase suggests that it does not take a proposition as its argument.<sup>20</sup>

- (40) \*nèixie      háizi      zuótiān      kū      de      lǎoshī      dōu      zěnmè      chéngfá      tāmen?  
 those      child      yesterday      cry      EXT      teacher      DIST      how      punish      them  
 Intended: ‘What was the manner x such that the children cried yesterday to the extent that the teacher punished them in x?’

I propose instead that in its epistemic use, *yào* modifies a strict comparative morpheme. Furthermore, I postulate that as a modifier, epistemic *yào* obligatorily selects for a strict comparative morpheme, and cannot combine with any other degree or non-degree morpheme. Its

<sup>19</sup> A difference between *yīnggāi* and *kěndìng* on the one hand and *xiǎnrán* and *wúyí* on the other is that the latter proposition modifiers can appear sentence initially. This difference has to do with the different lexical categories they belong to. While *yīnggāi* and *kěndìng* are modal verbs, *xiǎnrán* and *wúyí* are adverbs. Nothing in my analysis hinges on this difference, however.

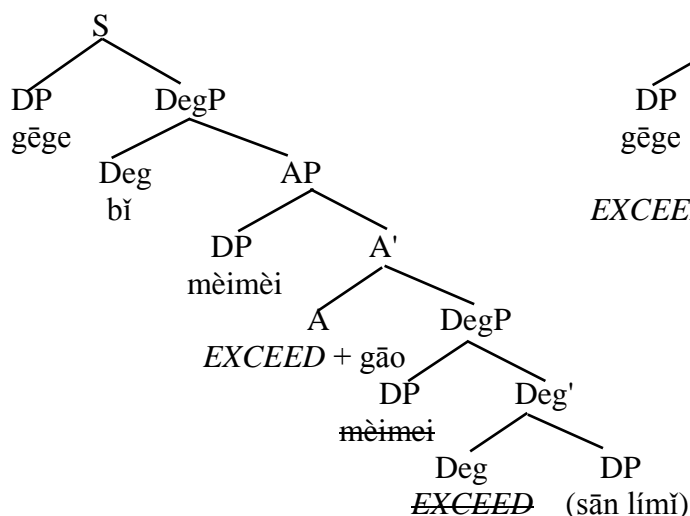
<sup>20</sup> At this stage, it remains an open question why such phrases as *yīnggāi*, *kěndìng*, *xiǎnrán* and *wúyí* fare worse when they appear right after the standard-of-comparison phrase than when they appear right before *bǐ*.

function is to “add an epistemic flavor” (so to speak) to the strict comparative morpheme. The “epistemicized” comparative morpheme, in turn, contributes the epistemic reading of the whole sentence.

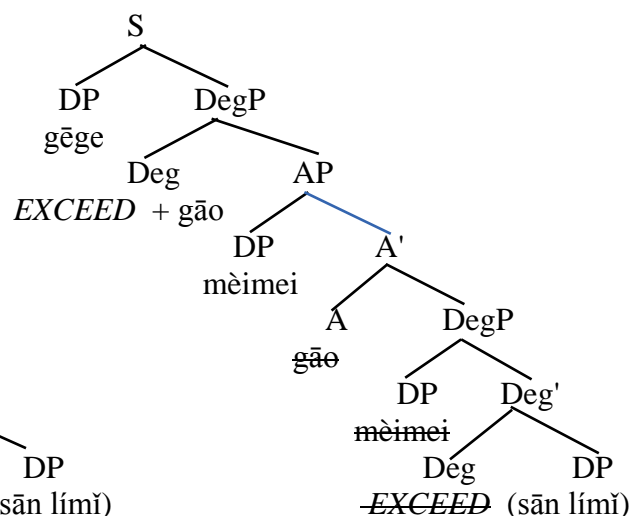
In order for the analysis to work, two reasonable assumptions are in order. First, epistemic *yào* immediately precedes what it modifies. This assumption trivially follows from the generalization that by default, Mandarin Chinese modifiers appear immediately before what they modify (Li and Thompson 1981). Second, modification of the strict comparative morpheme by epistemic *yào* takes place at the surface position of the morpheme. Hence, if a strict comparative morpheme moves, epistemic *yào* only modifies it at the final position where it ends up. This assumption is also reasonable, given the fact that Mandarin Chinese modifiers, except for certain cases of modification mediated by the relative marker *de* (see Zhang 2015), cannot be stranded.

Let us see how the above proposal regarding the function of epistemic *yào* can explain its distribution in comparative and other constructions. The first construction I discuss is the *bǐ* comparative, which is an explicit comparative construction that specifies a “>” relation. In this paper, I adopt Xiang’s (2005) DP-shell structure for this construction (a la Larson 1988), as represented in Figure 1 for the *bǐ* sentence in (41).

- (41) gēge                      bǐ      mèimei                      gāo      (sān límǐ).  
 elder brother      BI      younger sister              tall      three centimeter  
 ‘The elder brother is (three centimeters) taller than the younger sister.’



**Figure 1:** Structure of the *bǐ* comparative



**Figure 2:** Structure of the transitive comparative

Under Xiang’s (2005) analysis, the *bǐ* comparative construction involves two degree (Deg) heads. The higher Deg head corresponds to the overt strict comparative morpheme *bǐ*. The lower Deg head is a phonologically null strict comparative morpheme which Xiang dubbed *EXCEED* and which combines with the gradable predicate (cf., Grano and Kennedy 2012)<sup>21</sup>. As a modifier, epistemic *yào* can appear before either – or even both – of the two Deg heads (cf., (34) and (35)).

<sup>21</sup> Grano and Kennedy (2012) considered the possibility of *EXCEED* heading its own functional projection and then raising to affix on the gradable predicate (a la Xiang 2005) as well as the possibility of *EXCEED* affixing directly to the gradable predicate. My proposal is compatible with both possibilities.

Due to the “affinity” of the covert *EXCEED* degree morpheme to the gradable predicate and the adjacency of the gradable predicate to the standard-of-comparison phrase, appearing immediately before *EXCEED* amounts to appearing right after the standard-of-comparison phrase. When the extent marker *de* appears in a *bǐ* comparative sentence, the extent phrase introduces yet another comparative morpheme and hence opens up a third slot for epistemic *yào* (cf., (34) and (36)).

Epistemic *yào* can also appear in the transitive comparative construction, its close kin *guò* and *chū* comparatives (cf., (13), (16) and (17)) as well as the *gèng* comparative (cf., (18)). But differently from the *bǐ* comparative, none of these four comparative constructions – when used on their own – allows for positional flexibility or multiple occurrences of epistemic *yào*. The reason, however, is very simple: these comparative constructions each contain one (and only one) strict comparative morpheme for epistemic *yào* to modify.

For the transitive comparative construction, I adopt the syntactic representation as proposed by Xiang (2005) and Grano and Kennedy (2012), which is similar to that of the *bǐ* comparative. This is given in Figure 2 above for the sentence in (41). The covert comparative morpheme *EXCEED*, initially heading the lower Deg projection, raises to the higher Deg head. At that surface position, it combines with the gradable predicate, which also raises from the lower adjective phrase. Given the configuration in Figure 2 and the assumptions about modification by epistemic *yào*, it follows naturally that as a modifier of the strict comparative morpheme in a transitive comparative sentence, epistemic *yào* can appear immediately before the gradable predicate (along with the phonologically silent *EXCEED* morpheme), and in no other position. The *guò* and *chū* comparative constructions have been taken to be very similar to the transitive comparative, where *guò* and *chū* belong to the same class of *EXCEED* and affix to the gradable predicate (Grano and Kennedy 2012). Thus, if epistemic *yào* appears in a *guò* or *chū* comparative sentence, it must appear right before the gradable predicate. As for the *gèng* comparative construction, Liu (2010: p. 1593) convincingly argued that *gèng* is “a comparative morpheme denoting a greater-than relation”. Hence, when epistemic *yào* occurs in a *gèng* comparative sentence, it fills in the modifier position immediately before *gèng*.

Now that I have shown those constructions compatible with epistemic *yào* all contain at least one overt or covert strict comparative morpheme, next I will show that all constructions incompatible with epistemic *yào* lack a strict comparative morpheme. The *yǒu* degree construction (cf., (21), repeated in (42)) has been shown by Xie (2014) to be an equative construction comparable to the *as...as* construction in English. According to Xie’s analysis, the structure of the *yǒu* degree construction involves a covert degree morpheme. However, this degree morpheme encodes a “ $\geq$ ” relation, and as such, it is not a strict comparative morpheme as defined in this paper. Then, it comes as nothing strange that the *yǒu* degree construction cannot license epistemic *yào*.

- (42) \*Zhāngsān            de      chéngjì            yào            yǒu    tā            gēge            hǎo.  
 Zhāngsān            MOD grade            should            have    his            elder brother    good  
 Intended: ‘Zhangsan’s academic performance should be as good as his elder brother’s’  
 (Without *yào*): ‘Zhangsan’s academic performance is as good as his elder brother’s’

The equative construction marked with *hé/gēn/xiàng x yīyàng g* (cf., (5), repeated in (43)) establishes a strict identity (rather than strict comparison) relation between the two entities under comparison (Eckardt 2009). Thus, it does not involve a strict comparative morpheme, either. As for implicit comparative sentences, such as those marked by *gēn x bǐ qǐlái* “compared with *x*” (cf., (15), repeated in (44) with minimum stylistic modifications), by definition they make use of “the

inherent context sensitivity of the positive (unmarked) form” of gradable predicates (Kennedy 2007: p. 143). Their structures do not involve any comparative morphology to begin with, let alone morphology that expresses strict comparison. Similarly, it is a trivial fact that non-degree comparative constructions, on their own, do not involve any comparative morphemes (cf., (3), repeated in (45)), let alone strict comparative morphemes. This lack of strict comparative morphology sets implicit comparative constructions, equative constructions, and non-degree comparative constructions apart from explicit strict comparative constructions, and disallows them to license epistemic *yào*.

- (43) \* Dàiyù yào gēn Bǎochāi yíyàng cōngmíng.  
 Daiyu YAO with Baochai same smart  
 Intended: ‘Daiyu should be (exactly) as smart as Baochai.’
- (44) \*gēn bālǐ dǎo bǐqǐlái, xiàwēiyí yào hěn guì  
 with Bali island compare Hawaii YAO very expensive  
 Intended: ‘Compared with Bali island, Hawaii should be very expensive.’  
 (Without *yào*): ‘Compared with Bali island, Hawaii is very expensive.’
- (45) \*Bǎoyù míngtiān zǎoshàng yào zàijiā.  
 Baoyu tomorrow morning YAO at home  
 Intended: ‘It should be the case that Baoyu will be at home tomorrow morning.’

Given the above discussion, I think it is reasonable to claim that the presence of a strict comparative morpheme (whether overt or covert) in the structure of a comparative construction is the sole responsible factor for the acceptability of epistemic *yào* in that construction. Those constructions without a strict comparative morpheme disallow occurrence of epistemic *yào*, precisely because they lack such a morpheme.

I would like to briefly point out that explicit strict comparison is a necessary, but not sufficient, condition for licensing epistemic *yào*. Other constraints may rule out the epistemic reading of *yào* in an explicit strict comparative sentence. As already mentioned in Section 1, *yào* appearing in a dynamic sentence cannot be interpreted as an epistemic modal. This generalization applies to *yào* in dynamic sentences which at the same time specify explicit strict comparison. Take the Mandarin Chinese comparative correlative construction of the form “*yuè Verb yuè Gradable predicate*”, often paraphrasable through the English comparative conditional construction “the more ... the more.” It involves explicit comparison of the same or different individuals’ degrees associated with a gradable property (J. Lin 2007). However, the construction does not allow *yào* in it to have an epistemic reading, as illustrated by the unacceptable sentence in (46) in which *yào* is epistemically intended.<sup>22</sup> The unacceptability is attributable to the property that the *yuè... yuè* comparative correlative construction involves a dynamic change of state (J. Lin 2007). The same explanation lies behind the observation that *yào* cannot have an epistemic reading in the degree achievement construction (47), which can be analyzed as involving a strict comparison morpheme but which expresses dynamic changes (Kennedy and Levin 2008).<sup>23</sup>

<sup>22</sup> The sentence in (46) is acceptable under the dispositional reading about the child’s propensity of becoming more and more beautiful, given how the circumstances are in the relevant context. This dynamic, dispositional reading is different from epistemic reading (Portner 2009: Chapter 4).

<sup>23</sup> When *yào* appears before *jiākuān* ‘widen, be widened’, the sentence in (47) is acceptable under the non-epistemic interpretation that the roads are scheduled or required to be widened.



- (46) \*nà ge háizi yào<sub>epistemic</sub> yuè zhǎng yuè hǎokàn.  
 that CL child should YUE grow YUE good-looking  
 Intended: ‘It should be the case that the more the child grows, the prettier she becomes.’
- (47) shāngchǎng fùjìn de mǎlù (\*yào<sub>epistemic</sub>) míngnián (\*yào<sub>epistemic</sub>) jiǎkuān  
 department store near MOD road YAO next year YAO widen  
 Intended: ‘The roads near the department store will widen/be widened next year.’

One may raise the questions of whether other modal uses of *yào* are also morpheme modifiers. My answer is negative. The primary empirical motivation for treating epistemic *yào* as a modifier is the positional flexibility and possibility of multiple occurrences in certain comparative sentences. Neither property is attested with non-epistemic uses of *yào*. Another related question to ask is what (morpho-)syntactic category epistemic *yào* belongs to. That is, is epistemic *yào* a modal verb (like English *may* and *can*), a modal adjective/adverb (like English *possible* and *possibly*), or something else. In its non-epistemic modal uses (cf., Sec. 2.3), *yào* is generally taken to be a modal verb (T. Lin 2012, Ren 2008, Peng 2007). Out of consideration of lexical parsimony, I would think that the epistemic use of *yào* is a modal verb, as well. However, the positional flexibility and potential multiple occurrence of epistemic *yào* calls this categorization into question, for typically Chinese modal verbs do not show similar properties. Epistemic *yào* is likely to undergo grammaticalization from a verb to an adverbial element. Whether this is indeed the case and if so, what motivates the grammaticalization are questions that I have to leave open to future research.

### 3.2 Semantic interpretation of epistemic *yào*

To define the formal semantics of epistemic *yào*, two matters call for immediate attention. The first one is how to represent the function of epistemic *yào* as a modifier that “epistemicizes” the modified strict comparative morpheme, rather than directly taking the whole “prejacent proposition” as its argument. The second one is how to encode the weak necessity quantificational force of epistemic *yào*, which is comparable to English *should* and *ought to*. The incompatibility of epistemic *yào* with negation will be attributed to the morpho-syntactic status of epistemic *yào* of being a morpheme modifier and its lexical competition with another phrase with (almost) identical semantics (Section 3.3). As such, it does not need to be addressed in its formal semantic definition of epistemic *yào*.

In this paper, I assume that strict comparative morphemes, when modified by epistemic *yào*, serve as immediate arguments to the latter. Though such morphemes have the essential semantic “core” of establishing a strict superiority or inferiority relation between two degrees – through comparing two degrees directly or comparing with the mediation of individuals, their semantic definitions are far from being uniform, having to take into consideration such factors as the varied semantic types of gradable predicate and the phrasal vs. clausal comparative distinction. In this paper, I abstract away from all this potential “complications,” by naively assuming that all strict comparative morphemes (abbreviated as “SC” in (48)) in Mandarin Chinese involve individual comparison and that their semantic “core” takes the general shape as in (48) (Heim 1985, Beck 2011).<sup>24</sup> Furthermore, we assume a gradable predicate *P* to have the semantics as in (49), of

<sup>24</sup> This is a simplistic yet harmless assumption, so as to make the paper focused on its primary topic, viz., the epistemic use of *yào*. If the semantics of a certain strict comparative morpheme turns out to take a different form, the subsequent analysis in this paper can be adjusted accordingly. The semantics in (48) only outlines the “core” strict comparative

the type  $\langle d, \langle e, t \rangle \rangle$ , and the maximality operator used in (48) is defined as in (50).<sup>25</sup> Thus, the semantic “core” of strict comparative morphemes serves to establish a “>” relation between two individuals  $x$ ’s and  $y$ ’s respective maximum degrees of satisfying the predicate  $P$ .

- (48)  $[[SC]] = \lambda x_e \lambda P_{\langle e, t \rangle} \lambda y_e. \text{MAX}(\lambda d. P(d)(y)) > \text{MAX}(\lambda d'. P(d')(x))$   
 (49)  $[[P]] = \lambda d_d \lambda x_e. x \text{ satisfies the property associated with } P \text{ to a degree } d.$   
 (50)  $\text{MAX}(P) = \lambda d: P(d) \wedge \forall d' [ P(d') \rightarrow d' \leq d]$

Regarding the weak necessity quantificational force of epistemic *yào*, Copley’s (2006) and von Fintel and Iatridou’s (2008) discussion of the English modals *should* and *ought to* provides a possible formal means of handling it. The basic intuition in their analysis of *should* and *ought to* is that the semantics of a weak necessity modal requires: (i) the prejacent proposition of the modal be true in every world that is accessible from the speaker’s perceived evidence/knowledge/belief status in a possible world and that is ranked as most highly plausible according to some ideal<sup>26</sup>; and (ii) the prejacent proposition would be allowed (but crucially not required) to be false if the speaker found herself with a different knowledge/belief status or located in a world with a different set of evidence. The first requirement specifies that a weak necessity modal universally quantifies over a set of most relevant possible worlds – most relevant in the sense that the worlds are directly accessible from the world that the speaker is located at, viz., the speaker’s base world. The second requirement keys in the possibility of the prejacent proposition being false in a possible world that is compatible with a world alternative to the speaker’s base world. It is this secondary possibility – which exists only in a domain of quantification “stretched” beyond the speaker’s (base) world – that contributes the weaker necessity quantificational force perceived with such modals as *should* and *ought to*.

Copley’s (2006) and von Fintel and Iatridou’s (2008) analytic insights can be adopted to capture the weak necessity quantificational force of epistemic *yào*. An important distinction which needs to be accommodated for, though, is that being a modifier, epistemic *yào* does not directly take the prejacent (i.e., de-modalized) proposition as its argument. Rather, its direct argument is the comparative relation expressed by the modified strict comparative morpheme (i.e., (48)). Factoring in this selectional difference and ignoring any possible temporal information – which is irrelevant to the current discussion – I define the semantics of epistemic *yào* as in (51), by following Kratzer’s (1981) theoretical framework of modality, just as in Copley’s and von Fintel and Iatridou’s works.

- (51)  $[[yào_{\text{epistemic}}]] = \lambda w \lambda S \lambda x \lambda P \lambda y. \forall w' (w' \in \text{HIGH-PLAUSIBLE}(MB_{\text{epistemic}}(w)) \rightarrow [S(x)(P)(y)]^{w'} = 1) \wedge \exists M (M \in \text{ALT}(MB_{\text{epistemic}}(w)) \wedge \exists w'' (w'' \in \text{HIGH-PLAUSIBLE}(M) \wedge [S(x)(P)(y)]^{w''} = 0)),$  where  $S$  is a morpheme that specifies a strict comparative relation.<sup>27</sup>

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relation. Individual strict comparison morphemes may have their own “add-ons” in semantic definition, as will be discussed for *gèng* shortly.

<sup>25</sup> The semantic definition of gradable predicates does not affect my proposal, either. For instance, with some trivial adjustments I can recast the analysis in the remainder of this section, by assuming the gradable predicate  $P$  to denote a measure function of the type  $\langle e, d \rangle$ .

<sup>26</sup> In this paper, for the sake of simplicity I assume doxastic and epistemic modality to be one and the same thing. The interested reader can refer to such works as Roberts (2015) for insightful discussion of distinctions between doxastic and epistemic modalities.

<sup>27</sup> I assume that the set of alternatives used in this definition does not include the modal base accessible from the speaker’s base world. That is, I assume  $MB_{\text{epistemic}}(w) \notin \text{ALT}(MB_{\text{epistemic}}(w))$ .

The distributive restriction of epistemic *yào* to the very small number of explicit strict comparative constructions is encoded as a presupposition on the “S” argument. That is, the restriction is specified in the lexical semantics of epistemic *yào*. The shorthand “ $MB_{epistemic}$ ” in the definition stands for the epistemic modal base, which is the set of worlds compatible with, or accessible from, the speaker’s perceived evidence/knowledge/belief status in a possible world, typically her base world. The *HIGH-PLAUSIBLE* function, which corresponds to Kratzer’s (1981) notion of ordering among possible worlds, picks the most plausible worlds from the set of accessible worlds based on some contextual ideal, and discards those worlds that are far-stretched.  $ALT(MB_{epistemic}(w))$  yields a set of modal bases alternative to the modal base accessible from the world  $w$ . Each alternative modal base involves a set of worlds that are compatible with the evidence/knowledge/belief status that the speaker has, or is associated with, in a world dislocated from her (base) world (cf., fn. 27). Mediated by a strict comparative morpheme serving as its direct argument, the semantics of epistemic *yào*, in effect, requires: (i) the associated strict comparative proposition be true in all of the highly plausible worlds accessible from the speaker’s perceived evidence/knowledge/belief status in her (base) world, and (ii) the proposition be false in a highly plausible world accessible from the speaker’s perceived evidence/knowledge/belief status (sufficiently) different from her perceived evidence/knowledge/belief status that she has, or is associated with, in her base world.

With the above background, we have everything that we need to derive the semantics of epistemic *yào* sentences. Our example is the simple *gèng* sentence in (52). The degree morpheme *bǐ* and the proper name *Lǐsì* can be explicitly added after *zhāngsān* to introduce the standard of comparison. However, for the sake of simplicity, let us omit *bǐ* and *Lǐsì*, and assume that the standard of comparison is provided from prior linguistic contexts.

- (52) In discussing Zhangsan’s and Lisi’s heights, the speaker utters:  
 zhāngsān yào gèng gāo.  
 Zhangsan YAO GENG tall  
 ‘Zhangsan should be taller.’

I adopt the semantic definition of *gèng* as proposed by Liu (2010), which is the same as (48), except for the evaluative presupposition that specifies the properties predicated of the objects under comparison to be true in the absolute sense (i.e., their degrees exceeding the relevant contextual standard):

- (53)  $[[gèng]] = \lambda x_e \lambda P_{\langle e, dt \rangle} \lambda y_e. \text{MAX}(\lambda d. P(d)(y)) > \text{MAX}(\lambda d'. P(d')(x))$ , where the properties predicated of  $x$  and  $y$  are true in the absolute sense.

Applying the semantics of *gèng* to that of epistemic *yào* in (51) would yield the results in (54). In the context given here and assuming  $w_0$  to be the speaker’s base world, the semantic interpretation of the whole sentence is represented in (55). In prose, the final representation says: (i) the speaker believes that both Zhangsan and Lisi are tall in the relevant context, (ii) the speaker believes that Zhangsan is (even) taller (than Lisi), and (iii) at the same time, the speaker leaves open the possibility of Zhangsan is not taller than Lisi, should she have access to a different set of perceived evidence/knowledge/belief status. Roughly speaking, this semantics amounts to saying that the speaker has a strong belief that Zhangsan is taller than Lisi, but she cannot rule out for sure

the possibility of Zhangsan being not taller than Lisi. This interpretation, I think, captures native intuition regarding what the sentence in (52) means.

- (54)  $[[yào_{\text{epistemic}}]]([\text{gèng}]) = \lambda w \lambda x \lambda y. \forall w' (w' \in \text{HIGH-PLAUSIBLE}(MB_{\text{epistemic}}(w)) \rightarrow [\text{MAX}(\lambda d. P(d)(y)) > \text{MAX}(\lambda d'. P(d')(x))]^{w'} = 1) \wedge \exists M (M \in \text{ALT}(MB_{\text{epistemic}}(w)) \wedge \exists w'' (w'' \in \text{HIGH-PLAUSIBLE}(M) \wedge [\text{MAX}(\lambda d. P(d)(y)) > \text{MAX}(\lambda d'. P(d')(x))]^{w''} = 0)),$  where the properties predicated of  $x$  and  $y$  are true in the absolute sense.
- (55)  $[[ (52) ]] = \forall w' (w' \in \text{HIGH-PLAUSIBLE}(MB_{\text{epistemic}}(w_0)) \rightarrow [\text{MAX}(\lambda d. \text{height}(d)(\text{Zhangsan})) > \text{MAX}(\lambda d'. \text{height}(d')(\text{Lisi}))]^{w'} = 1) \wedge \exists M (M \in \text{ALT}(MB_{\text{epistemic}}(w_0)) \wedge \exists w'' (w'' \in \text{HIGH-PLAUSIBLE}(M) \wedge [\text{MAX}(\lambda d. \text{height}(d)(\text{zhangsan})) > \text{MAX}(\lambda d'. \text{height}(d')(\text{Lisi}))]^{w''} = 0)),$  where the properties predicated of Zhangsan and Lisi are true in the absolute sense.

Before I conclude this sub-section, I would like to point out informally that multiple occurrences of epistemic *yào* modifying distinguished strict comparative morphemes in a sentence would cause no problem for the theoretical analysis outlined above. Given how compositional semantic computation works, the possible-world semantic contribution of one epistemic *yào* would eventually serve as an argument input to that of the other epistemic *yào*. Because the two instances of epistemic *yào* are anchored to the same speaker in the same utterance context and in the same world, and because they “epistemicize” the same “prejacent proposition,” it is reasonable to identify the highly-plausible possible worlds that are quantified over in the semantic contributions of the two epistemic *yào*’s. Then, the semantic contribution of one of the two *yào*’s is vacuous. That is, the two occurrences of epistemic *yào* amount to one single occurrence, in terms of their semantic import. The effect of them occurring in the same sentence is most likely one of emphasis.

### 3.3 The lack of interaction between epistemic *yào* and negation

In this sub-section, I address the remaining question of why negation is unacceptable (or only marginally acceptable, for some speakers of Mandarin Chinese) in epistemic *yào* sentences, no matter whether negation appears before or after *yào*. Two separate stories are behind this rather unique restriction. First, I claim that the modifier status of epistemic *yào* gives rise to the prohibition of the modal appearing above negation, which is marked by *bù* and *méi* (i.e., *\*yào bù* and *\*yào méi*, but see fn. 12). Recall my analysis that epistemic *yào* is a modifier for strict comparative morphemes. Generally speaking, in Mandarin Chinese a modifier immediately precedes what it modifies (Li and Thompson 1981). Such modification disallows an intervening scope-bearing element – the negative markers *bù* and *méi* included – between the modifier and the modified. This requirement explains why *yào* cannot be followed by *bù* or *méi*. As evidence in support of this explanation, epistemic *yào* can co-occur with another epistemic modal *yīnggāi* in an explicit strict comparative sentence, as in (56). When they co-occur, *yīnggāi* must appear before *yào*. Switching the order of the two epistemic modals would yield an ungrammatical sentence. This observation is illustrated by the acceptability contrast between (56) and (57): the only difference between them is in the relative order of epistemically intended *yào* and *yīnggāi*. The unacceptability of (57) is due to the intervening *yīnggāi*, which breaks up the modification relation between epistemically intended *yào* and the comparative morpheme *bǐ*.<sup>28</sup>

<sup>28</sup> A likely alternative explanation of *yīnggāi* having to appear before co-occurring *yào* is to claim that they are epistemic modals of different nature. For instance, it is possible that *yào* is an objective epistemic modal and *yīnggāi* a subjective one, in the sense of Lyons (1977) and Papafragou (2006). Peng (2007) and Peng and Liu (2012) have posited that in Mandarin Chinese, a subjective (interpretation of an) epistemic modal always appears before an

- (56) jīntiān jiāoqū de kōngqì yīnggāi yào bǐ shìqū de hǎo.  
 today suburb MOD air should should BI city MOD good  
 ‘The air in the suburb today should be better than in the city.’
- (57) \*jīntiān jiāoqū de kōngqì yào yīnggāi bǐ shìqū de hǎo.  
 today suburb MOD air should should BI city MOD good  
 Intended: ‘The air in the suburb today should be better than in the city.’

Regarding the ban of epistemic *yào* appearing below negation (i.e., *\*bú yào* and *\*méi yào*),<sup>29, 30</sup> I hypothesize, rather tentatively, that the ban results from competition between lexical items with (almost) identical semantics. The semantic definition of epistemically intended *\*bú yào*, for example, is given in (58).

- (58)  $[[bú\ yào_{epistemic}]] = \lambda w \lambda S \lambda x \lambda P \lambda y. \exists w' (w' \in HIGH-PLAUSIBLE(MB_{epistemic}(w)) \wedge [S(x)(P)(y)]^{w'} = 0) \vee \forall M (M \in ALT(MB_{epistemic}(w)) \rightarrow \forall w'' (w'' \in HIGH-PLAUSIBLE(M) \rightarrow [S(x)(P)(y)]^{w''} = 1))$ ,  
 where S is a morpheme that specifies a strict comparative relation.

Between the two conjuncts linked by the disjunctive operator “ $\vee$ ,” the second conjunct, in effect, stipulates that all modal bases alternative to the one accessible from the speaker’s (base) world can verify the prejacent proposition of the strict comparative sentence where the epistemically intended *\*bú yào* appears. This requirement, however, cannot hold true in general, for it amounts to requiring that the modal base in the speaker’s (base) world rank the least ideal among all possible modal bases. Nothing *a priori* renders such an extreme under-privileged status for the modal base accessible from the speaker’s (base) world. Thus, the second conjunct is constantly false, and the semantics of epistemically intended *\*bú yào* would be equivalent to the first conjunct.

The semantic effect of the first conjunct – modulo the strict comparative relation requirement – is equivalent to the semantics of *kěnéng bù* ‘possibly not’. Due to the equivalence of semantic “core,” the epistemically intended *\*bú yào* competes with *kěnéng bù*, despite the extra strict comparative relation requirement with epistemic *yào*. I hypothesize that the former loses to the latter, for the simple reason, and preference, of quantifier scope rigidity observed in Mandarin Chinese. In Mandarin Chinese there is a very strong tendency that quantifiers admit surface scope readings and disallow inverse scope readings (Huang 1982, Aoun and Li 1989, among others). The semantic interpretation of epistemically intended *\*bú yào* has the scope of *bù* ‘not’ and *yào* ‘should’ reversed from the surface order. By contrast, the semantic interpretation of *kěnéng bù* is isomorphic with the surface order of *kěnéng* ‘possible, possibly’ and *bù* ‘not’. This scope order contrast makes *kěnéng bù* fare better with the general tendency of surface scope interpretation in Mandarin Chinese<sup>31</sup>. Of course, whether my hypothesis is on the right track crucially depends on the

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objective (interpretation of an) epistemic modal on the surface. If this is indeed the case, then it follows that epistemic *yào* has to follow epistemic *yīnggāi* when they co-occur. Unfortunately, at this point I cannot decide between the modification-based explanation discussed in the text and this alternative objectivity/subjectivity-based explanation.

<sup>29</sup> A side note: “*bù yào*” undergoes tone sandhi and changes to “*bú yào*.”

<sup>30</sup> The phrase *bú yào* is acceptable if it is used to mean “do not want/require” or “must not, forbid”, and so is *méi yào* if it is used to mean “did not want/require.” Under such readings, however, *yào* in *bú yào* and *méi yào* is not used as an epistemic modal.

<sup>31</sup> Some native speakers of Mandarin Chinese find epistemically intended *bú yào* marginally acceptable, rather than utterly ill-formed. I suspect that the marginal status of epistemically intended *bú yào* for such native speakers arises from these speakers’ *graded* preference of *kěnéng bù* over *bú yào*, rather than taking it to be a canonical ban of the latter.

(in)validity of the assumption that the strict comparative relation requirement in the semantics of epistemic *yào* ranks lower than the strong language-specific dis-preference of inverse scope interpretation. Whether there is independent evidence to motivate this assumption remains an open question. Thus, at this point my hypothesis about the ungrammaticality of epistemically intended *bú yào* is more suggestive than conclusive.

To summarize, in this section I provided theoretical analyses of the three major properties of epistemic *yào*. I argued that differently from many modal elements that take preadjacent propositions as their direct semantic argument, epistemic *yào* is in fact a modifier for strict comparative morphemes. This rather peculiar status of epistemic *yào* accounts for its restricted distribution as well as its inability to scope over negation. The weak necessity quantificational force of epistemic *yào* is captured by making recourse to alternative modal bases. The inability of epistemic *yào* to scope under negation is due to the loss of epistemically intended *\*bú yào* and *\*méi yào* to another lexical item, viz., *kěnéng bù*, that has (almost) identical semantics. However, this last idea is a mere stipulation at this point.

#### 4. Concluding remarks

It is well-known that modals in natural language can come with all sorts of peculiarities, in terms of form, distribution, interpretation, and so on. In this paper, I provided empirical description and theoretical investigation of the under-studied epistemic use of *yào* in Mandarin Chinese. The descriptive component focuses on three major properties of epistemic *yào*. First, epistemic *yào* is restricted to explicit strict comparative constructions, and is disallowed to appear in many other degree constructions and non-degree constructions. Second, epistemic *yào* cannot form any scopal relation with negation. Third, epistemic *yào* has a quantificational force stronger than that of existential modals, yet weaker than that of strong necessity modals. In this respect, epistemic *yào* is comparable to English modals *should* and *ought to*.

In the theoretical analysis component of this paper, I argued that epistemic *yào* differs from many other epistemic modal elements in that it does not take propositions as its direct argument. Rather, its function is to modify strict comparative morphemes. This modifier status accounts for not only epistemic *yào*'s restricted distribution to explicit strict comparative constructions, but its inability to appear above negation. The weak necessity quantificational force of epistemic *yào* is encoded in its semantics by making recourse to alternative modal bases, which I think may constitute an innovative means to capture weak necessity in general. Last but not least, the inability of epistemic *yào* to scope under negation arises from its competition with, and presumed loss to, a lexical item with (almost) identical semantics. My answer to this last question, however, is tentative, and further independent motivation is needed to (dis)confirm it.

Overall, I think the description and analysis of epistemic *yào* in this paper bring to the forefront some hitherto unnoticed interesting properties of modal elements existing in natural language, and reveal important new intra- and inter-linguistic variations in the distribution and meaning of modal elements. With that being said, there are certain other aspects of epistemic *yào* that I mostly ignored in this paper. For instance, I did not provide a comparative study of epistemic and other modal uses of *yào* (cf., Section 2.3). The interested reader is referred to Wu and Kuo 2010 and T. Lin (2012) for some discussion of non-epistemic readings of *yào*. In addition, epistemic *yào* can occur together with another epistemic modal *yīnggāi* 'should', a phenomenon that was briefly mentioned in Section 3.3. The co-occurrence manifests interesting properties, and addressing the phenomenon is likely to bear direct relevance to Papafragou's (2006) and

Hacquard's (2011) question of whether there are specialized modals for a subjective or objective reading (cf., fn. 28). Despite this theoretical potential, however, I have to leave it for future research, due to space limit.

### Acknowledgments

In this paper, I presented a new analysis of the same general phenomenon as discussed in Xie (2015). Helpful comments from Peter Klecha and Carl Pollard during the spring 2015 Synners weekly meetings at OSU contribute to the development of the new proposal. I also thank an anonymous reviewer for useful comments on the earlier version of this paper.

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