Restricting ignorance*

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1. Introduction

Mandarin existential *wh*-indefinites like *shénme* carry an obligatory ignorance inference in certain environments (Liu and Yang 2021). To derive the ignorance inference, Liu and Yang (2021) suggest that these *wh*-indefinites trigger obligatory exhaustification (Chierchia 2013). When there is an overt epistemic necessity modal scoping above the indefinite, *wh-**N***, exhaustifying the modal claim leads to ignorance: the speaker knows *only* that the proposition is true of an ***N***. Recent work from Chen (2017, 2021) and Liu and Yang (2021) find that Mandarin *wh*-indefinites can be used in simple positive contexts without overt modal elements. Here, the presence of ignorance inference can be derived by positing that a covert epistemic necessity modal, call it *K*, is inserted in the matrix clause at LF (Kratzer and Shimoyama 2002, Meyer 2013, 2014).[1]

A question arises: can the covert epistemic operator *K* be freely inserted? In this paper, I will demonstrate that positing *K* without constraints would lead to unattested parses. Two cases will be discussed: one involves negative polarity items (NPIs), and the other involves scope interactions with overt operators like 'only.' Given the data from Mandarin, I propose that *K* occurs only when forced syntactically by certain operators (e.g., Mandarin *wh*-indefinite *shénme*).

2. Data: ignorance in Mandarin *wh*-indefinites

Mandarin *wh*-indefinite *shénme* gives rise to ignorance inferences, as illustrated in a simple positive context like (1). The inference seems to be obligatory and uncancellable, as evidenced by the *namely* continuation shown in example (2) (Alonso-Ovalle and Menéndez-Benito 2010, Liu and Yang 2021).

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[1] While Kratzer and Shimoyama (2002) treats *K*-insertion as a last resort insertion, Meyer (2013) makes a concrete proposal hypothesizing that when a sentence *p* is used to make an assertion, it has the LF representation *K*(*p*).

(1) Zhāngsān zài kàn *shénme* diànyǐng.
ZS ASP watch what movie
'ZS is watching some movie, **(and that is all I know)**.'[2]

(2) *Namely-continuation*
(1) ..., míngzì #(kěnéng) jiào 2046.
name possibly call *2046*
'(1) ... whose name is #(possibly) *2046*.'

On the other hand, as illustrated in (3), under negation and in conditional antecedents, no ignorance is observed. See more discussion in Section 5.

(3) a. *Negation*
Lǐ Jiàoshòu méi mǎi *shénme* cài.
Prof. Li NEG buy what dish
'Prof. Li didn't buy any dish.' (≠ 'Prof. Li didn't buy a dish that **I don't know**.')

b. *Conditional antecedent*
Rúguǒ *shéi* qīfu nǐ, qǐng gàosù wǒ.
if who bully 2.SG please tell 1.SG
'If anyone bullies you, please let me know' (≠ 'If someone **whose identity I cannot identify** bullies you, ...') (Liu and Yang 2021: ex. (26))

Because the inference is obligatory in some contexts, it is presumably semantically derived. But it is not obligatory in all contexts, either, so the inference cannot be part of the lexical meaning of the *wh*-phrase. I thus assume that the ignorance inference is derived instead from the meaning of a silent morpheme. Following Liu and Yang (2021), I assume that the morpheme is *Exh*, which expresses exhaustification (Chierchia 2006, 2013; cf. Kratzer and Shimoyama 2002, Alonso-Ovalle and Menéndez-Benito 2010).

To derive the attested ignorance inference within grammar, Liu and Yang (2021) suggest that the covert operator *Exh* scopes over an epistemic modal, covert (i.e., *K*) when not overt (Kratzer and Shimoyama 2002). See (4) for the LF. As a result, meaning enrichment via exhaustification targets the speaker's epistemic claim.

(4) *LF of (1):* [*Exh* [*K* [ZS is watching ***shénme*** movie]]]
(All that holds true is that I know ZS is watching *some* movie.)

A lexical entry for *Exh* is given in (5). *Exh* has a similar meaning to 'only' and conveys that its prejacent p is true, and that the non-weaker alternatives are false.

(5) $Exh(ALT)(p) = \lambda w.\ p(w) \wedge \forall p' \in ALT[p'(w) \rightarrow p \subseteq p']$

[2]Example (1) also has a *wh*-question reading: 'What movie is ZS watching?' For simplicity, I only gloss the indefinite interpretation.

The alternatives are triggered by some alternative-triggering element, here the *wh*-indefinite *shénme*, and computed via point-wise functional application (Rooth 1985). Mandarin *wh*-indefinites are assumed to be existential quantifiers (6a) and trigger singleton (sub)domain alternatives (6b) (Liu and Yang 2021; cf. Chierchia and Liao 2015).

(6) a. $[\![\textit{shénme}\ \text{movie}]\!] = \lambda P_{\langle e,t\rangle}.\ \exists x \in D_e\ [\ \text{Movie}(x) \wedge P(x)\ ]$
b. $ALT([\![\textit{shénme}\ \text{movie}]\!]) = \{\lambda P_{et}.\ \exists x \in \{u\}\ [\ \text{Movie}(x) \wedge P(x)] \mid \{u\} \subseteq D_e\}$
(A set of lifted individuals that are movies[3])

Finally, *K* is an epistemic necessity modal as in (7) (Kratzer and Shimoyama 2002, Alonso-Ovalle and Menéndez-Benito 2010, Meyer 2013, Liu and Yang 2021):

(7) $[\![K]\!](p) = \lambda w.\ \forall w' \in Dox_S^w.\ p(w') = 1$
(Dox_S^w contains worlds compatible with the speaker S's knowledge/beliefs in w.)

Assume that (1) has the LF in (4), and that the contextually salient movie set is $D_1 = \{\textit{2046}, \textit{Hoppers}, \textit{Jaws}\}$. Asserting (1) implies that the speaker does not know whether ZS watched any of the movies, provided that no alternative is entailed by the prejacent. See (8) for illustration.

(8) a. $[\![(4)]\!] = Exh(ALT)([\![K(\text{ZS is watching } \textit{shénme}\ \text{movie})]\!])$
b. Prejacent: $\lambda w.\ \forall w' \in Dox_S^w.\ \exists x \in D_1[\ \text{Watching-in-}w'(x)(\text{ZS})\ ]$
c. $ALT = \{\lambda w.\ \forall w' \in Dox_S^w.[\ \text{Watching-in-}w'(x)(\text{ZS})\ ] \mid x \in D_1\}$
d. Enriched meaning: **I know** ZS is watching some movie, and **I don't know** whether he is watching *2046*, and **I don't know** whether he is watching *Hoppers*, and **I don't know** whether he is watching *Jaws*. [ignorance]

Under the exhaustification framework, if a certain syntactic object α mandatorily triggers exhaustification, it necessitates the presence of the operator *Exh* in the structure, assuming that α and *Exh* form some syntactic agreement (Chierchia 2013). Given that Mandarin *wh*-indefinites trigger obligatory ignorance, *Exh* seems to be syntactically required (see also Chierchia and Liao 2015). But this is not enough to derive the ignorance inference in simple positive contexts like (1). In fact, without *K*, mandatory exhaustification would lead to a contradiction. Suppose the LF for (1) does not have *K*, as illustrated in (9) instead, it yields infelicitously that 'ZS is watching some movie in D_1, but none of the movies in D_1.'

(9) a. *LF of (1) without K:* [*Exh* [ZS is watching ***shénme*** movie]]
b. Prejacent: $\lambda w.\ \exists x \in D_1[\ \text{Watching-in-}w(x)(\text{ZS})\ ]$
c. $ALT = \{\ \lambda w.\ \text{Watching-in-}w(x)(\text{ZS}) \mid x \in D_1\}$
d. Enriched meaning: ZS is watching some movie, and **he is not** watching *2046*, and **he is not** watching *Hoppers*, and **he is not** watching *Jaws*. [$\perp$]

[3]Following Montague (1973) and Partee (1987), I assume that an expression in type *e* can be lifted to its principal ultrafilter, giving it the type of a quantifier.

Therefore, it follows that both *Exh* and *K* are mandatory for the derivation of the ignorance in cases like (1). Assume that *Exh* is syntactically regulated, the data in (1) is compatible with *K* being freely inserted in the structure, since its job is to avoid contradiction. In what follows, I will show that if *K* is freely inserted, over-generation problems will emerge.

3. Puzzles

An immediate threat is embeddability. *K*-insertion has to be a matrix phenomenon (Meyer 2013). Embedding *K* under another embedding predicate would lead to unattested readings, even if one relativizes *K* to the local subject, as illustrated in (10).

(10) #John doubts that ***K*** Mary is at home.

a. *Unattested reading 1*: 'John doubts that **I know** that Mary is at home.'
b. *Unattested reading 2*: 'John$_1$ doubts that **he**$_1$ **knows** that Mary is at home.'

However, this is not all. I will present two more puzzles regarding the distribution of *K*. One puzzle is related to NPIs like *any*, and the other scope interaction with *only*.

3.1 Puzzle 1: NPIs

Recall that without *K*, exhaustification leads to a contradiction in simple positive contexts like (1). Similarly, these contexts do not permit NPIs, either, as shown in (11).

(11) *Zoe is watching *any* movie.

Can we then derive the distribution of NPIs (e.g., English *any*) wholly from contradiction by exhaustification? Here is an attempt: Chierchia (2006, 2013) treats NPIs as another expression that is obligatorily exhaustified and triggers (sub)domain alternatives. As shown in (12), mirroring (9), Chierchia assumes that the ungrammaticality of (11) results from logical contradiction. Again, assume $D_1 = \{2046,\ Hoppers,\ Jaws\}$ for the domain of movies.

(12) a. *LF of (11):* [*Exh* [Zoe is watching **any** movie]]
b. $[\![(12a)]\!] = Exh(ALT)([\![\text{Zoe is watching } \textit{any} \text{ movie}]\!])$
c. Prejacent: $\lambda w.\ \exists x \in D_1[\ \text{Watching-in-}w(x)(\text{Zoe})\ ]$
d. $ALT = \{\ \lambda w.\ \text{Watching-in-}w(x)(\text{Zoe}) \mid x \in D_1\}$
e. Enriched meaning: Zoe is watching some movie, and **she is not** watching *2046*, and **she is not** watching *Hoppers*, and **she is not** watching *Jaws*. [$\perp$]

Assuming that Chierchia's treatment of NPIs is correct, an over-generation problem emerges from a freely inserted *K*. Compare (11) and (1), repeated in (13).

(13) Zhāngsān zài kàn *shénme* diànyǐng. (Mandarin)
'ZS is watching some movie.'

If *K* could be inserted, we should allow for an unattested parse as shown in (14), where *any* is rescued in a matrix environment (Zeijlstra, p.c.).

(14) *LF of (11) with K:* [*Exh* [*K* [Zoe is watching **any** movie]]] ≈ (4)
(All that holds true is that I know Zoe is watching *any* movie.)

In other words, given an unrestricted *K* and the assumption that both the NPI *any* and Mandarin *shénme* trigger exhaustification over (sub)domain alternatives, we would predict a parse as in (15b) where English *any* behaves just like Mandarin *wh*-indefinite *shénme*, contrary to facts—(15a) is the only parse that leads to contradiction.

(15) a. [*Exh* [... *any* ...]] = ⊥ b. *[*Exh* [*K* [... *any* ...]]]

Two possible explanations are available. First, it could be that Chierchia's exhaustification framework does not extend to NPIs.[4] Second, one can argue that *K* is not freely insertable. In this paper, I follow the second route and argue for a restricted distribution of *K* determined by certain syntactic objects (e.g., *shénme*).

3.2 Puzzle 2: Scope of *K*

Let's now turn to example (16). If *K* were available in the first clause, one would have obtained a plausible reading as in (17), which, however, is not empirically attested.

(16) Carol saw only [Amy]$_F$. (# And possibly, she saw [Bani]$_F$.)

(17) *Intended LF for (16): Only > K*
*[[[Only Amy]$_1$ $\boxed{K\ [\ \text{Carol saw } t_1]}$] & ◇[Carol saw Bani]]
(I only know Carol saw Amy, and it is possible that Carol saw Bani.)

There are two possible explanations. One might stipulate that *only* is more scopally rigid and cannot scope over *K* (see Fox and Katzir 2021: fn. 5). As a result, there remains unexplained a difference between *only* and its covert counterpart *Exh*. Alternatively, if *K* is restricted syntactically, the LF in (17) is not available: nothing in (16) requires the presence of *K*, so it would not be inserted in the first place. No stipulation on scope is needed.

4. Solution: Restricting *K*

Our desideratum is to make sure that the distribution of *K* is restrictive enough to (i) maintain its co-occurrence with certain expressions (e.g., Mandarin *wh*-indefinites) and (ii) be

[4] Other analyses for NPIs do not necessarily face the current issue. For instance, under some globalist analyses for NPIs (Kadmon and Landman 1993, Lahiri 1998, Crnič 2014), the presence of *K* does not affect the global strength or likelihood of the proposition asserted and hence would not affect the modeling of the NPI distribution. I thank Daniar Kasenov for pointing it out.

blocked elsewhere. I will introduce the proposal by returning to the minimal comparison between *shénme* and *any*. What distinguishes them is whether they syntactically license *K*.

First, I claim that *K* is syntactically required by certain expressions. While Mandarin *shénme* requires *K*, English *any* does not. Concretely, I propose that *shénme* enters into an Agree relation with *K*, extending Chierchia's (2013) proposal for *Exh* to *K*. There are some syntactic objects that require agreement with *Exh* or *K*. In this respect, while *any* requires *Exh*, *shénme* is both an *Exh*-associate and a *K*-associate, requiring both *Exh* and *K* to be present in the structure. This is illustrated in (18) and (19):

(18) ZS is watching *shénme* movie.
[*Exh* [*K* [... *shénme* ...]]].
[*iExh*] [*iK*] [*uExh*; *uK*]

(19) *Zoe is watching *any* movie.
[*Exh* [... *any* ...]].
[*iExh*] [*uExh*]

I also claim that *K* is only inserted when syntactically forced by a licensing expression. As a result, there is no *K* in (20a), which, if present, would have permitted the NPI *any* in the same environment as Mandarin *shénme*.

(20) *Any & shénme in Non-DE environment*
a. [*Exh* [... $any_{[uExh]}$ ...]] = ⊥;
b. [*Exh* [*K* [... $shénme_{[uExh,uK]}$ ...]]]

In sum, the two puzzles are explained by the restriction of *K*. Since the insertion of *K* is conditioned by certain syntactic objects, we successfully rule out the overgenerated cases for *any* and *only*. A refined matrix *K* hypothesis is spelled out in (21) (cf. Meyer 2013).

(21) *The matrix K hypothesis*
When a sentence p is used to make an assertion, it has an LF representation $K(p)$ iff some element in p syntactically forces *K*.

One might wonder if *Exh* can be modeled in a similar fashion. While it has been proposed that some elements such as *any* triggers obligatory exhaustification, *Exh* itself is considered to optionally occur elsewhere. For example, not uncontroversially, the optional insertion of *Exh* provides a grammatical route to derive scalar inferences (e.g., Sauerland 2004, Chierchia et al. 2008, Meyer 2013). It remains an open puzzle why *Exh* is not subject to a last-resort requirement in a way *K* is.

5. Bleeding ignorance

In the current account, the implication of ignorance triggered by some uses of Mandarin *wh*-indefinites results from scope interaction between *Exh* and *K*. Given the hypothesis in (21), *K* is syntactically forced with Mandarin *wh*-indefinites. One would expect *K* to be present in all cases where the *wh*-indefinites occur. That is different from the proposal by Liu and Yang (2021), where *K* is a last resort insertion for simple positive contexts (Kratzer

and Shimoyama 2002). In Liu and Yang (2021), they observe that (i) ignorance inference is absent when the *wh*-indefinites occur in certain environments, such as negation, and (ii) on the other hand, ignorance is observed when *wh*-indefinites occur in the domain of an overt epistemic modal, and indifference under an overt root modal. Would positing a syntactically forced *K* make an incorrect prediction about when ignorance is (not) observed? Hopefully, even though having an additional operator *K* does allow for more scope ambiguities, it does not *eliminate* interpretations that would also be licit without *K* in the structure—*K* can simply take the widest scope over the exhaustified proposition p^+, and the sentence with the LF representation $K(p^+)$ means that 'I know that p^+ is true.'

I claim that the current proposal makes the insertion of *K* less stipulative. For example, sentence (3), repeated as (22), has at least two possible LFs as in (22a) and (22b), depending on the scopes of *K* and *Exh*.

(22) Lǐ Jiàoshòu méi mǎi ***shénme*** cài.
'Prof. Li didn't buy any dish.'

a. *LF1:* [*K* [*Exh* [¬ [Prof. Li bought ***shénme*** dish]]]] ($K > Exh$)
b. *LF2:* [*Exh* [*K* [¬ [Prof. Li bought ***shénme*** dish]]]] ($Exh > K$)

Recall that $Exh(ALT)(p)$ asserts the prejacent p and negates non-weaker alternatives. Exhaustification is vacuous when no alternatives in ALT are negated—here, when *K* scopes over *Exh*, the prejacent of *Exh* entails all the (sub)domain alternatives. See (23) for illustration. With the syntactically forced *K*, the sentence expresses that 'I know that all that holds true is that Prof. Li didn't buy any dish.'

(23) a. $[\![(22a)]\!] = K(Exh(ALT)([\![\text{Prof. Li didn't buy } \textit{shénme} \text{ dish}]\!]))$
b. Prejacent of *Exh*: $\lambda w.\ \neg\ \exists x \in D_{\text{Dish}}.$ [Bought-in-$w(x)$(Prof.Li)].
c. $ALT = \{\lambda w.\ \neg$ Bought-in-$w(x)$(Prof.Li) $\mid x \in D_{\text{Dish}}\}$

What about when *Exh* scopes over *K* in (22)? Here I show that the LF in (22b) results in a contradiction. Given that the prejacent is weaker than the alternatives, exhaustification is not vacuous. For the simplicity of computation as in (24d), I assume that the contextually salient dishes are of a set $\{a, b\}$, in which x is a member, p stands for the predicate 'bought-in-w', and the denotation for *K* is simplified as $\Box$.

(24) a. $[\![(22b)]\!] = Exh(ALT)(K([\![\text{Prof. Li didn't buy } \textit{shénme} \text{ dish}]\!]))$
b. Prejacent of *Exh*: $\lambda w.\ \forall w' \in Dox_S^w.\ \neg\ \exists x \in D_{\text{Dish}}.$ [Bought-in-$w'(x)$(Prof.Li)].
c. $ALT = \{\lambda w.\ \forall w' \in Dox_S^w.\ \neg$ Bought-in-$w'(x)$(Prof.Li) $\mid x \in D_{\text{Dish}}\}$
d. $[\![(22b)]\!] = \Box\neg p(x) \wedge \neg\Box\neg p(a) \wedge \neg\Box\neg p(b)$
$= \neg\Diamond\neg\neg p(x) \wedge \Diamond\neg\neg p(a) \wedge \Diamond\neg\neg p(b)$ ($\neg\Box q \equiv \Diamond\neg q$)
$= \neg\Diamond p(x) \wedge \Diamond p(a) \wedge \Diamond p(b) = \bot$ ($\neg\neg q \equiv q$)

Thus, a syntactically forced *K* does not generate unattested readings for (22). In fact, as noted in Liu and Yang (2021) (their ex. (49)), with overt root modals, sentences like (25) are

ambiguous between carrying an indifference (26a) and ignorance inference (26b). Under the current proposal, it is modeled as structural ambiguities resulting from the scope of *Exh*. Let's assume that the salient rooms are of the set $\{Rm\ A,\ Rm\ B,\ Rm\ C\}$. Details of computation are omitted due to the space limit.

(25) Lǐsì bìxū zài *shénme* fángjiān lǐ dāi mǎn yī xīngqī cái xíng.
LS must$_{deo}$ LOC what room in stay full one week CAI fine
'LS must stay in some room or other for a week.'

(26) a. *LF1:* [*K* [*Exh* [$\Box_{deo}$ [LS stay in *shénme* room for a week]]]]
(I know all that holds true is that LS has to stay in some room for a week, and she doesn't have to stay in *Rm A*, *Rm B*, or *Rm C*.)
$\rightsquigarrow$ I know there is no more requirement on room assignment. [indifference]
b. *LF2:* [*Exh* [*K* [$\Box_{deo}$ [LS stay in *shénme* room for a week]]]]
(All that holds true is that I know that LS has to stay in some room for a week, and that I don't know if she has to stay in *Rm A*, *Rm B*, or *Rm C*.)
$\rightsquigarrow$ All I know is that LS has to stay in some room or other. [ignorance]

When *Exh* takes the intermediate scope between *K* and the root modal, indifference results. When *Exh* takes the widest scope, the sentence expresses ignorance. Assuming *K* to be a last resort insertion cannot explain the motivation of the insertion, since the indifference reading is readily available. Alternatively, the ambiguity follows if *K* is always forced.

6. Conclusion

In this paper, I argue for a restricted distribution of a covert lexicalized operator *K*, which expresses an epistemic necessity relative to the speaker, *pace* the proposal by Meyer (2013, 2014). While the data observed from Mandarin *wh*-indefinites support the presence of *K* as a grammatical device given the obligatory ignorance inference observed in modal-less positive contexts, *K* cannot be freely insertable in the grammar. Otherwise, over-generation puzzles arise: (i) the NPI *any* occurring in the non-DE environment would not lead to contradiction but obligatory ignorance inference, and (ii) if *only* could scope over *K*, one would expect the modalized proposition $K(p)$ to be the prejacent of *only*, leading to plausible but empirically unattested readings. With *K* being possible only when syntactically required, the two puzzles follow for free. I propose that the introduction of *K* in the structure depends on the presence of some syntactic objects, for example, *wh*-indefinites in Mandarin. Other potential syntactic licensors for *K* might include disjunctions (Meyer 2013) and modal indefinites found crosslinguistically. I leave this open for future research.

7. Remaining issues

There are some remaining data to be accounted for. First, the occurrence of *wh*-indefinites does not rescue NPIs like *rènhé* 'any' (Giannakidou and Cheng 2006) from simple positive contexts. As illustrated in (27), *rènhé* 'any' cannot appear in these positive sentences.

(27) a. *Zhào Shūshu mǎi le rènhé lǐwù.
Uncle Zhao buy ASP any gift
b. *Zhào Shūshu gěi rènhé rén mǎi le shénme lǐwù.
Uncle Zhao give any person buy ASP what gift
c. *Zhào Shūshu gěi shénme rén mǎi le rènhé lǐwù.
Uncle Zhao give what person buy ASP any gift

Thus the current proposal of restricting *K* to Mandarin *wh*-indefinites will still overgenerate, if we continue to follow Chierchia's (2013) analysis for NPIs. Recall that the availability of Mandarin *wh*-indefinites and NPIs in simple positive contexts forces *K* to be only compatible with *wh*-indefinites, the co-occurrence found in (27b & 27c) would have been grammatical because, as shown in Section 3.1, the presence of *K* bleeds contradictions for *any*. One potential solution is assume that *rènhé* 'any' and *wh*-indefinites are interveners for each other, as illustrated in (28), where the higher indefinite blocks the lower one.

(28) *Uncle Zhao gave *anyone what* gift.
[*Exh* [*K* [... *any* *shénme* ...]]].
[*iExh*] [*iK*] [*uExh*] [∗*u**Exh***; *uK*]

However, on the other hand, to the Mandarin speakers I consulted with, it is possible to have multiple *wh*-indefinites in the same clause, as shown in (29a). The same goes to the co-occurrence of *rènhé* 'any.' The sentence in (29b) is fully grammatical.

(29) a. Tā zuótiān zài *nǎlǐ* bèi *shénme* rén tōu le qiánbāo
3.SG yesterday LOC where PASS what person steal ASP wallet
'Her wallet was stolen by someone somewhere yesterday.'
b. Tā méiyǒu gěi *rènhé* rén dài *rènhé* lǐwù.
3.SG NEG give any people bring any gift
'He didn't bring any gift to anyone.'

If examples in (27b & 27c) are ruled out by intervention, the intervention story would also have to explain the licit co-occurrence of multiple *any*s and multiple *wh*-indefinites. This will have to be addressed in future work.

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