On the role of classifiers in licensing Mandarin existential wh-phrases[1]

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Abstract. As in many languages in the world, wh-phrases in Mandarin can be interpreted as more than interrogative, depending on where they appear. This paper focuses on one of the non-interrogative readings of Mandarin wh-phrases, the existential reading, and presents an account of the licensing conditions for this particular reading by examining its distribution. Moreover, this paper aims to tackle the issue concerning the required co-occurrence of existential wh-phrases and classifiers in certain environments, a puzzle that has received much notice (Li, 1992; Lin, 1998; Liao, 2011) but is not yet resolved. This paper argues that Mandarin wh-phrases require two ingredients to be existential, non-veridicality (Xie, 2007; Lin et al., 2014) and existential closure (∃) (Kratzer and Shimoyama, 2002). And classifiers play the role of providing existential force to the wh-phrase when ∃ is unavailable. The (un-)availability of ∃ is conditioned by the application site of ∃ and the syntactic heights of non-veridical operators, whose scope constitutes the licensing domain for the wh-phrase: ∃ is unavailable when it falls outside the scope of the non-veridical operators, given a licensing condition proposed in this paper that limits the application of ∃ to wh-phrases to being within a non-veridical domain. In that case, a classifier is required for the existential interpretation of the wh-phrase.

Keywords: Mandarin, classifiers, wh-phrases, non-veridicality, existential closure

1. Introduction

The interpretation of Mandarin wh-phrases can vary, depending on the environments they appear in. Besides the interrogative reading, (1a),[2] Mandarin wh-phrases can have other non-interrogative readings, one of them being **existential**, (1b) (Huang, 1982; Cheng, 1991, 1994, 1995; Li, 1992; Lin, 1996, 1998, 2004, 2014; a.o.):

(1) a. Zhangsan xihuan **shenme**?
Zhangsan like what
'What does Zhangsan like?'

b. Zhangsan **bu** xihuan **shenme**
Zhangsan not like what
'What doesn't Zhangsan like?'
'Zhangsan doesn't like anything.'

However, the existential reading is not readily available in all situations: A wh-indefinite is not grammatical in most positive episodic sentences (Li, 1992; Lin, 1998). The following sentence can only obtain an interrogative interpretation:

[1]I would like to thank my two main advisors of this project, Seth Cable and Vincent Homer, for enlightening me and leading me along the way. I would also like to thank Kyle Johnson, Rajesh Bhatt, and the audience at the UMass Semantics Workshop fall 2015 for their valuable comments and suggestions. Yangsook Park and Jon Ander Mendia have my biggest gratitude for helping me with some of the semantic issues in the project. Finally, I would like to thank Rong Yin for many of the judgements on the scope readings of the wh-phrases. Of course, any errors that remain would be my own.

[2]Unlike English, Mandarin is a wh-in-situ language. In other words, there is no overt movement of the wh-phrase to Spec.CP to take scope, as in the case of English. To obtain the reading where the wh-phrase takes scope over the matrix clause, it is generally assumed that wh-phrases are inherently quantificational and undergo LF movement to take scope. Please see Huang (1982) for a more detailed account of Mandarin wh-interrogatives.

(2) Zhangsan kandao-le **shenme**
Zhangsan see-ASP[3] what
'What did Zhangsan see?'/*'Zhangsan saw something.'

Various licensing conditions have been proposed for Mandarin existential wh-phrases. Yet one fact that has been noted in the literature but not accounted for is the required co-occurrence of these wh-phrases and classifiers in certain environments (Li, 1992; Lin, 1998; Liao, 2011):

(3) a. Zhangsan haoxiang mai-le-**(ge) shenme**
Zhangsan seem buy-ASP-CL what
'It seems that Zhangsan bought something.'
b. Zhangsan bixu mai-***(ge) shenme**
Zhangsan must buy-CL what
'Zhangsan must buy something.'

Being in the scope of epistemic and deontic modals (i.e. *haoxiang* ('seem') in (3a) and *bixu* ('must') in (3b)) is reported to be one of the licensing conditions for existential wh-phrases. But clearly, the obligatory presence of the classifier in the deontically modalized environment suggests that we need to take into account the role classifiers play in licensing existential wh-phrases that distinguishes between the licensing environments as those in (3).

In fact, the deontic environment is not the only environment that requires a classifier for existential wh-phrases. In the remainder of this paper, we will scrutinize the distributions of existential wh-phrases and classifiers. The goal is to develop an analysis that implements classifiers into the licensing conditions for the wh-phrases, capturing their distribution correlation.

1.1. Distribution of existential wh-phrases

The following are the reported environments where existential wh-phrases are licensed:

— Under negation, in polar questions, and in conditionals:
(Huang, 1982; Cheng, 1994; Li, 1992; Lin, 1996, 1998, 2004, 2014)

(4) Zhangsan **mei** chi **shenme**
Zhangsan not eat what
'Zhangsan didn't eat anything.'

(5) Zhangsan chi-le **shenme ma**?
Zhangsan eat-ASP what Q
'Did Zhangsan eat anything?'

(6) **Yaoshi** Zhangsan chi-le **shenme**, qing gaosu wo
if Zhangsan eat-ASP what please tell me
'If Zhangsan eats anything, please tell me.'

[3] ASP stands for *aspect*. *Le*, in this case, is a perfective aspect in Mandarin. For following glosses, CL = *classifier*; Q = *question particle*; DE = *modification marker*; PAR = *particle*.

— Under epistemic modality:
(e.g. epistemic adverbs (7), non-factive epistemic verbs (8), and the inference *le* (9))[4]

(7) **Keneng/xiangbi shei** you qifu ta le
possibly/probably who again bully him ASP
'Possibly/most probably, somebody bullied him again.' (Lin, 1998)

(8) Zhangsan **yiwei/renwei** wo mai-le **shenme**, keshi wo genben mei mai renhe dongxi
Zhangsan think/think I buy-ASP what but I at-all not buy any thing
'Zhangsan thinks that I bought something, but I didn't buy anything at all.' (Li, 1992)

(9) Ta kandao-(le) **shenme le**
he see-$\text{ASP}_{\text{perfective}}$ what $\text{ASP}_{\text{inchoative}}$
'(It seems that) he saw something.' (Li, 1992)

— In BEFORE-clauses:

(10) **Zai** dui yuangong zuo **shenme zhiqian**, duo kaolu kaolu
at to employee do what before more think think
'You (should) think twice before doing something to the employees.' (Xie, 2007)

— Under imperfective/progressive aspect:

(11) Wo jinqu de shihou, ta **zhengzai** he **shenme**
I enter DE time he $\text{ASP}_{\text{progressive}}$ drink what
'When I went in, he was drinking something.' (Xie, 2007)

— In disjunction:

(12) **Yaome shei** lai-guo, **yaome** wo wangji guan chuanghu le
either who come-ASP either I forget close window ASP
'Either somebody came (broke in), or I forgot to close the window.' (Xie, 2007)

— Under deontic modality:

(13) Zhangsan **bixu** mai-***(ge) shenme**
Zhangsan must buy-CL what
'Zhangsan must buy something.'

[4]According to Li (1992), a way of indicating circumstantial inferences in Mandarin is through the sentence-final *le*, which is different from the perefective aspect *le* that attaches to verbs. The sentence-final *le* is often seen as an inchoative *le* that signals a change of state has occurred (Li and Thompson, 1981), and this property correlates with the fact that the inchoative *le* is often used in people's inferential statements.

— In "future" environments: (Lin, 1998)
(e.g. modal verbs (14), imperatives (15), and verb complements (16))

(14) Wo mingtian **hui** qu mai-***(ge) shenme** dongxi song ta
I tomorrow will go buy-CL what thing give him
'I will go to buy something for him tomorrow.'

(15) Guo-lai chi-***(dian) shenme** ba!
come eat-CL what PAR
'Come over to eat something.'

(16) Wo xiawu **dasuan**[5]qu mai-***(ben) shenme** shu lai kan
I this-afternoon plan go buy-CL what book come read
'I plan to buy some book to read this afternoon.'

For convenience, the following table summarizes the overall licensing environments for existential wh-phrases shown above, and a divide is made between the environments based on the obligatory presence of classifiers:

(17) Distributions of existential wh-phrases and classifiers:

No classifiers required:
- Negation
- Polar questions
- Conditionals
- Epistemic modality:
  - ◇ Epistemic adverbs
  - ◇ Non-factive epistemic verbs
  - ◇ Inference *le*
- BEFORE-clauses
- Imperfective/Progressive
- Disjunction

classifiers required:
- Future environment:
  - ◇ Deontic modality
  - ◇ Imperatives
  - ◇ Verbs with future-event-denoting complements

2. The classifier puzzles

Given the distribution of classifiers in the licensing environments of existential wh-phrases, we can roughly frame our first classifier puzzle as follows:

(18) Classifier puzzle #1:
Why does an existential wh-phrase require a classifier only in certain environments?

[5]The complement of verbs like *dasuan* ('plan') typically refer to actions in the future (Lin, 1998).

Another classifier puzzle concerns an observation made by Liao (2011), where the requirement of classifiers in the deontic environment can be lifted when the environment is embedded under an epistemic one:

(19) Zhangsan **haoxiang bixu** mai-**(ge) shenme**
Zhangsan seem must buy-CL what
'It seems that Zhangsan must buy something.' (Liao, 2011)

Thus, we may ask:

(20) Classifier puzzle #2:
Why is the classifier no longer needed in the above situation?

The next section is dedicated to developing an analysis that aims to tackle these puzzles by implementing classifiers into the licensing mechanism for Mandarin existential wh-phrases.

3. Analysis

Contra Huang (1982), this paper adopts the point of view that wh-phrases are inherently non-quantificational and acquire their quantificational force externally (Cheng, 1991; Tsai, 1999, 2003, 2010). They are analyzed as denoting sets of alternatives under Hamblin (1973) style semantics, following Kratzer and Shimoyama's (2002) treatment of Japanese indeterminate pronouns, as well as Li and Law's (2014) treatment of Mandarin wh-phrases:[6]

(21) a. $[\![\textbf{shenme}\text{ ('what')}]\!]^{w,g} = \{x_e : \text{thing}_w(x)\} \in D_{\langle e\rangle/t}$[7]
b. $[\![\textbf{shei}\text{ ('who')}]\!]^{w,g} = \{y_e : \text{person}_w(y)\} \in D_{\langle e\rangle/t}$

If the denotations of wh-phrases percolate up to the CP level via Pointwise Function Application (Yatsushiro, 2009), we will get the denotations of wh-questions, where each wh-question denotes a set of propositions. In order for a wh-phrase to be interpreted as existential, the set of propositions has to be captured by a sentential ∃, existentially closing the set (Kratzer and Shimoyama, 2002; pg. 7):

(22) For $[\![\alpha]\!]^{w,g} \subseteq D_{\langle st\rangle} : [\![\exists\alpha]\!]^{w,g} = \{\lambda w' . \exists p [p \in [\![\alpha]\!]^{w,g} \& p(w') = 1]\}$

Classifiers are hypothesized to be serving the role of ∃ within the domain of *v*P. Reasons for this hypothesis will be made clear later, but it is important to note that the existential closure of wh-phrases (either by the covert ∃ or by a classifier) is not without conditions. We simply cannot close the sets denoted by wh-phrases anywhere, given the following sentence:

[6]The motivation for Li and Law's (2014) treatment of Mandarin wh-phrases as sets of alternatives comes from the intervention effects when a focus operator like *zhiyou* ('only') enters certain hierarchical configurations with the wh-phrase.

[7]The type ⟨e⟩/t is the type of sets of alternatives defined in Yatsushiro (2009). The semantic composition of wh-phrases in this paper follows Yatsushiro's (2009) system, where wh-phrases compose via Pointwise Function Application and end up generating sets of propositions, i.e. the denotation of wh-questions.

(23) Zhangsan zuotian chi-le-**(ge)** **shenme**
Zhangsan yesterday eat-ASP-CL what
'What did Zhangsan eat yesterday?' / *'Zhangsan ate something yesterday.'

Even in the presence of a classifier, the wh-phrase in (23) can only be interpreted as an interrogative rather than an existential. Therefore, we also need to factor in all and only the environments where the existential reading is found. Given the nature of the licensing environments in the introduction, Xie (2007) and Lin et al. (2014) propose *non-veridicality* in the sense of Zwarts (1995) as the licensing condition for Mandarin existential wh-phrases:

(24) (Non-)veridicality for propositional operators:
A propositional operator F is veridical iff Fp entails p: Fp $\vDash$ p; otherwise, F is non-veridical. (Lin, Weerman, and Zeijlstra, 2014)

All of the boldfaced items (other than the wh-phrases) in (4) to (16) can be viewed as a non-veridical operator under the definition above,[8]leaving aside the case of imperatives, which has no overt operators though non-veridical in nature.

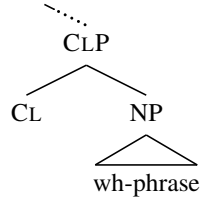
Taking the environmental factor into account, I propose the following licensing conditions for Mandarin existential wh-phrases that connect ∃ and non-veridicality:

(25) General licensing conditions for existential wh-phrases:
a. Non-veridicality:
A wh-phrase can only be grammatical under an existential reading when closed by ∃ in a non-veridical environment (i.e. in the scope of a non-veridical operator).
b. Existential closure:
(i) ∃ applies higher than *v*P with the following semantics:
$[\![\exists]\!]^{w,g} = \lambda\alpha_{\langle st\rangle/t}\lambda w' . \exists p [p \in \alpha \wedge p(w') = 1]$
(⟨st⟩/t being the type of sets of propositions)
(ii) A classifier can close the set denoted by its argument wh-phrase:[9]
$[\![CL_{\exists}]\!]^{w,g} = \lambda\alpha_{\langle e\rangle/t}\lambda P_{\langle e,\, est\rangle/t}\lambda y\lambda w' . \exists z [z \in \alpha \wedge P_{w'}(z)(y) = 1]$

[8]One might wonder why the *imperfective/progressive* aspect is viewed as non-veridical. According to Xie (2007), who follows Giannakidou (2002) in defining non-veridicality over temporal relations denoted by aspectual operators, an aspectual operator is veridical iff the topic time strictly follows the time of the resultant state of an eventuality the aspectual operator is predicated of. Otherwise, the aspectual operator is non-veridical. Since under the *imperfective/progressive* aspect the topic time is included in the event time of an eventuality (of which the time of resultant state is a part), the *imperfective/progressive* aspect is therefore non-veridical.

[9]This application assumes the structure proposed in Cheng and Sybesma (1999, 2005) for Mandarin nominals, where the classifier is a functional head CL(ASSIFIER) that forms a constituent with the wh-phrase following it:

(i)



Although rather stipulative, we need the condition of non-veridicality in (25a) to rule out sentences like (23), where the wh-phrase could potentially be existentially closed by ∃ or a classifier. Moreover, once we factor in the positions of the non-veridical operators, the condition in (25a) and the hypothesis that ∃ applies higher than *v*P (25b) can help us account for the environment-dependent co-occurrence of the wh-phrase and classifiers, which will be the focus of the next section.

This analysis also makes predictions about the scope of the wh-phrase, depending on where it is existentially closed. It will be shown that the predictions are borne out after establishing the syntactic positions of the non-veridical operators and their interactions with ∃.

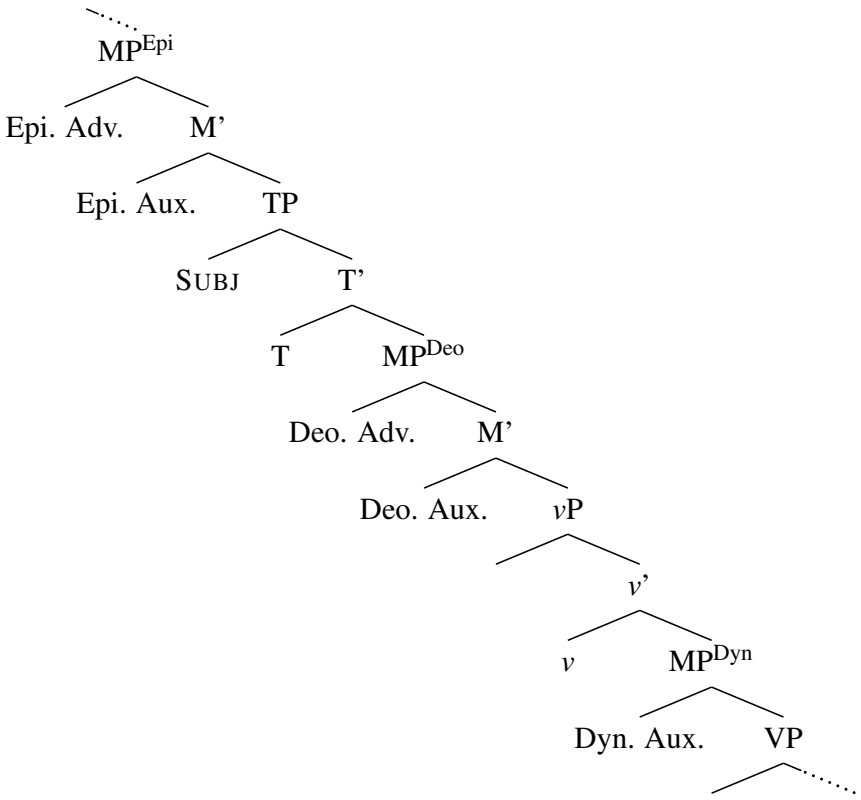
3.1. Application of ∃

The account for the classifier requirement in existential wh-phrase licensing will resort to the interaction between the non-veridical operators and the application site of ∃. The licensing reasoning goes as follows: (i) A wh-phrase has to be existentially closed within a non-veridical domain, (25a). (ii) ∃ applies higher than *v*P, (25b), contrary to the common assumption that it applies low at VP (Diesing, 1990, 1992). (iii) If the non-veridical operator is no higher than *v*P, existentially closing the wh-phrase would be ungrammatical, i.e. a violation of (25a). (iv) In that case, a classifier comes in as a replacement for ∃ (hence the hypothesis that classifiers serve as ∃ within the domain of *v*P).

Given this reasoning, we are in other words saying that the environments where classifiers are required are environments where the non-veridical operators scope lower than ∃. This statement can be corroborated by the clausal structure in Tsai (2010), where different types of modals assume different syntactic heights:[10]

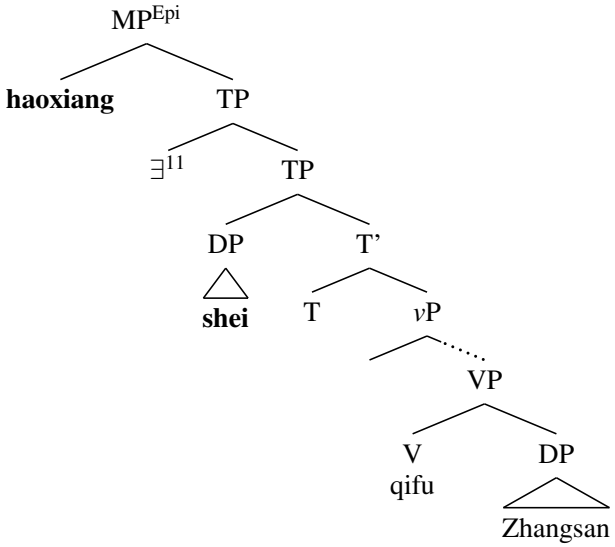
[10]Tsai (2010) reaches this structure after investigating the syntactic and scope interactions between the different types of modals (i.e. epistemic, deontic, and dynamic modals). His argument is not presented here due to reasons of space. For a detailed argument for this structure, I refer the readers to Tsai (2010).

(26)



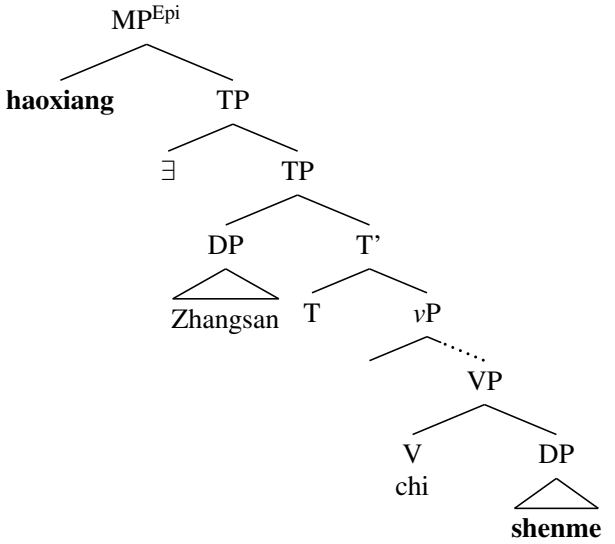
Given the positional difference between the epistemic and deontic modals, whose scopes constitute the licensing domains for existential wh-phrases, we can now explain the contrast between the epistemic and deontic environments in terms of the classifier requirement:

(27) **Haoxiang shei** qifu-le Zhangsan
seem who bully-ASP Zhangsan
'It seems that somebody bullied Zhangsan.'
$[_{TP_3}$ **haoxiang** $[_{TP_2} \exists [_{TP_1}$ **shei**$_i$ $[_{vP}$ t_i $[_{VP}$ qifu-le Zhangsan]]]]]



$[\![(27)]\!]^{w,\,g} = \exists w'' \in \mathscr{M}_{(w,\,\text{epistemic})}\,.\,\exists p\,[p \in \{\lambda w'\,.\,\text{bully}_{w'}(y, ZS) \mid \text{person}_w(y)\} \wedge p(w'') = 1]$[12]

(28) Zhangsan **haoxiang** chi-le **shenme**
Zhangsan seem eat-ASP what
'It seems that Zhangsan ate something.'
$[_{TP_3}$ **haoxiang** $[_{TP_2} \exists [_{TP_1}$ Zhangsan$_i$ $[_{vP}$ t_i $[_{VP}$ chi-le **shenme**]]]]]



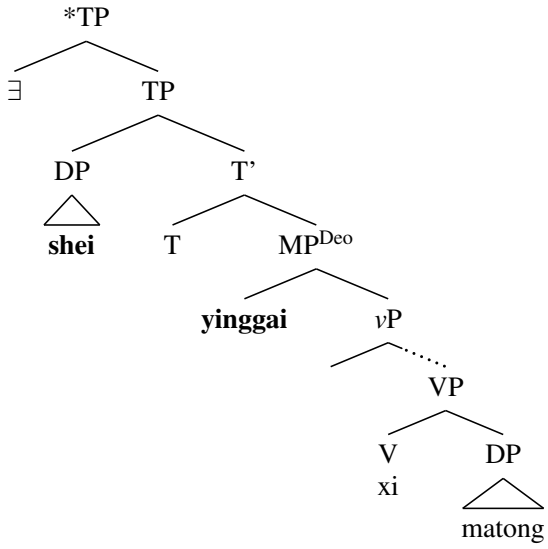
$[\![(28)]\!]^{w,\,g} = \exists w'' \in \mathscr{M}_{(w,\,\text{epistemic})}\,.\,\exists p\,[p \in \{\lambda w'\,.\,\text{eat}_{w'}(ZS, x) \mid \text{thing}_w(x)\} \wedge p(w'') = 1]$

[11]The covert existential closure ∃ is put in Spec.TP in the structure of (27). This is a position where it can compose with the TP of type ⟨st⟩/t given its semantics. However, it is not limited to being in this position. It can be in any position where its argument's type allows it to compose, as long as that position is higher than *v*P.

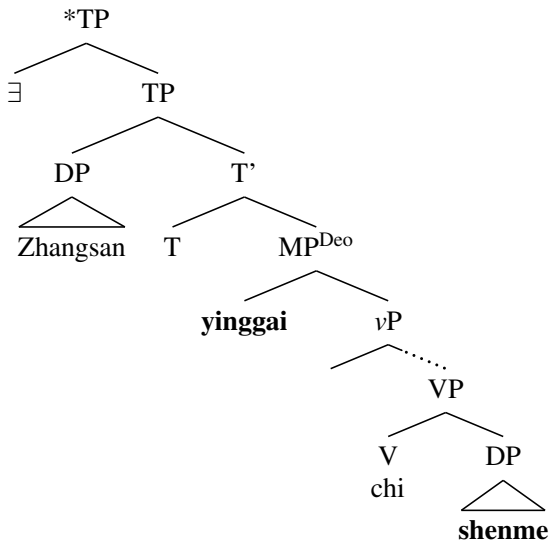
[12]For a thorough derivation of the semantics of the current and following examples, please see the appendix.

The epistemic modal is a sentential operator whose non-veridical licensing domain for the wh-phrase encompasses the application site of ∃. Therefore, the wh-phrase can be closed by ∃ and interpreted as an existential, following the condition in (25a). On the other hand, the deontic modal scopes low (at *v*P) and ∃ falls outside of its non-veridical domain. As a result, the wh-phrase, be it a subject or an object, cannot be closed by ∃ and obtain the existential reading:

(29) **Shei yinggai** xi matong
who should wash toilet
*'Somebody should wash the toilet.' / 'Who should wash the toilet?'
*[$_{TP_2}$ ∃ [$_{TP_1}$ **shei**$_i$ [$_{vP_2}$ **yinggai** [$_{vP_1}$ t_i [$_{VP}$ xi matong]]]]]



(30) Zhangsan **yinggai** chi **shenme**
Zhangsan should eat what
*'Zhangsan should eat something.' / 'What should Zhangsan eat?'
*[$_{TP_2}$ ∃ [$_{TP_1}$ Zhangsan$_i$ [$_{vP_2}$ **yinggai** [$_{vP_1}$ t_i [$_{VP}$ chi **shenme**]]]]]



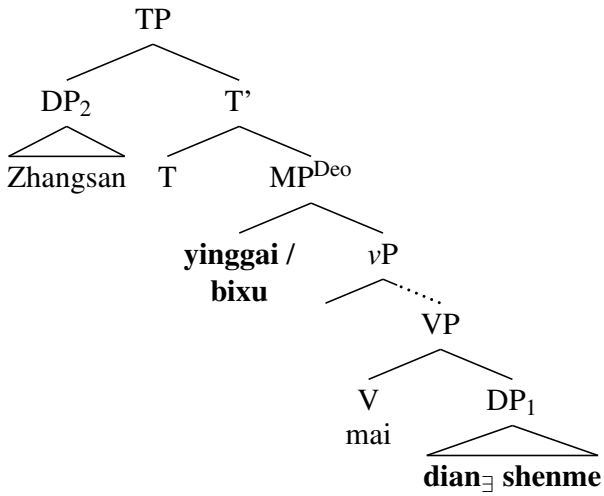
Due to the unavailability of ∃, the set of alternatives denoted by the wh-phrase cannot be existentially closed but has to percolate up, leading to the obligatory interrogative reading, i.e. the reading of a wh-question.

3.2. Classifiers as ∃

The only way for the wh-phrase to be existential in this case of low-scoping non-veridical operators is for the classifier to take over the job of ∃ and close the set denoted by the wh-phrase with the semantics proposed in (25bii), repeated here as (31a):

(31) a. $[\![\text{CL}_{\exists}]\!]^{w,g} = \lambda\alpha_{\langle e\rangle/t}\lambda P_{\langle e,\,est\rangle}\lambda y\lambda w'\,.\,\exists z\,[z \in \alpha \wedge P_{w'}(z)(y) = 1]$[13]

b. Zhangsan **yinggai/bixu** mai-**dian shenme**
Zhangsan should/must buy-CL what
'Zhangsan should/must buy something.'
[$_{TP}$ Zhangsan$_i$ [$_{vP_2}$ **yinggai/bixu** [$_{vP_1}$ t$_i$ [$_{VP}$ mai-**dian**$_{\exists}$ **shenme**]]]]



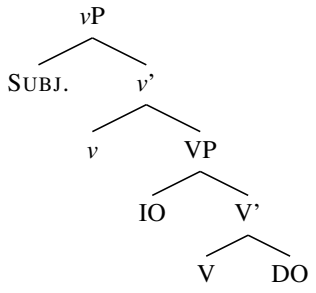
$[\![\textbf{shenme}]\!]^{w,g} = \{x_e : \text{thing}_w(x)\}$

$[\![\text{DP}_1]\!]^{w,g} = \lambda P_{\langle e,\,est\rangle}\lambda y\lambda w'\,.\,\exists z\,[z \in \{x_e : \text{thing}_w(x)\} \wedge P_{w'}(z)(y) = 1]$

$[\![(31b)]\!]^{w,g} = \forall w'' \in \mathscr{M}_{(w,\,\text{deontic})}\,.\,\exists z\,[z \in \{x_e : \text{thing}_w(x)\} \wedge \text{buy}_{w''}(ZS, z) = 1]$

[13]The denotation proposed for classifiers as ∃ may seem too restrictive since its second argument position assumes a predicate of type ⟨e, est⟩, i.e. the type of transitive verbs. However, we can allow for slight variation of the denotation between those in (ii), assuming the verbal structure proposed by Huang, Li, and Li (2009) in (i):

(i)

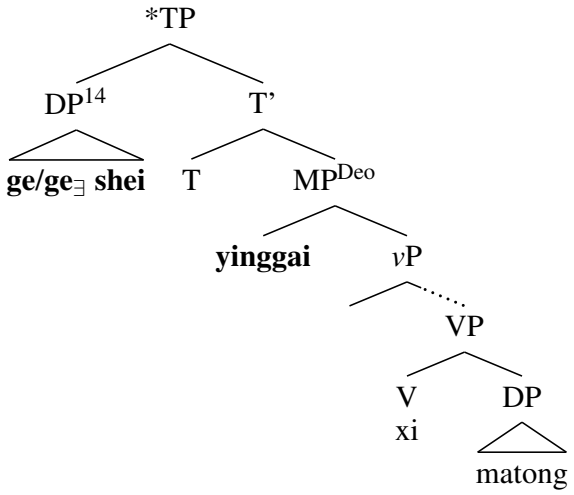


However, if what we have in the case of low-scoping deontic modals is a wh-subject as in (29), inserting a classifier before the wh-subject would not help for two reasons: (i) the wh-subject falls outside of the non-veridical licensing domain (i.e. outside of the scope of the deontic modals), and (ii) Mandarin classifiers are clitic-like items that usually need to attach to numerals, demonstratives, or verbs, and cannot stand alone sentence-initially:

(32) *__Ge ren__ xihuan Zhangsan
CL person like Zhangsan
'Somebody likes Zhangsan.'

The clitic need of classifiers thus makes sentences with a [CL + Wh] subject ungrammatical, even under an interrogative reading:

(33) *__Ge shei__ yinggai xi matong
CL who should wash toilet
*'Somebody should wash the toilet.' / *'Who should wash the toilet?'
*[$_{TP}$ [$_{DP}$ **ge/ge$_{\exists}$ shei**]$_i$ [$_{vP_2}$ **yinggai** [$_{vP_1}$ t$_i$ [$_{VP}$ xi matong]]]]



If we try to generalize the contrast between the epistemic and deontic modals under discussion to other licensing environments, we can see that generally speaking, the requirement of classi-

(ii) For [CL + Wh] direct objects (DOs),
$[\![CL_{\exists}]\!]^{w,g} = \lambda\alpha_{\langle e\rangle/t}\lambda P_{\langle e,\langle e,\,est\rangle\rangle}\lambda x\lambda y\lambda w'\,.\,\exists z\,[z \in \alpha \wedge P_{w'}(z)(x)(y) = 1]$
For [CL + Wh] indirect objects (IOs),
$[\![CL_{\exists}]\!]^{w,g} = \lambda\alpha_{\langle e\rangle/t}\lambda P_{\langle e,\,est\rangle}\lambda y\lambda w'\,.\,\exists z\,[z \in \alpha \wedge P_{w'}(z)(y) = 1] = (31a)$

Please note that when CL$_{\exists}$ shows up with a wh-phrase as the indirect object, the denotation for CL$_{\exists}$ remains the same as in the case of transitive verbs, because the first argument position in the denotation of the di-transitive verb will have been saturated by the direct object before the verb composes with the [CL$_{\exists}$ + Wh] IO.

[14] As will be clear in later sections, Mandarin classifiers assume two types of functions, that of regular classifiers (i.e. those that go with regular NPs) and that of ∃ (as in the case of existential wh-phrases). The two types are differentiated by the ∃ subscript on the classifier: CL$_{\exists}$ closes the set of alternatives denoted by the wh-phrase and renders it existential while CL is transparent to the set denotations of wh-phrases and the DP [CL + Wh] remains a wh-interrogative.

fiers can be seen as a reflection of high vs. low non-veridical operators. All of the non-veridical operators that do not require a classifier in their scope to license an existential wh-phrase are sentential (or not sentential but higher than *v*P as in the case of the imperfective/progressive aspect), or can embed structures bigger than a *v*P (e.g. non-factive epistemic verbs). Classifiers are needed elsewhere; that is, under the operators that are not higher than a *v*P (e.g. deontic modals) or cannot embed structures larger than a *v*P (e.g. the *future* verbs, which cannot embed a full finite TP). Our first puzzle concerning the environment-dependent requirement of classifiers is thus solved.

4. Classifier distribution

Having established the licensing mechanism for Mandarin existential wh-phrases, we can now also explain our second classifier puzzle, where the classifier that was once required under a deontic modal is no longer needed when the deontic modal is further embedded under an epistemic modal:

(34) Zhangsan **haoxiang bixu** mai-**(ge) shenme**
Zhangsan seem must buy-CL what
'It seems that Zhangsan must buy something.'
[$_{TP_3}$ **haoxiang** [$_{TP_2}$ $\exists$ [$_{TP_1}$ Zhangsan$_i$ [$_{vP_2}$ **bixu** [$_{vP_1}$ t$_i$ [$_{VP}$ mai-(**ge**$_{\exists}$) **shenme**]]]]]]

As shown by the LF above, the epistemic modal expands the licensing domain of the wh-phrase from the *v*P to the sentential level to include the high $\exists$, providing another option of existential closure for the wh-phrase. As a result, the classifier is no longer necessary for the existential reading. The second classifier puzzle is also solved.

Given the way the current account is set up, it makes a prediction that if we expand the licensing domain of the wh-phrase by embedding a classifier-requiring environment under a non-classifier-requiring one, we can remove the need of a classifier for licensing the wh-phrase. The following examples show that this prediction is indeed borne out:[15]

(35) Zhangsan **hui** qu mai-**(xie) shenme** dongxi song ta **ma**?
Zhangsan will go buy-CL what thing give him Q
'Will Zhangsan go to buy something for him?'
[$_{CP}$ [$_{TP_2}$ $\exists$ [$_{TP_1}$ Zhangsan **hui** qu mai-(**xie**$_{\exists}$) **shenme** dongxi song ta]] **ma**]?

[15]The existential interpretation of the wh-subject in the case of low non-veridical operators (e.g. deontic modals) that was non-rescuable by the insertion of a classifier can now be rescued under embedding, as predicted, given the availability of $\exists$ made by domain expansion. Example (29) embedded under the polar question particle *ma* is shown here for illustration:

(i) **Shei yinggai** xi matong **ma**?
who should wash toilet Q
'Should somebody wash the toilet?'
[$_{CP}$ [$_{TP_2}$ $\exists$ [$_{TP_1}$ **Shei**$_i$ [$_{vP_2}$ **yinggai** [$_{vP_1}$ t$_i$ [$_{VP}$ xi matong]]]]] **ma**]?

(36) **Yaoshi** Zhangsan **bixu** chi-**(dian) shenme**, qing gaosu wo
if Zhangsan must eat-CL what please tell me
'If Zhangsan must eat something, please tell me.'
[$_{TP_2}$ **yaoshi** $\underline{\exists}$ [$_{TP_1}$ Zhangsan **bixu** chi-(**dian**$_{\exists}$) **shenme**, ...]]

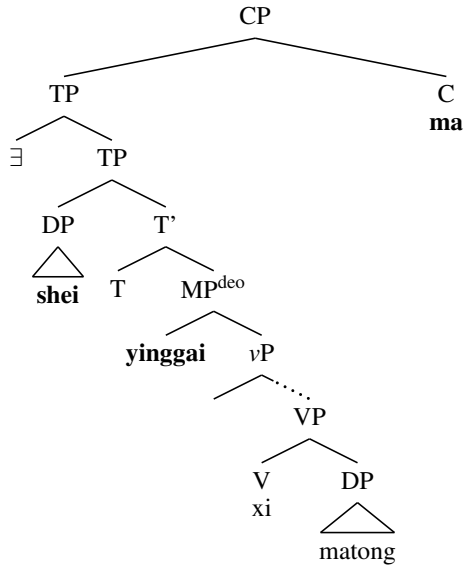
(37) Wo **yiwei** Zhangsan **dasuan** zhao-**(ge) shei** lai bangang
I think Zhangsan plan find-CL who come help
'I thought Zhangsan planned to find somebody to help.'
[$_{TP_3}$ Wo **yiwei** [$_{CP}$ [$_{TP_2}$ $\underline{\exists}$ [$_{TP_1}$ Zhangsan **dasuan** zhao-(**ge**$_{\exists}$) **shei** ...]]]]

Above are three instances of non-veridical operators that require a classifier in their scope (a modal verb **hui** ('will') in (35), a deontic modal **bixu** ('must') in (36), and a *future* verb **dasuan** ('plan') in (37)) being embedded under operators that do not (the polar question particle **ma** in (35), a conditional morpheme **yaoshi** ('if') in (36), and a non-factive epistemic verb **yiwei** ('think') in (37)). And the classifiers are now optional in all of the instances.

5. Scope of wh-phrases

The issue about what options of existential closure are available to the wh-phrase makes another prediction about the scope interpretation of the wh-phrase. In the examples shown above, we should have scope ambiguity of the wh-phrase, depending on what it is closed by in its licensing domain. And we do indeed find scope ambiguity in cases like those:

(38) Zhangsan **haoxiang bixu** chi-**dian shenme**
Zhangsan seem must eat-CL what
'It seems that Zhangsan must eat something.' (*seem* > *must* > $CL_{\exists}$)
'It seems that there is something such that Zhangsan must eat it.' (*seem* > $\exists$ > *must*)



The scope ambiguity exists under the assumption that classifiers only serve as ∃ in the case of existential wh-phrase licensing when needed. In other words, they do not necessarily close the set denoted by the wh-phrase if the higher covert ∃ is also available. Consequently, the wh-phrase has two options of existential closure given the domain expansion by the epistemic modal, leading to the scenario where the two options of existential closure fall on either side of the low non-veridical operator (i.e. the deontic modal). Hence, the wide and narrow scope reading of the wh-phrase with respect to the low non-veridical operator are both accessible.

Given the presence of the classifier in (38) and the possibility of obtaining a wide scope reading of the wh-phrase, we are in a way saying that classifiers are ambiguous between ∃ and regular classifiers so that the set denotation of the wh-phrase can percolate up the structure and be closed by the higher ∃ in the latter case.[16] This is a necessary hypothesis to make, given how the licensing mechanism is constructed: Existentially closing the wh-phrase in environments other than non-veridical would result in ungrammaticality. However, the following sentence is grammatical, but only with an interrogative reading of the wh-phrase:

(39) Zhangsan tingdao-le-**xie shenme**
Zhangsan hear-ASP-CL what
*'Zhangsan heard something.' / 'What did Zhangsan hear?'

Furthermore, in the absence of a classifier in environments like (38), the wh-phrase is predicted to be non-ambiguous and have only wide scope with respect to the low non-veridical operator, which is attested by the following example:

(40) Zhangsan **haoxiang bixu** chi **shenme**
Zhangsan seem must eat what
'It seems that Zhangsan must eat something.' ($seem > must > \text{CL}_{\exists}$)
'It seems that there is something such that Zhangsan must eat it.' ($seem > \exists > must$)

It is the higher covert ∃ that is existentially closing the wh-phrase in this case under the licensing domain of the high non-veridical operator. Given the application site of ∃, i.e. higher than *v*P, the wh-phrase necessarily has wide scope with respect to the low non-veridical operator.

[16] According to Cheng and Sybesma (1999, 2005), from whom I adopt the structure of Mandarin nominals, the function of the CL head is the ι operator that renders the definite reading of the NP it composes with. Apparently, our analysis of wh-phrases as denoting sets of alternatives would not be able to compose with a regular classifier if we follow Cheng and Sybesma's analysis. Therefore, we need to propose another denotation for the classifier so that it can compose with a wh-phrase and pass up the wh-phrase's set denotation:

(i) $[\![\text{CL}_{\text{wh}}]\!]^{w,\,g} = \lambda f_{\langle e\rangle/t} \,.\, f$

The classifier in this case is treated as denoting an identity function whose first argument is a set of alternatives. This denotation guarantees the exclusive relationship between this type of regular classifiers and wh-phrases (as opposed to the ι-classifier with regular NPs), as well as the derivation of the interrogative reading of a wh-question as in (39).

6. Conclusion

To conclude, the analysis of licensing Mandarin existential wh-phrases presented in this paper builds on two major factors that make necessary conditions for the existential interpretation of wh-phrases: Non-veridicality and existential closure (∃). By attributing the role classifiers play in the licensing mechanism to fulfilling the function of ∃ when ∃ is unavailable, we are able to account for the distribution of classifiers that is environment-dependent. The (un-) availability of ∃ is conditioned by two other factors: The application site of ∃, i.e. above *v*P, and the syntactic heights of non-veridical operators that license the wh-phrase. Given our hypothesis that a wh-phrase can only be grammatically closed by ∃ in a non-veridical domain, classifiers are required to take over the job of ∃ when the licensor of the wh-phrase is a low non-veridical operator, outside of whose scope ∃ falls. Thus, the distribution of classifiers in the case of existential wh-phrases is licensor-related, i.e. their environment-dependent nature, and their obligatory presence can be made optional under the expansion of the non-veridical licensing domain by embedding a low licensor below a high licensor to include the covert ∃ that was once out of reach. And the availability of both means of existential closure in this case renders the wh-phrase scope ambiguous, which is also proven true in this paper.

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Appendix. Semantic derivations of existential wh-phrases

The proposed denotations for Mandarin wh-phrases:

(i) $[\![\textbf{shenme}\text{ ('what')}]\!]^{w,g} = \{x_e : \text{thing}_w(x)\} \in D_{\langle e\rangle/t}$
(ii) $[\![\textbf{shei}\text{ ('who')}]\!]^{w,g} = \{y_e : \text{person}_w(y)\} \in D_{\langle e\rangle/t}$

Yatsushiro's (2009) definition of Pointwise Functional Application:

(iii) Semantic types of alternative sets (Yatsushiro, 2009; pg. 152)
For any type α; α/t is the type of sets of entities of type α, $D_{\alpha/t} = \text{POW}(D_\alpha)$

(iv) Pointwise Functional Application (Yatsushiro, 2009; pg. 153):
If X is a phrase with two immediate subconstituents Y and Z, then $[\![X]\!]^g$ is defined as follows:

. . . . . .
if $[\![Y]\!]^g$ is of type α; $[\![Z]\!]^g$ is of type $\langle\alpha, \beta\rangle$, then $[\![X]\!]^g = [\![Z]\!]^g([\![Y]\!]^g) \in D_\beta$;
. . . . . .
if $[\![Y]\!]^g$ is of type α/t; $[\![Z]\!]^g$ is of type $\langle\alpha, \beta\rangle$, then $[\![X]\!]^g = \{[\![Z]\!]^g(y) \mid y \in [\![Y]\!]^g\} \in D_{\beta/t}$;
. . . . . .
if $[\![Y]\!]^g$ is of type α; $[\![Z]\!]^g$ is of type $\langle\alpha, \beta\rangle/t$, then $[\![X]\!]^g = \{z([\![Y]\!]^g) \mid z \in [\![Z]\!]^g\} \in D_{\beta/t}$;
. . . . . .
if $[\![Y]\!]^g$ is of type α/t; $[\![Z]\!]^g$ is of type $\langle\alpha, \beta\rangle/t$,
then $[\![X]\!]^g = \{z(y) \mid z \in [\![Z]\!]^g \text{ and } y \in [\![Y]\!]^g\} \in D_{\beta/t}$
. . . . . .

Semantic derivation of (27):

(27) **Haoxiang shei** qifu-le Zhangsan
seem who bully-ASP Zhangsan
'It seems that somebody bullied Zhangsan.'
$[_{TP_3}$ **haoxiang** $[_{TP_2} \exists\, [_{TP_1}$ **shei**$_i$ $[_{vP}$ t_i $[_{VP}$ qifu-le Zhangsan]]]]]

$[\![\textit{Zhangsan}]\!]^{w,g} = \textit{Zhangsan} \in D_e$
$[\![\textit{qifu}]\!]^{w,g} = \lambda x \lambda y \lambda w'\,.\, \text{bully}_{w'}(y, x) \in D_{\langle e,\langle e,\, st\rangle\rangle}$
$[\![vP]\!]^{w,g} = \lambda y \lambda w'\,.\, \text{bully}_{w'}(y, ZS) \in D_{\langle e,\, st\rangle}$
$[\![TP_1]\!]^{w,g} = \{\lambda w'\,.\, \text{bully}_{w'}(y, ZS) \mid \text{person}_w(y)\} \in D_{\langle s\rangle/t}$
$[\![\exists]\!]^{w,g} = \lambda \alpha_{\langle st\rangle/t} \lambda w''\,.\, \exists p\, [p \in \alpha \wedge p(w'') = 1]$
$[\![TP_2]\!]^{w,g} = \lambda w''\,.\, \exists p\, [p \in \{\lambda w'\,.\, \text{bully}_{w'}(y, ZS) \mid \text{person}_w(y)\} \wedge p(w'') = 1] \in D_{\langle st\rangle}$
$[\![\textit{haoxiang}]\!]^{w,g} = \lambda P\,.\, \exists w''' \in \mathscr{M}_{(w,\,\text{epistemic})}\,.\, P(w''') = 1$
$[\![TP_3]\!]^{w,g} = \underline{\exists w''' \in \mathscr{M}_{(w,\,\text{epistemic})}\,.\, \exists p\, [p \in \{\lambda w'.\, \text{bully}_{w'}(y, ZS) \mid \text{person}_w(y)\} \wedge p(w''') = 1]}$

Semantic derivation of (28):

(28) Zhangsan **haoxiang** chi-le **shenme**
Zhangsan seem eat-ASP what
'It seems that Zhangsan ate something.'
[$_{TP_3}$ **haoxiang** [$_{TP_2}$ ∃ [$_{TP_1}$ Zhangsan$_i$ [$_{vP}$ t$_i$ [$_{VP}$ chi-le **shenme**]]]]]

$[\![chi]\!]^{w,g} = \lambda x \lambda y \lambda w' . \text{eat}_{w'}(y, x) \in D_{\langle e,\langle e, st\rangle\rangle}$
$[\![vP]\!]^{w,g} = \{\lambda y \lambda w' . \text{eat}_{w'}(y, x) \mid \text{thing}_w(x)\} \in D_{\langle e, st\rangle/t}$
$[\![TP_1]\!]^{w,g} = \{\lambda w' . \text{eat}_{w'}(ZS, x) \mid \text{thing}_w(x)\} \in D_{\langle st\rangle/t}$
$[\![\exists]\!]^{w,g} = \lambda \alpha_{\langle st\rangle/t} \lambda w'' . \exists p [p \in \alpha \wedge p(w'') = 1]$
$[\![TP_2]\!]^{w,g} = \lambda w'' . \exists p [p \in \{\lambda w' . \text{eat}_{w'}(ZS, x) \mid \text{thing}_w(x)\} \wedge p(w'') = 1] \in D_{\langle st\rangle}$
$[\![haoxiang]\!]^{w,g} = \lambda P . \exists w''' \in \mathscr{M}_{(w, \text{epistemic})} . P(w''') = 1$
$[\![TP_3]\!]^{w,g} = \underline{\exists w''' \in \mathscr{M}_{(w, \text{epistemic})} . \exists p [p \in \{\lambda w' . \text{eat}_{w'}(ZS, x) \mid \text{thing}_w(x)\} \wedge p(w''') = 1]}$

Semantic derivation of (31b):

(31b) Zhangsan **bixu** mai-**dian shenme**
Zhangsan must buy-CL what
'Zhangsan must buy something.'
[$_{TP}$ Zhangsan$_1$ 1 [$_{vP_2}$ **bixu** [$_{vP_1}$ t$_1$ [$_{VP}$ mai [$_{DP}$ **dian**$_\exists$ **shenme**]]]]]

$[\![dian_\exists]\!]^{w,g} = \lambda \alpha_{\langle e\rangle/t} \lambda P_{\langle e,\langle e, st\rangle\rangle} \lambda y \lambda w' . \exists z [z \in \alpha \wedge P_{w'}(z)(y) = 1]$
$[\![DP]\!]^{w,g} = \lambda P_{\langle e,\langle e, st\rangle\rangle} \lambda y \lambda w' . \exists z [z \in \{x : \text{thing}_w(x)\} \wedge P_{w'}(z)(y) = 1]$
$[\![mai]\!]^{w,g} = \lambda x \lambda y \lambda w'' . \text{buy}_{w''}(y, x) \in D_{\langle e,\langle e, st\rangle\rangle}$
$[\![VP]\!]^{w,g} = \lambda y \lambda w' . \exists z [z \in \{x_e : \text{thing}_w(x)\} \wedge \text{buy}_{w'}(y, z) = 1] \in D_{\langle e, st\rangle}$
$[\![vP_1]\!]^{w,g} = \lambda w' . \exists z [z \in \{x_e : \text{thing}_w(x)\} \wedge \text{buy}_{w'}(g(1), z) = 1] \in D_{\langle st\rangle}$
$[\![bixu]\!]^{w,g} = \lambda P . \forall w''' \in \mathscr{M}_{(w, \text{deontic})} . P(w''') = 1$
$[\![vP_2]\!]^{w,g} = \forall w''' \in \mathscr{M}_{(w, \text{deontic})} . \exists z [z \in \{x_e : \text{thing}_w(x)\} \wedge \text{buy}_{w'''}(g(1), z) = 1]$
$[\![1\ vP_2]\!]^{w,g} = \lambda y . \forall w''' \in \mathscr{M}_{(w, \text{deontic})} . \exists z [z \in \{x_e : \text{thing}_w(x)\} \wedge \text{buy}_{w'''}(y, z) = 1]$
$[\![TP]\!]^{w,g} = \underline{\forall w''' \in \mathscr{M}_{(w, \text{deontic})} . \exists z [z \in \{x_e : \text{thing}_w(x)\} \wedge \text{buy}_{w'''}(ZS, z) = 1]}$