John *knows* Mary Likes *what*: Learning Attitude Verbs by Speech Acts in a *Wh*-in-Situ Language

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1. Introduction

When learning a verb, children have to grasp various facts about both its form and its meaning, such as the specific syntactic frames in which the verb can appear. In particular, for attitude verbs, their subtypes impose different requirements on the *wh*-words they can take. For example, English learners must discern that the 'responsive' verb, like *know,* can select both declarative complements (1a) and interrogative complements (1b). Conversely, 'antirogative' verbs like *think* are restricted to declarative complements only, and 'rogative verbs' like wonder are restricted to interrogative complements (Lahiri 2002).

(1) a. Mary VERB [John likes cakes]. *Declarative complement*
b. Mary VERB [what John likes]. *Interrogative complement*

In English, the distinct word order between declarative and interrogative complements provides clear evidence for these requirements. However, *wh*-in-situ languages like Mandarin present a challenge for learning such subcategorization. While these verbs share the subcategorization properties of their English counterparts, word order is a far less reliable cue in Mandarin. Because *wh*-phrases in Mandarin remain in their canonical positions rather than being fronted, interrogative complement clauses can be string-identical to non-interrogative complements that happen to contain a *wh*-phrase, as in (2). Such ambiguous structures are referred to here, following Huang et al's (2022b), as 'potentially interrogative' complements (see **Table 1**).

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(2) Potentially interrogative complements in Mandarin Chinese (MC)
Mary gorp [John xihuan shenme]
Mary gorp John like what
a. 'Mary gorps what John likes.' *Interrogative complement*
b. 'What does Mary gorp John like?' *Declarative complement*

Table 1. Selective constraints of different types of attitude verbs on their embedded clauses.

	Declarative Complement	***Interrogative Complement***
Responsive verbs (e.g., *know*)	✔	✔
Antirogative verbs (e.g., *think*)	✔	*
Rogative verbs (e.g., *wonder*)	*	✔

This paper investigates how Mandarin learners of a *wh*-in situ language like Mandarin Chinese acquire the equivalent difference between *zhidao* 'know,' *juede* 'feel/think,'[1] and *xiang-zhidao* 'wonder.'

The challenge of disambiguating these complements carries weight beyond mere syntax. In principle, a Mandarin-speaker could determine the scope of a *wh*-phrase in a potentially interrogative complement by referring to its matrix verb: if *gorp* is a *know*-like verb that selects interrogative clauses, the *wh*-phrase takes narrow scope; if *gorp* is a *think*-like verb that selects declarative clauses, the *wh*-phrase must take matrix scope. However, we cannot assume that learners are aware of the requirements these modal verbs place on their *wh*-complements before they have mastered the semantics of these verbs. Previous researchers have linked whether an attitude verb is responsive (selecting interrogatives and declaratives) to whether it has factive semantics (3) (e.g. Hintikka 1975; Ginzburg 1995; Egré 2008; cf. Lahiri 2002, White & Rawlins 2018).

(3) a. Mary knows John likes cakes. $\vDash$ 'John likes cakes.' *Factive*
b. Mary thinks John likes cakes. $\nvDash$ 'John likes cakes.' *Non-Factive*

From the perspective of verb learning, such a correlation could be promising. Since attitude verbs like *know*, *think* and *wonder* denote abstract mental states, and children could not readily infer their meanings from physical contexts *per se*. Furthermore, children often lack opportunities to observe discourse cues indicating that *know* is factive and *think* is not (Dudley 2017; Dudley et al.

[1] In Mandarin Chinese, the more formal and written equivalent of 'believe/think' is *xiangxin* or *renwei*, while *juede* is more common in Northern Mandarin, particularly in spoken language, and occurs more frequently in child-directed speech and children's spontaneous speech (Yang et al. 2022).

2017). A possible solution to this problem with learning semantics is syntactic-bootstrapping: children might exploit the subcategorization difference between know and think and the link between responsivity and factivity to infer that know is factive (Dudley 2017, Dudley et al. 2017; Gleitman 1990; Gleitman et al. 2005; Papafragou et al. 2007; Hacquard & Lidz 2019; Harrigan et al. 2019; Huang et al., 2022; among many others). However, such a strategy critically assumes that the subcategorization difference can be reliably observed in the input. While this is the case for English, one could reasonably question this assumption for a *wh*-in situ language like Mandarin.

Huang et al. (2022b) have identified the prevalence of this kind of ambiguous configuration in child-ambient speech and suggested that children may use non-word order cues, such as speech acts and question particles as cues to learn the subtypes of attitude verbs. And the aim of this study is to investigate whether children actually utilize such semantic-pragmatic bootstrapping strategies through an experiment. This paper is organized as follows: We elaborate on the learning problem and the hypotheses about non-word order cues by Huang et al. (2022) in Section 2; in Section 3, by reviewing Huang et al.'s (2022) corpus research on the acquisition of attitude verbs by Mandarin children, we introduce our research questions and the motivation for our experiment in Section 4. Then we discuss the result in Section 5, before concluding and further discussion in Section 6.

2. Subcategories of Attitude Verbs and Their Requirements for *Wh*-complements in Mandarin

2.1. Attitude subcategorization and *wh*-scope

In Mandarin, as in other languages like English, attitude verbs can be classified based on whether they select interrogative complements. Responsive verbs like *zhidao* 'know' and *faxian* 'discover/find-out' can either take interrogative or non-interrogative complements (4a); anti-rogative verbs, like *juede* 'feel/think' or *gaosu* 'tell,' cannot take interrogative complements but only declarative complements (4b); rogative verbs, like *xiang-zhidao* 'wonder' and *wen* 'ask, inquire' only take interrogative complements (4c).

(4) a. Mary zhidao John xihuan {dangao/shenme}. *Responsive*
Mary know John like cake what
✔ 'Mary knows John likes cake.'
✔ 'Mary knows what John likes.'

b. Mary juede John xihuan {dangao/*shenme}. *Antirogative*
Mary think John like cake what
✔ 'Mary thinks John likes cake.'
* 'Mary thinks what John likes.'

c. Mary wen Bill John xihuan {shenme/*dangao}. *Rogative*
Mary ask Bill John like what cake
* 'Mary asked Bill John likes cake.'
✔ 'Mary asked Bill what John likes.'

This study aims to investigate the developmental process of the above three types of attitude verbs among beginners of Mandarin (4a, b, & c). As mentioned in the introduction, from a Mandarin learner's perspective, such difference is obscured by the fact that Mandarin *wh*-phrases generally appear *in situ*, consistent with the canonical word order in declarative sentences. This word order fact produces string ambiguity between interrogative complements (5a) and non-interrogative complements containing an in-situ *wh*-phrase (5b).[2]

(5) a. Mary **zhidao** [John xihuan shenme]. *Interrogative complement*
Mary know John like what
'Mary knows what John likes.'
b. Mary **juede** [John xihuan shenme]? *Declarative complement*
Mary think John like what shenme *'what' takes wide scope*
'What does Mary think John likes?'

To summarize what we have reviewed so far: Mandarin word order presents a challenge for learning the subcategorization of attitude verbs, since there are no word order cues that overtly indicate whether a *wh*-phrase (more broadly, *haishi*- or A-not-A-Questions) scopes over the entire sentence or merely over the complement clause. Compounding the issue is that Mandarin, unlike certain *wh*-in situ languages like Japanese, lacks particles like *ka* that obligatorily mark the scope of these interrogative markers, and Mandarin learners cannot count on such syntactic cues either. Furthermore, as noted by Huang et al. (2018; 2022), a more classic strategy for learning verb syntax – by bootstrapping with verb semantics (c.f. Pinker 1984, a.o.) – is also unlikely to be useful here. This strategy would require learners to first master verb semantics, a significant

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[2] The issue with potential interrogatives applies more generally, beyond canonical *wh*-phrases like 'what' and 'who.' Embedded polar interrogatives, which are either marked with *haishi* 'or'(interrogative disjunctor), as in (i), or A-not-A question, as in (ii), can receive either wide or narrow scope, just like standard *wh*-phrases. As a consequence, polar interrogative complements are just as uninformative about attitude verb subcategorization as *wh*-interrogatives.

(i) a. Mary zhidao [John xihuan dangao haishi mianbao]. *Narrow scope*
Mary know John like cake or-*inq* bread
'Mary knows whether John likes cakes or bread.'
b. Mary juede [John xihuan dangao haishi mianbao]? *Wide scope*
Mary think John like cake or-*inq* bread
'Does Mary think that John likes cakes, or does Mary think that John likes bread?'
(ii) a. Mary zhidao [John xihuan-bu-xihuan dangao]. *Narrow scope*
Mary know John like-not-like cake
'Mary knows whether John likes cakes.'
b. Mary juede [John xihuan-bu-xihuan dangao]? *Wide scope*
Mary think John like-not-like cake
'Does Mary think that John likes cakes, or does Mary think that John does not like cakes?'

hurdle in itself in the case of attitude verbs, as is well-documented in the syntactic bootstrapping literature.

Huang's (2022) analysis of four Mandarin child-ambient speech corpora shows that the string ambiguity problem is actual. At the same time, their analysis also shows that there is clear non-word order information available in the input, namely, *speech act* information.[3] Learners sensitive to the distribution of these cues can exploit them to resolve the ambiguity problem.

2.2. Non-word order cues

If potentially interrogative complements pose a problem for the learning of attitude verb subcategorization, what alternative strategies might be available for learners? Huang et al. (2022b) have suggested one possibility, which is to take advantage of the speech act information of an utterance. Wide scope *wh*-phrases (more broadly, *haishi*- or A-not-A-question) within complement clauses are generally associated with questions, and narrow scope ones, i.e. interrogative complement clauses, are associated with non-questions (i.e. assertions or orders/commands). These correlations between scope and speech acts can be useful for learning verb subcategorization, in the following way: Suppose learners observe a sentence like (6a) where the complement clause contains a *wh*-phrase, and can infer that the sentence is a *wh*-question, due to the presence of a *wh*-phrase and the absence of polar question markers, like the question particle ma, A-not-A morphology, or *haishi* 'or.' They might infer from these observations that the *wh*-phrase, even though *in situ*, scopes over the entire sentence. This would further indicate that the complement clause of gorp is not an interrogative.

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[3] In the paper, they also mentioned the role of the Polar Question marker *ma*, as in (iii), which is closely related to the *speech-act* cue. In this paper, we do not discuss the function of *ma* particularly, because its nature is identical to the role that speech acts play for learners: In Mandarin, *ma* acts as a mandatory clausal typing marker that resides in the CP, where its presence obligatorily assigns a 'polar question' speech act to an otherwise declarative sentence. Consequently, *ma* forces the preceding proposition to be interpreted as a declarative, but not interrogative, thereby providing a reliable syntactic cue for learners to determine that any embedded *wh*-phrase must take narrow scope within an interrogative complement, as in (iv).

(iii) Mary xihuan dangao ma? *PolQ-reading*
Mary like cake Q
'Does Mary likes cake?'

(iv) Mary xihuan shenme (*ma)? *WhQ-reading*
Mary like what Q
'What does Mary like?'

(6) a. Mary gorp [John xihuan shenme]?
Mary gorp John like what
'What does Mary gorp John likes?'
b. Mary gorp [John xihuan shenme].
Mary gorp John like what
'Mary gorps what John likes.'

In contrast, suppose learners observe a non-question speech act with essentially the same syntactic frame, like (6b). This observation would suggest that the *wh*-phrase scopes over blick's complement clause and not the entire clause. Learners can then conclude that the complement clause is an interrogative.

To the extent that the first scenario (6a) applies exclusively to a certain verb, learners might conclude that the verb does not take interrogative complements, i.e. is anti-rogative. Conversely, if both scenarios in (6) apply regularly to a verb, learners should conclude that the verb is responsive. This learning strategy rests on a few key assumptions. First is the assumption that learners can identify question speech acts in their input and can use this knowledge to infer the clause type (interrogative) of the sentence. This is not unreasonable: much research has shown that children can understand questions and associate interrogative clauses with questions around three years old, and possibly as early as 18 months old (Shatz 1978, Tamir 1980, Grosse et al. 2010, Grosse and Tomasello 2012, Soderstrom et al. 2011, Casillas and Frank 2017, Perkins and Lidz 2020, Yang et al. 2022, more recently).

3. Huang et al.'s (2022) Corpus Search in Child-Ambient Speech

In their study on the acquisition of attitude subcategorizations in Mandarin, Huang, et al. (2022) provided important empirical evidence regarding how children resolve 'string ambiguity' in *wh*-in-situ languages. The core of this study lies in examining whether there are sufficient non-parasyntactic cues in child-ambient speech to help children distinguish between responsive verbs (e.g., *zhidao* 'know') and anti-rogative verbs (e.g., *juede* 'think'). They utilized the dataset from Huang et al. (2018) and analyzed four major Mandarin corpora from the CHILDES database: Beijing (Tardif 1993, 1996), Context (Tardif et al. 1999), Chang1 (1998), and Zhou1. The sample covered adult utterances encountered by children aged 1 year and 9 months to 6 years.

By extracting 468 tokens containing attitude verbs and their complements, including 287 anti-rogative verbs (primarily *xiang*, *yiwei* and *juede*, roughly 'think') and 181 sensitive verbs (primarily *zhidao*, 'know'), the study first confirmed the prevalence of 'potentially interrogative complements' from children's input. Their data indicate that: In sentences containing *juede* 'think' and *zhidao* 'know,' 37% and 67% of complements, respectively, included *in-situ wh*-words, selective interrogative disjunctor (*haishi*), and A-not-A questions.

This confirms that relying solely on word order or the presence/absence of complements is insufficient for children to acquire subcategorization distinctions. Subsequently, Huang et al. (2022) validated two key alternative cues: The study found that the overall speech act of a sentence is highly correlated with verb type: When 'think' or 'believe' introduce an implicit interrogative complement, 98% of sentences function as questions, implying that the embedded *wh*-word must have wide scope. In contrast, when 'know' introduces such complements, the proportion of non-question functions (such as statements or commands) is significantly higher (approximately 24%), directly demonstrating that this verb allows for nested questions (narrow scope).

While the exhaustive corpus analysis by Huang et al. (2022) demonstrates a robust statistical correlation between speech acts and the subcategorization properties of attitude verbs in Mandarin child-directed speech, whether this distributional pattern is functionally utilized by children as a learning strategy remains an open question. As the authors themselves acknowledge, corpus evidence alone is insufficient to prove that learners actively recruit pragmatic information to resolve *wh*-scope ambiguities and infer grammatical constraints during real-time language acquisition.

There is currently a lack of experimental research investigating whether exposure to distinct speech act contexts (e.g., questioning vs. asserting) is sufficient to trigger correct subcategorization inferences for a novel attitude verb. Consequently, the present study aims to fill this gap by an experiment in Mandarin-speaking children: In the absence of overt word-order cues, can Mandarin-speaking children successfully leverage speech act information to identify and represent the subcategorization requirements of attitude verbs?

4. Experiment

4.1. Participants

Data were collected from 69 monolingual Mandarin-speaking children from the city of Xi'an, Shaanxi Province, Northern China. Fifty-two children (R_{age}=3;3–6;7, M_{age}= 4;10) were adopted into analysis. Seventeen children's data were excluded because they did not pass the practice trials or cannot keep answering the first judgement question in the task consistently. None of the participants had a history of language or cognitive impairment.

4.2. Stimuli and Design

The experiment adopted (a modified version of) the Question-Statement Task (QST, Zhou & Crain (2011)) with a 3 × 2 design, within-subject, crossing three Attitude Types (*know*, *think*, and *wonder*) and two Speech Acts (Statement vs. Question). To make the speech acts in the experiment more salient to the child participants, we made some modifications to the original version of QST: We introduced an additional puppet whose role was to 'constrain the context.' Specifically, before or after the puppet in charge of uttering the target sentence

(Puppet A, or the Target Puppet) spoke, Puppet B was required to: (i) ask a question for Puppet A to answer, ensuring that Puppet A uttered a declarative sentence in that context; or, (ii) after Puppet A utters an interrogative sentence, express confusion or curiosity, so that in that context, Puppet A utters an interrogative sentence. See the following **Table 2** for a detailed description of the expected answers to the corresponding conditions under each sentence type, and (7) for the detailed three target sentence types with varied attitude verbs.

Table 2. Sample Auditory Stimuli

Assertion Condition	**Puppet B**: Does the monkey know what Mr. Rabbit has hidden? **Puppet A** (**Target**): The monkey ***knows*** Mr. Rabbit hid ***what***.
Question Condition	**Puppet A** (**Target**): The monkey ***knows*** Mr. Rabbit has hidden ***what***? **Puppet B**: Hmm… I am also not sure/clear about that…

(7) **Target Sentence Type**

a. Xiaozhu **zhidao** Tuzi-xiansheng cang-le shenme. *Responsive*
Piggy know Mr.rabbit has.hidden what

b. Xiaozhu **juede** Tuzi-xiansheng cang-le shenme? *Anti-rogative*
Piggy think Mr.rabbit has.hidden what

c. Xiaozhu **xiang-zhidao** Tuzi-xiansheng cang-le shenme. *Rogative*
Piggy wonder Mr.rabbit has.hidden what

Fig.1 shows a sample visual stimuli. In a sample story, Mr. Rabbit plays the role of a magician who performs magic tricks for his two audiences, 'Monkey' and 'Piggy.' To make the game more fun, he randomly selects one of them to be blindfolded and asks that audience to guess what he has been hidden (under his magic hat), while the other character, who is not blindfolded, can see what is happening all the time during a trick but is not allowed to reveal the answer beforehand. Each participant received 12 target sentences, 2 training and 12 filler trials, evenly inserted in six stories.

Fig. 1. An example of a two-frame visual stimuli: In a guessing game, the Monkey is blindfolded and must guess what is hidden under the hat.

Sessions took place in a relatively quiet space with the participant seated in front of a laptop next to the experimenter. A session started with the experimenter telling the child that they were going to play a game with Elmo (always Puppet A) and Cookie Monster (always Puppet B), two hand puppets played by the experimenter. Participants started with two practice trials, where the Target Puppet made one good guess and one bad guess. This was meant to familiarize participants with the experimental procedure. The experimenter explained to the child that they were going to listen to some stories with the two puppets.

After each story, the puppet attempted to explain to the child subject what he thought had happened in the story, using one of the test sentences. It was made clear to the child that the Target Puppet didn't always pay close attention to the story and was sometimes unsure about the outcome, thus they might ask a question about what was going on, or simply make some guesses. On each trial of the task, the child first had to decide whether the Target Puppet made a statement or posed a question: If the puppet made a statement, then the child's task was to judge whether the statement was an accurate description of what happened in the story; and if the puppet posed a question about the story, then the child's task was to answer the question.

On one practice trial, the puppet made a statement informing the subject about what had happened in the story, and on the other practice trial, the puppet asked the child a question. Only those subjects who correctly judged that the puppet had made a statement on the first practice trial and had posed a question on the second trial were permitted to advance to the main session.

4.3. Predictions

The central prediction of this experiment is that there will be a significant interaction between the learning context (speech act) and the acceptability of the test sentences.

Assertion Condition: It is expected that children will demonstrate a significantly higher acceptance rate of sentences containing *zhidao* and *xiang-zhidao* (e.g., 'The monkey ***knows***/***wonders*** Mr. Rabbit hid ***what***.') during the testing phase. This is because, in the assertion context, children identify the attitude verb 'know' as a responsive verb and 'wonder' a rogative verb—that is, a verb that allows for the embedding of interrogative complements (narrow scope)—which is fully compatible with the pragmatic requirements.

Question Condition: It is predicted that children under such condition will significantly demonstrate a significantly higher acceptance rate of sentences containing *zhidao* and *think* (e.g., 'What does the Monkey ***know***/***think*** Mr. Rabbit has hidden?') during the testing phase. This acceptance demonstrates that children identify the attitude verb as a responsive or an anti-rogative verb, requiring the *wh*-element to have a wide scope (matrix scope), and thus make judgments based on the principle in standard Mandarin grammar that the questioning speech act of a *wh*-element embedded under anti-rogatives can only be projected into the matrix clause but not narrower.

5. Results

The primary dependent variable was children's' acceptance rate of the target sentences, where a matrix attitude verb *know*/*think*/*wonder* was paired with a complement containing an in-situ *wh*-phrase (e.g., The Piggy [*zhidao*/*juede*/*xiang-zhidao*] Mr. Rabbit has hidden *what*), with a potential interrogative complement. Children's responses were coded as 'yes/no' and 'referential' based on their answers to the two tasks in the experiment: Whether they perceived the sentence as declarative or interrogative, and their corresponding responses to the two clause types. **Fig. 2** summarizes the mean acceptance rates across age groups. Despite differences between groups, a clear divergence was observed based on verb category: Participants across all ages demonstrated a high sensitivity to the subcategorization differences between responsive, rogative and anti-rogative verbs.

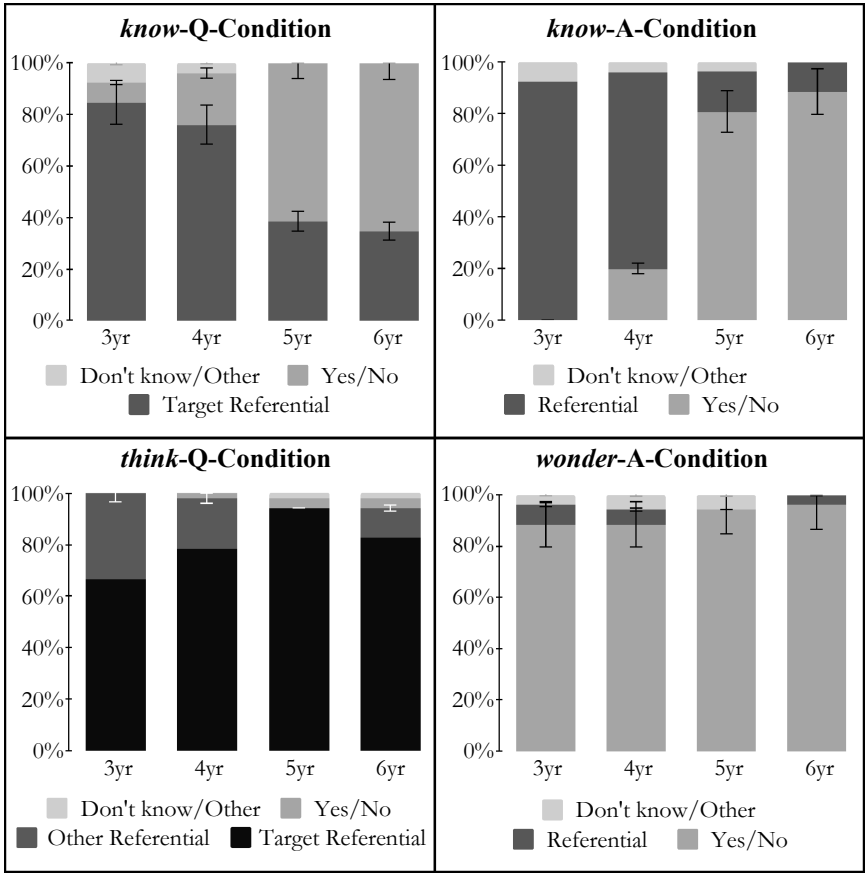

Fig. 2. Type of Children's Responses to Three Target Attitude Types under Two Clause Type Conditions

To evaluate the statistical significance of these observations, a Generalized Linear Mixed-Effects Model (GLMM) was conducted using the lme4 package in R. The model included 'Acceptance' as the dependent variable, 'Verb Type' and 'Age Group' as fixed effects, and random intercepts for subjects and items. The analysis revealed a highly significant main effect of Verb Type ($\beta = 5.24$, SE = 0.64, $z = 8.19$, $p < .001$). Responsive Verb (*zhidao*, 'know'): High acceptance rates across all groups indicate that participants recognized *zhidao* as a verb that selects interrogative complements. In these cases, *wh*-word 'what' was correctly interpreted as taking scope over the entire matrix clause, while the *wh*-phrase took narrow scope within the complement. For antirogative Verbs (*juede*, 'think'), participants significantly accepted the co-occurrence of these verbs with *wh*-words under Question Condition. This confirms the grammatical constraint in Mandarin where *wh*-phrases under anti-rogative verbs must take wide scope (forming a direct question).

While core differences existed across all age groups, a significant interaction existed between age and verb type, reflecting a developmental trajectory towards adult-level precision. Nevertheless, 3-4 year olds still overgeneralize: Younger children are more likely to ignore the conditional context we set, over 82.7% of 3-year-olds and 76.2% of 4-year-olds incorrectly accepted 'know' sentences with *wh*-words. This suggests that while young children are sensitive to categorical distinctions, their selection constraints on verbs like 'know' are not yet fully stable, possibly due to the inherent ambiguity of 'know' sentences; furthermore, the high frequency of *shemme* 'what' in their input may lead younger children to perceive *wh*-words as 'strong interrogative markers,' automatically recognizing the entire sentence as an interrogative regardless of its context. The 5-year-old group significantly outperformed the 3-year-old group ($p < .05$), exhibiting rejection rates for interrogative verbs approaching adult levels. By age five, Mandarin-speaking children seem to have internalized the subcategory framework for distinguishing between responsive and antiresponsive verbs quite well.

Consistent with the corpus findings of Huang et al. (2022), participants' judgments were highly aligned with the pragmatic context of the trials. In trials where the context restricted an 'assertion' (e.g., the Target Puppet is making a guess), the preference for *zhidao* and *wonder* was bolstered. Conversely, when the context implied an 'inquiry,' participants showed acceptance of the Question Reading when encountering the *zhidao* and *juede* construction. This suggests that the statistical distribution of speech acts in child-ambient speech indeed informs the psychological representation of these verbs. The results confirm that Mandarin-speaking children establish distinct subcategorization representations for attitude verbs as early as age three. They successfully utilize *speech act* as a diagnostic for clause typing and scope, effectively resolving the string ambiguities inherent in a *wh*-in situ language.

6. Conclusion and Discussion

Through a new-developed version of Question-Statement Task (QST), this study validated the hypothesis proposed by Huang et al. (2022) based on corpus analysis: in *wh*-in-situ languages lacking syntactic cues, children can use speech acts as a pragmatic cue to infer the subcategorization properties of attitude verbs. The experimental results show that when attitude verbs appear in declarative contexts, children are more likely to identify them as responsive verbs that allow embedded interrogative complements, while they demonstrate a significantly high degree of acceptance with the rogative verbs that allow embedded interrogative complements to project a matrix questioning speech act.

This finding holds significant theoretical implications. First, it supports the extension of the syntactic bootstrapping theory at the foundational level: children not only use syntactic structures to infer semantics but can also utilize pragmatic information (speech acts) in reverse to determine the syntactic framework of attitude verbs. Second, this study fills a gap in previous corpus-based research regarding 'causality,' demonstrating that children can indeed transform the statistical correlations between speech acts and verb properties in the linguistic environment into effective internalized learning strategies.

The string ambiguity of 'implicit *wh*-complements' in Mandarin was once considered a major challenge for verb acquisition. This study demonstrates that Mandarin-speaking children do not rely solely on word order (a cue that is effective in English but fails in Mandarin), but instead exhibit a high degree of cross-domain cue integration.

Although this study provides positive experimental evidence, the following limitations remain:

(a) **Prosodic Cues**: Although the experiment attempted to control intonation, in natural contexts, broad-range *wh*-questions typically carry specific prosodic salience (Yang et al. 2020). This experiment has not yet fully isolated the potential contribution of prosody to children's judgments; future research should employ methods such as synthetic speech to further control prosodic variables.

(b) **Real Words as Materials**: The use of real words are not enough to account for the influence of *prior lexical experience*. Given that verbs like *zhidao* 'know' and *juede* 'think' are highly frequent in natural speech, children may rely on retrieved memory of specific collocations rather than actively recruiting speech act cues to resolve ambiguities during the experimental task. Also, real words might introduce a confound between semantic and syntactic cues. Because these verbs possess established semantic profiles (e.g., factivity), children might leverage known meanings to infer syntactic properties, making it impossible to determine whether their grammatical representations stem from 'semantic bootstrapping' or the 'pragmatic-syntactic' interface targeted in this study. Consequently, evidence from real-word tasks alone is insufficient to demonstrate a productive, generalized mechanism for disambiguating *wh-in situ* structures in novel contexts.

(c) **Diversity of Verb Semantics**: This study primarily focused on contrasts such as ‘know’ and ‘think.’ However, attitude verbs also include words with different presuppositions, such as ‘remember,’ ‘forget,’ or ‘believe.’ Whether speech act cues remain robust in the acquisition of these semantically more complex verbs requires further verification.

Future research could proceed in two directions. First, we should prioritize the *Novel Verb Learning Paradigm* to rigorously test the productivity of the mechanisms underlying the acquisition of attitude verb subcategorization. While existing studies involving real words (e.g., *zhidao* or *juede*) provide a foundational understanding of children's performance, their findings are inherently confounded by prior lexical experience and frequency effects. Second, cross-linguistic comparisons: investigating whether learners in other languages with similar *wh*-in-situ characteristics (such as Japanese or Korean) also rely on similar speech acts or scope markers (e.g., Japanese *ka*) for grammatical initiation.

In summary, this study demonstrates that Mandarin-speaking children, when acquiring attitude verbs, are able to keenly capture non-parametric cues in the linguistic environment. The distribution patterns of speech act information provide a crucial framework for children to resolve the structural ambiguity caused by *wh*-in-situ. This conclusion not only deepens our understanding of the mechanisms underlying the acquisition of *wh*-in-situ but also provides new empirical support for exploring the interface interactions among linguistic knowledge in the domains of semantics, syntax, and lexicon.

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