

What do you think? Learning attitude verbs in a wh-in situ language

Introduction Part of learning a verb involves learning its selectional restrictions, e.g. whether it selects only interrogative clausal complements, declarative complements, or both (1) (Lahiri 2002). In the context of attitude verbs, their selectional restrictions are often postulated as correlated with their meaning (Égre 2008, Theiler et al. 2019, a.o.). As these verbs often describe mental states that are hard to learn from physical contexts alone (Gleitman 1990), learning the selectional restrictions is a prerequisite for learning the semantics of these verbs (Hacquard & Lidz 2019, Huang et al. *to appear*). However, in certain *wh* in-situ languages, like Mandarin, it may be difficult to distinguish an interrogative complement from a declarative complement containing a *wh*-phrase (that scopes over the whole sentence), since both complements are string-identical (2) (Huang 1982). Failure to correctly disambiguate these complements might cause complications both for syntactic bootstrapping (Huang et al. *to appear*) and for parsing sentences with embedded *wh*-phrases. How do Mandarin-speaking children learn the subcategorization of attitude verbs and the scope of *wh*-phrases? With a corpus study of child-ambient speech, we show that children have available in the input syntactic cues like the distribution of sentence final particles that could help them with this learning problem; additionally, the speech act of the utterance could be useful but might lead them to wrong conclusions.

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| (1) | a. Mary thinks {that Alex likes cake / *what Alex likes}. | Anti-rogative |
| | b. Mary wonders {*that Alex likes cake / what Alex likes}. | Rogative |
| | c. Mary knows that Alex likes cake / what Alex likes. | Responsive |
| (2) | Potentially interrogatives complement configuration:
Lisi VERB [Zhangsan xihuan shenme]
Lisi VERB Zhangsan like what | |
| | (i) "Lisi VERB what Zhangsan likes." | [VERB = <i>zhidao</i> "know" / <i>wen</i> "ask"] |
| | (ii) "What does Lisi VERB that Zhangsan likes?" | [VERB = <i>xiang</i> "think"] |

Corpus study We extracted utterances containing the highly-frequent responsive verb *zhidao*, anti-rogative verb *xiang* "think, want", and rogative verb *wen* from child-ambient speech in four Mandarin CHILDES corpora. **Predictions: Syntactic cues** (i) Rogative and responsive verbs might appear with complement clauses containing question words like *wh*-phrases (henceforth **potential interrogatives**) more frequently than anti-rogative verbs (e.g. *xiang* "think, want"). (ii) The *yes/no question* particle *ma* is in complementary distribution with *wh*-questions (3), so the occurrence of *ma* in sentences with potential interrogatives provides unambiguous evidence that these complement clauses are interrogative, i.e. the attitude verb should allow interrogative complements (4).

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| (3) | a. Zhangsan xihuan dangao ma?
Zhangsan like cake Q
"Does Zhangsan like cake?" | b. | *Zhangsan xihuan <u>shenme</u> ma?
Zhangsan like what Q
(Intended): "What does Zhangsan like?" |
| (4) | Lisi {zhidao/ *xiang} Zhangsan xihuan <u>shenme</u> ma?
Lisi {know think} Zhangsan like what Q
With <i>zhidao</i> : 'Does Lisi know what Zhangsan likes?' | | |

Speech Act cues For anti-rogative verbs with potential interrogatives, the sentence is likely to be associated with the question speech act, as in (2ii). As questions are likely to be associated with matrix interrogatives, which is only possible if the embedded question word takes matrix scope, learners could use the speech act of the sentence as a cue to infer that the matrix verb is an anti-rogative. We thus predict that with the same configuration, anti-rogatives should be associated with questions more often than rogatives and responsives.

	Verb	<i>wh</i> -scope	Allow <i>ma</i> ?	Likely speech act
Responsive	<i>zhidao</i> "know"	Embedded, *Matrix	Yes	Assertion
Rogative	<i>wen</i> "ask"	Embedded, *Matrix	Yes	Assertion
Anti-rogative	<i>xiang</i> "want/think"	*Embedded, Matrix	No	Question

Table 1: A summary of attitude verbs and the permitted scope of embedded *wh*-phrases

Results We find that syntactic cues are readily available, as hypothesized: Compared to *xiang*, (i) *zhidao* and *wen* take potential interrogatives more often ($\chi^2(2, N = 507) = 99.0, p < 0.01$) (Table 2); (ii) *zhidao/wen*+potential interrogatives co-occur with *ma* more frequently ($\chi^2(4, N = 286) = 56.6, p < 0.01$) (Table). Speech act cues are informative, but less so (Table). While the relative frequencies of questions vs. non-questions vary by verb ($\chi^2(4, N = 286) = 42.8, p < 0.01$), *zhidao/wen*+potential interrogatives are often (indirect) questions (5). This suggests learners cannot rely on speech acts alone; learners who do so might infer that question words can scope over the whole sentence in all three cases, concluding incorrectly *wen* can take declarative complements.

Type of complements	<i>Xiang</i>	<i>Zhidao</i>	<i>Wen</i>	Total
Potentially interrogative (ambiguous between interrogative and declarative + question word)	97 (37%)	121 (67%)	68 (100%)	286
Others (unambiguous declaratives, e.g.)	162 (63%)	59 (33%)	0 (0%)	221

Table 2: Clausal complements for select verbs in 4 CHILDES corpora (Beijing, Context, Chang1, Zhou1) (% = frequency as percentage of verb's clausal complements)

	<i>Xiang</i>	<i>Zhidao</i>	<i>Wen</i>
<i>ma</i>	0 (0%)	36 (30%)	6 (9%)
Other particles	18 (19%)	19 (16%)	28 (41%)
No particles	79 (81%)	66 (55%)	34 (50%)
Total	97	121	68

Table 3: Co-occurrence of sentence-final particles and potential interrogatives

(5) *Zhidao zhe shi shenme ma?*

know this is what Q

"Do [you] know what this is?"

["Beijing-tt1" subcorpus, sentence uttered by mother]

	<i>Xiang</i>	<i>Zhidao</i>	<i>Wen</i>
Question	97 (100%)	92 (76%)	51 (75%)
Assertion	0 (0%)	29 (24%)	12 (18%)
Command	0 (0%)	0 (0%)	5 (7%)
Total	97	121	68

Table 4: Speech acts for verb+potential interrogatives

Discussion *Wh*-in situ languages like Mandarin poses a potential problem for the learning of attitude verbs, in particular, it is unclear whether the learning strategy syntactic bootstrapping, which is found to be helpful for English-speaking children, would be possible. With a corpus study, we show that it is possible for children to use the syntactic frames that the verb occurs in and the speech act of the sentence to learn the selectional restrictions of attitude verbs. In future work, we plan to test whether Mandarin learners use these distributional cues in learning attitude verbs.

References Lahiri 2002. Questions and answers in embedded contexts. Égre 2008 Question embedding and factivity. Gleitman 1990. The structural sources of verb meanings. Language Acquisition. Hacquard&Lidz 2019. Children's attitude problems: bootstrapping verb meaning from syntax and pragmatics. Mind & Language. Huang, N. et al to appear. Syntactic bootstrapping attitude verbs despite impoverished morphosyntax. Language Acquisition. Huang, C.-T. J. 1982. "Move WH in a language without WH movement." The Linguistic Review. Theiler et al. 2019. Picky predicates: Why believe doesn't like interrogative complements, and other puzzles. Natural Language Semantics.