

Syntactic Bootstrapping Mental Verbs and Perception Verbs with Limited Morphosyntactic Cues

Daoxin Li

1. Introduction

How do children learn the meaning of words that are abstract and lack reliable correlates in the world, such as mental verbs (e.g. *think, know, believe, remember*) and perception verbs (e.g. *see, watch, hear, listen*)? It has been shown that the visual world itself is quite unhelpful for learning such words (e.g. Gillette et al., 1999; Medina et al., 2010): Those words describe some internal state/activity that are generally unavailable for outside evaluation, so even though the learner observes a corresponding event, it is still almost impossible to figure out the meaning from pure observation of the non-linguistic context. It has been proposed that this learning problem can be alleviated by the strategy of syntactic bootstrapping: Learners use the linguistic context to restrict the possible word meanings (e.g. Gillette et al., 1999; Gleitman, 1990; Gleitman et al., 2005; Papafragou et al., 2007). For example, the types of arguments that a word can take have been demonstrated to be a helpful syntactic cue for learning mental verbs: Mental verbs are associated with sentential complements, so when learners encounter a novel word that takes sentential complements, they can use this systematic form-meaning mapping knowledge to infer that the novel verb may be a mental verb as well (Harrigan et al., 2019; Harrigan, 2020; Papafragou et al., 2007).

However, what if different classes of words overlap in the types of arguments that they can take? This is the case for mental verbs and perception verbs: Across languages, the two classes of verbs are often associated with both CP complements (1) and NP complements (2) (e.g. Fisher et al., 1991; Landau & Gleitman, 1985; Whitt, 2009), but they do differ in their meanings. Thus, how do children learn the semantic distinction between mental verbs and perception verbs?

- (1) a. John knew that it rained. [mental verb]
 b. John saw that it rained. [perception verb]
- (2) a. John knew the answer. [mental verb]
 b. John saw the answer. [perception verb]

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In this paper, we present a corpus study on whether there are reliable distributional cues to distinguish between belief verbs and perception verbs in children's input, taking Mandarin Chinese as a case study. We choose to focus on Mandarin Chinese because this language is poor in overt morphosyntactic marking, so in principle, it would provide fewer morphosyntactic cues for the syntactic bootstrapper. Therefore, if there are enough distributional cues for the distinction in Mandarin, suggesting syntactic bootstrapping is viable in a language with minimal morphosyntactic cues, then it will strongly indicate the robustness of syntactic bootstrapping, which is expected to work even better for languages with richer morphosyntax.

This paper is organized as follows: We first introduce the semantics and syntax of mental verbs and perceptions verbs in general in Section 2, followed by discussion of the semantics and syntax of mental verbs and perception verbs specifically in Mandarin in Section 3. Section 4 presents the corpus analyses, showing that there is indeed distributional information in Mandarin child-directed speech that reliably differs between belief verbs and perceptions verbs. Finally, Section 5 summarizes the findings, and discusses the implications of the study and the open questions.

2. Semantics and syntax of mental verbs and perception verbs

2.1. Mental verbs

Mental verbs refer to mental states, such as *know*, *think*, *guess*, *remember*, and *believe*. Syntactically, mental verbs mainly take CP and NP arguments (e.g. Fisher et al., 1991; Papafragou et al., 2007), though other types of arguments such as prepositions may be possible in some languages as well. Mental verbs have been classified into two major sub-types: belief verbs and desire verbs (e.g. Bolinger, 1968; Searle & Vanderveken, 1985; Villalta, 2008; White et al., 2014). Belief verbs express judgments of truth, such as *think*; whereas desire verbs express preferences, such as *want*. The two types of mental verbs often exhibit morpho-syntactic differences in their complements as well. For instance, in English, belief verbs are usually associated with finite complements, (3); in contrast, desire verbs are usually associated with non-finite complements, (4). The specific morphosyntactic cues that distinguish between belief verbs and desire verbs vary across languages, but their existence is robustly attested (e.g. Bolinger, 1968; Searle & Vanderveken, 1985; Villalta, 2008; White et al., 2014). In this paper, we will focus on belief verbs from the two types of mental verbs, because as will be shown later, the syntactic and semantic properties of belief verbs are more similar to perception verbs, so the learning problem is more challenging and theoretically more interesting in this case.

(3) She thinks [it will rain].

(4) She wants [it to rain].

2.2. Perception verbs

Perception verbs convey the experience of physical senses. They have two major usages: epistemically neutral, and epistemically non-neutral (e.g. Bairwise, 1981; Higginbotham, 1983; Moulton, 2009). In their epistemically neutral usage, perception verbs only refer to the perceptual stimulus, without any reference to the perceiver's mental state. For instance, the sentence (5) can be true even if what Mary actually perceived does not match her belief, e.g. she thought what she perceived was snow rather than rain. On the other hand, perception verbs in the epistemically non-neutral usage refer to the perceiver's mental representation of the stimulus as well as the stimulus itself. For example, for the sentence (6) to be true, Mary did not only need to witness the rain, but she must also believe that what she saw was rain.

(5) Mary saw the rain.

(6) Mary saw that it rained.

Another classification of perception verbs distinguishes between verbs of perceptual exploration and verbs of perceptual achievement (e.g. Fisher et al., 1991; Levin, 1993; Viberg, 1983). Verbs of perceptual exploration describe attempts to explore some object or event, such as *watch* and *listen*; whereas verbs of perceptual achievement describe the consequence of the exploration, such as *see* and *hear*. A general pattern in English is that verbs of perceptual achievement are more likely than verbs of perceptual exploration to be used epistemically non-neutrally (e.g. Fisher et al., 1991). For example, we can express the epistemically non-neutral meaning with *see*, (7), but not with *watch*, (8).

(7) Mary saw that it was raining.

(8) *Mary watched that it was raining.

Syntactically, similar to mental verbs, perception verbs can usually take both CP complements (9) and NP complements (10) across languages. In some languages, though, there may be a few syntactic frames that are allowed for one verb class but not the other, such as small clauses for perception verbs in English, (11). Combining syntax and semantics, CP complements are associated with epistemically non-neutral semantics, whereas epistemically neutral meanings can only be expressed in non-embedded complements (e.g. Fisher et al., 1991; Levin, 1993; Viberg, 1983). Therefore, overall, the syntax-semantics mapping rule of perception verbs in English can be summarized as in Table 1.

(9) Mary heard that he's visiting.

(10) Mary heard the music.

(11) Mary heard him [speak]/[speaking]/[spoken to].

Table 1. Syntax-semantics mapping of perception verbs in English

Syntax	Semantics	Semantics
CP complement	Epistemically non-neutral	Perceptual achievement
NP complement	Epistemically neutral	Perceptual exploration

Now let us return to the central question of this paper: How do children learn the semantic difference between mental verbs and perception verbs? As shown in Table 2, the different classes of verbs have some non-overlapping argument types in English, which could be helpful for learning the distinction. For instance, learners can use small clauses to distinguish perception verbs from mental verbs, since perception verbs are the only verb class in the table that can take small clauses as complements. However, Table 2 only describes the pattern in English, which does not hold true cross-linguistically. In a language with minimal morphosyntactic cues such as Mandarin Chinese, the different classes of verbs may not exhibit any superficial difference in their syntactic frames, (12). Thus, are there reliable distributional information for the learner to distinguish between mental verbs and perception verbs in morpho-syntactically poor languages as well? The current paper aims to explore this question, taking Mandarin Chinese as a case study. But before presenting the corpus analysis, we will briefly introduce the semantics and syntax of mental verbs and perception verbs in Mandarin in the next section.

Table 2. Argument types of mental verbs and perception verbs in English

Type	Finite clause	Non-finite clause	Small clause	NP
Belief verbs	Yes	No	No	Yes
Desire verbs	No	Yes	No	Yes
Perception verbs	Yes	No	Yes	Yes

(12) a. wo zhidao ta lai. [belief verb]

I know 3s come

‘I know s/he will come.’

b. wo tingdao ta lai. [perception verb]

I hear 3s come

‘I hear her/him come.’

3. Semantics and syntax of mental verbs and perception verbs in Mandarin

3.1 Mental verbs

Mental verbs in Mandarin mainly take CP complements (13a) and NP complements (13b) as well, although different from English, there is no overt morphosyntactic cue whether the CP complements are finite or not. However, there are other morphosyntactic cues that can potentially help with the distinction between belief verbs and desire verbs in Mandarin: belief verbs allow a range of

elements including overt subjects, modal auxiliaries and adverbs, and aspect markers in their CP complements, while desire verbs usually do not (e.g. Huang, 1989; Li, 1990). Moreover, as will be discussed later, those elements are also allowed in the CP complements of perception verbs in Mandarin. Therefore, in this paper, we will focus on how to learn the distinction between Mandarin belief verbs and perception verbs, since this distinction seems particularly challenging given their similar syntactic frames.

- (13) a. ta zhidao diqiu rao taiyang zhuan.
 3s know earth around sun revolve
 ‘S/he knows that Earth goes around the sun.’
 b. ta zhidao da’an.
 3s know answer
 ‘S/he knows the answer.’

3.2. Perception verbs

Perception verbs in Mandarin draw the same distinction between epistemically neutral and epistemically non-neutral usages and the distinction between perceptual exploration and perceptual achievement as discussed above. However, different from English, in Mandarin it is the perceptual exploration verb *kan* ‘watch’ rather than the perceptual achievement verb *kandao* ‘see’ that is more strongly associated with epistemically non-neutral semantics. For instance, in (14), *kan* ‘watch’ is fundamentally interpreted as ‘think’ ‘believe’, but *kandao* ‘see’ cannot be used in this way.

- (14) wo kan/ *kandao zhe shi neng cheng.
 I watch/*see this business can succeed
 ‘I think this business will succeed.’

Syntactically, perception verbs in Mandarin mainly take CP complements (15a) and NP complements (15b) as well. Different from English, though, since Mandarin does not have overt marking for case or tense, there is no overt cue for small clauses in Mandarin. Therefore, in (12), repeated here as (16), although the syntactic frames of the belief verb and the perception verb in English differ regarding whether the sentential complement is a finite CP or a small clause, in the corresponding Mandarin sentences, the structures of the embedded clauses are superficially identical. Besides, all the morphosyntactic elements allowed in the CP complements of belief verbs, such as modals and aspects, are allowed in the CP complements of perceptions verbs as well. Therefore, for belief verbs and perception verbs in Mandarin, there is no syntactic frame that is licensed for one verb class but not for the other. This poses a problem for language acquisition: Can children still learn the difference between belief verbs and perception verbs in Mandarin through syntactic bootstrapping? Are there sufficient distributional cues in Mandarin input to distinguish between belief verbs and perception verbs?

- (15) a. ta tingdao wo shuohua.
 3s hear I speak
 ‘S/he heard me speak.’
 b. ta tingdao shengyin.
 3s hear sound
 ‘S/he heard the sound.’
- (16) a. wo zhidao ta lai. [belief]
 I know 3s come
 ‘I know s/he will come.’
 b. wo tingdao ta lai. [perception]
 I hear 3s come
 ‘I hear her/him come.’

4. Corpus study

In this section, we present a corpus study that examines whether there are enough morphosyntactic cues to distinguish between belief verbs and perception verbs in Mandarin child-directed speech. To preview the results, we find that although belief verbs and perception verbs share the same syntactic frames in Mandarin, they reliably differ in the input regarding the frequency of CP complements, the frequency of embedded overt subjects, and the type and frequency of aspect markers, suggesting that it is still plausible that learners can acquire the difference between the two verb classes through syntactic bootstrapping in such a morphosyntactically-poor language.

4.1. Possible cues

We first review the morpho-syntactic cues that we examined. The first cue is the frequency of CP complements. As discussed before, perception verbs can be used with an epistemically neutral meaning, but belief verbs cannot. Furthermore, CP complements are associated with epistemically non-neutral semantics cross-linguistically. Therefore, we predict that belief verbs will occur with CP complements more frequently than perception verbs.

Next, we look at overt subjects in the sentential complements. Recall that one distinction between belief verbs and perception verbs in English is that the latter can take small clauses as complements while the former usually cannot, (17). One syntactic difference between (17a) and (17b) is *it* is a grammatical subject in (17a) but is a grammatical object in (17b). A relevant rule in Mandarin is that old information is more likely to appear at the beginning of a sentence and also more likely to be omitted (e.g. Li & Thompson, 1981). Therefore, if belief verbs and perception verbs in Mandarin have a similar difference as in (17a) vs (17b), then we predict that when taking embedded complements, belief verbs will be less likely to have overt embedded subjects than perceptions verbs. Note that we do not intend to use this to test whether there are small clauses in Mandarin, which is a debated topic in literature (e.g. Li, 1985; Paul, 2021; Sybesma, 1999; Tang,

1998; Zhang, 2016). Even if we find a difference in the frequency of overt embedded subjects, it may be due to syntactic differences such as finite clauses vs. small clauses, but it may also be due to other reasons. For example, it may just be more likely semantically and/or pragmatically to talk about old information under belief verbs compared to perception verbs; or there may be an interaction between syntax and semantics. The present study is only concerned with whether there is sufficient distributional information to distinguish between the two classes of verbs; further syntactic analysis is left for future research.

- (17) a. Mary know it rained. [belief verb]
 b. Mary saw it rain. [perception verb]

Finally, we examine the type and frequency of aspect markers in the main clause. According to theories of events, mental verbs and verbs of perceptual achievement are “states”, whereas verbs of perceptual exploration are “activities”; furthermore, “activities” but not “states” can co-occur with imperfective aspects (e.g. Vendler, 1957). Therefore, perception verbs, in particular perceptual exploration verbs, are predicted to occur with aspect markers more frequently, especially with imperfective aspect markers.

4.2. Methods

We used eight Mandarin corpora from the CHILDES database (MacWhinney 2000): AcadLang (collected by Zhou), Chang1 (Chang, 1998), Chang2 (Chang, 2004), ChangPlay (Chang, 2005), TCCM (collected by Cheung & Chang), Zhou1 (Zhou, 2001), Zhou2 (Li & Zhou, 2004), and Zhou3 (Zhang & Zhou, 2009). They all contain naturalistic interactions between children and caregivers; the target children are 0;8 - 6 years of age.

We extracted all caregivers’ utterances that contain the most frequent belief verbs or perception verbs in child-directed speech, as shown in Table 3. The number of tokens for each verb is also included in the table. For each token, we coded the syntactic category of the verb complement (null, NP, CP) and the aspect marker in the matrix clause; for examples with a CP complement, we also coded whether there is an overt embedded subject.

Table 3. Belief verbs and perception verbs examined

Class	Verb	Count
Belief verb	<i>zhidao</i> 'know'	998
	<i>juede</i> 'think'	239
	<i>cai</i> 'guess'	73
	<i>jide</i> 'remember'	53
Perception verb	<i>kan</i> 'look, watch'	5961
	<i>kandao</i> 'see'	784
	<i>ting</i> 'listen'	432
	<i>tingdao</i> 'hear'	243

4.3. Results

Figure 1 visualizes the results for the frequency of CP complements among all tokens. Chi-square tests show that at both verb class level and individual word level, belief verbs are significantly more likely than perception verbs to take CP complements; the only exception is *kan* ‘watch’, which is not significantly different from belief verbs *zhidao* ‘know’ or *jide* ‘remember’. However, this exception is not surprising, as we have demonstrated that *kan* ‘watch’ in Mandarin is strongly associated with epistemically non-neutral meanings, which is semantically similar to belief verbs.

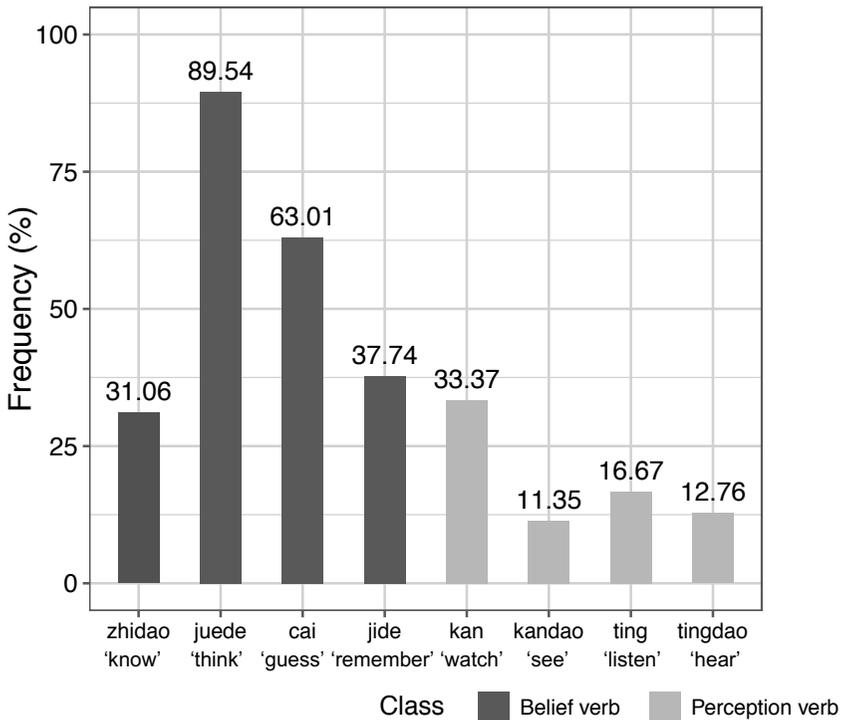


Figure 1. Frequency of CP complements

Figure 2 illustrates that the prediction for overt embedded subjects is also born out: when taking CP complements, perception verbs are more likely to have an overt embedded subject than belief verbs. Again, chi-square tests indicate the difference is statistically significant at both verb class level and individual word level, except for *kan* ‘watch’, which is not significantly different from the belief verb *zhidao* ‘know’.

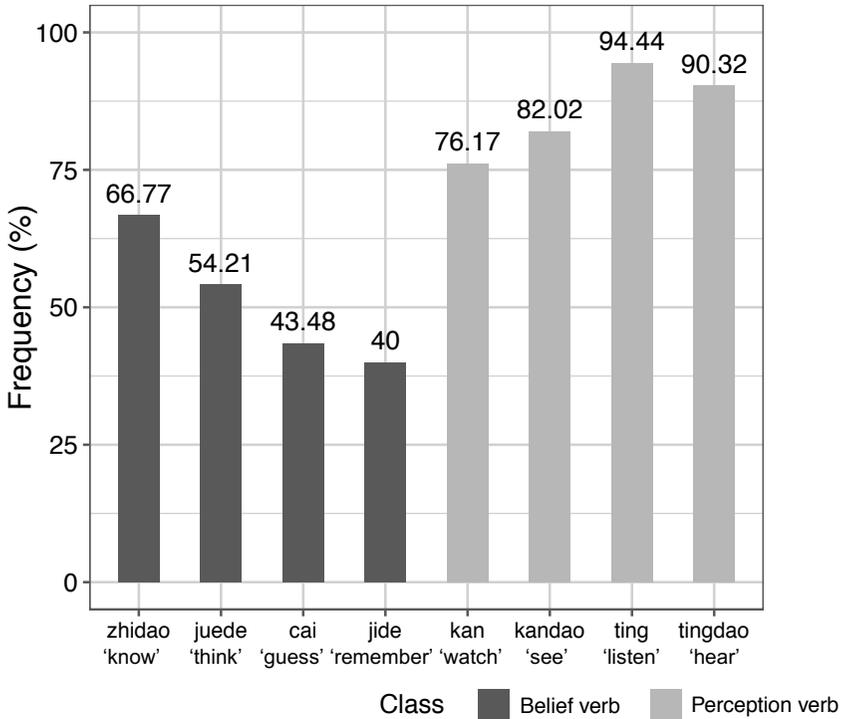


Figure 2. Frequency of overt subjects in CP complements

Figure 3 presents the frequency of aspect markers in the main clause, suggesting that as predicted, perception verbs appear with aspect markers more frequently than belief verbs do, which is confirmed by chi-square tests. Again, the only exception is *kan* 'watch', which behaves more similar to belief verbs.

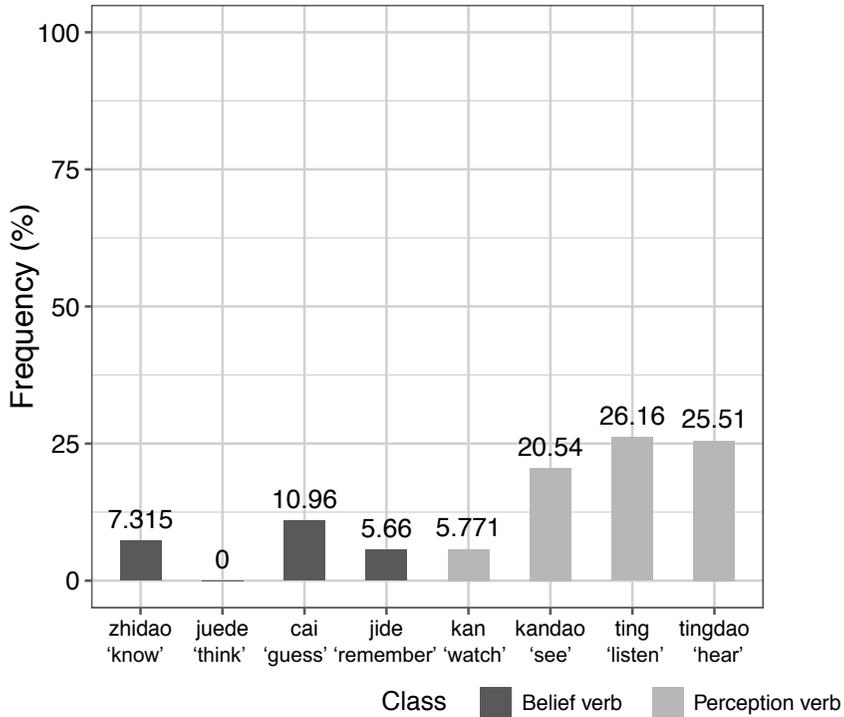


Figure 3. Frequency of aspect markers

Moreover, when we focus on the frequency of the perfective aspect *le* among all aspect markers, then as Figure 4 shows, there is a nearly categorical difference: The “states”, including belief verbs and verbs of perceptual achievement, almost never appear with aspect markers other than the perfective *le*; on the other hand, verbs of perceptual exploration appear with other aspects with a considerable frequency. The difference between “states” and “activities” is statistically significant according to a chi-square test. Although this difference does not exactly match the distinction between belief verbs and perception verbs, it could be useful for learning the finer classifications within the two classes of verbs, such as the difference between verbs of perceptual exploration and verbs of perceptual achievement. It could also be helpful for learning to distinguish *kan* ‘watch’ from belief verbs, which is desirable because the other syntactic cues we investigated above do not reliably reveal this distinction.

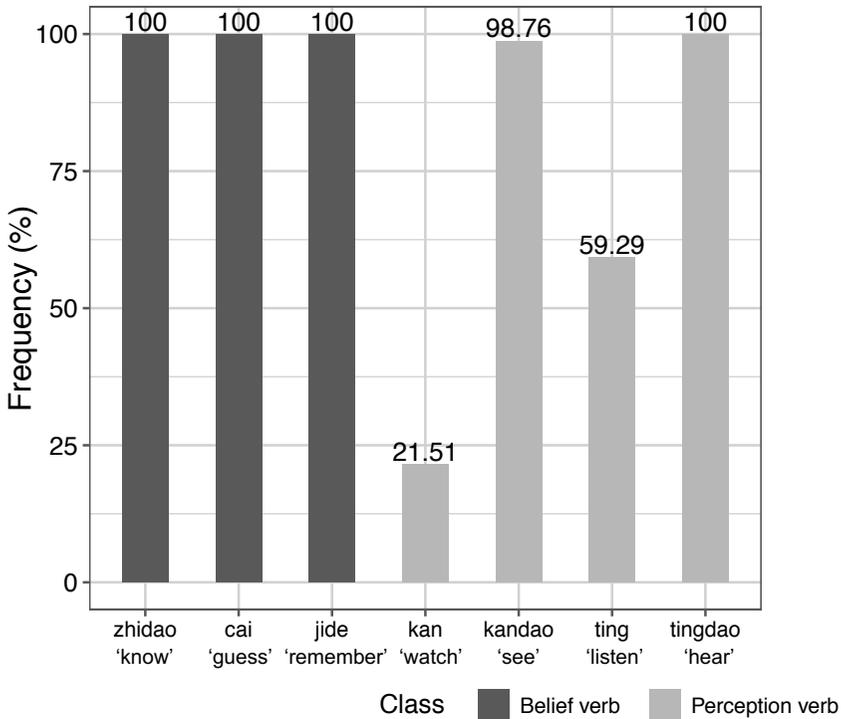


Figure 4. Frequency of the perfective aspect among all aspect markers

In summary, at both individual verb level and verb class level, we find that perception verbs are significantly more likely than belief verbs to take non-embedded complements, to have overt embedded subjects, and to co-occur with aspect markers, particularly with aspect markers other than the perfective marker *le*. The only apparent exception is *kan* 'watch', which often patterns with belief verbs rather than perception verbs; but this is not unexpected given its semantic similarity to belief verbs.

5. General discussion

Through the corpus study, we demonstrate that while belief verbs and perception verbs overlap in the types of arguments they can take, there are reliable distributional cues to distinguish between the two classes of verbs, including the frequency of embedded complements, the frequency of overt embedded subjects, and the type and frequency of aspect markers in the main clause. Assuming that children are sensitive to such distributional cues, we suggest that Mandarin-speaking children can learn the difference between belief verbs and perception verbs through distributional learning.

The current results bear implications beyond the learning problem specifically in Mandarin. As has been discussed earlier, Mandarin Chinese has little verbal or nominal morphology. Therefore, it is expected to provide fewer morphosyntactic cues for syntactic bootstrapping than languages that have richer morphosyntax. The fact that there is enough distributional information in Mandarin implies that distributional learning is a reliable language acquisition strategy: To the extent that the input in other typologically similar languages (i.e. those with little morphosyntactic marking and null arguments) offers similar information, learners of those languages will also be able to learn the distinction between the verb classes via syntactic bootstrapping; and it should be even easier to learn the distinction in languages with more complex morphosyntax, since those languages would provide richer distributional information. Therefore, by testing syntactic bootstrapping to its limit, we demonstrate it could be a universal learning strategy, as it is feasible even in a language with such impoverished morphosyntax.

An interesting contrast between this study and previous work is that studies in English have suggested an association between CP complements and perceptual achievement verbs (e.g. Fisher et al., 1991; Whitt, 2009), whereas this study indicates the opposite in Mandarin: it is verbs of perceptual exploration such as *kan* ‘watch’ that are more likely to take CP complements. This is relevant to a fundamental question about syntactic bootstrapping: While it has been demonstrated that children learning different languages can use knowledge of syntax-semantics mapping to learn word meanings (e.g. Lee & Naigles, 2008; Naigles, 1990), where does this knowledge of syntax-semantics mapping come from in the first place? The current results argue against attributing the knowledge to an innate, universal grammar (e.g. Pinker, 1989), because innate knowledge of syntax-semantic mapping cannot capture the cross-linguistic differences in the world, such as the association of CP complements with perceptual achievement verbs in English and with perceptual exploration verbs in Mandarin. Actually, even within a single language, there are abundant exceptions to such mapping relations. For example, while double object constructions are often associated with a caused-possession meaning, such as *give sb. sth.*, Levin (1993) pointed out that among nearly 250 English caused-possession verbs, only less than half of them can take double objects. Why would we be born with innate knowledge that fails to account for so many exceptions? Instead, we suggest that it would be more plausible for children to learn the syntax-semantics mapping rules from their language specific experience: They extract generalizable syntax-semantics mapping rules from the modest vocabulary they have already acquired, and then they use those rules to guide further word learning; the rules themselves will also be updated upon encountering new words. Indeed, a range of syntax-semantics mapping rules have been shown to be learnable from children’s early vocabulary (e.g. Irani, 2019; Yang, 2016; Yang & Montrul, 2017).

Finally, while we have shown reliable distributional information that distinguishes between belief verbs and perception verbs in Mandarin input, we still do not have a complete learning story for those verb classes yet. There are several open questions that future research must investigate. First, can children

actually detect such morphosyntactic cues? Next, if children can indeed detect those cues, do they actually use them to learn the distinction between belief verbs and perception verbs? If so, how exactly do they learn it? Specifically, while we have shown the distributional information statistically differs for the two verb classes, the real psychological mechanism that processes the distributional information from the input remains unknown. Finally, although distributional cues may help with restricting the possible word meanings, they by no means provide the precise word definitions. Children still need to use other cues to learn the exact meaning of the verbs. How those different types of information is coordinated and integrated is left for future studies.

References

- Barwise, Jon. (1981). Scenes and other situations. *Journal of Philosophy*, 78(1), 369-397.
- Bolinger, Dwight. (1968). *Aspects of language*. New York: Harcourt, Brace & World.
- Chang, Chien-ju. (1998). The development of autonomy in preschool Mandarin Chinese speaking children's play narratives. *Narrative Inquiry*, 8 (1), 77-111.
- Chang, Chien-ju. (2004). Telling stories of experiences: Narrative development of Young Chinese children. *Applied Psycholinguistics*, 25(1), 83-104.
- Chang, Chien-ju. (2005). *Parent-child interaction and child language/literacy development [Technical report]*. Taipei, Taiwan: National Science Council, Taiwan.
- Fisher, Cynthia, Henry Gleitman, & Lila R. Gleitman. (1991). On the semantic content of subcategorization frames. *Cognitive Psychology*, 23, 331-392.
- Gillette, Jane, Henry Gleitman, Lila R. Gleitman, & Anne Lederer. (1999). Human simulations of vocabulary learning. *Cognition*, 73, 135-176.
- Gleitman, Lila. (1990). The structural sources of verb meanings. *Language Acquisition*, 1, 3-55.
- Gleitman, Lila, Kimberly Cassidy, Rebecca Nappa, Anna Papafragou, & John C Trueswell. (2005). Hard words. *Language Learning and Development*, 1, 23-64.
- Harrigan, Kaitlyn, Valentine Hacquard, & Jeffrey Lidz. (2019). Hope for bootstrapping. *Language*, 95(4), 642-682.
- Harrigan, Kaitlyn. (2020). Finite complements trigger reality responses in attitude verb acquisition... but so do on-finite complements. In *Proceedings of Linguistic Society of America*, 5(1), 200-212.
- Higginbotham, James. (1983). The logic of perceptual reports: An extensional alternative to situation semantics. *Journal of Philosophy*, 80(2), 100-127.
- Huang, C.-T. James. (1989). Pro-drop in Chinese: A generalized control theory. In *The null subject parameter* (pp. 185-214). Springer.
- Irani, Ava. (2019). *Learning from positive evidence: The acquisition of verb argument structure* [Doctoral dissertation, University of Pennsylvania].
- Landau, Barbara., & Lila R. Gleitman. (1985). *Language and experience: Evidence from the blind child*. Cambridge, MA: Harvard University Press.
- Lee, Joanne N., & Letitia R. Naigles. (2008). Mandarin learners use syntactic bootstrapping in verb acquisition. *Cognition*, 106, 1028-1037.
- Levin, Beth. (1993). *English verb classes and alternations: A preliminary investigation*. Chicago: University of Chicago Press.
- Li, Audrey Y.-H. (1985). *Abstract case in Chinese* [Doctoral dissertation, University of Southern California].
- Li, Audrey Y.-H. (1990). *Order and constituency in Mandarin Chinese*. Dordrecht: Kluwer.

- Li, Charles N., & Sandra A. Thompson. (1981). *Mandarin Chinese: A functional reference grammar*. Berkeley, CA: University of California Press.
- Li, Xiaoyan, & Jing Zhou. (2004). *The effects of pragmatic skills of mothers with different education on children's pragmatic development* [Master's thesis, Nanjing Normal University].
- MacWhinney, Brian. (2000). *The CHILDES project: Tools for analyzing talk. Third Edition*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Medina, Tamara Nicol, Jesse Snedekerc, John C. Trueswell, & Lila R. Gleitman. (2011). How words can and cannot be learned by observation. *PNAS*, 108 (22), 9014-9019.
- Moulton, Keir. (2009). *Natural selection and the syntax of clausal complementation* [Doctoral dissertation, University of Massachusetts Amherst].
- Naigles, Letitia R. (1990). Children use syntax to learn verb meaning. *Journal of Child Language*, 17(2), 357-374.
- Papafragou, Anna, Kimberly Cassidy, & Lila Gleitman. (2007). When we think about thinking: The acquisition of belief verbs. *Cognition*, 105, 125-165.
- Paul, Waltraud. (2021) De-constructing small clauses: The case of Mandarin Chinese. *Glossa*, 6(1), 30.
- Pinker, Steven. (1989). *Learnability and cognition: The acquisition of argument structure*. Cambridge: MIT Press.
- Searle, John R., & Daniel Vanderveken. (1985). *Foundations of illocutionary logic*. Cambridge: Cambridge University Press.
- Sybesma, Rint. (1999). *The Mandarin VP*. Dordrecht: Kluwer.
- Tang, Sze-Wing. (1998). *Parametrization of features in syntax* [Doctoral dissertation, University of California Irvine].
- Vendler, Zeno. (1957). Verbs and times. *The Philosophical Review*, 66(2), 21-32.
- Viberg, Åke. (1983). The verbs of perception: A typological study. *Linguistics*, 21, 123-62.
- Villalta, Elisabeth. (2008). Mood and gradability: An investigation of the subjunctive mood in Spanish. *Linguistics and Philosophy*, 31, 467-522.
- White, Aaron Steven, Rachel Dudley, Valentine Hacquard, & Jeffrey Lidz. (2014). Discovering classes of attitude verbs using subcategorization frame distributions. In *Proceedings of the 43rd Annual Meeting of the North East Linguistic Society*, 2, 249-260. Amherst, MA: GLSA Publications.
- Whitt, Richard. (2009). *Evidentiality and perception verbs in English and German*. Bern: Peter Lang.
- Yang, Charles. (2016). *The price of linguistic productivity*. Cambridge, MA: MIT Press.
- Yang, Charles, & Silvina Montrul. (2017). Learning datives: The Tolerance Principle in monolingual and bilingual acquisition. *Second Language Research*, 33(1), 119-144.
- Zhang, Li, & Jing Zhou. (2009). The development of mean length of utterance in Mandarin-speaking children. In *The application and development of international corpus-based research methods* (pp. 40-58). Beijing: Education Science Publishing House.
- Zhang, Niina Ning. (2019). Sentence-final aspect particles as finite markers in Mandarin Chinese. *Linguistics*, 57(5), 967-1023
- Zhou, Jing. (2001). *Pragmatic development of Mandarin speaking young children: From 14 months to 32 months* [Doctoral dissertation, The University of Hong Kong].

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