

UC Merced

Proceedings of the Annual Meeting of the Cognitive Science Society

Title

Semantic Cues in the Learning of Alternating Argument Structures: An Insight from Mandarin Ditransitive Alternation in the Adult Input

Permalink

<https://escholarship.org/uc/item/17v0t7tp>

Journal

Proceedings of the Annual Meeting of the Cognitive Science Society, 48(0)

Authors

Wu, Yulun

Yang, Xiaolu

Publication Date

2026

Copyright Information

This work is made available under the terms of a Creative Commons Attribution License, available at <https://creativecommons.org/licenses/by/4.0/>

Peer reviewed

Semantic Cues in the Learning of Alternating Argument Structures: An Insight from Mandarin Ditransitive Alternation in the Adult Input

Yulun Wu (yulun.tze@foxmail.com)

Department of Foreign Languages and Literatures, Tsinghua University
Beijing, China, 100084

Xiaolu Yang (xlyang@mail.tsinghua.edu.cn)

Department of Foreign Languages and Literatures, Tsinghua University
Beijing, China, 100084

Abstract

Ditransitive alternation in adult input leads to multiple ways of syntactic-thematic mapping, posing challenges for child language acquisition. Semantic cues associated with arguments may guide children in overcoming this problem, as the semantic bootstrapping hypothesis assumes. This study attempts to explore whether such semantic cues are available and reliable in adult input that might help children to establish thematic-syntactic mappings of alternating ditransitive syntactic frames. We extracted all double-object sentences and post-object *GeiP* sentences from the adult input of 16 Mandarin-speaking children, which approximate the English double-object sentences and dative sentences, and coded both the indirect and direct objects along the dimensions of animacy, pronominality, givenness, and indefiniteness. The results show that the indirect and direct objects differ systematically across all dimensions. These distinctions are robust across syntactic frames. This suggests that cues for thematic-syntactic mapping are available in the input, which is consistent with the semantic bootstrapping hypothesis.

Keywords: semantic cues; ditransitive alternation; child language acquisition

Introduction

Verb argument structures in human languages exhibit considerable flexibility and are able to alternate across syntactic frames (Ramchand, 2008). Probably the most well-known example is the ditransitive alternation, as illustrated by the double-object sentence in (1a) and the dative sentence in (1b) in English, where the orders of the recipient and theme arguments are different.

- (1) a. I gave [John]_{Recipient} [a book]_{Theme}.
b. I gave [a book]_{Theme} to [John]_{Recipient}.

The two syntactic frames exemplified by (1a) and (1b) denote a similar thematic relation: the agent causes the recipient to possess the theme¹. And both of them exist in the ambient language perceived by the children (Tomasello & Campbell, 2001). Children's task, therefore, is to acquire two syntactic frames that convey the same thematic meaning; that is, children must learn the multiple-to-one form-meaning mapping.

¹ While (1a) and (1b) differ in some subtle aspects of pragmatics (e.g., Goldberg, 1995), such pragmatic differences may not hold in all languages (Haspelmath, 2015).

Of course, such a learning problem would not arise if the children learn the alternating argument structures independently. If children acquire only item-based lexical chunks like “[Giver]-give-[Receiver]-[Thing]” for (1a), and “[Giver]-give-[Thing]-to-[Receiver]” for (1b), and if they do not abstract general rules that govern how to map the recipient and theme roles to the object arguments (e.g., Tomasello, 2003), children would learn the two syntactic frames independently, and they would not face the challenge of multiple-to-one mapping. But experimental evidence suggests that children are able to generalize across syntactic frames when learning ditransitive verbs. In a novel verb learning experiment, 3- to 4-year-olds who were trained on the novel verbs in the dative frame performed significantly better in comprehending those verbs in the double-object frame (Arunachalam, 2017). Such evidence does not support the independent learning of the two syntactic frames.

Moreover, the experimental evidence confirms that the alternating constructions are challenging in acquisition. Rowland, Noble and Chan (2014) revealed a cross-linguistic difference between English-speaking and Welsh-speaking children. There is no ditransitive alternation in Welsh, so the mapping between the thematic structure of transfer and the argument structure is one-to-one. As a result, English-speaking 3-year-olds in the study could not correctly assign the recipient and theme roles in interpreting either double-object sentences or prepositional dative sentences with novel verbs; Welsh-speaking 3-year-olds, however, correctly assigned the recipient and the theme roles.

Thus, the acquisition of ditransitive alternation raises a question: how do children establish thematic-syntactic mapping when the ambient input provides multiple syntactic forms for the same thematic structure?

The solution to this question proposed by the semantic bootstrapping hypothesis is that children can establish the thematic-syntactic mapping by tracking the language-universal association between the arguments and a bundle of semantic and pragmatic properties (Grimshaw, 1981; Pinker, 1984). It is assumed that the core thematic roles in human languages have a set of prototypical semantic and pragmatic properties. For example, the subject argument tends to have the properties of “designating agent of actions, cause of the causal sequences, subject of attribution, autonomous reference, and definiteness” (Pinker, 1984, p. 46). Children can identify the syntactic arguments based on these

prototypical features, thereby learning the verb argument structure.

Notably, this learning mechanism does not deny children's capacity for distributional learning (e.g., Aslin & Newport, 2012), nor does it diminish the importance of distributional learning. Rather, in its view, "children always give priority to distributionally based analyses", and it is intended to "explain how the child knows *which* distributional contexts are relevant ones to examine" (Pinker, 1984, p. 42-43). In the acquisition of argument structure, semantic guidance is grounded in systematic correlations between thematic roles and argument structures (e.g., Marantz, 1984), and directs children to examine relevant semantic and pragmatic cues.

With respect to the thematic structure of transfer events, it has been proposed that the recipient is higher than the theme in the thematic hierarchy (Givón, 1984; Bresnan & Kanerva, 1989; Grimshaw, 1990; Jackendoff, 1990; Primus, 1999). Meanwhile, at the level of argument structure in ditransitive constructions, the indirect object (IO) is typically more prominent than the direct object (DO), as IOs tend to be animate, definite, discourse-given, and pronominal, whereas DOs are more often inanimate, indefinite, discourse-new, and non-pronominal (Collins, 1995; Bresnan et al., 2007; Haspelmath, 2015). Under a semantic bootstrapping account, such systematic correspondences allow children to align thematic roles with argument positions (objects), even when surface forms in the input exhibit alternation.

The hypothesis that semantic cues guide the acquisition of ditransitive alternation leads to two falsifiable predictions. The first prediction is that these cues must be available to children: semantic and pragmatic cues that can differentiate between IOs and DOs are consistently encoded in the adult input across human languages. The second prediction is that children must be able to perceive these cues: they must be sensitive to these semantic and pragmatic cues in mapping the recipient and theme roles. The second prediction has been evidenced by previous experimental studies, as studies show that the semantic cues of pronominality, animacy, and definiteness associated with object arguments crucially facilitate 3- to 4-year-old children's comprehension of ditransitive sentences (Osgood & Zehler, 1981; Rowland & Noble, 2011; Conwell, 2019; Wu, Yang & Christie, 2025). This study focuses on the first prediction. Previous corpus analyses have shown that IOs and DOs are distinct in the adult input of English (Snyder, 2003; de Marneffe et al., 2012) and German (Saueremann & Höhle, 2018). The current study extends the investigation to Mandarin Chinese, a non-Indo-European language.

The Mandarin Ditransitive Alternation

Mandarin ditransitive alternation consists of a double-object frame, as in (2a), and a post-object *Gei*P frame, as in (2b) (Gu, 1999; Her, 1999). They are approximately comparable to the English counterparts, as in (1a) and (1b). The post-verbal *-gei* that attaches to the main verb in (2a) is obligatory or optional, depending on the verb's semantic

subclasses (Li & Thompson, 1981; Chung & Gordon, 1998). The post-verbal *-gei* is either a verbal compounding element or a verbal ditransitive suffix, while the post-object *gei* in (2b) is a preposition in many syntactic analyses (Huang & Ahrens, 1999; Her, 2006). A special case is that *gei* can be used as a main verb, as exemplified in (2c) and (2d), where the main verb *gei* was boldfaced. In (2c), *gei* must be the main verb since there is no other verbal element; in the post-object *Gei*P sentence (2d), the boldfaced *gei* is the main verb and the non-boldfaced *gei* is a preposition, since one can only add aspect markers to the boldfaced *gei*. For (2c), it is ungrammatical to add a verbal suffix *-gei* to the main verb *gei*. Perhaps this is because of the phonological restrictions that disallow adding a suffix to a verb that has the same phonological form as the suffix (Wang, 2005).

- (2)a. Wo song(-gei) [Zhangsan] [yi-ben shu]
I give(-suffix) Zhangsan one-book
"I give Zhangsan a book."
b. Wo song [yi-ben shu] [gei Zhangsan]
I give one-book prep. Zhangsan
"I give a book to Zhangsan."
c. **Gei** [jiejie] [yi-kuai binggan]!
Give sister one-cookie
"Give your sister one cookie!"
d. Na ni **gei** [yi-zhang] [gei wo].
Then you **give** one prep. me
"Then you give one (card) to me."

Thus, there are two ways to map the recipient and the theme roles in Mandarin: the recipient-theme mapping in (3a) and (3b), and the theme-recipient mapping in (3c). The grammatical status of different *geis* is a matter of ongoing debate, but the acquisition problem remains the same: Mandarin-speaking children need to learn the two ways of mapping the thematic roles from their ambient language that denote the same thematic relation.

- (3) a. V IO DO (recipient-theme)
b. V-*gei* IO DO (recipient-theme)
c. V DO *gei* IO (theme-recipient)

In addition, a Mandarin-specific challenge in learning verb argument structure is the high frequency of argument-dropping and topicalization. Previous corpus analyses report that over 70% of ditransitive sentences in Mandarin child-directed speech involve either topicalization or object-dropping (Zhang, Gao & Wang, 2018), as in (4a) to (4d). In such cases, arguments are either moved, or the IO and DO are not explicit. These properties of Mandarin Chinese make the task of establishing the thematic mapping of the recipient and theme even more complicated, since the input, even if available, seems insufficient.

- (4)a. Song le yi-ge pingguo
Give PERF one-CL apple
"I gave an apple (to someone)."

- b. Song le mama
Give PERF mom
“I gave (something) to mom.”
- c. Pingguo, wo song mama le
Apple, I give mom PERF
“About the apple, I gave it to mom.”
- d. Mama, wo song le pingguo
Mom, I give PERF apple
“About the mom, I gave her an apple.”

However, the acquisition of Mandarin ditransitive constructions is not delayed despite the reduced availability of surface cues. In corpus analyses, Mandarin children begin to spontaneously produce the ditransitive constructions before the age of 3 (Zhou, 1997; Zou, 2012), a timeline that is comparable to that of English-speaking children (Campbell & Tomasello, 2001). In comprehension studies, although no study has tested young children’s comprehension of the post-object *GeiP* sentences in (2b), it has been shown that 3-year-olds are able to correctly interpret the double-object sentences in (2a) (Wang, 2017; Wu, Yang & Christie, 2025).

A possible source of cues for children is the semantic and pragmatic properties associated with the IOs and DOs. Mandarin-speaking children are sensitive to the semantic cues differentiating between IOs and DOs, since 3-year-olds are sensitive to the definiteness associated with object arguments: their comprehension accuracy was significantly enhanced when the DOs took the indefinite form (Wu, Yang & Christie, 2025). This study further explores the availability of semantic and pragmatic cues by focusing on IOs and DOs in the adult input. It is predicted that if the semantic and pragmatic distinctions between IOs and DOs are universal, they should be observed in the adult input of Mandarin.

Method

Corpus Data

We examined the longitudinal data of 16 Mandarin-speaking children from the Erbaugh corpus, the Zhou3 corpus, the Tong corpus, and the TCCM corpus, which are all open-access in the CHILDES database (Erbaugh, 1982; MacWhinney, 1998; Zhou, 2009; Cheung & Yang, 2015; Deng & Yip, 2018). Children’s age range was from 1 year 6 months to 4 years 9 months.

Data Extraction and Coding

Our target syntactic frames were in (3a), (3b), and (3c). First, we extracted all utterances containing “*gei*” in adult input, and then manually identified the utterances in (3b) and (3c). Second, we extracted all utterances containing the 452 Mandarin verbs listed in Xu (2004) that are licensed in the double-object frame without *-gei*, and manually identified the utterances in (3a). The final data included 336 ditransitive utterances from Mandarin adult input, consisting of 225 double-object ditransitive utterances (as in (3a) and

(3b), henceforth DOD) exhibiting the recipient-theme mapping, and 111 post-object *GeiP* ditransitive utterances (as in (3c), henceforth PGD) exhibiting the theme-recipient mapping. Then, following previous studies on German and English (Snyder, 2003; de Marneffe et al., 2012; Sauermann & Höhle, 2018), all IOs and DOs were coded along the following dimensions.

Animacy The objects that refer to humans, animals, or animal puppets were coded as animate; other objects were coded as inanimate.

Pronominality The objects in the form of personal pronouns or demonstrative pronouns were coded as pronominal; other objects were coded as non-pronominal.

Indefiniteness (NumCI) Definiteness cannot be directly coded based on grammatical forms in Mandarin; for example, the bare noun can have either a definite, indefinite, or generic reading. Given that the video data were not available in most Mandarin child corpora, deciding whether an NP referred to the unique entity in the context is often difficult. In practice, we identified the indefiniteness based on the presence of Numeral-Classifier phrase. The Numeral-Classifier phrase is a strong marker for the indefiniteness of objects in Mandarin, and children know this by 2 years of age (Wu, 2024). The objects with the form of Numeral-Classifier phrases (henceforth NumCI) were coded as NumCI; other objects were coded as non-NumCI.

Discourse-giveness In corpus studies, the discourse-giveness is usually measured by recency of mention (Bresnan et al., 2007; de Marneffe et al., 2012). In our case, if the referents of the objects were mentioned in the previous ten lines, the objects were coded as discourse-given; otherwise, the objects were coded as discourse-new. The objects that referred to either the speaker or the hearer were coded as discourse-given, since the speaker and the hearer are usually established as old information in conversations. This included first and second pronouns and the proper names that were used to refer to the speaker or the hearer.

Data analysis

Our primary interest lay in the distributional patterns of semantic and pragmatic properties. Accordingly, we calculated the proportions of IOs and DOs exhibiting each property, and employed non-parametric statistical tests to assess whether the observed differences between IOs and DOs were consistent across syntactic frames. Fisher’s exact tests were appropriate in this context because the coded variables were categorical, and the distributional assumptions required by parametric tests are often unwarranted in corpus-based studies of child-directed speech. We attempted to construct generalized linear mixed-effects models to test the distribution of Animacy, Pronominality, and Indefiniteness (NumCI) with the fixed

effects of Object and Syntactic Frame. However, these properties showed quasi-complete separations, resulting in insufficient variability for reliable model estimation. Therefore, only the distribution of Discourse-givenness was analyzed by the mixed-effects logistic regression, with IO/DO, Syntactic Frame, and their interaction as fixed effects, and Sentence ID and Verb as random intercepts.

As a supplementary analysis, we fitted conditional inference trees using the “ctree” function from the “partykit” package in R. For each object property, the property was treated as the response variable, with Role (IO vs. DO) and Frame (DOD vs. PGD) as predictors. Conditional inference trees recursively partition the data based on statistically significant associations between predictors and the response.

Prediction

Our prediction is that, if semantic cues of the ditransitive alternation universally exist in human languages, in the current Mandarin data, there should be a robust distinction between the semantic/pragmatic properties associated with IOs and DOs, and this distinction should be consistent across the syntactic frames of DOD and PGD.

Results

The Distribution of Semantic Properties

Across the adult input, IOs and DOs showed a robust differentiation in their semantic/pragmatic properties, as illustrated in Figure 1 and Figure 2. Table 1 presents the results of tests that examined whether each property was differently distributed across IOs and DOs. Table 2 presents the results of Fisher’s exact tests that examined the distribution of these properties across syntactic frames.

Table 1. Fisher’s exact tests: IO vs. DO

Property	DOD	PGD
Animacy	IO>DO; $p<0.001$	IO>DO; $p<0.001$
Pronominality	IO>DO; $p<0.001$	IO>DO; $p<0.001$
NumCl	DO>IO; $p<0.001$	DO>IO; $p<0.001$
Givenness	IO>DO; $p<0.001$	IO>DO; $p<0.001$

Table 2. Fisher’s exact tests: DOD vs. PGD

Property	IO	DO
Animacy	n.s.; $p=0.345$	n.s.; $p=0.105$
Pronominality	DOD>PGD; $p=0.001$	n.s.; $p=1.000$
NumCl	n.s.; $p=1.000$	DOD>PGD; $p<0.001$
Givenness	DOD>PGD; $p=0.012$	n.s.; $p=0.230$

Animacy The distinction between animate IO and inanimate DO was very robust. In DOD, IOs were significantly more likely than DOs to be animate (100% for IO, 8.9% for DO; $p<0.001$). The same pattern was found in PGD (98.2% for IO, 7.2% for DO; $p<0.001$). At the same time, the contrast in animacy was stable across the two frames. The proportion of animate IOs did not differ significantly between DOD

and PGD ($p=0.345$), and the proportion of animate DOs also did not differ significantly across frames ($p=0.105$).

Pronominality Pronominality also strongly distinguished IOs from DOs in both frames. In DOD, IOs were significantly more likely than DOs to be pronominal (82.7% for IO, 0.9% for DO; $p<0.001$). The same asymmetry was found in PGD (64.9% for IO, 0% for DO; $p<0.001$). Across frames, pronominal IOs were significantly more frequent in DOD than in PGD ($p=0.001$), whereas no frame difference was found for pronominal DOs ($p=1.000$). This demonstrated that pronominality is a strong cue for identifying IOs from DOs, and this cue is more available in DOD than in PGD.

Indefiniteness (NumCl) None of the IOs were in the indefinite NumCl form in either DOD or PGD, while 66.7% DOs in DOD and 42.3% DOs in PGD were indefinite, marked by NumCl. Thus, the indefiniteness of objects that was indicated by the NumCl form is a strong cue for identifying DOs from IOs, although the cue was more frequently attested in the DOD frame, compared with in the PGD frame ($p<0.001$). NumCl-marked indefiniteness was a robust cue for identifying DOs in both frames, though it is more frequent in DOD.

Discourse-givenness For the discourse-givenness, the mixed-effects logistic regression revealed a significant effect of IO/DO ($\beta=-3.70$, $SE=0.44$, $z=-8.47$, $p<0.001$), indicating that DOs were less likely to be discourse-given. There was also a significant IO/DO $\times$ Syntactic Frame interaction ($\beta=1.50$, $SE=0.51$, $z=2.92$, $p=0.004$), indicating that the distinct distribution across IOs and DOs in Discourse-givenness was weaker in PGD than in DOD. The main effect of Syntactic Frame was not significant ($\beta=-0.97$, $SE=0.54$, $z=-1.79$, $p=0.074$).

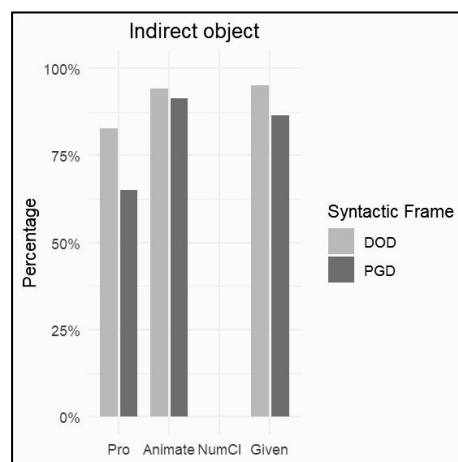


Figure 1. The properties associated with IO

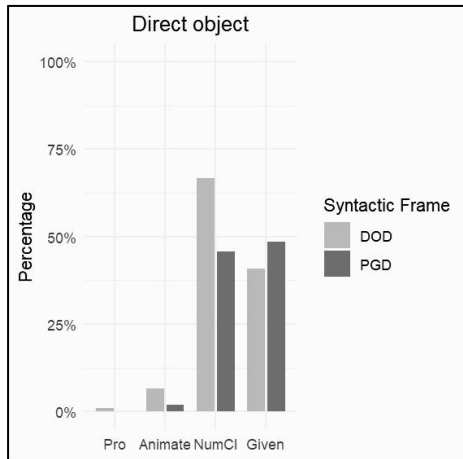


Figure 2. The properties associated with DO

In sum, a robust distinction between the IOs and DOs was observed across the entire data set. Across the two frames of DOD and PGD, the semantic and pragmatic properties associated with objects could serve as reliable cues for differentiating the IO and DO, though these cues were more frequently instantiated in the DOD frame.

The analysis based on conditional inference trees

The conditional inference tree analyses revealed a consistent contrast between IOs and DOs, as shown in Figure 3, 4, 5, and 6.

For Animacy, the tree showed a single split based on Role, with IOs overwhelmingly animate and DOs predominantly inanimate. No further partitioning by Frame was observed, indicating that animacy is robustly associated with object across syntactic frames.

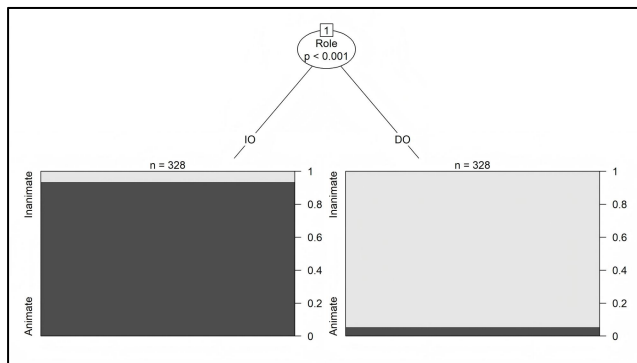


Figure 3. The conditional inference tree for Animacy

For Givenness and Pronominality, Role again emerged as the primary partitioning factor. Within IOs, an additional split by Frame was observed, suggesting a secondary influence of syntactic frame on the distribution of these properties.

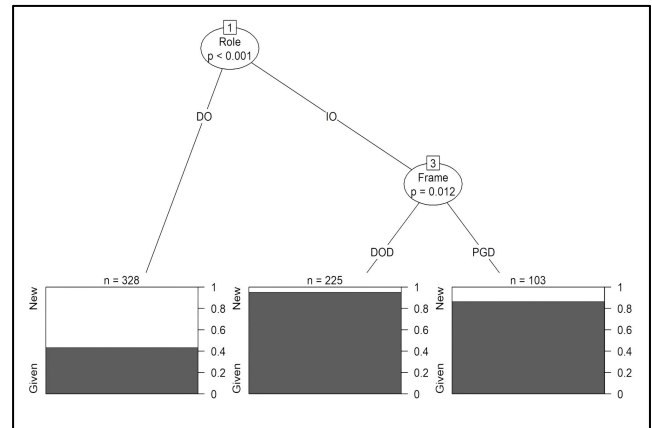


Figure 4. The conditional inference tree for Givenness

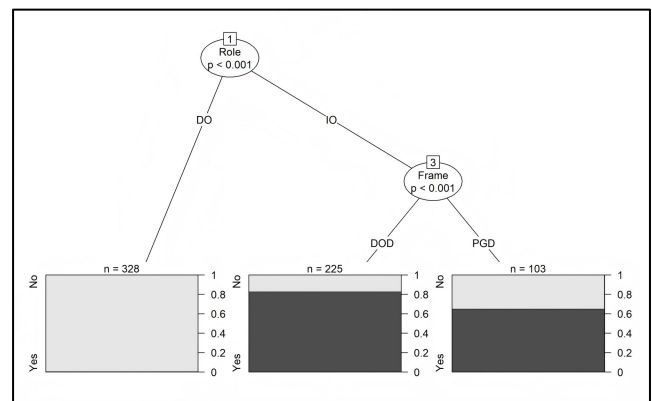


Figure 5. The conditional inference tree for Pronominality

For NumCl, IOs showed no variation (uniformly lacking NumCl marking), while DOs were further partitioned by syntactic frame, indicating that frame modulates NumCl distribution specifically for direct objects.

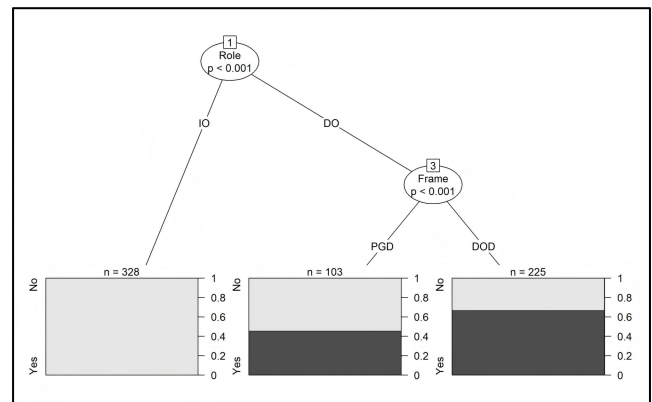


Figure 6. The conditional inference tree for NumCl

Overall, these tree-based analyses suggest that object properties are primarily organized by Role, with Frame exerting only a more limited influence.

Discussion

This study aimed to examine whether the semantic and pragmatic cues indicating the thematic-syntactic mappings of Mandarin ditransitive alternation are available in Mandarin adult input. The ditransitive utterances were extracted from the adult input in the longitudinal data of 16 Mandarin-speaking children, and the indirect and direct objects were coded along the dimensions of animacy, pronominality, discourse-givenness, and whether they took the indefinite form. There were three important findings. First, it has been found that the frequency of ditransitive constructions is extremely low in Mandarin, similar to other languages, such as English. Second, the distinct semantic and pragmatic properties between indirect and direct objects are consistent for all verbs, for the verbs that frequently involve alternation, and at the sentence level. Third, compared with the post-object *Gei*P frame, the semantic and pragmatic distinction between indirect and direct objects is more robust in the double-object frame.

Many ditransitive verbs tend to appear in either DOD or PGD and do not alternate, as our data indicate. The item-based learning account may take this as the evidence for the assumption that children can learn the syntactic frames of DOD and PGD independently. As mentioned before, if this hypothesis is true, there should be no problem of multiple-to-one mapping at all. However, experimental evidence suggests that children make cross-verb and cross-frame generalizations when learning ditransitive verbs (Rowland, Noble & Chan, 2014; Arunachalam, 2017). As a result, children must relate multiple syntactic frames to the same thematic relations. Thus, although many ditransitive verbs tend to appear in either DOD or PGD, Mandarin children still need to solve the problem of multiple-to-one mapping.

Our results support the prediction that semantic and pragmatic cues are robust and consistent in differentiating IOs and DOs across the ditransitive alternation, thereby being consistent with the semantic bootstrapping hypothesis. While ditransitive alternations change the way of thematic-syntactic mappings, the semantic and pragmatic properties associated with the indirect and direct objects are consistent. Nearly all indirect objects are animate and pronominal, whereas direct objects are often inanimate and non-pronominal. In addition, the indirect objects are more likely to be discourse-given and definite, compared with the direct objects. The contrasts of properties remain stable across syntactic frames, and are observed at the level of individual sentences, indicating that they are reliable as a guide in the learning of ditransitive alternation. Therefore, children track these cues, and this may compensate for the insufficient data in the adult input. Of course, these properties are not independent from each other: a pronoun is more likely to be animate, and it can hardly be indefinite or discourse-new. It is reasonable to assume that children perceive multiple cues that are not mutually independent in their language acquisition.

Our findings suggest that the semantic cues that hint at the thematic mapping are more available in the double-object

frame, compared with the post-object *Gei*P frame. For example, 82.7% indirect objects in the double-object frame were pronouns, while 64.9% indirect objects in the post-object *Gei*P frame were pronominal. The cue availability of pronouns is comparatively higher for the double-object frame. This result is consistent with findings from previous studies in English (Conwell, O'Donnell & Snedeker, 2011): the indirect object has more variations in the dative frame, compared with the double-object frame. Though the cause of the phenomenon is open for further study, children may benefit from this distribution in learning the double-object frame. Previous studies have shown that, in acquiring ditransitive alternations, children experience greater difficulty with the double-object frame than with the dative frame (Osgood & Zehler, 1981; Conwell & Demuth, 2007; Rowland & Noble, 2011; Arunachalam, 2017; Conwell, 2019). At the same time, pronouns have been shown to facilitate children's learning of the double-object frame (Conwell, 2019) and of verb argument structure more generally (Conwell & Auen, 2021). Therefore, the higher availability of pronominal cues in the double-object frame may facilitate the acquisition of this more challenging construction.

Taken together, these findings are in line with the semantic bootstrapping hypothesis: semantic cues can be the source of information for identifying the syntactic entities (Pinker, 1984). Verb argument structure alternations are very frequent in human languages, such as the ditransitive alternation, causative alternation, locative alternation, among others. Children can track semantic and pragmatic cues to differentiate alternating constructions that denote the same thematic meanings. In this sense, the alternating nature of verb argument structure does not lead to extra difficulties in child language acquisition.

Conclusion

Children need to establish the thematic-syntactic mappings of the recipient and theme, while ditransitive sentences in the ambient language often alternate to change the way of thematic-syntactic mapping, rendering the learning of the mapping quite difficult. Following previous corpus studies (Snyder, 2003; de Marneffe et al., 2012; Sauermann & Höhle, 2018), the present study investigates whether the semantic/pragmatic properties associated with the indirect and direct objects are distinct in Mandarin adult input. The results show that such distinctions are very robust. The indirect objects are often animate, pronominal, discourse-given, and definite, while the direct objects are often inanimate, non-pronominal, discourse-new, and indefinite. The pattern is very stable across syntactic alternations. This suggests that Mandarin adult input provides robust semantic and pragmatic cues that are compatible with the semantic bootstrapping hypothesis.

Acknowledgments

This study is supported by the National Social Science Grant of China (21BYY019) to Xiaolu Yang. We thank the anonymous reviewers for their comments and suggestions. Part of this work was presented at the 6th Conference on Neo-descriptivism (October 2024, Shenzhen, China), and we thank the audience for their valuable feedback.

References

- Arunachalam, S. (2017). Preschoolers' acquisition of novel verbs in the double object dative. *Cognitive Science*, 41(Suppl.4), 831–854. <https://doi.org/10.1111/cogs.12368>
- Aslin, R. N., & Newport, E. L. (2012). Statistical learning: From acquiring specific items to forming general rules. *Current Directions in Psychological Science*, 21(3), 170–176. <https://doi.org/10.1177/0963721412436806>
- Becker, M. (2014). *The acquisition of syntactic structure: Animacy and Thematic Alignment*. Cambridge University Press.
- Bresnan, J., & Kanerva, J. M. (1989). Locative inversion in Chicheŵa: A case study of factorization in grammar. *Linguistic Inquiry*, 20(1), 1–50.
- Bresnan, J., Cueni, A., Nikitina, T., & Baayen, R. H. (2007). Predicting the dative alternation. In G. Bouma, I. Kramer, & J. Zwarts (Eds.), *Cognitive foundations of interpretation* (pp. 1–33). Royal Netherlands Academy of Arts and Sciences.
- Campbell, A. L., & Tomasello, M. (2001). The acquisition of English dative constructions. *Applied Psycholinguistics*, 22(2), 253–267. <https://doi.org/10.1017/S0142716401002065>
- Cheung, H., Yang, J. (2015). Exploring individual differences and contextual variations in child language corpora. *Journal of Chinese Linguistics Monograph Series*, 25, 30–38.
- Chung, T.-T. R., & Gordon, P. (1998). The acquisition of Chinese dative constructions. In Annabel Greenhill, Mary Hughes, Heather Littlefield & Hugh Walsh (Eds.), *Proceedings of the 22nd Annual Boston University Conference on Language Development* (pp. 109–120). Cascadia Press.
- Collins, P. (1995). The indirect object construction in English: An informational approach. *Linguistics*, 33, 35–49. <https://doi.org/10.1515/ling.1995.33.1.35>
- Conwell, E. (2019). The effects of the pronoun me on dative comprehension. *Journal of Child Language*, 46(6), 1127–1141. <https://doi.org/10.1017/S0305000919000424>
- Conwell, E., & Auen, A. (2021). Argument types affect children's acquisition of a novel argument structure. *Child Development*, 92(5), e1038–e1047. <https://doi.org/10.1111/cdev.13625>
- Conwell, E., & Demuth, K. (2007). Early syntactic productivity: Evidence from dative shift. *Cognition*, 103(2), 163–79. <https://doi.org/10.1016/j.cognition.2006.03.003>
- de Marneffe, M. C., Grimm, S., Arnon, I., Kirby, S., & Bresnan, J. (2012). A statistical model of the grammatical choices in child production of dative sentences. *Language and Cognitive Processes*, 27(1), 25–61. <https://doi.org/10.1080/01690965.2010.542651>
- Deng, X., & Yip, V. (2018). A multimedia corpus of child Mandarin: The Tong corpus. *Journal of Chinese Linguistics*, 46(1), 69–92. <https://doi.org/10.1353/jcl.2018.0002>
- Erbaugh, M. (1982). *Coming to order: Natural selection and the origin of syntax in the Mandarin speaking child*. (Doctoral dissertation, University of California, Berkeley).
- Givón, T. (1984). *Syntax: A functional-typological introduction (Vol. 1)*. John Benjamins.
- Goldberg, A. E. (1995). *Constructions: A construction grammar approach to argument structure*. University of Chicago Press.
- Grimshaw, J. (1981). Form, function, and the language acquisition device. In C. L. Baker & J. J. McCarthy (Eds.), *The Logical Problem of Language Acquisition* (pp. 165–182). MIT Press.
- Grimshaw, J. (1990). *Argument structure*. MIT Press.
- Gu, Y. (1999). Shuangbinyu jieguo [The double-object construction]. In L. Xu (Ed.), *Gongxing yu gexing: Hanyu yuyanxue zhong de zhengyi [Universals and variations: debates in Chinese linguistics]* (pp. 60–90). Beijing Language and Culture University Press. (in Chinese)
- Haspelmath, M. (2015). Ditransitive constructions. *The Annual Review of Linguistics*, 1(1), 19–41. <https://doi.org/10.1146/annurev-linguist-030514-125204>
- Her, O. S. (2006). Justifying part-of-speech assignments for Mandarin gei. *Lingua*, 116(8), 1274–1302. <https://doi.org/10.1016/j.lingua.2005.06.003>
- Her, O.-S. (1999). Interaction of thematic structure and syntactic structures: On Mandarin dative alternations. In Y. Yin, I. Yang & H. Chan (Eds.), *Chinese Languages and Linguistics V: Interaction of Form and Function* (pp. 373–412). Academia Sinica, Taipei.
- Huang, C.-R., & Ahrens, K. (1999). The function and category of gei in Mandarin ditransitive constructions. *Journal of Chinese Linguistics*, 27(2), 1–26.
- Jackendoff, R. (1990). *Semantic structures*. MIT Press.
- Li, C., & Thompson, S. (1981). *Mandarin Chinese: A functional reference grammar*. University of California Press.
- Osgood, C., & Zehler, A. (1981). Acquisition of bi-transitive sentences: Pre-linguistic determinants of language acquisition. *Journal of Child Language*, 8(2), 367–83. <https://doi.org/10.1017/S030500090000324X>
- Pinker, S. (1984). *Language learnability and language development*. Harvard University Press.
- Primus, B. (1999). *Cases and thematic roles: Ergative, accusative, and active*. Max Niemeyer Verlag.
- Ramchand, G. C. (2008). *Verb meaning and the lexicon: A first phase syntax*. Cambridge University Press.
- Rowland, C. F., & Noble, C. L. (2011). The role of syntactic structure in children's sentence comprehension: Evidence from the dative. *Language Learning and Development*, 7(1), 55–75. <https://doi.org/10.1080/15475441003769411>

Rowland, C. F., Noble, C. H., & Chan, A. (2014). Competition all the way down: How children learn word order cues to sentence meaning. In B. MacWhinney, A. Malchukov, & E. Moravcsik (Eds.), *Competing Motivations in Grammar and Usage* (pp. 127–143). Oxford University Press.

Sauermann, A., & Höhle, B. (2018). Word order in German child language and child-directed speech: A corpus analysis on the ordering of double objects in the German middlefield. *Glossa: A Journal of General Linguistics*, 3(1), 1–32. <https://doi.org/10.5334/gjgl.281>

Scott, R. M., & Fisher, C. (2009). Two-year-olds use distributional cues to interpret transitivity-alternating verbs. *Language and Cognitive Processes*, 24(6), 777–803. <https://doi.org/10.1080/01690960802573236>

Snyder, K. M. (2003). *The relationship between form and function in ditransitive constructions*. (Doctoral dissertation, University of Pennsylvania).

Tomasello, M. (2003). *Constructing a language: A usage-based theory of language acquisition*. Harvard University Press.

Wang, Q. (2005). Possession and the structure of the double object construction in English and Chinese. *Modern Foreign Languages*, 28(2), 129–137. (in Chinese)

Wang, Q. (2017). *The acquisition of giving-type double object construction in Mandarin-speaking children*. (Master's thesis, Xiangtan University).

Wu, Y., Yang, X., & Christie, S. (2025). *Effect of indefiniteness on Mandarin-speaking children's comprehension of the double-object construction*. Poster presentation at 50th Annual Boston University Conference on Language Development, Boston, MA, United States.

Wu, Z. (2024). *Hanyu Ertong Yuyanzhong de Yufa-Yuyong Jiekou Yanjie [The study on the syntax-pragmatics interface in Mandarin child language]*. Science Press. (in Chinese)

Xu, D. (2004). *Xiandai Hanyu Shuangbin Gouzao Yanjiu [The study on the double object constructions in Mandarin Chinese]*. Shanghai Lexicographical Publishing House. (in Chinese)

Zhang, Y., Gao, L. & Wang, C. (2018). Child language acquisition of Mandarin ditransitive constructions. *Contemporary Linguistics*, 20(3), 335–356. (in Chinese)

Zhou, G. (1997). An investigation of 1-5-year-old children in using the Chinese bi-object construction. *Journal of Psychological Science*, 2, 131–135+191. (in Chinese)

Zhou, J. (2009). *Hanyu Ertong Yuyan Fazhan Yanjiu [The study on the language development of Mandarin-speaking children]*. Education Science Press. (in Chinese)

Zou, L. (2012). A case study of the acquisition of gei sentences by a Putonghua speaking child. *Chinese Teaching in the World*, 26(4), 560–573. (in Chinese)