

Processing Factors and Syntactic Choice in Mandarin Child and Caregiver Speech

Jidong Chen, Gan Fu, Shu Yang, and Bhuvana Narasimhan

1. Introduction

Adult speakers often adapt the production of language (e.g., syntactic choice of active versus passive voice) to mitigate processing demands as well as to meet the informational needs of the interlocutors in specific speech contexts. The variation in the choice of syntactic structures is often influenced by a number of factors that are thought to influence utterance production, including the conceptual accessibility of entity, its givenness or topicality, the weight or length of a noun phrase (NP), and lexical-syntactic priming (prior occurrence of the target expression or structure (Bock et al. 2004; MacDonald 2013). Children acquire the core components of a language (e.g., phonology, morphology, syntax) by age 4 or 5 years (e.g., Hoff 2009), but we still know little about the processing and communicative factors that shape their language production (e.g., Höhle et al. 2016). How do these kinds of factors influence children's production, specifically their choice of syntactic construction and word order?

The present study investigates this question by examining how a number of processing factors influence the choice between SVO (Subject Verb Object) versus SOV (Subject Object Verb) constructions in child and adult speakers of Mandarin Chinese (henceforth Mandarin). Mandarin was selected as the target language because young children acquiring the language produce both constructions at an early age (Erbaugh 1992; Yang & Xiao 2008), but we know little about the factors influencing their syntactic choices in early production. We specifically investigate how syntactic choice is influenced by the information status (i.e., givenness/newness) of object NP referents, the animacy and the weight or length of object NPs (e.g., the number of syllables that they are comprised of), and lexical-syntactic priming (i.e., the use of the same morphosyntactic construction in prior discourse). We analyzed the longitudinal naturalistic speech of a Mandarin-learning child and his caregivers to see whether and how these factors affect syntactic choice in the child versus in the adults' speech production.

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2. Background

Multiple factors have been found to influence syntactic choice in the literature, including the accessibility of a referent due to its inherent properties (e.g., due to animacy, imageability) (e.g., Bock et al. 1992; Prat-Sala 1997; Tanaka et al. 2011) or its information status (e.g., givenness: higher activation/accessibility due to recent mention) (e.g., Bock & Irwin 1980; Ferreira & Yoshita 2003; Prat-Sala & Branigan 2000). The weight (length) of object NPs also plays an important role in syntactic choice. Heavy constituents tend to occur later in a sentence, whereas lighter constituents tend to occur earlier in a sentence (e.g., Arnold et al. 2000; Hawkins 1994). But the short-before-long preference is not universal since adult speakers of Japanese and Korean prefer the long-before-short word order in spontaneous and elicited speech (Choi 2007; Yamashita & Chang 2001). Lexical-syntactic priming, due to prior occurrence in discourse, also has a robust influence on syntactic choice in both adult and child speech (e.g., Bencini & Valian 2008; Huttenlocher et al. 2004; Rowland et al. 2012).

Syntactic choice is often manifested in the choice of different word orders. Word order requires linearizing thinking for the purpose of speaking, which is universal in spoken language. Children have been found to be attuned to sequential order at a very early age (Slobin 1985). But specific word order varies crosslinguistically and intra-linguistically. Speakers are thus often presented with choices of potentially different word orders to express the same event. The ordering of constituents in utterances has been explained in terms of facilitation of comprehension and/or production (Arnold et al. 2000). In the speaker-oriented account, referents that have been encountered in a prior context are more activated than new referents. Because such “old” or “given” referents are relatively accessible, they are also good candidates for early mention during incremental utterance production (Branigan, McLean, & Reeve, 2003). In the addressee-oriented account, speakers may prefer the “old-before-new” word order on the assumption that comprehension is easier for the hearer when a referent (and its label) to which incoming information can be linked is already available (Clark & Haviland 1977). But other research suggests that the “old-before-new” preference is reduced or reversed depending on construction type (Clifton & Frazier 2004), cognitive load (Narasimhan et al. 2015; Slevc 2011), age (Chen et al. 2020; Narasimhan & Dimroth 2008), and discourse-pragmatic features of the target language (Chen et al. 2020).

Mandarin provides an ideal test domain to explore the factors influencing syntactic choice in development. Mandarin has a basic SVO word order (e.g., Li & Thompson 1981; Sun & Givón 1985), but allows a grammaticalized SOV BA construction, where the use of the morpheme BA preposes the object to the preverbal position, as illustrated in (1b) in contrast to the alternative SVO word order in (1a) (ASP = aspect marker).

- (1) a. 他吃完了煎饼。 SVO (active construction)
ta chi wan le jianbing
 he eat finish ASP food
 ‘He ate up the pancakes.’
- b. 他把煎饼吃完了。 SOV (BA construction)
ta ba jianbing chi wan le
 he BA pancake eat finish ASP
 ‘He ate up the pancakes.’

Typologically Mandarin is known as a discourse-prominent language, which often results in varied word orders such as SOV, OSV, and VOS. Mandarin also has impoverished morphological markings on the moved NPs and prevalent omission of arguments that are given or retrievable from the context. (e.g., Li & Thompson 1981). The SOV BA construction is one of the most studied syntactic constructions in Mandarin and has been examined from many different aspects, e.g., syntactic properties, semantic constraints, historical evolution, acquisition, and the status of BA. But only a few studies have examined its actual use and alternation with the SVO order in discourse (e.g., Liu 2007; Yao 2014; Yao 2018). Liu (2007) investigated the effects of information status and weight (length) of the object NPs on the choice of preverbal SOV versus the postverbal SVO sentences in adult spoken and written discourse in Mandarin. Liu’s preverbal SOV sentences included both BA constructions (55% of her data) and topicalized preposed object sentences (also SOV) without the BA (10% of her data). She found that information status played a significant role in the distribution of the preverbal (SOV) versus postverbal sentences (SVO). Old object NPs tend to occur preverbally and new object NPs tend to occur postverbally. The weight of an object NP interacts with its information status in word order choices. Old NPs that are light (1–5 syllables) and medium weight (6–10 syllables) are more likely to occur preverbally, whereas new light and medium weight NPs tend to occur postverbally (100% and 75%). In contrast, heavy NPs (11 syllables or more) show the opposite pattern: old heavy NPs tend to occur postverbally and new heavy NPs tend to occur preverbally. Liu concludes that the BA construction is more likely to be chosen when the BA NP carries old information and when it is new and heavy (the BA NP is never new and light).

Yao (2014; 2018) examined the influence of the weight of the object NPs on Mandarin speakers’ use of the SVO word order versus the SOV word order in the BA constructions. Two frequent verbs, 放 *fang* ‘put’ and 拿 *na* ‘take’, were analyzed for their occurrence in the SVO and the SOV BA constructions in the 10-million-word Academia Sinica Balanced Corpus of Mandarin Chinese (Chen et al. 1996), which contains both spoken and written Mandarin. The data were coded for 14 features, including the semantic and morphosyntactic features of the object NP (e.g., length, animacy, use as a pronominal form or with a demonstrative), information

status of the object NP (e.g., old/given or new based on prior mention in discourse), whether the BA construction was preceded or followed by another BA construction, syntactic features of the target BA construction utterance (e.g., presence of an adverbial before the target verb phrase, a complement verb, or a verb phrase after the target verb), and the genre of the data source. The results show significant effects of object NP prominence and prior use, i.e., the BA constructions are more likely to be used with a given object NP in a context with a preceding BA construction. The weight effects are nonlinear (U-shaped quadratic curve): very short and very long object NPs are both more likely to occur in the BA constructions compared with medium length object NPs (4-5 syllables). Yao (2014, 2018) also showed that the weight effects are verb-specific: longer object NPs are less likely to occur in the BA constructions with the verb *fang* ‘put’, but more likely with the verb *na* ‘take’. Further, significant interaction occurs with the givenness of the object NPs for the verb *na* ‘take’, but not *fang* ‘put’ – given light and new heavy object NPs tend to occur in the SOV BA constructions with the verb *na* ‘take’.

Turning to child language, Mandarin-learning children have been found to produce both the SVO and SOV BA constructions as early as 2-3 years of age (e.g., Erbaugh 1992; Yang & Xiao 2008) and exhibit sensitivity to the syntactic and semantic features of the BA construction before 2;6 (Yang & Xiao, 2008). But few studies have compared the production of the BA construction versus the alternative SVO order in naturalistic child and child-directed speech. It remains an open question whether the same processing factors affect the syntactic choice of SVO and SOV BA construction in both child and child-directed speech.

3. The current study

Our specific research questions are:

1. What factors influence syntactic choice, i.e., the likelihood of the SOV BA construction versus the SVO construction, in caregiver speech in Mandarin?
2. Do the same factors influence syntactic choice in child speech in similar ways?

3.1. Methodology

We analyzed the speech of a Mandarin-learning child Tong (1;07 – 3;04) and his caregivers in a longitudinal naturalistic corpus consisting of monthly recordings with a total of 22 transcripts (Deng & Yip 2018; MacWhinney 2000). We identified 323 verbs that were used in the BA constructions in child-caregiver speech and extracted their uses in the canonical SVO sentences as well. We excluded incomplete sentences,

sentences with omitted object NPs, and SOV sentences without BA. A total of 4264 utterances, including 650 BA constructions and 3614 SVO sentences, were coded by two native Mandarin speakers, who each coded half of the data. The following independent variables were coded for each utterance: 1) speaker (child versus adult), 2) information status of the object NP (given versus new), 3) animacy of the object NP (inanimate versus animate), 4) length of the object NP (short versus long), and 5) priming (primed versus unprimed).

A given NP or referent is defined as either discourse-old or hearer-old (Prince 1992) if the same referent or NP is mentioned 10 utterances before the target utterance. In our coding, we define a new NP or referent as not having been mentioned at all in a window of 10 clauses before the target line (cf. Yao, 2014, 2018). The weight of the object NP is measured by the number of syllables since a syllable corresponds to a morpheme in Mandarin, which corresponds to a character. This measure amounts to counting the number of characters in transcripts, the standard way of measuring length in Chinese. For the purpose of the statistical analysis, we classified object NPs as “short” if they consisted of up to 2 syllables, otherwise they were coded as “long”. The BA construction was considered to be “primed” if it was preceded by another BA construction within a 10-utterance window; otherwise it was coded as “unprimed”.

Intercoder reliability was established by having a third native Mandarin speaker randomly code about 35% of all the utterances. Disagreements were resolved by discussing and revising the first or second coder’s coding to reach an agreement.

3.2. Results

The overall distribution shows that the majority of the utterances are in the SVO word order in both the child (89%) and the caregiver (83%) speech. Thus, although the BA constructions are attested in the child speech in the second year of life, they constitute only 11% of the transitive utterances in the child’s speech, and are relatively infrequent even in the caregiver speech (17%). The infrequent use of the BA construction is consistent with prior empirical findings that the OV word order (including the BA constructions) makes up about 10% in adult-directed speech and even less in written texts in Modern Chinese (Sun & Givón 1985). The child’s lower uses of the BA construction compared with those in the adults’ speech is also consistent with previous findings showing that the frequency of the BA construction is much lower in children than in adult speakers (Erbaugh 1982; 1992).

We conducted logistic regression analyses in R (Baayen 2008) with *speaker*, *information status*, *animacy*, *NP length*, and *priming* as the predictor variables and *construction* (SOV BA versus SVO) as the outcome variable. The results reveal significant main effects of the predictor variables (Table 1). We also used likelihood ratio tests comparing the full model with nested models that

eliminated each of the predictor variables one by one. The comparisons showed that each variable contributed significantly to the distribution of the SOV BA versus SVO constructions: *speaker* ($\chi^2(1) = -31.84, p < .001$), *information status* ($\chi^2(1) = -46.01, p < .001$), *animacy* ($\chi^2(1) = -7.34, p < .001$), *NP length* ($\chi^2(1) = -3.89, p < .05$), and *priming* ($\chi^2(1) = -213.01, p < .001$).

Table 1. Significant main effects of speaker, information status, animacy, NP length, and priming

	Estimate	Std. error	z value	Pr(> z)	
(Intercept)	0.50329	0.1643	3.063	0.002	**
Speaker: CHILD	0.60211	0.11114	5.418	<.001	***
information_status:NEW	0.71758	0.11083	6.474	<.001	***
animacy: INAN	-0.36778	0.13981	-2.631	0.008	**
NP_length: SHORT	0.18506	0.09335	1.982	0.047	*
priming: NBB	1.44911	0.09612	15.076	<.001	***

Note: NBB = No BA before (no BA construction in the window of 10 utterances preceding the target utterance)

We further examined two-way interactions between the five predictor variables. Nested models consisting of the five predictor variables with and without the interaction term in question were compared using likelihood ratio tests. Among the 10 possible pairwise interactions, significant interactions were found between *information status* and *animacy* ($\chi^2(1) = 16.73, p < .001$), *information status* and *priming* ($\chi^2(1) = 30.58, p < .001$), and *speaker* and *NP length* ($\chi^2(1) = 5.03, p < .05$); however, the last did not survive a Bonferroni correction (see Figures 1-3).

Figure 1 shows the distribution of the BA and the SVO constructions by *information status of the object NPs* and *animacy*. The significant interaction can be seen in the interesting pattern revealed in Figure 1: the BA constructions are preferred when the object NPs are new (22%), but only when they are animate. When the object NPs are inanimate, the BA constructions are more likely to be used with the object NPs that are given (19%).

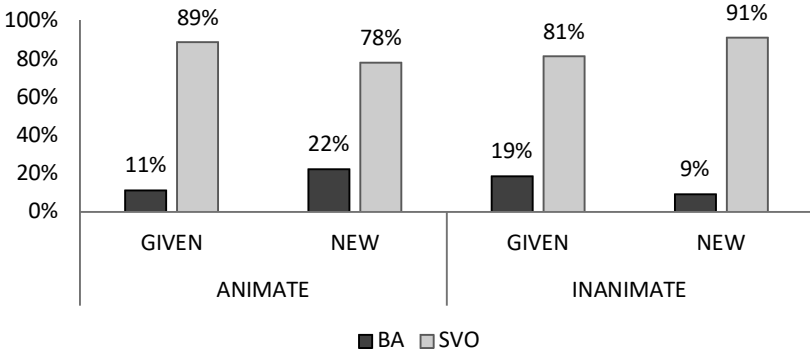


Figure 1. Use of the BA constructions by givenness and animacy

Figure 2 shows the proportions of the BA and the SVO constructions by *priming* and *information status of the object NPs*. Speakers are more likely to produce the BA construction when it is given than when it is new, but this tendency is stronger when the BA construction is primed (42%) than when there is no priming from a prior utterance containing a BA construction (12%).

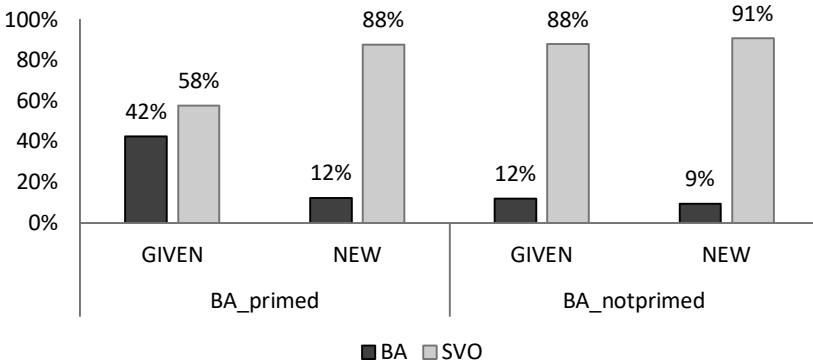


Figure 2. Use of the BA constructions by information status of the object NPs and priming

Figure 3 shows the proportions of the BA and the SVO constructions by *speaker* and *NP length*. Adults are more likely to use the BA constructions when the object NP is heavier, i.e., 3 syllables or more (19% versus 16%). The child has a roughly similar distribution of NPs in the BA constructions in terms of weight (10% heavy versus 11% light).

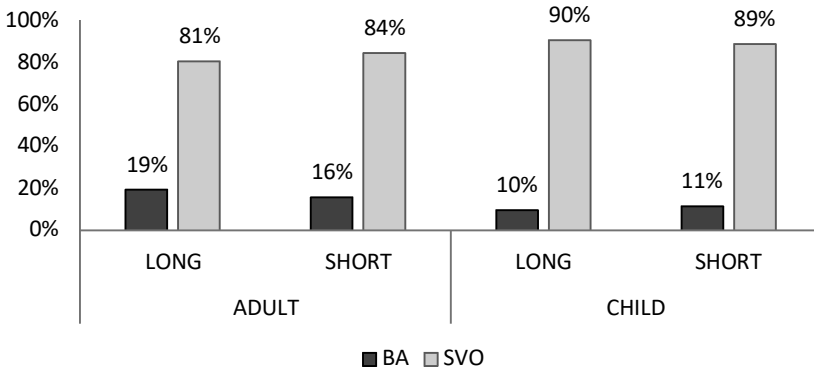


Figure 3. Use of the BA constructions by speaker and length of the object NP

4. Discussion and conclusion

Our study shows that *age*, *information status of the object NP*, *animacy*, *NP length*, and *priming*, influence the production of the SOV BA versus the SVO constructions in naturalistic longitudinal child and caregiver speech in Mandarin. Each factor contributes significantly to the syntactic choice between the SOV BA and the SVO constructions.

Age: The adults produced significantly more BA constructions than the child, but the SVO word order remain dominant in both the adult and the child speech. This finding supports prior research arguing that the SVO word order is the basic word order in modern Mandarin whereas the functional distribution of OV word order in Mandarin (including the BA constructions) is a marked, specialized, contrastive/emphatic discourse device (Sun & Givón 1985). It also supports findings that children's acquisition of SOV word order as in the BA construction tends to lag behind that of the SVO construction (Erbaugh 1982; 1992).

Our results also reveal that a number of processing factors influenced adult and child Mandarin speakers' syntactic choice in similar ways.

Information status and animacy of the object NP: The information status of the object NP interacts with animacy in child and adult speech. Significantly more SOV BA versus SVO constructions were produced with animate new NPs and with inanimate given NPs. These results show that both the child and the adults are sensitive to the inherent feature of animacy of the object NPs as well as the acquired feature of discourse givenness.

Priming: The BA constructions were produced significantly more often with given versus new referents. This tendency is stronger when the BA construction is preceded by another BA construction in prior discourse, suggesting the effect of lexical-syntactic priming via repetition of the BA-marking on the object NP and/or the repetition of the construction with its

marked word order. This priming effect aligns with structural parallelism in the use of the BA constructions reported in Yao (2014, 2018).

NP length: The length of the object NP influences the syntactic choice. The BA construction is more likely to be used when the object NP is long (3 syllables or more) versus short. This result seems to differ from the findings in adult-directed discourse in Liu (2007) and Yao (2014, 2018). Liu (2007) reported interactive effects of weight (length) and givenness, i.e., light given and heavy new object NPs tend to occur in the BA constructions, whereas Yao (2014, 2018) found nonlinear verb-specific weight effects. This apparent difference may have resulted from the different definitions of light versus heavy NPs. Liu's (2007) light NPs have 1-5 syllables, whereas Yao (2014, 2018) found that NPs with 4-5 syllables had the lowest probability of occurrence in the BA constructions. Our definition of heavy (long) NPs, i.e., 3 syllables or more, differs from that of both Liu (2007) and Yao (2014; 2018). We also found trends suggesting that the length of the object NPs influenced syntactic choice differently in child versus adult speech. The BA constructions occur with long object NPs (3 or more syllables) 19.5% of the time in the caregivers' uses of transitive constructions; the use of the BA constructions drops to 15.6% when object NPs are short. The child's use does not seem to be affected by the length of the object NPs in the same way. The BA constructions occur with long object NPs in 10% of transitive constructions versus 11% with short object NPs. These numerical trends may reach statistical significance in a larger speech sample.

Our study shows that even though there are fewer BA constructions in child speech compared to child-directed speech, their usage is conditioned by the same factors, namely, information status, animacy, and use of the construction in prior discourse. Our findings extend prior research demonstrating the influence of information status, animacy, and weight of object NPs on argument realization and syntactic choice in child and caregiver speech to Mandarin Chinese. They also extend prior studies on syntactic priming effects in child language in the laboratory (e.g., Bencini & Valian 2008; Huttenlocher et al. 2004; Rowland et al. 2012) to child-caregiver interactions in naturalistic contexts. Ongoing research is aimed at exploring the effects reported in the present study in a larger sample of child-caregiver discourse.

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Proceedings of the 45th annual Boston University Conference on Language Development

edited by Danielle Dionne
and Lee-Ann Vidal Covas

Cascadilla Press Somerville, MA 2021

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ISSN 1080-692X
ISBN 978-1-57473-067-8 (2 volume set, paperback)

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