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# The Role of Maternal Input in Early Word Order Acquisition: The Case of Mandarin Chinese

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# The Role of Maternal Input in Early Word Order Acquisition:

## The Case of Mandarin Chinese

Margaret Ya-Ching Yeh, Ph.D.

University of Connecticut, 2015

This dissertation examined the role of maternal input in word order acquisition of Mandarin-speaking children from the one-word to multi-word stages. Four questions about the role of maternal input were addressed: frequency effects, age-related changes, utterance type effects, and verb diversity effects. Predictions for each question were made based on the generativist and constructivist accounts. Spontaneous speech of 40 Mandarin-speaking mother-child dyads selected from CHILDES Zhou corpus, with 10 dyads in each of four age groups: 14-, 20-, 26-, and 32-month-olds, were coded for word order, utterance type, and verb type. Both maternal and child distributions were compared for analyses. Mothers across all four age groups produced a variety of word orders and constructions in their speech. Frequency effects were found in most child word order uses but not in the Ba and different multiple-verb constructions. Most child word order uses reached adult levels of frequency at either 26 or 32 months. Maternal speech did not show age-related changes as child production grew from one word to multi words. No significant relationship was found between mothers

and children in most word orders. Utterance type effects were not found because mothers used different word orders for different utterance types while child production did not reflect this tendency. The distribution of verb diversity within maternal and child word orders shared a similar pattern. Word orders with greater verb diversity tended to be acquired earlier. The findings that frequency effects and verb diversity effects were found in early word order acquisition support both generativist and constructivist claims. The lack of age-related changes and utterance type effects in maternal word order uses is contrary to the constructivist view. Although maternal input (e.g., frequency and verb diversity) may play a role in acquisition of Mandarin word order, there are possible influences other than input. These influences may include child linguistic competence, linguistic complexity of constructions being learned, and semantic/pragmatic factors that constrain the choice of word order.

Margaret Ya-Ching Yeh – University of Connecticut, 2015

The Role of Maternal Input in Early Word Order Acquisition:  
The Case of Mandarin Chinese

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APPROVAL PAGE

Doctor of Philosophy Dissertation

The Role of Maternal Input in Early Word Order Acquisition:

The Case of Mandarin Chinese

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## **Introduction**

Mandarin Chinese depends crucially and exclusively on word order to convey the idea of who does what to whom. The canonical word order used in Mandarin Chinese is Subject-Verb-Object (SVO). In addition to SVO order, non-SVO word orders are produced due to different language-specific properties and constructions in Mandarin Chinese (Li & Thompson, 1981). Thus, with these different word orders in their language, child Mandarin learners are faced with a complex task for their word order acquisition.

Although it is established that SVO order appears with higher frequency than all the other word orders (e.g., SOV and OSV) in Mandarin Chinese (Sun & Givón, 1985; Wei, 1989), and the early utterances of Mandarin learners also reflect this frequency (Erbaugh, 1982; Cheng, 1986), the role of maternal input in early word order acquisition has not yet been systematically examined. By analyzing all different word orders produced in both maternal input and child speech when children develop from the one-word stage to multi-word stage, this dissertation aims to examine how maternal word order uses play a role in the word order acquisition of Mandarin learners. Four questions about word order uses in maternal input are addressed in this dissertation. The first question concerns frequency effects in the distribution of child word order uses and in the order of acquisition of different word orders. The second question concerns whether there are age-related changes in maternal word

order uses. The third question asks whether mothers use different word orders for different utterance types. The fourth question concerns the role of verb diversity within word orders between mothers and children. In what follows, I will present the different word orders used in Mandarin Chinese and two theoretical accounts on the role of input and word order acquisition. Then I will address the four research questions in turn. Finally, I will discuss previous studies on Mandarin input and give my prospectus.

### ***Word Orders in Mandarin Chinese***

Like English, Mandarin Chinese canonically uses SVO word order. Examples of SVO sentences are presented in Sentences (1) and (2).

(1) wo3    xi3    le    wan3

I        wash   PFV   dish                      (PFV: perfective aspect)

‘I washed the dish.’

(2) ta1    hui4    shuo1   chun1wen2

He    can        speak   Chinese

‘He can speak Chinese.’

Previous studies have found that typical child-directed speech in Mandarin may contain different word orders and/or constructions other than canonical word order (Slobin & Bever, 1982; Wells, 1981; Cameron-Faulkner, Lieven, & Tomasello, 2003). Thus, in addition to

utterances in SVO word order, this dissertation also seeks to document the frequency distribution of other word orders, and of specific linguistic constructions whose structures are not described in terms of SVO word order in both Mandarin-speaking mothers' and children's speech, and examine the relation between mothers' and children's use of these non-SVO word orders and constructions.

*Non-SVO word orders.* Some linguistic properties in Mandarin Chinese, such as the Ba construction, the definite/indefinite contrast, topicalization, ellipsis of noun arguments, and passive construction, all yield non-SVO word orders (Li & Thompson, 1981). First, the *ba3* (to have) morpheme is used as an object marker in the Ba construction, in which the object precedes the verb (i.e., S Ba O V), forming an SOV order as in Sentence (3).

(3) wo3    ba3    wan3    xi3    le

I        Ba    dish    wash    PFV/CRS        (CRS: currently relevant state)

‘I washed the dishes.’

The Ba construction is used to denote how the state of the NP introduced by the Ba marker is affected due to the Subject's action upon it. To perform such a communicative function, production of the Ba construction has to follow two major constraints: (i) the definiteness constraint, which means that the object in the Ba construction (Ba-object) has to be definite, specific, or generic, and (ii) the complexity constraint, which requires the verb

(Ba-verb) to be morphologically complex, co-occurring with an appropriate verbal complement and/or an aspect marker (Li & Thompson, 1981; Du, 2004; Xu, 2012). Thus, the Ba construction is not considered an easy construction to acquire for both first- and second-language Mandarin learners (Li & Thompson, 1981; Lee, 1996; Du, 2004; Xu, 2012).

Sometimes, Mandarin speakers put the direct object before the verb, as in Sentence (4), instead of using the Ba construction. This also leads to SOV order.

(4) wo3      wan3      xi3      le

I              dish      wash   PFV                      ‘I washed the dishes.’

Sentences (1), (3), and (4) (i.e., SVO, SBaOV, SOV orders) implicate subtly different semantics. In general, the SVO form simply indicates that the speaker has done the action (i.e., washing dishes). The notion of the dish being affected is not emphasized and specified in this form. The SBaOV form focuses on how the state of the Object is changed due to the Subject’s action upon it. Thus, the dish in (3) becomes clean due to the speaker’s action of washing. The ‘bare’ SOV form is typically used in a situation in which the speaker replies to a question/suggestion and the conveyed information is contrary to the expectation of the hearer (as one might say in English: “(but) I already washed the dish”) (Li & Thompson, 1981).

Second, the contrast of definiteness and indefiniteness can also influence how subjects and objects appear with verbs in sentences. In simple intransitives, either SV or VS is possible.



Sentence (5) demonstrates an SV order and can be interpreted as ‘The person(s) whom the speaker and the hearer are expecting has/have come’. The preverbal subject is interpreted as *definite*. On the other hand, Sentence (6) shows a VS order, in which the postverbal subject is interpreted as *indefinite* because the subject is not known to the hearer at least (Li & Thompson, 1981). It is noteworthy that utterances in VS order are rare in Mandarin Chinese.

(5) ren2      lai2      le                      (SV order)

Person      come      PFV/CRS                      ‘The person(s) has/have come.’

(6) lai2      le              ren2      le              (VS order)

Come      PFV      person      CRS                      ‘Some person(s) has/have come.’

In simple transitives, the same situation applies. An unmarked postverbal object as in (7) may be taken as *indefinite* and the sentence appears with an SVO order, while preverbal positions render the object *definite*, as in (8) to (10) (Li & Thompson, 1981).

(7) wo3      zai4      mai3      shu1                      (SVO order)

I      DUR      buy      book                      ‘I am buying a book.’

(8) wo3      ba3      shu1      mai3      le                      (SOV order)

I      BA      book      buy      PFV/CRS                      ‘I bought the book.’

(9) shu1      wo3      mai3      le                      (OSV order)

Book      I      buy      PFV/CRS                      ‘The book, I bought it.’

(10) wo3 shu1 mai3 le (SOV order)

I book buy PFV/CRS 'I bought the book.'

Third, one of the most notable features of Mandarin sentence structure is the prominence of “topic”. Many linguists have suggested that the sentence structure of Mandarin may be described in terms of topic-comment relations rather than subject-predicate relations (as in English) (Li & Thompson, 1976; Chu, 2010). The topic of a sentence is the thing being talked about and always occupies the sentence-initial position to attract the listener’s attention (Li & Thompson, 1976). Topics may or may not have a direct semantic relationship with the verb.

Compare Sentences (11) and (12):

(11) na4 sho3 ge1 wo3 ting1 guo4 le

That song I hear EXP CRS (EXP: experiential aspect)

‘That song, I already heard (it).’

(12) zher4 ke1 shu4 ye4zi zhang3 de kwai4

This CL tree leaf grow fast (CL: classifier)

‘This tree, (its) leaves grow fast.’

Sentences (11) and (12) have both subjects and topics. The subject in (11), the one who does the hearing, is wo3 ‘I’, while the subject in (12), the one that grows fast, is ye4zi ‘leaf’. Their topics are ‘that song’ (which is also the object) in (11) and ‘this tree’ in (12). Thus, the

word orders of Sentences (11) and (12) are [NP(topic, object), NP(subject) V] and [NP(topic), NP(subject) V], respectively; these word orders are considered to be distinct from [NP(subject) V NP(object)] in SVO sentences (Li & Thompson, 1976). In fact, a subject may be absent in ordinary conversation. Thus, Sentence (11) can become Sentence (13). The one who heard the song in (13) can be inferred from the context, and the word order for this sentence becomes NP(topic, object), V.

(13) na4 sho3 ge1 yi3jing1 ting1 guo4 le

That song already hear EXP CRS ‘That song, (I) already heard.’

Fourth, Mandarin allows pervasive ellipsis of noun arguments, which leads to the omission of subjects and/or objects in a sentence, as in Sentences (14), (15) and (16).

Sentence (17) shows a complete expression of (14), (15), and (16).

(14) na2 dao4 zher4li3 lai2 (verb alone)

Take arrive here come ‘Take (it) here.’

(15) ni3 na2 dao4 zher4li3 lai2 (SV order)

You take arrive here come ‘You take (it) here.’

(16) ba3 ta1 na2 dao4 zher4li3 lai2 (OV order)

BA it take arrive here come ‘Take it here.’

(17) ni 3 ba3 ta1 na2 dao4 zher4li3 lai2 (SOV order)

You BA it take arrive here come ‘You take it here.

Both subject and object respectively in (14), (15) and (16) can be inferred from the context if they are missing. All three sentences express the same proposition but manifest different word orders when different arguments are dropped.

Finally and relatedly, the passive construction in Mandarin Chinese is termed the Bei construction (i.e., O Bei S V), which functions similarly to the Ba construction, describing how the state of the Object is changed due to the Subject’s action upon it. The bei4 morpheme in the Bei construction is used as a subject marker. A standard Bei construction begins with a direct object noun phrase in sentence-initial position, which is an entity affected by the action of the verb in sentence-final position. Following the direct object noun phrase, the bei4 marker introduces the agent who does the action (Li & Thompson, 1981) (Example 18).

(18) pin2guo3 bei4 ta1 chi1 le

Apple Bei he eat PFV ‘The apple was eaten by him.’

There are a number of variations for the Bei construction. One commonly used variation occurs without the agent of the action (i.e., O Bei V) (Example 19). Such variation is used when the agent is unknown or not important for the speaker and/or hearer. Relative to the passive construction in Indo-European languages, the Bei construction occurs rarely in Mandarin Chinese. Instead, the topic-comment construction is preferred (as Example 13)

when there is a need to say something about the direct object of the action.

(19) pin2guo3    bei4    chi1    le

Apple          Bei          eat    PFV          ‘The apple was eaten.’

***Other constructions.*** This dissertation includes two kinds of linguistic constructions that are produced in their own distinct structures. These constructions are copular sentences and presentative sentences. As in other languages, the copula verb (i.e., shi4 ‘to be’) in Mandarin Chinese functions as a link between a referential subject noun phrase and a nonreferential noun phrase (Example 20). Although the verb phrase of such a copular sentence consists of the copula verb and the nonreferential noun phrase, this nonreferential phrase is not the object of the copula verb. Instead, the role it plays is to identify the referent of the subject noun phrase (Li & Thompson, 1981).

(20) ta1    de    shu2shu2    shi4    xiao1fang2yuan2

He    GEN    uncle          be          fireman          (GEN: genitive)

‘His uncle is a fireman.’

The copula verb can also be used to link a referential subject noun phrase and an adjective, describing that the subject noun phrase possess/demonstrates a specific property (Example 21).

(21) tian1    shi4    lan2 de



A presentative sentence with the existential verb is used to denote the existence of an entity at/in/on a specific location. The location is led by a locative particle, *zai4* (Li & Thompson, 1981). Such presentative sentence may be produced in two word orders (Examples 23 & 24):

A: [(*zai4* 'at/in/on')] [Location] [Existential verb: *you4*] [Introduced noun phrase]

(23) (*zai4*)      *he2zhili3*      *you4*      *yi1ge4wan2ju4*

(In)      box(inside)      exist      one CL toy      'There is a toy in the box.'

B: [Existential verb: *you4*] [Introduced noun phrase] [*zai4* 'at/in/on'] [Location]

(24) *you4*      *yi1ge4wan2ju4*      *zai4*      *he2zhili3*

Exist      one CL toy      in      box(inside)      'There is a toy in the box.'

It is noteworthy that the locative particle (i.e., *zai4*) in Pattern A is optional. Sometimes, a presentative sentence in Pattern A without the locative particle sounds more natural in daily conversation. However, the locative particle in Pattern B is obligatory. Furthermore, the pragmatic difference between Patterns A and B is that the location, when occurring in the sentence-initial position, functions as a topic. Thus, this location must be definite, and its existence (or referent) must have already been added to the discourse context before such a presentative sentence is produced (Li & Thompson, 1981).

In Mandarin Chinese, it is also possible to denote the existence of an entity with the

copula verb, *shi4*. However, only the existential verb in Pattern A can possibly be replaced by the copula verb (Example 25); replacement in Pattern B is rare.

(23) (zai4)      he2zhili3      you4      yi1ge4wan2ju4

(In)      box(inside)      exist      one CL toy      ‘There is a toy in the box.’

(25) (zai4)      he2zhili3      shi4      yi1ge4wan2ju4

(In)      box(inside)      be      one CL toy      ‘What’s in the box is a toy.’

The pragmatic difference between Sentences (23) and (25) can be best illustrated by comparing their respective question counterparts (Sentences 26 & 27).

(26) he2zhili3      you4      she2me?

box(inside)      exist      what      ‘What is there in the box?’

(27) he2zhili3      shi4      she2me?

box(inside)      be      what      ‘What is it that is in the box?’

When a person asks a question with *you4* (Sentence 26), s/he is not sure whether there is something in the box. However, when a question with *shi4* (Sentence 27) is produced, the speaker assumes that something is in the box and s/he intends to know what it is (Li & Thompson, 1981; Liu, Pan, & Gu, 1996).

***Multiple-verb utterances.*** All the above word orders/constructions are produced with only one verb in an utterance. Do Mandarin-speaking mothers and children produce



utterances containing two or more verbs? To discover whether and how multiple-verb utterances appear in both mothers' and children's speech, this dissertation also examines occurrences of multiple-verb utterances.

The multiple-verb utterances that are examined in this dissertation are so-called serial verb constructions, which refer to a sequence of verb phrases or clauses that are juxtaposed in a sentence but whose relationship is not indicated with any marker of syntactic dependency (Li & Thompson, 1981; Aikhenvald & Dixon, 2006). In this dissertation, the term 'multiple-verb utterances' instead of serial verb construction is used in contrast to the one-verb utterances presented above. Although composed of more than one verb phrase/clause, multiple-verb utterances describe what is conceptually considered a single event or process. Four examples are given as follows.

(28) xiao3hai2 mei3tian1 chang4ge1 you2xi4 (SV1V2)

Kids everyday sing play

'The kids sing and play everyday.'

(29) ta1 jiao4 wo3 ming2tian1 lai2 (SV1NV2, N: noun phrase)

He ask me tomorrow come

'He asked me to come tomorrow.'

(30) wo3 yi3wei2 ni3 mai3 le zhe4ben3shu (S1V1S2V2O)

I think you buy PFV this CL book

‘I thought you bought this book.’

(31) ni3 chang4 yi4shou3ge1 gei3 ma1ma1 ting1 (S1V1O1forNV2)

You sing one CL song for mother hear

‘You sing a song for Mama to hear.’

It is noteworthy that in some situations, a multiple-verb utterance can be produced partially or fully in non-SVO word orders or constructions to meet communicative needs.

Examples of such utterances are provided as follows (Sentences 32-34).

(32) ni3 xiang3 ge4 ban4fa3 ba3 men2 da3kai1 (S1V1O1BaOV2)

You think CL method Ba door open

‘You come up with a method to open (the) door.’

(33) ni3 cai1 zhe4 shi4 she2me (SV1+Copular sentence)

You guess this is what

‘You guess what this is.’

(34) yi3zi ban1lai2 fang4zhe4li3 (OV1V2)

Chair move come put here

‘Move (the) chair over and put it here.’

***Theories about the Role of Input and Acquisition of Word Order***

Language development cannot occur without input. Acquiring basic word order is no exception. To acquire the basic word order of a language, children learning that language have to detect from input the prevailing word order used in that language community. Their knowledge of word order can be observed in their growing linguistic ability. After their first birthday, young children are typically at the one-word stage of production over the course of their language development. Then they move from the one-word stage to two-/multi-word stage when starting to combine words together in a single utterance. The systematic patterns shown in children's utterances suggest that they attend to and begin to master the basic principles of grammar in their native language (Radford, 1990). Although systematic patterns can be observed in children's production, the role of input in the acquisition of word order has been the topic of considerable theoretical debate among language researchers. Two families of theories have been proposed to explain this relationship: generativist and constructivist accounts. Although both accounts recognize the importance of linguistic input to the acquisition of word order (Atkinson, 1987), the constructivist accounts place more emphasis on the linguistic input that children receive in their acquisition of word order compared to the generativist accounts.

The generativist accounts claim that language is a system of marvelous complexity. Because of the abstractness and complexity of the system, children who had no idea where to

start would have an infinite number of possible rules to consider and no way of knowing which is the correct one even if they were given a set of input data. To solve this problem, the generativist accounts argue that the grammars of all languages share a series of universal principles, which include (1) abstract elements such as categories of Noun, Verb, Subject, and Object, and (2) basic rules for organizing these elements into phrases and sentences. These invariant principles across languages will not have to be learned by children because children are born with an innate knowledge of these universal principles (Chomsky, 1995; Radford, 1990; Yang, 2004). Therefore, from the generativist viewpoint, input plays a minor role in the language acquisition process and is considered an inadequate database from which to induce language structure.

In addition to universal principles, the generativist accounts also assume that there is some variation that leads grammars to vary from one language from another. Such variation is language-specific aspects of structure, which are specified by a set of parameters. Each parameter may offer a choice of two “settings” and children’s task is to identify from the input which setting reflects the structure of language they are learning (Snyder, 2007; Sakas & Fodor, 2012). For example, one word order-related parameter is the “head-direction” parameter, which concerns whether a *head* (e.g., the verb in a verb phrase) appears before or after its complement(s). The possible settings for this parameter include (1) *head-initial*:

languages like English typically put a head verb (e.g., ‘give’) before its complement(s) (e.g., ‘*give* the ball to Mommy’), leading to VO order, and (2) *head-final*: languages like Japanese normally put a head verb (e.g., ‘*kakimasu*’/write) after its complement(s) (e.g., ‘John-ni tegami-o *kakimasu*’/literally ‘John-to letter *write*’), leading to OV order. From the generativist viewpoint, the role of the input is simply a “trigger” for parameter setting, helping children find the head direction in their native language (Hyams, 1986; Roeper & Williams, 1987; Gibson & Wexler, 1994; Yang, 2012). Therefore they will know whether they are learning a ‘head-initial’ or ‘head-final’ language, and using VO or OV order in language learning. Following the generativist accounts, the acquisition of basic word order can be accomplished quite early on the basis of relatively little input (Pinker, 1994).

In contrast to the generativist accounts, the constructivist accounts consider language an inventory of constructions, each of which is paired with a particular meaning. For example, the transitive Subject Verb Object construction is represented in the form of Noun1 Verb Noun2, which denotes that Noun1 acts upon Noun2, causing Noun2 to be affected in some way (Croft & Cruse, 2004). Unlike the generativist assumption of constructions governed by abstract rules, the constructivist accounts allow constructions to be formulated at different levels of abstraction. An utterance ‘Noun1 Verb Noun2’ can be formed by several possibilities from abstract to concrete: (1) by the wholly abstract rule: the Subject-Verb- Object

construction; (2) by forming it as an item-based construction, in which at least one component of the construction is a specific lexical item, e.g., [pusher]-[the verb PUSH]-[pushee]; and (3) by memorizing it as a frozen phrase, e.g., “*John pushed Mary*” (Croft & Cruse, 2004). From the constructivist perspective, the structure of language is less abstract and thus, language is more accessible through the input. With these assumptions, input per se plays a major role in the language acquisition process.

Unlike the generativist emphasis on innate linguistic structure, the constructivist accounts argue that children do not bring any innate constraints to their language acquisition. They do not possess the fully abstract categories when they are born. Instead, children induce language structure from their input and acquire the structure gradually from a concrete to abstract level (MacWhinney, 2004). They begin with concrete pieces of language (e.g., words, fixed constructions) and acquire language on an item-specific basis (e.g., Braine, 1963; Lieven, Pine, & Baldwin, 1997; Tomasello, 2003). For example, when hearing an utterance such as “*John pushes Mary*”, children may not initially form a representation such as the Subject-Verb-Object combination. Instead, they form a verb-centered construction such as [pusher]-[the verb PUSH]-[pushee]. Similarly, when an utterance “*David kisses Sue*” is heard, the verb-centered construction for the verb ‘kiss’ is formed as [kisser]-[the verb KISS]-[kissee]. After having acquired an inventory of item-based constructions, children

arrive at a fully abstract construction (i.e., the Subject Verb Object construction) by analogizing these item-based constructions. Therefore, children's acquisition of an abstract understanding of word order is a slow process of inducing general patterns from the input: how items are represented and the similar distributional patterns of different verbs. The abstract notions of Subject, Object, Agent, and Patient are *gradually* constructed, in a piecemeal fashion, when children compare verbs that have similar meanings and appear in similar sentences (Tomasello, 2003).

The role of input in Mandarin-speaking children's acquisition of word order is examined in this dissertation with a focus on four questions about maternal and child word order uses. These questions are frequency effects, age-related changes, utterance type effects, and verb diversity. The developmental patterns found in the comparison between maternal and child word order uses will be investigated from the perspectives of these two accounts. In what follows, I presented each question and reviewed relevant literature. Predictions based on these two theoretical perspectives are proposed for each question.

### ***The Role of Frequency in Input***

Research on language development has been devoted to identifying properties of input that influence age of acquisition. One of the widely recognized properties is frequency of occurrence, which affects the availability of a given word or form in input to young children.

Frequency effects are considered pervasive in many domains of language development, such as acquisition of single words, inflectional morphology, and syntactic constructions (e.g., Ambridge, Kidd, Rowland, & Theakston, 2015). The relationship between frequency effects and age of acquisition is that, all other things being equal, higher frequency leads to earlier acquisition. Studies on early lexical development reveal that words used more frequently by mothers tend to be found in their children's early vocabulary. Such effects of input frequency have been found in the domains of nouns (Brown, 1958; Goodman, Dale, & Li, 2008), verbs (Naigles & Hoff-Ginsberg, 1998), and adjectives (Blackwell, 2005). Findings based on cross-linguistic studies also provide support for the role of frequency. Young learners of languages (e.g., Mandarin Chinese, Korean) in which verb types are more frequent than noun types in the input appear to learn verbs at least as early as they learn nouns compared to their counterparts learning languages (e.g., English, Italian) in which noun types are more frequent in the input and thus acquired earlier than verb types (Choi & Gopnik, 1995; Tardif, 1996; Tardif, Shatz, & Naigles, 1997).

Taken together, input frequency facilitates early word learning. However, it is worth noting that, the frequency effects shown by the above findings occur within the open class of words (i.e., nouns, verbs, adjectives), but other studies have reported that they could not account for the order of acquisition of the closed class (i.e., prepositions, grammatical



morphemes) (e.g., Brown, 1973; Gleitman & Wanner, 1984; de Villiers, 1985).

Some evidence exists for frequency effects in the acquisition of grammatical forms. For example, the passive in English is a low-frequency grammatical form, which has been observed to be acquired later than the same form that appears with greater frequency in languages such as Inuktitut, Sesotho, and Bahasa Indonesia (Allen & Crago, 1996; Kline & Demuth, 2010; Demuth, Moloi, & Machobane, 2010; Gil, 2006). Similar effects have been reported for the present perfect in American English and Scottish (Gathercole, 1986). Another telling case is the acquisition of auxiliary verbs. Studies with differing methodologies (e.g., input study and experimental research) found that hearing questions including auxiliary inversion (i.e., yes/no questions) more frequently in the input contributes to children's subsequent auxiliary verb uses (Newport, Gleitman, & Gleitman, 1977; Hoff-Ginsberg, 1985; Shatz, Hoff-Ginsberg, & MacIver, 1989). Finally, longitudinal analyses of the relation between input and early syntactic development have found that the frequency of particular grammatical forms in the input is associated to the emergence of those corresponding forms in children (Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). For example, object complements (e.g., "I think *it's over there*.") were used more frequently by caregivers than adjunct clauses (e.g., "Put on a sweater, *before you go outside*."), and correspondingly, object complements were produced by children starting at 22 months, whereas adjunct clauses were

first produced at 26 months.

In sum, the role of frequency in input has been shown in early lexical and syntactic development. Evidence from the foregoing studies supports the constructivist accounts, suggesting the major role of input in language development process. Furthermore, it suggests that young language learners not only pay attention to frequency distributions in the input but also make use of these distributional patterns in the input. However, other aspects of language, such as word order, seem resistant to frequency effects. For example, Turkish relies on case markers to denote thematic relation. With appropriate case markers, Turkish word order can be relatively flexible. Varied word orders, such as SOV, SVO, OVS, OSV, VSO, and VSO were found in Turkish child-directed speech (e.g., Slobin & Bever, 1982). Although SOV order is not always the most frequent in the input, young Turkish learners exploit this order from an early age for extracting thematic relation when case-marking is absent (Candan, Küntay, Yeh, Cheung, Wagner, & Naigles, 2012; Slobin & Bever, 1982). It appears that Turkish learners' reliance on SOV order does not reflect a frequency effect. For a language that has no case-marking system and depends heavily on word order for decoding thematic relation, like Mandarin Chinese, how is frequency in input related to the acquisition of word order in Mandarin learners? As mentioned above, SVO is a high-frequency order compared to all the other non-SVO word orders in Mandarin Chinese (Sun & Givón, 1985; Wei, 1989),

and appears early in Mandarin learners' production (Erbaugh, 1982; Cheng, 1986). These findings support the generativist accounts in that canonical word order in Mandarin is produced frequently from early in the child's life so young Mandarin learners could set the relevant parameters early for the canonical word order in their language. The findings also support the constructivist accounts in that canonical word order in Mandarin is acquired on a frequency-related basis. However, the question still remains unanswered: do frequency effects exist for the acquisition of all the other word orders in Mandarin? Specifically, do Mandarin learners acquire non-SVO word orders and constructions on a frequency-related basis? To answer this question, this dissertation will explore frequency effects through investigation of the full range of word orders used in Mandarin maternal input and child production, and examine the role of input frequency in explaining age of acquisition of different word orders. Following the generativist accounts, non-canonical word orders would appear less frequently and be learned later than the canonical word order. Following the constructivist accounts, variant word orders in maternal speech might appear with different frequencies in response to children's growing linguistic ability. Mandarin learners would acquire these word orders in a piecemeal fashion and on a frequency-related basis. When a given word order is first introduced and how frequently it is used would, by hypothesis, determine when Mandarin learners acquire it.

### *Age-related Changes in Input*

A question that has been asked in the studies on maternal input is whether mothers adapt their speech over the course of child language development. If mothers are sensitive to linguistic advances in their children, then the speech of mothers would be finely tuned to their children's age and/or growing linguistic competence; this is known as the fine-tuning hypothesis (Cross, 1977; Snow, 1989; Sokolov, 1993). To test this hypothesis, many studies have been devoted to investigating whether age-related adjustments occurred in different aspects of maternal input, such as acoustic-phonetic features (e.g., Soderstrom, Blossom, Foygel, & Morgan, 2008; Liu, Tsao, & Kuhl, 2009), prosodic features (e.g., Stern, Spieker, Barnett, & MacKain, 1983; Kitamura & Burnham, 2003; Ko, 2012), discourse features (e.g., Cross, 1977; Sokolov, 1993), and syntactic features (e.g., Snow, 1972; Phillips, 1973; Newport et al., 1977). However, these studies have yielded mixed results. For example, among studies on syntactic complexity shown in maternal speech, Snow (1972) found that mothers produced longer mean length of utterances (MLU), more compound verbs and more subordinate clauses in their speech to ten-year-olds than to two-year-olds. Phillips (1973) found that significant differences in maternal MLU between speech to 18- and 28-month-olds. Longhurst and Stephanich (1975) reported similar findings when comparing speech to 1-, 2-, and 3-year-olds. In contrast, non-adjustment of maternal MLU to child MLU has been

reported in Snow (1977) for a sample of children aged 3 to 18 months and in Nelson, Bonvillian, Denninger, Kaplan, and Baker (1984) with a sample of children between 22 and 27 months of age.

This inconsistency among studies raised two issues about how to test the fine-tuning hypothesis: the linguistic phenomena (i.e., what aspect of maternal speech provides the best place to explore the fine-tuning hypothesis) and the ages of the children being studied (i.e., what age range/interval is appropriate for testing the fine-tuning hypothesis) (Sokolov, 1993). As for the issue of child age, Snow, Perlmann, and Nathan (1987) pointed out that, studies comparing children with relatively large age differences provided evidence for “gross-tuned”, rather than fine-tuned adaption. Thus, for a more conservative test of the fine-tuning hypothesis, the focus should be on correlations between mothers’ and children’s speech during much shorter spans of development. Taking a further step, Ko (2012) has recently invoked the importance of major linguistic milestones over the course of language development. Based on the idea that mothers may not feel the need to adapt their speech until the child appears to understand speech or begins to produce utterances, Ko (2012) proposes that a better test of fine-tuned adaption should go beyond a mere correlation between maternal and child speech (e.g., Newport et al., 1977; Nelson et al., 1984; Sokolov, 1993), and instead focus on looking for relevant adjustment of maternal speech that occurs around the time the child begins to

respond to maternal speech distinctively, i.e., around the time the child begins to speak or when she begins to combine words. By covering an extensive child age range from preverbal to multi-word stage, Ko (2012) looked for developmental changes in maternal speaking rate and abrupt changes that were related to children's linguistic milestones. Her results indicate a nonlinear developmental pattern in maternal speaking rate over the course of language development. Before children began to speak, no uniform linear trend in maternal speaking rates was found. Around the onset of child speech production, maternal speaking rate rapidly increased until a certain point around the age two. After this breakpoint, mothers did not show a consistent pattern in the direction of the change in their speaking rate. Ko's study on maternal speaking rate illustrates the importance of covering an extensive period during which children reach major linguistic milestones to detect developmental changes.

Although a variety of features of maternal input have been examined for possible age-related changes, no study has yet explored age-related changes in word order uses in maternal input to Mandarin learners. Thus, this dissertation addresses whether Mandarin-speaking mothers adapt their word order uses to their developing children, given the many different word orders available in their language. When considering the age range during which child speech develops from producing one word to forming word orders, this dissertation incorporates the importance of major linguistic milestones highlighted in Ko

(2012), i.e., including the time when children begin to produce one word until the time they produce multiple words/clauses. Because the generativist accounts do not assume age-related changes, my prediction follows the constructivist accounts: Mandarin-speaking mothers would adapt their word order usage to meet the changing communicative competence of their developing children. That is, verb-alone fragments and utterances produced in word orders involving one argument (i.e., SV, VO, and OV) will appear more frequently in speech to younger children while utterances produced in word orders involving two arguments (e.g., SVO, SOV, OSV, SBaOV, and OBeiSV), copula utterances, and multiple-verb utterances will appear more frequently in speech to older children.

### ***Utterance Types and Verb Diversity within Different Word Orders***

In addition to frequency effects and age-related changes, this dissertation also examines whether utterance types and verb diversity within different word orders are related to early word order acquisition. In English, word order for questions may not always be the same as that for declaratives (e.g., wh-questions). Thus, categorization of utterance types in English is likely to distinguish the word orders used. However, this distinction does not exist in Mandarin because questions and declaratives share identical word orders. Previous studies on Mandarin input (e.g., Li, 1991; Tardif, 1993) found that Mandarin-speaking mothers produced different proportions of utterance types when talking to their children. Li (1991) reported that

more questions were produced than declaratives and imperatives. With mothers' educational level considered, Tardif (1993) found that more declaratives appeared in the speech of mothers with higher educational level (i.e., college or above) whereas more imperatives were produced by mothers with lower educational level (i.e., high school or below). None of these studies, however, examined the distribution of utterance types with different word orders; that is, whether mothers tended to use different word orders for different utterance types. What is more important, if mothers use different word orders for different utterance types, does acquisition of different word orders reflect this tendency? For example, if children produce declaratives earlier than questions, are the word orders used in maternal declaratives acquired earlier than those in maternal questions? By addressing these issues, this dissertation will extend the traditional utterance type distribution to the level of word order. Because the generativist accounts do not assume utterance type effects on word order acquisition, my prediction follows the constructivist accounts: children's word order uses reflect utterance type effects; that is, mothers tend to use different word orders for different utterance types, and this tendency would be found in children's word order production.

To examine the influence of input on language development, frequency effects have been considered an important role. In addition to frequency effects, previous studies have found that diversity-related effects may also play a role (e.g., Naigles & Hoff-Ginsberg, 1998;



Huttenlocher et al., 2010). The assumption on which diversity-related effects work is that, by providing a more complete sample of particular words or constructions in a fixed length passage, greater diversity in input should lead to greater growth in child language. For example, the greater number of different elements (i.e., words or phrases) used within a clause in input was found to predict diverse elements in subsequent child clauses (Huttenlocher et al., 2010). The diversity of syntactic frames in which verbs are used in input has been shown to predict token frequency and syntactic diversity in subsequent child verb use (Naigles & Hoff-Ginsberg, 1998). These findings lead to the prediction that hearing a verb in a variety of syntactic frames would contribute to verb learning; thus, this dissertation is particularly interested in whether hearing a word order containing with a variety of verb classes (e.g., motion, communication, emotion, etc.) would help Mandarin learners abstract the frame itself and enable them acquire it earlier. The reason to emphasize verb classes rather than verb types is that, grammatically speaking, verbs in the same class may behave similarly, whereas verbs with different semantics may behave differently (Naigles & Hoff-Ginsberg, 1995; Lee & Naigles, 2005). For example, motion verbs (e.g., jump, push) tend to co-occur with a prepositional phrase whereas internal state verbs (e.g., think, know) tend to appear in embedded sentences. Focusing on verb classes appearing in a word order will highlight the syntactic diversity shown in that word order. Thus far, however, there has been little effort

made to explore the relation of verb diversity to word order acquisition of Mandarin learners.

This dissertation aims to investigate whether this diversity effect could apply to learning a word order. Both generativist and constructivist accounts assume that verb diversity would help word order acquisition; that is, word orders with greater verb diversity tend to be acquired earlier. Thus, my prediction is that word orders that co-occur with more different verb classes in the input will be acquired earlier than those with fewer verb classes.

### ***Studies on Mandarin Input***

Thus far, only a few studies of Mandarin input have investigated variations in word order production. Erbaugh (1982) conducted the first frequency analysis of word order uses in Mandarin maternal input to explore the role of input. She collected two Mandarin-speaking mothers' speech monthly when their children were 21-35 months old, and 34-46 months old, respectively, and examined the frequencies of different word order uses. Although Erbaugh (1982) established a comprehensive inventory for coding all utterances that were produced in a variety of word orders and constructions, her results did not provide a frequency distribution of all the different word orders and constructions. Instead, her main findings were concerned with the following four indicators: (1) percentage of utterances that could be coded for word order (i.e., orderable utterances in Erbaugh's terms), (2) percentage of non-SVO utterances (i.e., the Ba and Bei constructions, OV, OSV, and SOV), (3) number of Ba utterances, and (4)

percentage of Ba utterances out of utterances in non-SVO word orders.

The speech data of these two Mandarin-speaking mothers showed that age-related changes were not evenly distributed across word orders. The percentages of mothers' orderable utterances (mean: 55% for both mothers) remained constant over time. That is, the frequency of orderable utterances produced by mothers did not change with time and children's developing linguistic competence. While the percentage of non-SVO utterances increased with time much more for the younger child (21-35 months; mean: 7.52%) than for the older (34-46 months; mean: 8.40%), no correlation was found when comparing percentages of non-SVO utterances in maternal and child speech. Looking specifically at the Ba construction, Erbaugh (1982) observed that the percentage of Ba utterances out of non-SVO utterances remained constant in the speech for the younger child (mean: 21.08%) but increased for the older (mean: 28.70%). However, there was a significant correlation between maternal and child Ba production ( $r = 0.32$  and  $0.37$ ,  $ps < 0.05$ ).

Partly relevant to maternal word order uses, Lee and Naigles (2005) examined variations in the types of postverbal elements that appeared in Mandarin maternal speech to 22-26 month olds (MacWhinney, 2000; Tardif, 1993 & 1996). They found that SVO was the most frequent word order. As for non-SVO word orders, both the Ba construction (SBaOV) and Bei construction (OBeiSV) were used with quite low frequency ( $< 1\%$ ). Moreover, direct object

ellipsis was pervasive, occurring in up to 60% of transitive utterances in the mothers' speech.

A recent study by Li and Cheung (2010) examined word order variations in speech to Mandarin learners under age 2 (1;5-1;10). Using three dyads' speech data drawn from the NTU Adult-Child conversation database (Cheung, 1998), they analyzed variations in word order in simple declarative sentences; other types of constructions, such as negations, questions, copular utterances, and multiple-verb utterances were excluded from their analysis. They found, indeed, a variety of word orders in Mandarin input: about 42% of the utterances appeared with one noun phrase (NP) (i.e., SVt, SVi, VO, OV, VS) (t: transitive; i: intransitive), while 21% of the utterances appeared with two NPs (i.e., SVO, SOV, OSV). When a verb co-occurred with two NPs, SVO was the most frequent word order used (See also Lee & Naigles, 2005). However, other word orders (e.g., SOV, OSV, OV, VS), although low in frequency and occurring earlier than Erbaugh's observations (1982), were attested in the input.

In sum, there are two gaps in the literature on Mandarin input. First, none of the above studies have reported a comprehensive frequency distribution of maternal word order uses. Erbaugh (1982) established a variety of word order categories to code all qualified utterances but failed to report the frequencies of all different word orders and constructions. Moreover, her findings were limited to only four indicators; how those unreported word orders are

produced still remains unknown. Thus, the role of frequency in early word order acquisition has not yet been fully explored. Lee and Naigles (2005) focused on the postverbal elements and did not examine all possible word order variations in detail. Although their study yielded some word order-related findings, complete word order uses in maternal speech were still not obtained. Li and Cheung's (2010) analysis only included simple declarative sentences, excluding questions, copular utterances, and multiple-verb utterances. Thus, their distribution of word orders is not definitive. Because questions, copular utterances, and multiple-verb utterances might make up in total a relatively large proportion of maternal speech to young children (e.g., about 50% in English maternal input, Cameron-Faulkner et al., 2003), it is plausible to suppose that leaving unexplored word orders in those utterances may result in an incomplete understanding of maternal word order uses. To demonstrate the full range of word order uses in Mandarin input, all different types of utterances need to be included for analyses.

The second gap is concerned with age-related changes. Erbaugh's study (1982) examined maternal input to children aged 21-46 months but failed to include maternal speech produced during earlier stages (i.e., preverbal and/or one-word stages), which may pave the way for subsequent word order acquisition (i.e., two-word and multi-word stages). Typically, children begin to learn languages from input long before their production occurs; thus, the input given

to them before and/or around the onset of their speech production should be considered for age-related changes in maternal word order uses, as mentioned above (Ko, 2012).

Furthermore, Lee and Naigles' (2005) corpus was analyzed at only one developmental point while Li and Cheung's (2010) analysis was based on data collapsed across three time points within only three months. Thus, both studies failed to include data across *substantial* periods of time, which is essential in detecting a complete developmental trajectory. To bridge these gaps, this dissertation intend to include the full range of word order uses in Mandarin-speaking mothers' and children's speech and analyze their word orders for age-related changes as children develop from one-word stage to multi-word/clause stage.

### ***Prospectus***

This dissertation examines the role of maternal input in Mandarin word order acquisition. By analyzing all different word orders produced in both maternal input and child speech during the one-word to multi-word stages, this dissertation documents the full range of word order uses in early maternal and child speech, and aims to examine four issues: frequency effects, age-related changes, utterance types, and verb diversity within word orders. The issue of frequency effects concerns whether input frequency influences child word order uses and the order of acquisition of different word orders. The issue of age-related changes concerns whether maternal adjustment of word order uses occurs as function of the child's age and/or

growing linguistic competency, helping to explain the developmental pattern in Mandarin learners' acquisition of word order. The third issue concerns whether mothers use different word orders for different utterance types. The fourth issue concerns whether verb diversity within mothers' word order uses accounts for child word order uses and the order of acquisition of different word orders.

At the heart of this dissertation is the analyses of maternal and child word order uses regarding the four foregoing issues. The same measures are used to analyze both mothers' and children's word order uses, and examine the relation between these two.

### ***Speech Data Used in the Current Study***

The data for this study come from CHILDES (MacWhinney, 2000). The Mandarin corpora in CHILDES consist of three contributors: Tardif, 1993 and 1996; Chang, 1998; Zhou, 2001. Tardif (1993 & 1996) collected longitudinal data on mothers' and children's speech during children's ages 2;0-2;6. Chang (1998) collected cross-sectional data on children's speech between ages four and six. Zhou (2001) collected cross-sectional speech data from mother-child dyads in four groups, based on the age of the child: 14, 20, 26, and 32 months old. After these three sets of data were carefully reviewed, Zhou's data (2001) were selected because her data examined the age range of 14 months through 32 months, a developmental time span during which young children go from one-word stage to multi-clause stage (c.f.,

Brown, 1973; Hoff, 2001). Thus, Zhou's data are more appropriate than Tardif's and Chang's to reveal the changes that this current study aims to investigate during this developmental time span.

As for sample size, power analyses based on previous studies on Mandarin Chinese maternal input (e.g., Tardif, 1993; Tardif et al., 1997; Zhou, 2001) indicate that an  $n$  of 10 per condition (i.e., age group) is needed for medium to large effect sizes. Thus, there is a sample size of 10 for each age group.

## **Method**

### ***Participants***

The participants included 40 Mandarin Chinese-speaking mother-child dyads selected from the CHILDES Mandarin corpus (MacWhinney, 2000; Zhou, 2001). All participants were native Mandarin speakers living in Nanjing, China. The children were from one of four age groups: 14-, 20-, 26-, and 32-month-olds. Within each group, the age difference was not more than one month and the numbers of girls and boys were equal. None of the children showed a hearing impairment or developmental delay. Due to China's one-child policy, all the children were the first born and only child in their families. Most children had mothers whose education was at the college level. All the mothers belonged to the middle class, working as government officers, editors, teachers, accountants, etc.



### ***Procedure***

The mother-child conversation and interactions were video-recorded in each child's day care classroom. After the warm up period, the mother and her child began semi-structured play, in which they played and talked using the contents of four boxes. The four boxes respectively contained (1) a ball, (2) a popular toy, (3) paper and crayons, and (4) a picture book with stories in Mandarin. The mothers were free to spend whatever amount of time on each box but they could open only one box open at a time; all explored all four boxes in about 20 minutes.

### ***Transcription***

The transcripts were obtained from the CHILDES Mandarin corpus (MacWhinney, 2000; Zhou, 2001). Both mothers' and children's speech were used for data analysis. Coding was restricted to utterances appearing in their spontaneous speech. Therefore, all those utterances appearing in memorized or routine phrases, such as social routines (e.g., *thank you*, *bye-bye*), songs, poems, nursery rhymes, and story narratives were excluded from coding. Utterances that were immediate repetitions of the other interlocutor's utterances were also excluded. All utterances that fit the above criteria and included one or more verbs were manually parsed and coded.

### ***Parsing***

Both the mothers' and children's qualified utterances were parsed and coded by the author for (1) word order, (2) utterance type, and (3) verb type used in the utterances.

**Units.** The purpose of the parsing was to capture the different types of word order frames that were produced in both mothers' and children's speech. To investigate the variety of word order use in Mandarin Chinese, I restricted the units to grammatical ones such as Subject (S), Object (O), Verb (V), instead of semantic ones such as agent, action, and recipient. The details of word order categories were listed below. Utterances containing one verb are presented first and followed by utterances containing two or more verbs.

**Word order categorization.** Utterances containing one verb can be classified into five categories: (1) Verb alone, (2) Canonical word orders, (3) Non-canonical word orders, (4) Copula utterances, and (5) Topicalized utterances. The reason to include 'verb alone' as a category is to examine whether there is any age-related changes in the course of word order acquisition as children develop from the one-word to multi-word stages.

**One-verb utterances.** The Verb-alone category included utterances that had verbs only and did not have Subjects or Objects. There were three subcategories: Vi (intransitive verbs), Vt (transitive verbs), and Va (adjectival verbs). Intransitive verbs are those that can only appear with Subjects and do not take any direct objects. Transitive verbs are those that can appear with Subjects and a Direct Object. Both Subjects and Objects, under some

circumstances, can be omitted because Mandarin Chinese allows ellipsis of the noun arguments in an utterance. Thus, intransitive verbs can appear alone while transitive verbs can appear either with Subjects only or with Objects only, or appear alone. Adjectival verbs are equivalent to English adjectives in meaning, but they can function as full verbs in Mandarin Chinese. Unlike English adjectives, which are preceded by a copula, adjectival verbs in Mandarin Chinese can appear right after Subjects (Ross & Ma, 2006). The category of Va was established when the Subject was omitted.

(35) zuo4 xia4 (Vi)

Sit down

‘Sit down.’

(36) na2 hao3 (Vt)

Take well

‘Take (it) well.’

(37) Jen1 piao4liang4 (Va)

Very pretty

‘(Someone/something is) very pretty.’

The Canonical word order category included utterances that appeared in the SVO frame.

There were two subcategories: SV and SVO. The SV frame consisted of SVi, SVt, and SVa.

The SVO frame consisted of SVtO and VtO.

(38) ni3 zuo4 (SVi)

You sit

‘You sit (down).’

(39) wo3 kai1 (SVt)

I open

‘I open (it).’

(40) bao3bao1 kwai1 (SVa)

Baby good

‘Baby (is) good.’

(41) xiao3 tu4tu4 pai1 pi2qui2 (SVtO)

Little bunny bounce ball

‘Little bunny bounces (the) ball.’

(42) kan4 xiao3go3 (VtO)

See doggy

‘(I/you) saw (the) doggy.’

The Non-canonical word order category included utterances that had preverbal objects, i.e., the object preceded the verb. This category had four subcategories: *SBaOV* (*Ba*

construction), OV, OSV, SOV, and *OBeiSV*.

(43) ni1 ba3 chi4che1 bai3 zhe4li3 (SBaOV)

You Ba car put here

‘You put (the) car here.’

(44) chi4che1 bai3 zhe4li3 (OV)

Car put here

‘Put (the) car here.’

(45) zhe4ge4 wo3 hui4 hua4 (OSV)

This I can draw

‘I can draw this.’

(46) wo3 gong1ke4 zhuo4 wan2 le (SOV)

I homework do finish PFV

‘I finished (my) homework.’

(47) qiu2 bei4 wo3 diu1 diao4 le (OBeiSV)

Ball Bei I throw away PFV

‘The ball was thrown away by me.’

Copular utterances included copula sentences involving a copula (*shi4*, ‘*to be*’) and presentative sentences that did not use a copula but needed one when translated into English.

The reason to make copula utterances an independent category is that these utterances always use the same small set of verbs (shi4, ‘to be’, zai4, ‘to be/exist’, you3, ‘to exist; there be’).

As mentioned above, adjectival verbs can stand alone like full verbs. However, they can also function as pure adjectives when one places the particle ‘de’ after an adjective. In such situation, a copula is needed between Subject and Adjective (See Example 49)

(48) zhe4 shi4 she2me yen2se4? (SPnom: Subject + copula + Nominal predicate)

This be what color

‘What color is this?’

(49) hua1 shi4 hong2 de (SPadj: Subject + copula + Adjectival predicate)

Flower be red

‘(The) flower is red.’

(50) er3duo3 zai4 na3li3? (SzaiLoc: Subject + zai4 + Loc)

Ears be where

‘Where (are) (the) ears?’

(51) zhe4 he2zi li3 shi4 she2me3? (LocBeNP: Loc + shi4 + Noun Phrase)

This box inside be what

‘What is inside this box?’

(52) zhe4 he2zi li3 you3 she2me? (LocYouNP: Loc + you3 + Noun Phrase)

This box inside exist/there be what

‘What is there in this box?’

To reflect the linguistic property “topic-comment” in Mandarin Chinese discourse, I added the category of topicalized utterances to include those with a topic in the sentence-initial position, in addition to the presence of Subject and/or Object in the same utterance. In most Mandarin sentences, Topic and Subject/Object can be identical. However, they can also be entirely independent from each other and have different referents (Li & Thompson, 1981). This category allows me to examine how often a topic (not overlapping with Subject/Object) can appear with different word orders in both mothers’ and children’s speech. Examples of topicalized utterances are given below:

(53) xiao3 tu4zi er3duo3 chang2 (TSVa)

Little rabbit ear long

‘Little rabbit has long ears.’

(54) xiao3 huo3ch1 hai2 cha1 yi1ge4 (TVO)

Small train still lack one piece

‘As for small trains, (I/you) still lack one of them.’

***Multiple-verb utterances.*** Utterances containing two or more verbs were classified according to their sentence structure. Six categories were needed to code all the multiple-verb

utterances found in the current speech data (See Li & Thompson, 1981, for detailed categories). Frame details and examples are as follows.

- (a) The S V<sub>1</sub> (O) V<sub>2</sub> (O) frame refers to utterances that include the juxtaposition of two or more verb phrases/clauses to describe two or more separate actions.

(55) wo<sub>3</sub>men lai<sub>2</sub> kan<sub>4</sub> zh<sub>4</sub>ge (SV<sub>1</sub>V<sub>2</sub>O)

We come see this

‘We come to see this.’ (‘Let’s come to see this’).

(56) ni<sub>3</sub> ba<sub>3</sub> zhe<sub>4</sub>ge wan<sub>2</sub>ju<sub>4</sub> na<sub>2</sub>chi<sub>3</sub>lai<sub>2</sub> kan<sub>4</sub>kan<sub>4</sub> (SBaOV<sub>1</sub>V<sub>2</sub>)

You Ba this toy take up look

‘You take this toy up and take a look (at it).’

- (b) The S V<sub>1</sub> V<sub>2</sub> (O) frame refers to utterances in which the second verb phrase/clause functions as the direct object of the first verb. Both verb phrases share the same subject.

(57) ni<sub>3</sub> xiao<sub>3</sub>huan<sub>1</sub> hua<sub>4</sub> she<sub>2</sub>me (SV<sub>1</sub>V<sub>2</sub>O)

You like draw what

‘What do you like to draw?’

(58) qiu<sub>2</sub> yao<sub>4</sub> bu<sub>2</sub> yao<sub>4</sub> awn<sub>2</sub> (OV<sub>1</sub>V<sub>2</sub>)

Ball want not want play



‘Want to play with (the) ball?’

- (c) The S1 V1 (O) S2 V2 (O) frame is similar to embedded sentences in English, in which sentences appear after the first verb. In such utterances, each verb phrase has its own subject.

(59) ma1ma1 kan4 ni3 hua4 she2me (S1V1S2V2O)

Mother look you draw what

‘Mother looks what you draw.’

(60) ni3 kao4su4 ma1ma1 zhe4 shi4 she2me (S1V1O1S2Pnom)

You tell mother this is what

‘You tell Mother what this is.’

(61) ni3 sho1 na3 yi1 ge4 shi4 hong2 de (S1V1O1S2Padj)

You say which one is red

‘You say which one is red.’

(62) ni3 kan4 shu1 zai4 na3ge he2zi li3 (S1V1S2zaiLoc)

You see book be which box inside

‘You see in which box is (the) book?’

(63) ma1ma1 bu4 zi1dao4 zh4 li3mian4 shi4 she2me (S1V1LocBeNP)

Mother not know this inside be what

‘Mother does not know what is inside this (item).’

(64) ni3 cai1 he2zi li3 you3 sh2me (S1V1LocYouNP)

You guess in the box there be what

‘You guess what there is in (the) box?’

(d) The S V1 N V2 (O) frame refers to utterances that contain a noun phrase that is simultaneously the direct object of the first verb and the subject of the second verb.

(65) ma1ma1 jiao1 ni3 hua4 chi4qui2 (SV1NV2O)

Mother teach you draw balloon

‘Mother teaches you to draw balloon(s).’

(66) yao4 ta1 ba3 mao2yi1 chuan1shang4 (V1NBaOV2)

Want him/her Ba sweater wear on

‘Want him/her to put on (his/her) sweater.’

(e) The S V1 (O) P N V2 frame has similar structure to Frame (d). The difference is that the noun phrase here is not the direct object of the first verb; it is a benefactive noun phrase, which is indirectly affected by the action signaled by the first verb. A benefactive noun phrase is marked by the preceding preposition/coverb ‘gei3’, which may be translated as ‘for’ in English.

(67) ma1ma1 chao3 xia1zi gei3 ni3 chi1 (SV1OPNV2)

Mother stir fry shrimp for you eat

‘Mother stirred/fried (the) shrimp for you to eat.’

(f) The sixth category includes utterances that combine any two of the above frames.

(68) ni3 kan4 ma1ma1 jiao1 ni3 tao4 (Frame (c) & (d): S1V1S2V2 NV3)

You watch mother teach you encase

‘You watch mother teach you to encase (it).’

(69) ni3 lai2 fei1 gei3 a1yi2 kan4 (Frame (a) & (d): S1V1V2 NV3)

You come fly for Auntie see

‘You come to show Auntie (your) flying.’

All word orders/frames and example sentences are presented in Table 1.

Table 1

*Word Orders and Example Sentences*

Word order	Pinyin	Translation
Verb Alone		
Vi	Zuo4 xia4	Sit down
Vt	Na2 hao3	Take (it) well
Va	Jen1 piao4liang4	Very pretty
SV		
SVi	Ni3 zuo4	You sit (down)
SVt	Wo3 kai1	I open (it)
SVa	Bao3bao1 kai1	Baby (is) good
SVO		
SVtO	Xiao3 tu4tu4 pai1 pi2qui2	Little bunny bounces (the) ball
VtO	Kan4 xi ao3go3	See (the) doggy

Table 1 (cont.)

*Word Orders and Example Sentences*

Word order	Pinyin	Translation
Non-Canonical		
Ba	Ni1 ba3 chi4che1 bai3 zhe4li3	You put (the) car here
OV	Chi4che1 bai3 zhe4li3	Put (the) car here
OSV	Zhe4ge4 wo3 hui4 hua4	I can draw this
SOV	Wo3 gong1ke4 zhao4 wan2 le	I finished (my) homework

Table 1 (cont.)

*Word Orders and Example Sentences*

Word order	Pinyin	Translation
Copula utterances		
SPnom	Zhe4 shi4 she2me yen2se4?	What color is this?
SPadj	Hua1 shi4 hong2 de	(The) flower is red
SzaiLoc	Er3duo3 zai4 na3li3?	Where (are the) ears?
LocBeNP	Zhe4 he2zi li3 shi4 she2me?	What is inside this box?
LocYouNP	Zhe4 he2zi li3 you3 she2me?	What is there in this box?
Multiple-verb utterances		
SV1(O)V2(O)	Wo3men lai2 kan4 zhe4he	We come to see this
SV1V2(O)	Ni3 xiao3huan1 hua4 she2me	What do you like to draw?
S1V1(O)S2V2(O)Ma1ma1	kan4 ni3 hua4 she2me	Mothers looks what you draw
SV1NV2(O)	Wo3 jiao1 ni3 hua4 chi4qui2	I teaches you to draw balloon(s)
SV1(O)PNV2	Wo3 chao3 xia1zi gei3 ni3 chi1	I stir (the) shrimp for you to eat

**Utterance types.** All qualified utterances were coded for utterance type: (a) Declarative, (b) Imperative, (c) Question. Examples are given as follows.

(70) xiao3xiong2 kou3ke3 le (Declarative)

Little bear thirsty CRS

‘Little bear is thirsty.’

(71) xian1 wan2 zhe4ge4 (Imperative)

First play this

‘Play (with) this first.’

(72) zhe4ge4 shi4 shen2me (Question)

This is what

‘What is this?’

**Verb Type.** To investigate whether distinct classes of verbs occur in a specific frame, this dissertation also examined the diversity of verb classes in different word orders. Because syntactic categorization is represented in the word order categories, this part focuses on semantic categorization. These analyses only examined word orders that involved intransitive (i.e., Vi, SVi) and transitive verbs (i.e., Vt, SVt, SVtO, VtO, BaOV, OV, and OSV; SOV and OBeiSV were excluded from verb type analyses due to rare occurrences). The Va and SVa frames were not included in this coding because both Va and SVa utterances used adjectival

verbs, which, though they may function like intransitive and transitive verbs, their meaning is to describe the quality and/or property of person/entity/event, and they do not appear in other frames. Copula utterances were also excluded because the verbs that can be used in Copula utterances are fixed.

After the verbs were extracted from all qualified utterances, the next step was to divide these verbs into semantic classes. To discover semantic classes, the recent literature on linguistic and psycholinguistic classifications of Mandarin verbs was reviewed (See Li & Thompson, 1981; Chu, 2010; Li and Tsao, 2009; Ross & Ma, 2006; Her, 2008; Tang, 1979; Liu et al., 1996; Tardif, 1996 & 2006; Lee & Naigles, 2005). From the perspective of lexical semantics, researchers have agreed about the traditional distinction of action vs. state verbs. Action verbs describe actions/events (e.g., pao3, ‘run’; chi1 ‘eat’) while state verbs describe situations or physical/psychological states that do not involve action (e.g., ai4, ‘love’; dong3, ‘understand’). To distinguish semantic differences among verbs, these two categories should be further subcategorized into a variety of semantic classes. However, there has been no agreement on how these two categories are subcategorized. My review suggested that Li and Thompson (1981) have provided a relatively detailed inventory of semantic classes of Mandarin verbs, which can account for most of the verbs in my data. I also adopted a few categories from other researchers to classify verbs that did not easily fit into Li and



Thompson's classification: (a) verbs of Body care, Manipulation, Motion, and Change of possession (Levin, 1993), (b) verbs of Communication and Social interaction (Chiang, 2006; Chiang, 2011; Lai, 2011), (c) Light verbs (Tardif, 1996 & 2006; Lee & Naigles, 2005), (d) Relation verbs (Ross & Ma, 2006; Liu et al., 1996). Thus, all intransitive and transitive verbs were classified into the following categories: Eight classes of Action verbs: (1) verbs of Body care, (2) verbs of Communication, (3) verbs of Manipulation, (4) verbs of Motion, (5) verbs of Posture, (6) verbs of Change of possession, (7) verbs of Social interaction, (8) Light verbs. Seven classes of State verbs: (1) verbs of Cognition, (2) verbs of Desire, (3) verbs of Emotion, (4) verbs of Experience, (5) verbs of Perception, (6) verb of Possession, (7) Relation verbs. Examples of each semantic category are presented in Table 2. A total of 226 verb types were used by mothers and 102 by children. Most of children's verb types were also used by mothers and only five were not.

Table 2 *Examples of Each Semantic Category*

Semantic category	Examples
Body Care (11, 10)	chi1 ‘eat’, chuan1 ‘wear’, dai4 ‘wear’
Communication (13, 6)	shuo1 ‘say’, gao4su4 ‘tell’, wen4 ‘ask’
Manipulation (59, 22)	wan2 ‘play’, xiu1 ‘repair’, jia2 ‘pinch’
Motion (64, 30)	pa2 ‘crawl’, pao3 ‘run’, reng1 ‘throw’, tui1 ‘push’
Posture (8, 5)	zhan4 ‘stand’, zuo4 ‘sit’, dun1 ‘squat’
Change of Possession (10, 4)	gei3 ‘give’, mai3 ‘buy’, huan4 ‘exchange’
Social Interaction (12, 1)	qin1 ‘kiss’, bao4 ‘hug’, rang4 ‘allow’
Light (5, 5)	gan4 ‘do’, nong4 ‘do’, zho4 ‘do’
Cognition (19, 5)	zhi1dao4 ‘know’, wang4 ‘forget’, xiang3 ‘think’
Desire (1, 1)	yao4 ‘want’
Emotion (9, 4)	xi3huan1 ‘like’, ku1 ‘cry’, pa4 ‘fear’
Experience (2, 1)	yong4 ‘use’, shi4 ‘try’
Perception (5, 3)	kan4 ‘see’, ting1 ‘hear’
Possession (4, 2)	you4 ‘have’, cha2 ‘lack’
Relation (4, 2)	xing4 ‘be surnamed’, xiang4 ‘resemble’

Note. Numbers in parentheses: verb types used by mothers and children respectively

***Reliability of coding.*** All the qualified utterances were coded by the author. A research assistant who is a native speaker of Mandarin coded the speech of 20 percent of speakers (i.e., 2 mothers and 2 children from each age group). If the coders did not agree on the word order for an utterance, a third coder reviewed the utterance until agreement was made. Inter-coder reliability was calculated between the two coders ( $r = 0.93, p < 0.01$ ).

As for reliability of verb type classification, a graduate student who is also a native speaker of Mandarin classified all the 228 verbs into the above 15 categories. If any verb fell into different categories, a third coder reviewed the verb until agreement was made. Inter-coder reliability was calculated between the two coders ( $r = 0.95, p < 0.01$ ).

### ***Measures and data analysis***

Frequencies of word order and utterance type were recalculated as percentages (of the total qualified utterances) and compared. Group differences within mothers and children in producing each word order were examined to see whether any age-related changes occurred. Correlations between mothers' and children's speech were calculated to see whether mothers (from a given age group) who used a specific word order more frequently had children who did the same. Mothers' and children's word order uses were compared for distribution across utterance types and age-related changes. Number of verb types that occurred in mothers' and children's different word orders was counted for the diversity measure.

## **Results**

This dissertation investigated the role of maternal word order uses in word order acquisition of Mandarin-speaking children. Four questions about maternal word order uses were addressed: (1) whether there are frequency effects in the distribution of child word order uses and in the order of acquisition of different word orders, (2) whether there are age-related changes in maternal word order uses, (3) whether mothers use different word orders for different utterance types, and (4) how verb diversity in mothers' word order uses is related to that in children. The Results section is divided into six subsections. The first section presents the total utterances produced by the mothers and children in each age group. The second section presents the frequency distribution of different word orders produced by the mothers and children. The third section includes the statistical analyses of the age-related changes in the mothers' and children's word orders. The fourth section examines the relationships between the mothers' and children's uses of different word orders. The fifth section shows the frequency distribution of word order in different utterance types. The sixth section investigates the role of verb diversity shown in the mothers' and children's word order uses.

### ***Total Utterances of Mothers and Children in Each Age Group***

The transcripts for the 40 mother-child dyads yielded 6,965 qualified utterances, of which mothers produced 6,006 utterances, and children produced 959 utterances. Descriptive

statistics for mothers' and children's utterances in each age group are presented respectively in Tables 3a and 3b.

Given the same items to explore in their semi-structure play, the dyads in the four age groups varied in the amount of speech. Mothers of 20- and 26-month-olds produced more utterances (approximately 200) than those of 14- and 32-month-olds (around 110). The number of children's utterances generally increased with age, reaching the maximum of 48.2 by 26-month-olds; 32-month-olds' group mean of utterances fell between 20- and 26-month-olds'. It seems that mothers and children in the 32-month group unusually produced fewer utterances than those in the 20- and 26-month groups. However, information about their smaller numbers of utterances is not available in the transcripts. Not surprisingly, mothers typically produced much more than their children.

Table 3a

*Descriptive statistics for mothers' number of utterances in each age group*

Age Group	Mean	SD	Min	Max
14m	109.20	37.71	55	180
20m	185.50	86.34	66	315
26m	194.80	57.55	104	289
32m	111.10	30.87	57	167

Table 3b

*Descriptive statistics for children's number of utterances in each age group*

Age Group	Mean	SD	Min	Max
14m	1.60	2.27	0	6
20m	17.10	18.24	1	53
26m	48.20	35.29	8	97
32m	29.20	18.02	10	67

### *Frequency Distribution of Different Word Orders: Descriptive Analyses*

After all the qualified utterances were coded for word order, token frequencies of different word orders produced by all the speakers were obtained and turned into percentages. Group means and standard deviations were calculated based on the percentages of each word order produced in each age group. Figures 1a and 1b present the distribution of group means of all word orders used by mothers and children respectively.

As shown in Figure 1a, mothers across all age groups produced a variety of word orders, including verb-alone fragments, SVO word orders, non-SVO word orders, copular utterances, and multiple-verb utterances. However, not all word orders were evenly distributed. About 23% of mothers' utterances were verb-alone fragments (i.e., Vi, Vt, and Va), with Vi and Vt utterances being overwhelmingly more frequently produced than Va utterances. This relatively large proportion of verb-alone utterances is similar to findings from studies on English maternal input (e.g., Broen, 1972; Newport et al., 1977; Cameron-Faulkner et al., 2003), suggesting that prevalence of fragments could be one of the features of early speech to young children (Cameron-Faulkner et al., 2003).

Utterances produced in all SVO word orders made up about 37% of maternal speech. This proportion is higher than individual proportion of verb-alone, non-SVO, copular, and multiple-verb utterances, supporting the claim that SVO word order is the most frequent order

in Mandarin (Sun & Givón, 1985; Wei, 1989). Among these SVO word orders, the proportion of VtO utterances (14%) is roughly equal to the total of all SV utterances (e.g., SVi, SVt, and SVa; 13%). This is contrary to Li and Cheung (2010), which found more SV utterances (28%) than VtO utterances (10%). It is important to point out that only declaratives were analyzed by Li and Cheung (2010); thus, their frequency distribution may only reflect maternal word order uses in declaratives, rather than in all utterances. The frequency distribution might be different when other utterance types, such as imperatives and questions, are included. Among SV utterances, many more SVi and SVt utterances were produced than SVa utterances. This proportion contrast is similar to that in verb-alone utterances as mentioned above. However, it is not surprising to observe such proportion contrast between uses of adjectival verbs and transitive/intransitive verbs in the current study because frequency differences (both type and token) between adjectives and transitive/intransitive verbs have been found in the studies on English and Mandarin maternal input (Sandhofer, Smith, & Luo, 2000; Goodman et al., 2008). SVtO utterances account for 10% of mothers' utterances, which is similar to the proportion of SVtO utterances in English maternal input (Cameron-Faulkner et al., 2003), but lower than the proportion reported by Li and Cheung (2010).

About 10% of the utterances were produced in non-SVO word orders (i.e., Ba construction, OV, OSV, and SOV), with Ba and OV utterances (3-5%) occurring much more



frequently than OSV and SOV utterances (0-1%). The proportion of Ba construction found in this study is higher than that in Lee and Naigles (2005). A possible explanation could be that the current speech data were collected when mother-child dyads engaged in activities that involved more manipulation and thus, elicited more Ba utterances (Erbaugh, 1982).

The remaining 31% of the utterances were non-SVO constructions, including copular utterances (16%) and multiple-verb utterances (15%). Their proportions suggest that these two kinds of constructions are quite frequent in Mandarin maternal input. When comparing both English and Mandarin maternal speech, copular utterances account for similar proportions (15% vs. 16%) in the two languages (Cameron-Faulkner et al., 2003), whereas multiple-verb utterances are more frequently produced in Mandarin (15%) than in English (6%).

As shown in Figure 1b, the frequency distribution of children's word order uses was mainly composed of the production of 20-, 26-, and 32-month-olds, because 14-month-olds only produced verb-alone fragments, most of which were Vi and Vt utterances. When beginning their two-word utterances, children still produced a high number of verb-alone utterances. Meanwhile they also produced VtO and Copula utterances frequently, followed by SVi, SVt, and SVtO utterances. Their Va, SVa and OV utterances appeared less frequently. The Ba construction, OSV, and SOV utterances were rare in occurrence. The high percentage

of SVa in the 20-month-olds is due to outliers in the group. That is, there were only two 20-month-olds who produced SVa utterances (two SVa utterances by each). Their total numbers of utterances were low (four and five by each) so that their individual percentages inflated the group mean.

Both mothers' and children's word order frequencies showed similar distribution patterns. Generally speaking, the frequent and infrequent word orders in mothers' speech tend to be those in children's production. An obvious inconsistency is the Ba construction, which was as roughly frequent as OV utterances in mothers' speech, but much less frequent than OV utterances in children's production. Further comparison between mothers' and children's frequencies of different word orders found that, except for the Vi and Vt utterances that decreased with age, most of children's word order uses reached adult frequency at either 26 or 32 months (Table 4). Additionally, word orders that reached adult levels at 26 months were those appearing with higher frequencies in mothers' speech while word orders that reached adults levels at 32 months were those produced with lower frequencies by mothers.

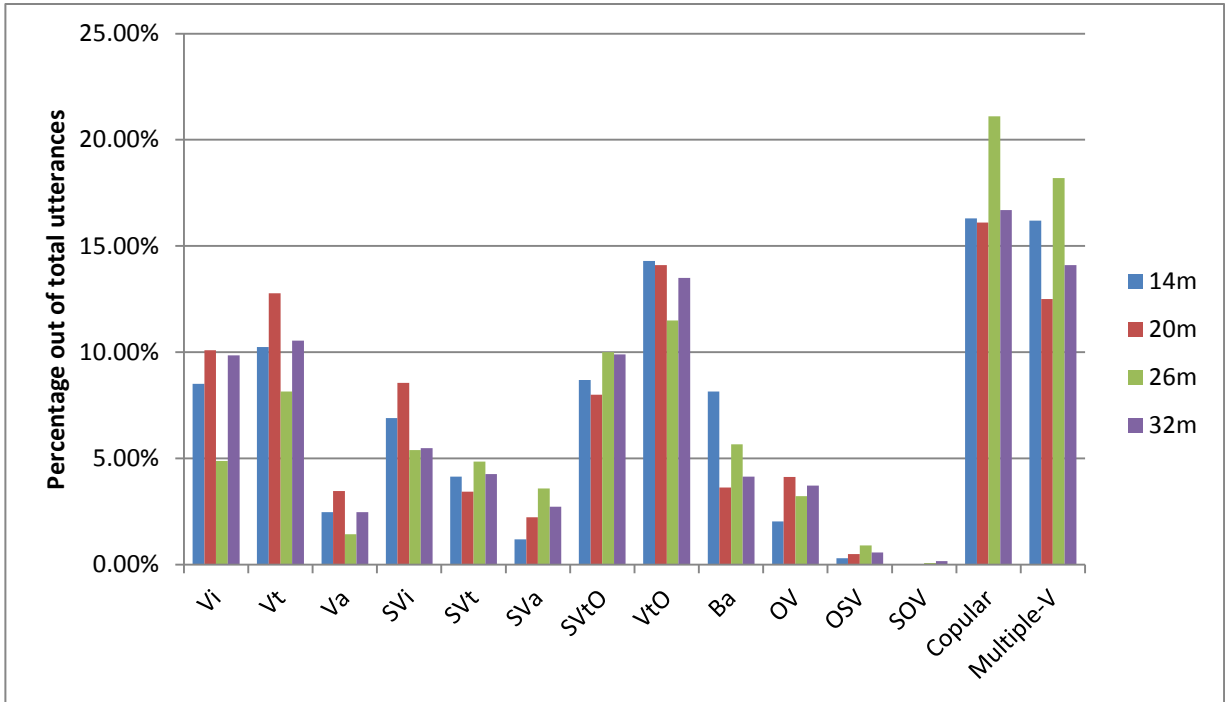


Figure 1a Distribution of word orders used by mothers of the four age groups

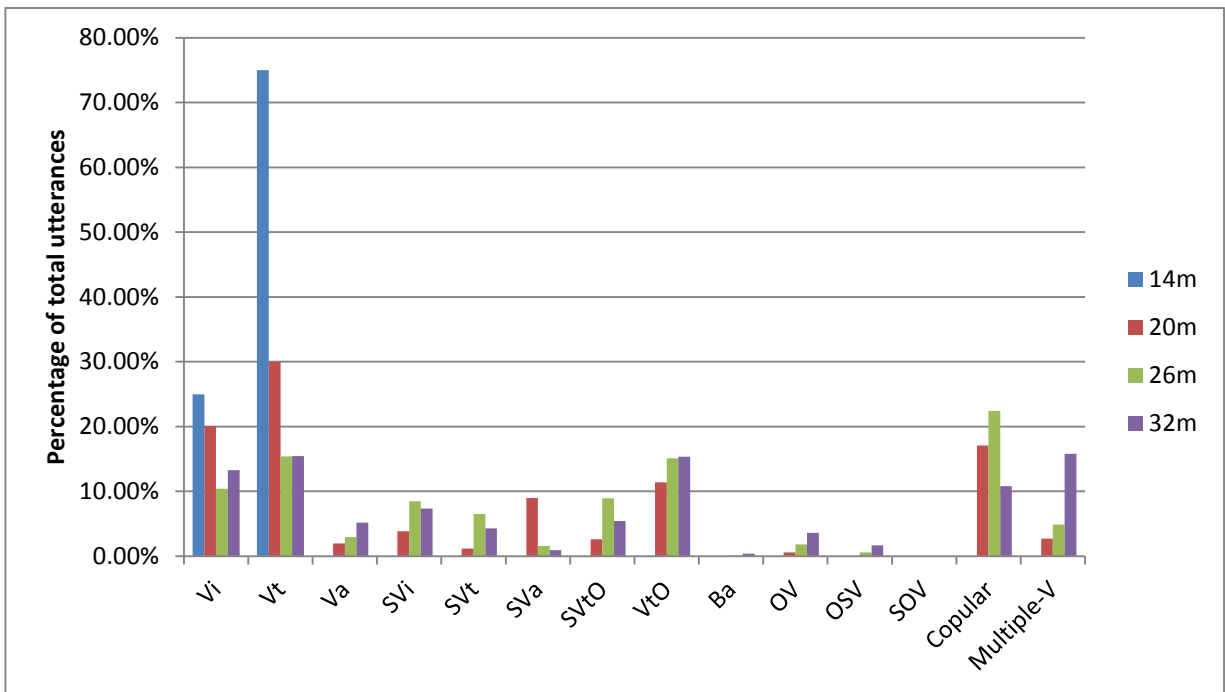


Figure 1b Distribution of word orders used by children of the four age groups

Table 4

*Children's word order uses that reached adult frequency by 26 and 32 months*

Word order	Mothers	Children
26 months		
SVi	5.40%	8.51%
SVt	4.85%	6.51%
SVtO	10.00%	8.96%
VtO	11.50%	15.12%
Copular	21.10%	22.40%
32 months		
Va	2.47%	5.18%
OV	3.73%	3.63%
OSV	0.57%	1.70%
Multiple-verb	14.10%	15.80%

As introduced in the Method, both Copular and Multiple-Verb utterances included several subcategories. The distributions of these subcategories are given as follows. The percentages for each subcategory were calculated by dividing the number of utterances in a given subcategory by the total number of Copular or Multiple-verb utterances. For example, one mother produced 10 Copular utterances, of which there were 5 SPnom, 2 SPadj, and 3 LocYouNP utterances. The percentages for these three subcategories would be 50% (5/10), 20% (2/10), and 20% (2/10) respectively.

Figures 2a and 2b present the distribution of group means of all Copular utterance types produced by mothers and children respectively. As Figure 2a shows, mothers across the four age groups produced SPnom utterances much more frequently and LocYouNP utterances less frequently. The other three types of Copular utterances were produced with very low frequencies (See Table 1 for examples of these utterances).

Children also produced SPnom utterances very frequently. The other types of Copula utterances appeared with lower frequencies (See Figure 2b). The unusually high percentage of LocYouNP utterances in 20-month-olds resulted from one of the children in that group whose only utterance was LocYouNP. Taken together, both mothers' and children's copular utterance frequencies also demonstrate similar distribution patterns.

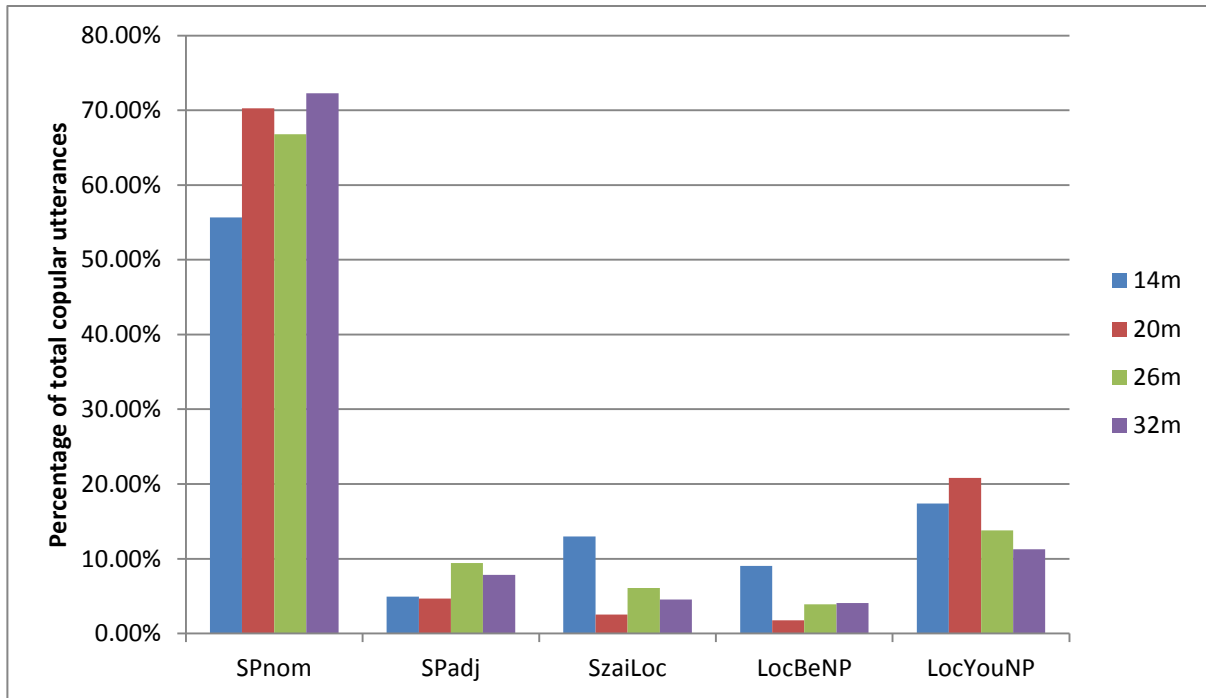


Figure 2a Distribution of Copular utterances used by mothers of the four age groups

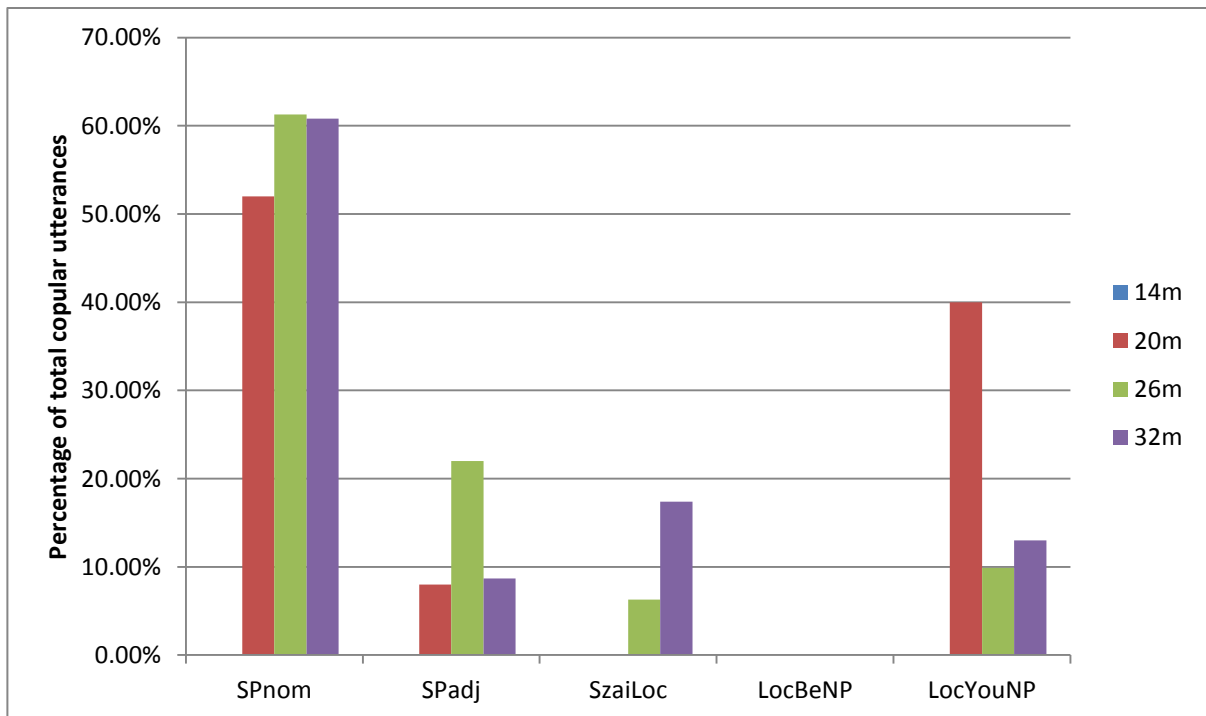


Figure 2b Distribution of Copular utterances used by children of the four age groups

Figures 3a and 3b present the distribution of group means of all kinds of Multiple-verb utterances produced by mothers and children respectively. As Figure 3a shows, the frame SV1(O)V2(O) appeared with the highest frequency in mothers' speech and followed by the frame S1V1(O)S2V2(O). The frames SV1(O)V2(O) and SV1NV2(O) appeared with lower frequencies, and SV1(O)PNV2 and Combinations with much lower (See Table 1 for examples of these utterances).

Unlike their mothers, children began with the frames SV1(O)V2(O) and SV1V2(O). The frame SV1V2(O) increased more than SV1(O)V2(O) as children developed. The rest were rare or non-existent (See Figure 3b). Although children produced multiple-verb utterances as frequently as their mothers at 32 months of age, further comparison between distributions of mothers' and children's different multiple-verb utterances found that children's multiple-verb utterances did not fully reflect their input frequency. Although mothers produced all different types of multiple-verb utterances, children began with and focused on two of them: SV1(O)V2(O) and SV1V2(O). The other constructions did not appear until 26 and/or 32 months.

As mentioned in the Method, multiple-verb utterances can be produced in non-SVO word orders and constructions. To examine how non-SVO word orders and constructions appear in multiple-verb utterances, frequency of multi-verb utterances involving non-SVO

word orders and/or constructions used by all the speakers were obtained and turned into percentages out of total numbers of multiple-verb utterances (i.e., production percentage).

Table 5 presents the numbers of mothers in each age group who produced non-SVO word orders and constructions in their multiple-verb utterances as well as the ranges and group means of their production percentages. Surprisingly, almost all mothers used non-SVO word orders in their multiple-verb utterances. When comparing whether difference in the production percentages exists among all the age groups, no significant difference among groups was found.

Additionally, to show what word orders and constructions were used and whether they were commonly used, Table 6 presents the numbers of mothers in each age group who used different non-word orders and constructions. As found in Table 5, within each age group, most non-SVO word orders and constructions were used by different numbers of mothers. In the age group of 14 months, the frame LocYouNP was used by most mothers, and all the other frames by a few or none. In the age group of 20 months, the frame SPnom was used by most mothers, Ba construction, LocBeNP, and LocYouNP by some. In the age group of 26 months, the frames SPnom and LocYouNP were used by most mothers, and Ba construction, OV, and LocBeNP by some. In the age group of 32 months, no frame was found to be commonly used; only the frames OV, SPnom, LocBeNP, and LocYouNP were used by some mothers. Thus, the



frames LocYouNP and SPnom were commonly used and followed by Ba construction, the frames OV, and LocBeNP when mothers involved non-SVO word orders and constructions. In sum, like mothers' single-verb utterances, the multiple-verb utterances of mothers across ages also included a variety of word orders and constructions.

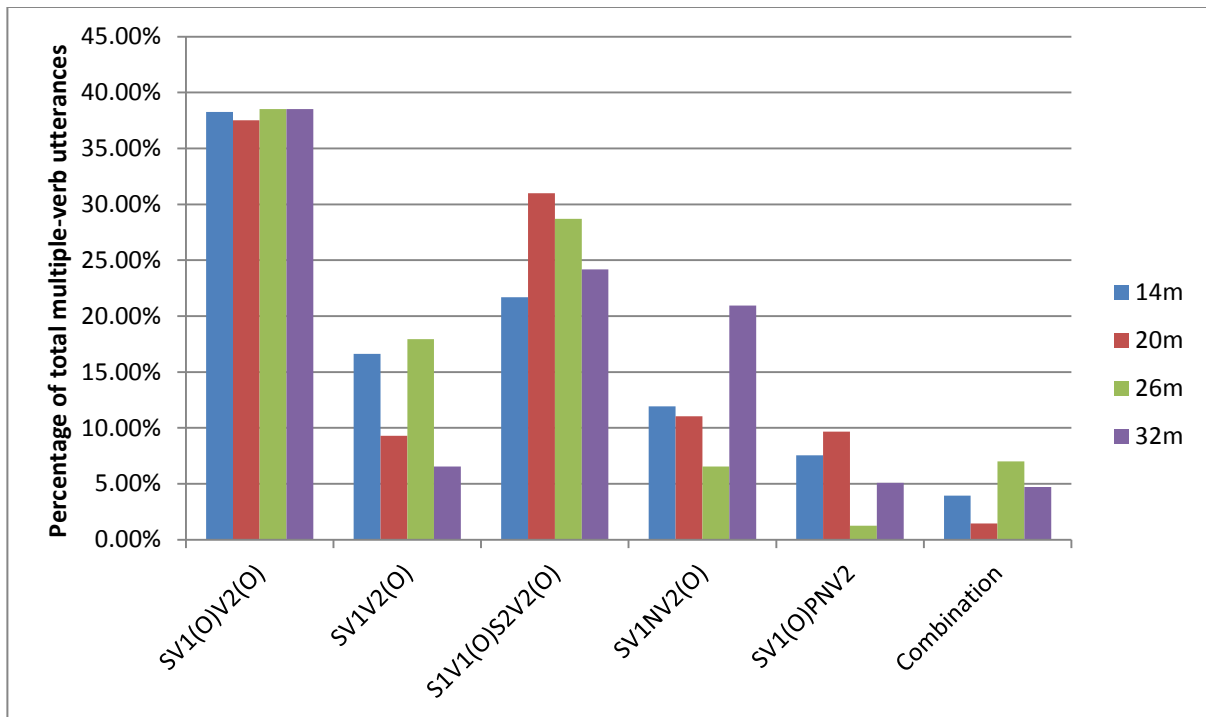


Figure 3a Distribution of Multiple-verb utterances used by mothers of the four age groups

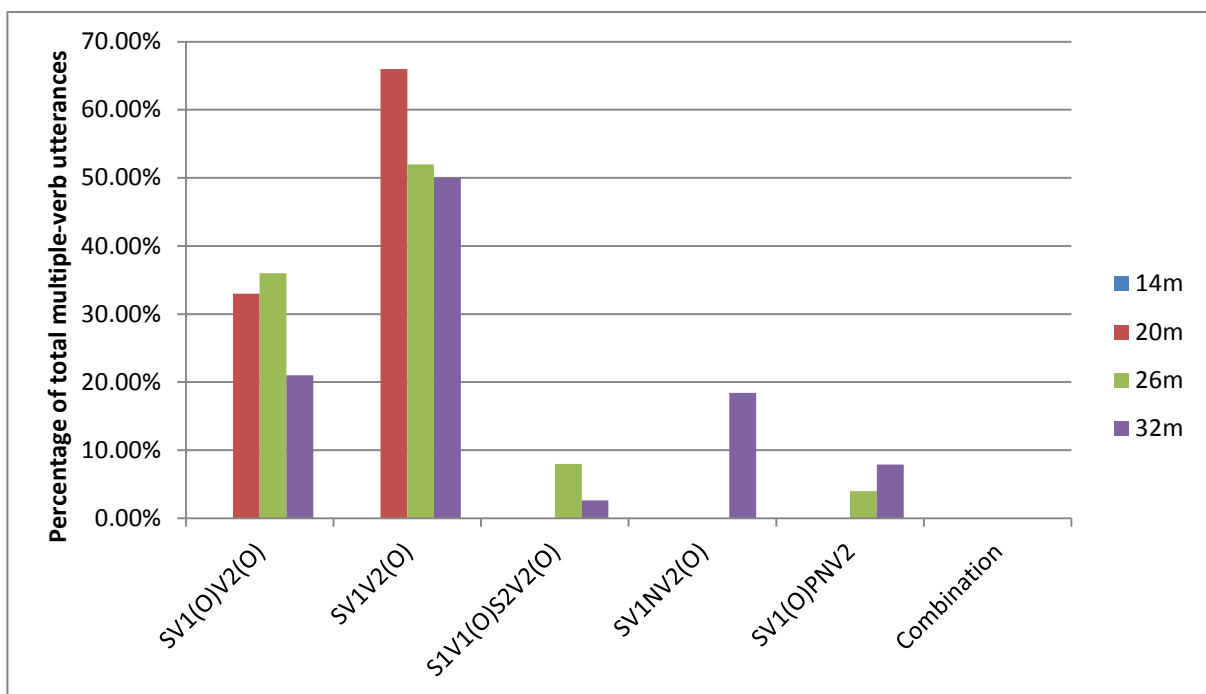


Figure 3b Distribution of Multiple-verb utterances used by children of the four age groups

Table 5

*Numbers of mothers using different non-SVO word orders and constructions in their multiple-verb utterances*

Age Group	Number of users	Range	Group mean
14m	9	0%-38.46%	20.81%
20m	9	0%-46.67%	24.38%
26m	10	13.64%-41.86%	27.24%
32m	10	5.56%-22.22%	14.42%

Table 6

*Numbers of multiple-verb utterances involving non-SVO word orders and constructions produced by mothers*

Age Group	Ba	OV	OSV	SPnom	SPadj	SzaiLoc	LocBeNP	LocYouNP
14m	2	3	0	0	1	2	1	9
20m	6	2	1	8	1	0	5	5
26m	6	4	2	8	2	1	5	8
32m	1	4	0	4	0	1	4	4

Compared to other word order categories, both the Bei construction and topicalized utterances were rare and were produced by few participants. Only three mothers and one child produced the Bei construction (one utterance from each person). Topicalized utterances were used by one to three people in each age group for a given type of topicalized utterances. Thus, the Bei construction and topicalized utterances appeared with very low frequency (Bei construction: 0%-0.09% by mothers and 0%-0.11% by children; topicalized utterances: 0.32%-1.08% by mothers and 0%-0.41% by children). Due to extremely low frequencies, both Bei construction and topicalized utterances were not included in the subsequent analyses.

### ***Age-related Changes in Different Word Orders***

Given the preceding presentation of the frequency distribution of word orders, this section investigated how the frequency of different word order uses in the mothers' speech varied as a function of the child's age, i.e., age-related changes in different word orders. First, a series of one-way MANOVA tests were conducted with Child Age as the between-subjects factor (Rencher & Christensen, 2012; Weifurt, 1994; Cone & Foster, 2006). When a MANOVA test was conducted, each word order category (i.e., Verb Alone, SV, SVO, Non-Canonical word order, Copula, and Multiple-V) was considered a synthetic variable with its subcategories (e.g., Vi, Vt, and Va in Verb-alone category) as dependent variables examined simultaneously within a single test to reduce the likelihood of Type I error. When

the MANOVA revealed a significant multivariate main effect, individual dependent variables were examined with separate ANOVA tests to see which specific word order showed a univariate main effect. The significance level for separate ANOVA tests was adjusted by dividing the alpha level by the number of tests that were conducted. For example, for the Verb-alone category, there were three ANOVA tests respectively for the dependent variables: Vi, Vt, and Va. The adjusted significance level for each ANOVA is  $p < 0.017$  ( $0.05/3$ ). When a separate ANOVA test revealed a significant main effect, post-hoc comparisons with Tukey tests for the dependent variables were conducted to see which mean differences contributed to the significant main effect.

For mothers' word order uses, one-way MANOVA tests showed significant multivariate main effects for Child Age with two word orders: (1) Verb alone (Wilks'  $\lambda = 0.599$ ,  $F(9, 82.898) = 2.162$ ,  $p < 0.05$ ,  $\eta^2 : 0.157$ , power: 0.744) and (2) Non-canonical word orders (Wilks'  $\lambda = 0.483$ ,  $F(12, 87.601) = 2.309$ ,  $p < 0.05$ ,  $\eta^2 : 0.215$ , power: 0.893). Follow-up ANOVA tests found a significant effect of Child Age with two specific orders: (1) **Vi frame** ( $F(3, 36) = 3.985$ ,  $p < 0.017$ ,  $\eta^2 : 0.249$ , power: 0.793) and (2) **Ba construction** ( $F(3, 36) = 5.716$ ,  $p < 0.0125$ ,  $\eta^2 : 0.323$ , power: 0.924).

For **Vi utterances**, post hoc comparisons indicated that the mothers of 26-month-olds ( $M = 4.89\%$ ,  $SD = 2.77\%$ ) produced significantly fewer Vi utterances than those of

20-month-olds ( $M = 10.09\%$ ,  $SD = 4.23\%$ ) and 32-month-olds ( $M = 9.86\%$ ,  $SD = 3.39\%$ )

(See Figure 4). No other pairwise comparisons differed significantly.

For the **Ba construction**, post hoc comparisons indicated the mothers of 14-month-olds ( $M = 8.15\%$ ,  $SD = 3.61\%$ ) produced significantly more Ba utterances than those of 20-month-olds ( $M = 3.64\%$ ,  $SD = 2.39\%$ ) and 32-month-olds ( $M = 4.14\%$ ,  $SD = 2.53\%$ ) (See Figure 5).

The above analyses indicated age-related changes occurred in two word orders. First, the mothers of 26-month-olds produced significantly fewer Vi utterances. However, scrutiny of the distribution of mothers' word order uses (Figure 1a) found a similar (although not significant) trend when this group of mothers produced Vt and Va utterances. Thus, it is possible that the way the mothers of 26-month-olds in the current speech corpus produced verb-alone utterances might just reflect their own talking style; (at least) some of them did not prefer verb-alone utterances when talking to their children. To test this possibility, analysis of more maternal speech to 26-month-olds is needed.

Second, the mothers of 14-month-olds produced significantly more Ba utterances. One possible explanation is concerned with situational effects. According to Erbaugh's observation (1982), some activities (e.g., handcrafts) favor the occurrence of Ba construction while some do not (e.g., horseplay, naming). Specifically, activities that rely on instruction for

manipulation of physical objects usually elicit Ba utterances. As presented in the Method, some of the toys/materials provided to induce mother-child interaction during data collection had more to do with manipulation, such as using crayons to draw pictures and building blocks to create something. When playing with such objects, 14-month-olds might need more instructions compared to older children. For this reason, perhaps, their mothers tended to produce more Ba utterances.

In sum, Mandarin-speaking mothers did produce a variety of word orders in their speech, but, contrary to my prediction, the frequencies of most word orders in mothers' speech did not vary in response to children's age and/or linguistic competence. That is, Mandarin-speaking mothers produced a variety of word orders when talking to children of one-word to multi-word stages, and most of their word orders appeared in similar frequencies during these stages.

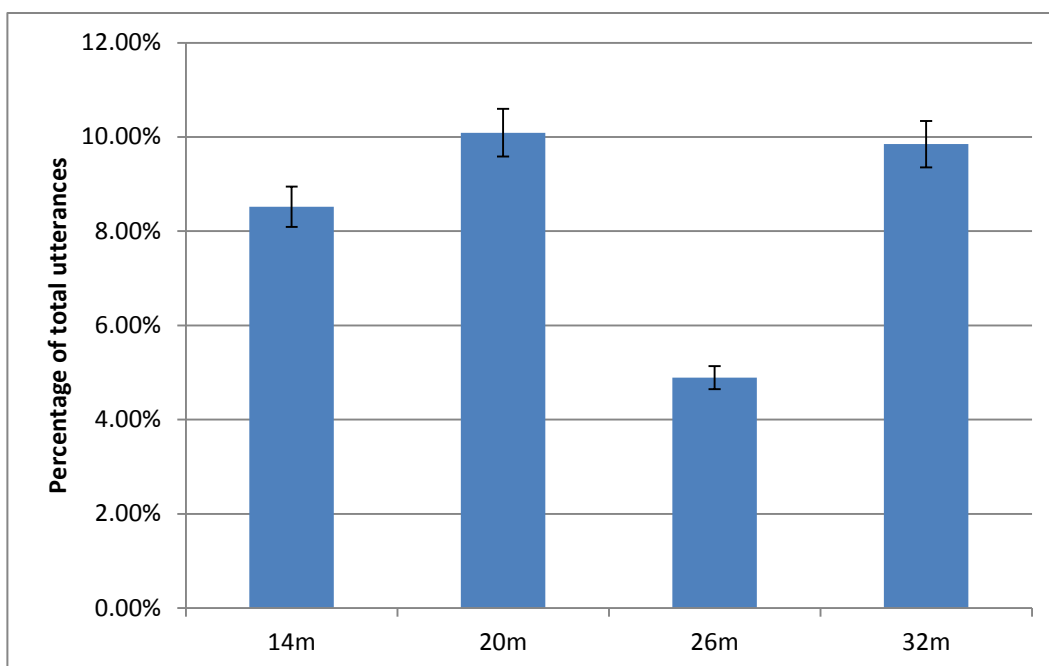


Figure 4 Group means of Vi utterances by mothers of the four age groups

Note. Significant pairs: 20m vs. 26m; 26m vs. 32m

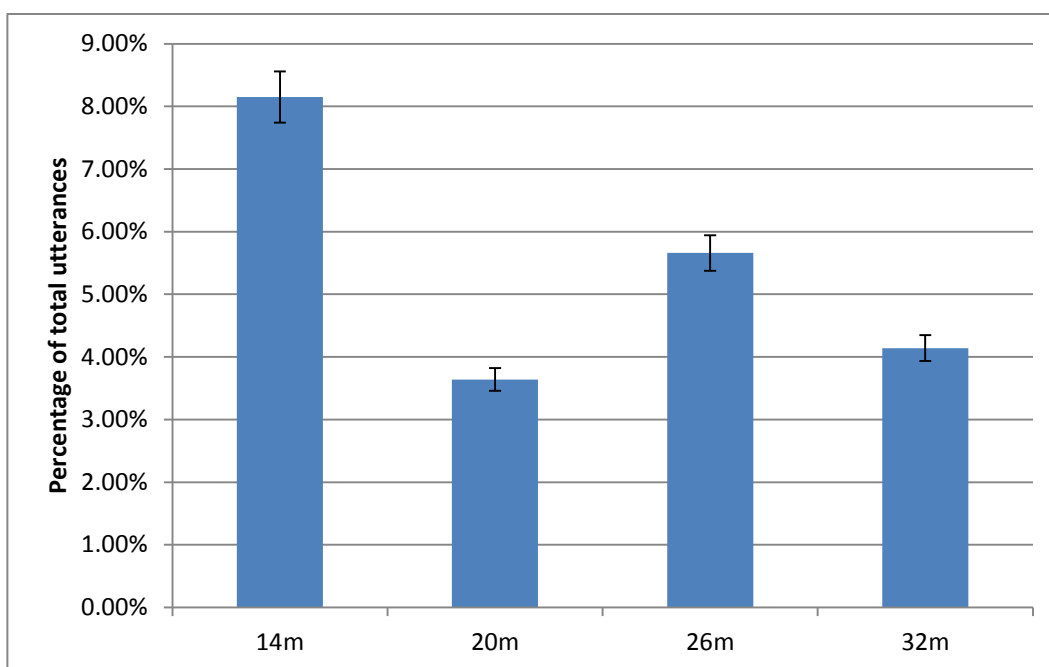


Figure 5 Group means of Ba construction by mothers of the four age groups

Note. Significant pairs: 14m vs. 20m; 14m vs. 32m



The same procedures were applied to analyze whether there were age-related changes in children's word order uses. One-way MANOVA tests showed significant multivariate main effects for Age with six different word orders: (1) Verb Alone (Wilks'  $\lambda = 0.610$ ,  $F(9, 82.898) = 2.073$ ,  $p < 0.05$ ,  $\eta^2: 0.152$ , power: 0.722), (2) SV frame (Wilks'  $\lambda = 0.538$ ,  $F(9, 82.898) = 2.669$ ,  $p < 0.01$ ,  $\eta^2: 0.187$ , power: 0.844), (3) SVO frame (Wilks'  $\lambda = 0.470$ ,  $F(6, 70) = 5.355$ ,  $p < 0.01$ ,  $\eta^2: 0.315$ , power: 0.993), (4) Non-canonical word orders (Wilks'  $\lambda = 0.622$ ,  $F(9, 82.898) = 1.985$ ,  $p = 0.05$ ,  $\eta^2: 0.146$ , power: 0.699), (5) Copula utterances (Wilks'  $\lambda = 0.364$ ,  $F(12, 87.601) = 3.400$ ,  $p < 0.01$ ,  $\eta^2: 0.286$ , power: 0.982), and (6) Multiple-verb utterances (Wilks'  $\lambda = 0.388$ ,  $F(12, 88.739) = 2.421$ ,  $p < 0.01$ ,  $\eta^2: 0.271$ , power: 0.958) .

Follow-up ANOVA tests found significant effects of Age with eight specific word orders/frames: (1) **Va frame** ( $F(3, 36) = 4.488$ ,  $p < 0.017$ ,  $\eta^2: 0.272$ , power: 0.843), (2) **SVi frame** ( $F(3, 36) = 4.724$ ,  $p < 0.017$ ,  $\eta^2: 0.282$ , power: 0.862), (3) **SVtO frame** ( $F(3, 36) = 6.818$ ,  $p < 0.025$ ,  $\eta^2: 0.362$ , power: 0.962), (4) **VtO frame** ( $F(3, 36) = 6.453$ ,  $p < 0.025$ ,  $\eta^2: 0.350$ , power: 0.952), (5) **OV frame** ( $F(3, 36) = 4.449$ ,  $p < 0.017$ ,  $\eta^2: 0.270$ , power: 0.839), (6) **SPnom frame** ( $F(3, 36) = 8.148$ ,  $p < 0.0125$ ,  $\eta^2: 0.404$ , power: 0.985), and (7) **SPadj frame** ( $F(3, 36) = 7.430$ ,  $p < 0.0125$ ,  $\eta^2: 0.382$ , power: 0.975). It is noteworthy that although the MANOVA test for the **Multiple-verb utterances** revealed a significant multivariate main effect for Age, follow-up ANOVA tests for the different types of multiple-verb utterances

found no significant age effect. This apparently contradictory result could be due to the fact that the group differences on each type of multiple-verb utterances were too small to satisfy the criterion of significance. However, if these differences on all types of multiple-verb utterances were combined, the total difference would be large enough to show a significant age effect. Therefore, all types of multiple-verb utterances were combined into a composite measure instead, and a one-way ANOVA with Age as a between-subject variable was conducted to see whether there were age-related changes in children's all multiple-verb utterances. The effect of age is significant ( $F(3, 36) = 10.310, p < 0.01, \eta^2: 0.462$ , power: 0.997).

For **Va utterances**, post hoc comparisons indicated that 32-month-olds ( $M = 5.18\%$ ,  $SD = 4.20\%$ ) produced significantly more Va utterances than 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 6).

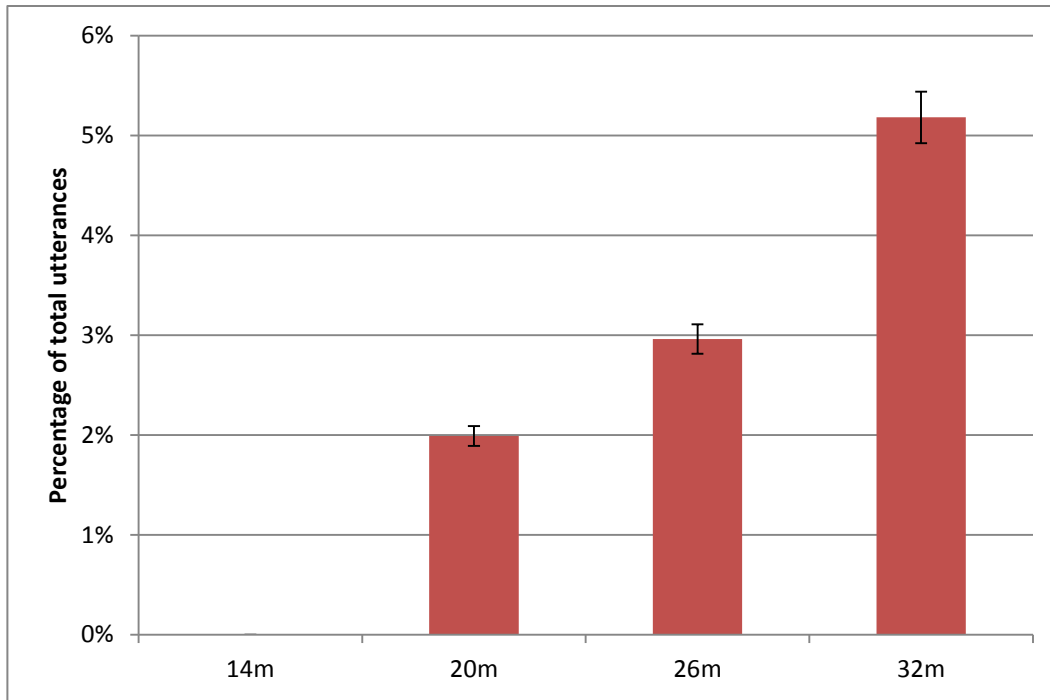


Figure 6 Group means of Va utterances by children of the four age groups

Note. Significant pair: 14m vs. 32m

For **SVi utterances**, both 32-month-olds ( $M = 7.38\%$ ,  $SD = 4.41\%$ ) and 26-month-olds ( $M = 8.51\%$ ,  $SD = 8.39\%$ ) produced significantly more SVi utterances than 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 7).

The follow-up ANOVA for **SVt utterances** yielded a marginally significant effect ( $F(3, 36) = 3.582$ ,  $p < 0.023$ ,  $\alpha = 0.017$ ). The distribution of group means of SVt utterances is similar to that of SVi utterances (See Figure 8).

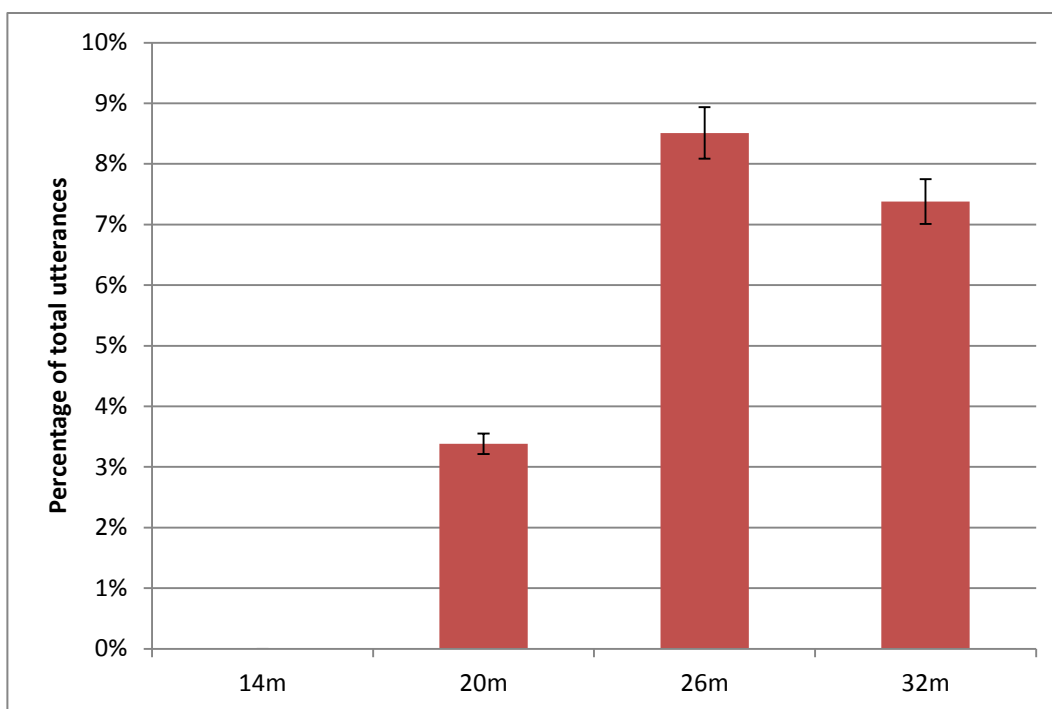


Figure 7 Group means of SVi utterances by children of the four age groups

Note. Significant pairs: 14m vs. 26m; 14m vs. 32m

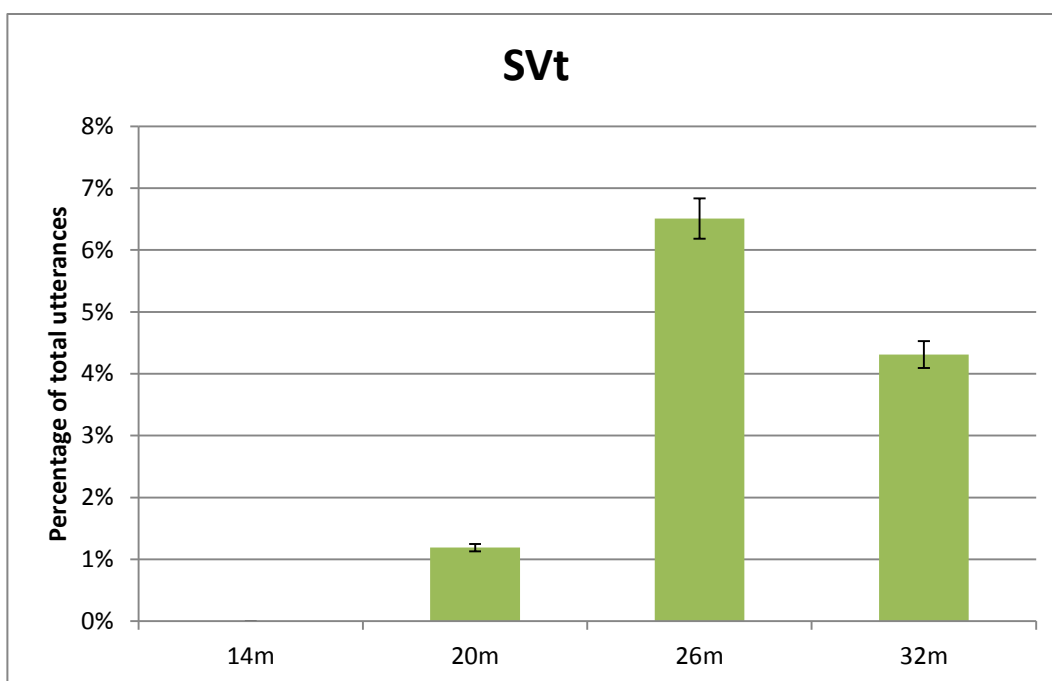


Figure 8 Group means of SVt utterances by children of the four age groups

For **SVtO utterances**, 26-month-olds ( $M = 8.95\%$ ,  $SD = 7.05\%$ ) produced significantly more SVtO utterances than 20-month-olds ( $M = 2.60\%$ ,  $SD = 4.50\%$ ) and 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 9).

For **VtO utterances**, 32-month-olds ( $M = 15.38\%$ ,  $SD = 10.95\%$ ), 26-month-olds ( $M = 15.40\%$ ,  $SD = 5.29\%$ ), and 20-month-olds ( $M = 11.40\%$ ,  $SD = 13.43\%$ ) produced significantly more VtO utterances than 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 10).

For **OV utterances**, 32-month-olds ( $M = 3.88\%$ ,  $SD = 4.45\%$ ) produced significantly more OV utterances than 20-month-olds ( $M = 0.61\%$ ,  $SD = 1.33\%$ ) and 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 11).

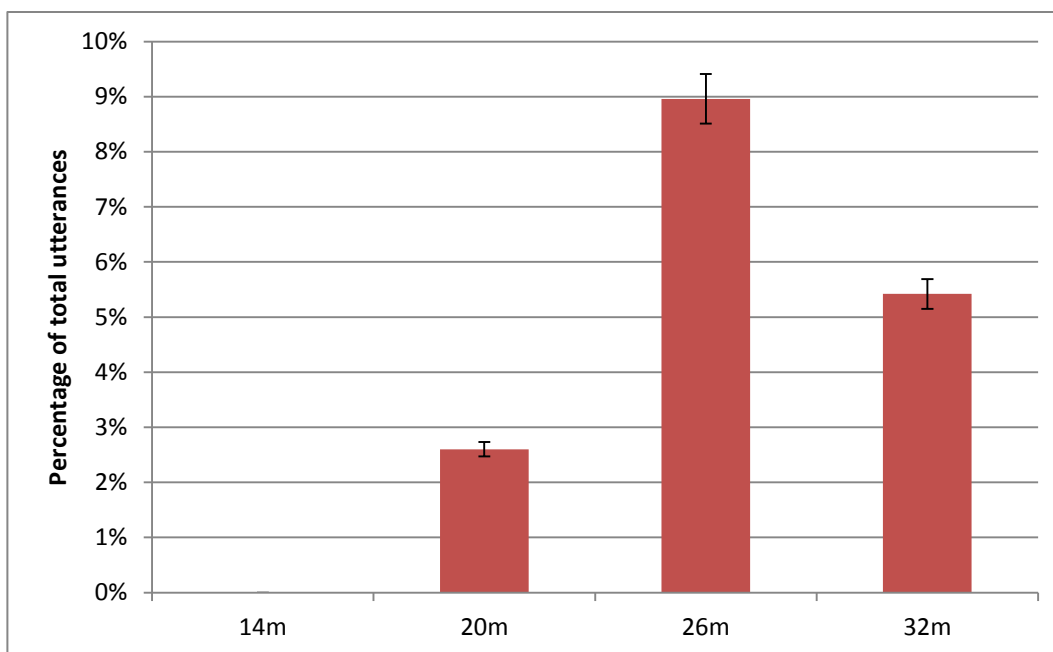


Figure 9 Group means of SVtO utterances by children of the four age groups

Note. Significant pairs: 14m vs. 26m; 20m vs. 26m

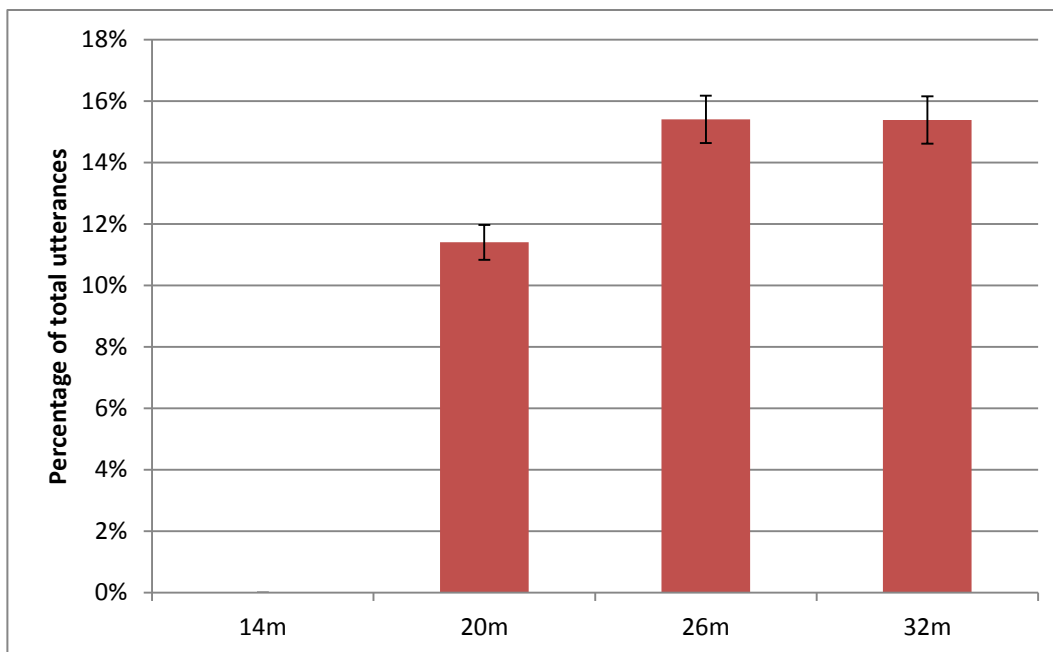


Figure 10 Group means of VtO utterances by children of the four age groups

Note. Significant pairs: 14m vs. 20m; 14m vs. 26m; 14m vs. 32m

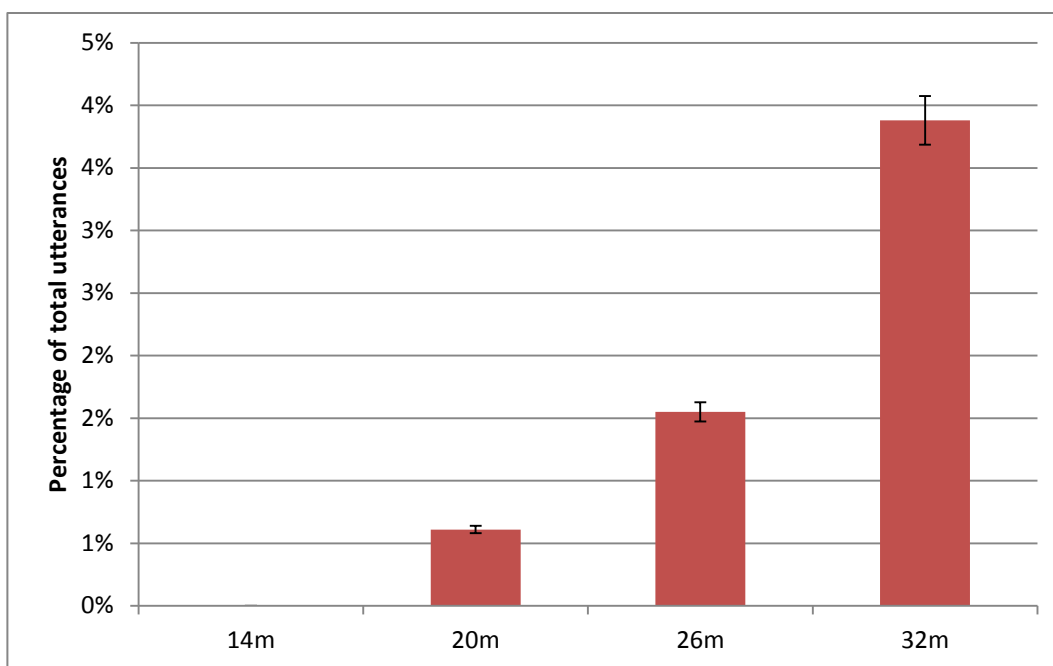


Figure 11 Group means of OV utterances by children of the four age groups

Note. Significant pairs: 14m vs. 32m; 20m vs. 32m



For **SPnom utterances**, 26-month-olds ( $M = 15.27\%$ ,  $SD = 9.01\%$ ) produced significantly more SPnom utterances than 32-month-olds ( $M = 5.46\%$ ,  $SD = 8.01\%$ ), 20-month-olds ( $M = 4.53\%$ ,  $SD = 7.59\%$ ), and 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 12).

For **SPadj utterances**, 26-month-olds ( $M = 4.34\%$ ,  $SD = 4.00\%$ ) produced significantly more SPadj utterances than 32-month-olds ( $M = 0.60\%$ ,  $SD = 1.89\%$ ), 20-month-olds ( $M = 0.47\%$ ,  $SD = 1.47\%$ ), and 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 13).

For **Multiple-Verb utterances**, 32-month-olds ( $M = 15.77\%$ ,  $SD = 11.97\%$ ) produced significantly more Multiple-verb utterances than 26-month-olds ( $M = 4.20\%$ ,  $SD = 5.06\%$ ), 20-month-olds ( $M = 2.68\%$ ,  $SD = 4.36\%$ ), and 14-month-olds ( $M = 0\%$ ,  $SD = 0\%$ ) (See Figure 14).

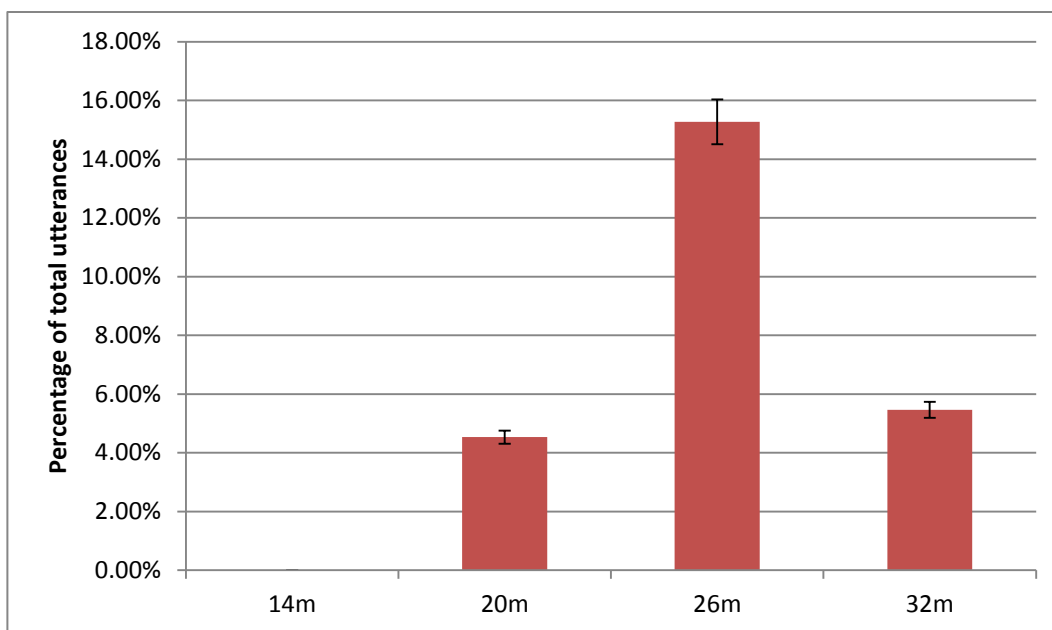


Figure 12 Group means of SPnom utterances by children of the four age groups

Note. Significant pairs: 14m vs. 26m; 20m vs. 26m; 26m vs. 32m

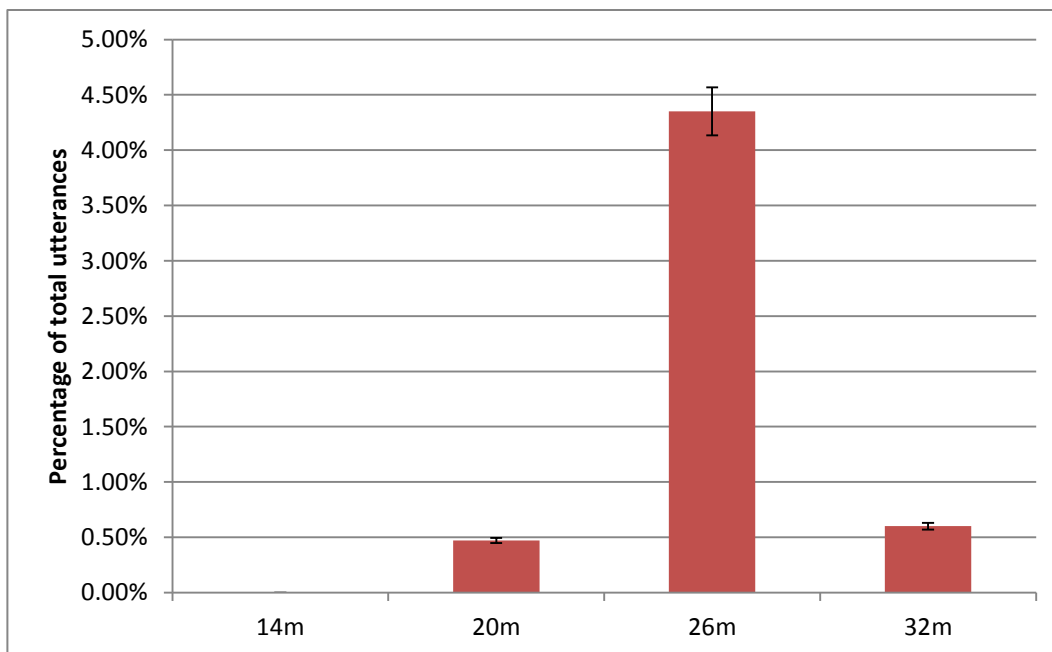


Figure 13 Group means of SPadj utterances by children of the four age groups

Note. Significant pairs: 14m vs. 26m; 20m vs. 26m; 26m vs. 32m

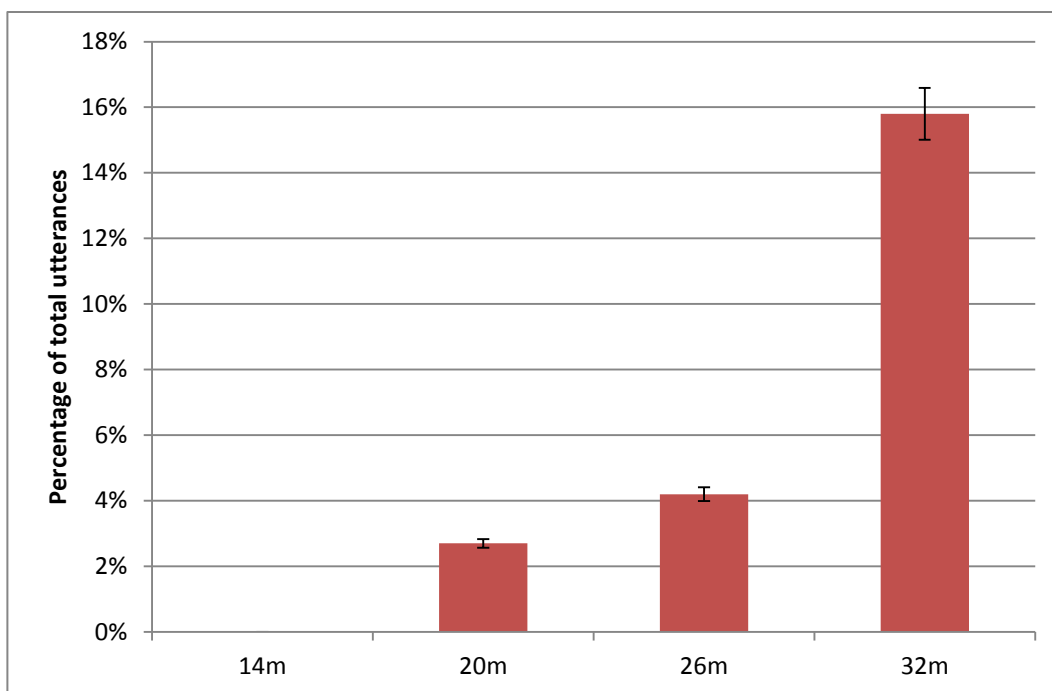


Figure 14 Group means of Multiple-verb utterances by children of the four age groups

Note. Significant pairs: 14m vs. 32m; 20m vs. 32m; 26m vs. 32m

In sum, most of children's word order production showed significant age-related changes, indicating the progressive nature of language development. Word orders that showed age-related changes included Va, SVi, (SVt), SVtO, VtO, OV, SPnom, SPadj, and Multiple-verb utterances. As Figures 6-14 show, these word orders showed two growth patterns; the frequencies were lowest at 14 months and reached their highest either at 26 months or at 32 months. Those highest frequencies were close to their mother's (i.e., adult levels). Thus, word orders that reached the adult levels at 26 months included SVi, (SVt), SVtO, VtO, SPnom, and SPadj, while those that reached the adult levels at 32 months include Va, OV, and Multiple-verb utterances (See also Table 4).

Most word orders that were found to reach adult levels earlier in the current study are also those found to be early-produced frames in previous studies on Mandarin learners (Erbaugh, 1982; Cheng, 1986; Hsu, 1996). These word orders are SVO-related: SVi, SVt, SVtO, and VtO. The SVi, SVt, and VtO word orders emerged when Mandarin learners began to combine words at 20 months of age, followed by SVtO utterances at 26 months of age. This finding supports previous observations that Mandarin learners mastered the canonical word order earlier than non-canonical word orders (Erbaugh, 1982).

In addition to SVO-related word orders, the SPnom and SPadj production also reached adult levels at 26 months. It is noteworthy that the SPnom construction appeared highly

frequently in mothers' speech while the SPadj construction did not. It seems that maternal frequency cannot fully account for why both SPnom and SPadj production reached adult levels at the same time. One possibility could be that Mandarin learners treated these two constructions as the same type of frame because they share similar structure (i.e., Subject + shi4 + \_\_\_\_\_), in which both constructions begin with Subject and a copula (shi4, 'to be'). The children's task was to produce what they meant to fill in the slot after the copula. Thus, hearing a great number of SPnom utterances might also help Mandarin learners grasp the SPadj frame. As a check on this possibility, examination of data in different corpora for more SPadj utterances is needed.

Word orders that were found to reach adult levels at 32 months include Va, OV, and Multiple-verb utterances. Reviewing children's verb-alone production, Vi and Vt utterances made up almost all 14-month-olds' production and decreased to adult levels after 26 months, making way for utterances in other word orders. In contrast, Va utterances appeared later and increased to adult level at 32 months. Taken together with the very small proportion of SVa utterances that children produced, these findings suggest that adjectival verbs might be acquired later than action verbs even though adjectival verbs may function as full verbs in Mandarin Chinese. Frequency can be a reason because, as mentioned above, action verbs used in mothers' speech obviously outnumbered adjectival verbs in both type and token. As a result,

there were many more action verbs than adjectival verbs in children's vocabulary.

The only non-SVO word order that showed age-related changes and reached adult level by age three is OV. Children produced 25 OV utterances (3 utterances by two children of 20 months; 11 utterances by five children of 26 month; 11 utterances by six children of 32 months). All of these OV utterances are well-formed. These findings are consistent with Erbaugh's observation (1982) that early OV utterances emerge at around age two with extremely low frequency, but are produced perfectly correctly (the rate of error: 6% by 2-3 year olds; 1% after age three; Erbaugh, 1982). Children's OV production in the current data formed a sharp contrast with their Ba construction; only sporadic Ba utterances were produced by few children (3 utterances by two 26-month-olds; 2 utterances by one 32-month-old). Comparing Figures 1a and 1b, while the Ba construction was relatively frequent in the early input, it was rarely produced by children. Instead, the OV frame matched the Ba construction in frequency in the input, growing significantly from 26 months on.

Age-related changes were also found in children's multiple-verb utterances, which reached adult level by age three. This suggests that as children develop from multi-word to multi-clause stages, they produce longer and more complex utterances. This finding is consistent with Hsu's longitudinal speech data (1996). It is noteworthy that age-related changes appeared when children's multiple-verb utterances were considered as a whole

category but not individual types of multiple-verb utterances. As mentioned above, the reason could be that the group differences on each type of multiple-verb utterances were too small to be significant.

### ***Relationship between Mothers' and Children's Word Order Uses***

The above results indicated that there are more age-related changes in children's word order uses than in their mothers'. This section explored the relationships between mothers' and children's word order uses. To gain insight into these relationships, scatterplots were first created with different word orders used by the mother-child dyads in the four age groups. All the scatterplots have mothers' percentage of utterances in a specific word order on the x axis and children's on the y axis. To highlight and compare group trends, different age groups have been plotted using different symbols. These scatterplots generally display two distribution patterns: (1) most children produced no utterances for a given word order regardless of how much their mothers produced, with the few producers being outliers, and (2) many (or some) dyads did produce a given word order, forming a cluster, and the remainder stayed on the x axis because the children did not produce any at all.

A series of correlational analyses were conducted to examine the relation between mothers' and children's specific word order use. To determine appropriate correlation tests, analyses of the skewness of each word order of mothers and children were first conducted.

When the skewness value is greater than 1.0, which means the distribution is significantly skewed, Spearman correlations should be performed. Otherwise, Pearson correlations should be conducted (Howell, 1999). Because the skewness values from the children's word order production were all greater than 1.0, Spearman tests were selected for these correlation analyses. The only exception was the skewness value of children's VtO use, which was 0.782; thus, a Pearson's correlation was conducted for this association.

Recall that 14-month-olds began with Vi and Vt utterances only, and that the other word orders were produced with different frequencies by older groups. In order to better consider variance in each age group and reflect children's development of word order, the correlation analyses were conducted in three ways: (1) all the four groups separately, (2) the three older groups together (20-, 26-, and 32-months), and (3) the two older groups together (26- and 32-months). The reason to conduct correlation analyses with the three and two older groups instead of all the four groups together is that, although 14-month-olds produced Vi and Vt utterances, their production provided little variance (most of their production percentages were either 0% or 100%,). They also produced no utterances in the other word orders. Table 7 presents the correlations between mothers' and children's different word order uses.



Table 7

*Correlation coefficients between mothers' and children's word order uses*

Word order	14m	20m	26m	32m	3 older groups	2 older groups
Verb Alone						
Vi	-.0290	.485	<b>.681*</b>	.212	.494**	.452*
Vt	-.027	<b>.633*</b>	<b>.766**</b>	.362	.557**	.527*
Va	----	-.037	<b>.686*</b>	.620	.315	.731**
SV						
SVi	----	.366	.406	.111	.121	.369
SVt	----	.365	.117	.452	.149	.209
SVa	----	.685*	.803**	.469	.677**	.650**
SVO						
SVtO	----	.362	<b>.693*</b>	.433	.313	.525*
VtO	----	.138	.401	.028	.085	.105

Note. \*  $p < 0.05$ ; \*\*  $p < 0.01$ , ----: no tests due to no occurrences by children

Table 7 (cont.)

*Correlation coefficients between mothers' and children's word order uses*

Word order	14m	20m	26m	32m	3 older groups	2 older groups
Non-Canonical						
Ba	----	----	.290	-.407	----	-.107
OV	----	.104	.317	-.013	.080	.153
OSV	----	----	.022	.838**	----	.465*
SOV	----	----	----	----	----	----
Copular utterances						
SPnom	----	.052	<b>.677*</b>	.494	.436*	.549*
SPadj	----	.407	.533	-.411	.361*	.329
SzaiLoc	----	----	.377	-.373	----	-.059
LocBeNP	----	----	----	----	----	----
LocYouNP	----	.529	.238	-.217	.227	.072

Note. \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; ----: no tests due to no occurrences by children

Table 7 (cont.)

*Correlation coefficients between mothers' and children's word order uses*

Word order	14m	20m	26m	32m	3 older groups	2 older groups
Multiple-V	----	-.306	.200	.079	.092	.014
SV1(O)V2(O)		.112	.127	.097	.080	.083
SV1V2(O)		.705*	.202	.188	.188	-.255
S1V1S2V2(O)		----	.290	.522	----	.406
SV1NV2(O)		----	----	.437	----	----
SV1(O)PNV2		----	.588	.402	----	.465*

Note. \*  $p < 0.05$ ; \*\*  $p < 0.01$ , ----: no tests due to no occurrences by children

As shown in Table 7, ten word order uses showed significant relationships: Vi, Vt, Va, SVa, SVtO, OSV, SPnom, SPadj, SV1V2(O), and SV1(O)PNV2. What follows presents scatterplots of these word orders.

As for the **Vi frame**, there was a significant relation between mothers and their 26-month-olds. Significant relations were also found when the three older groups together and two older groups together were considered (See Figure 15).

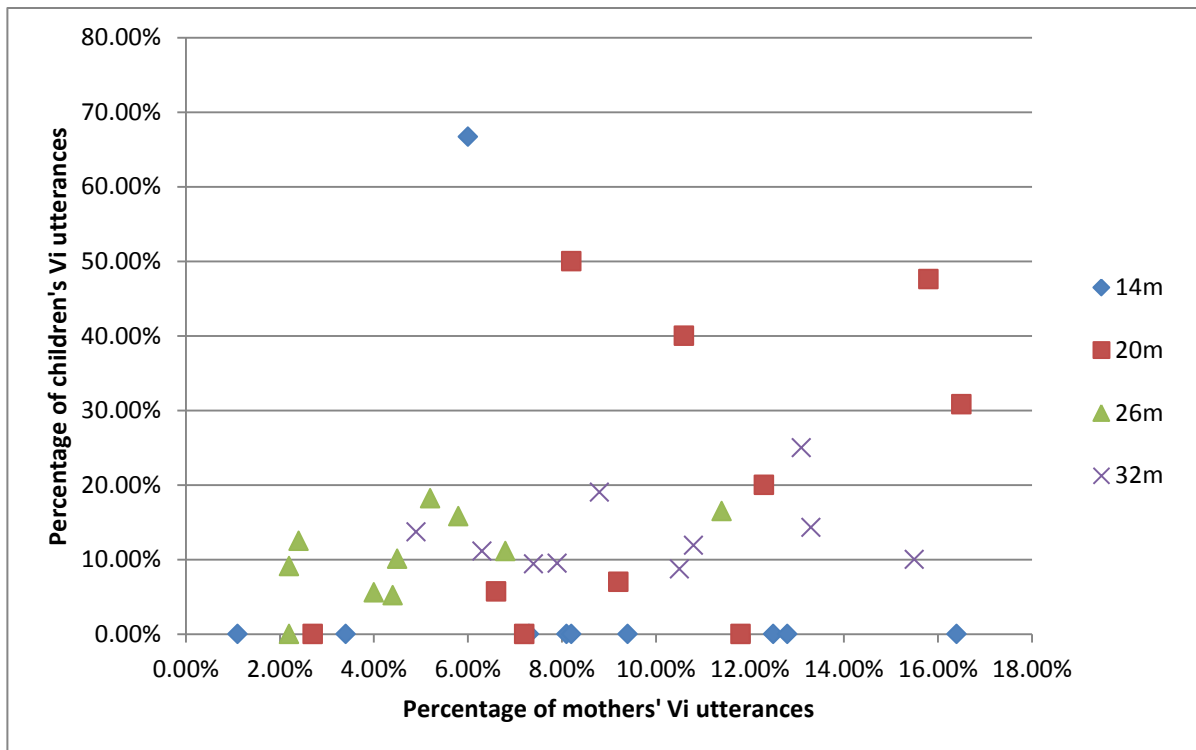


Figure 15 Scatterplot of mothers' and children's Vi utterances

As for the **Vt frame**, there was a significant relation between mothers and their 20-month-olds and between mothers and their 26- month-olds. Significant relations were also found when the three older groups together and the two older groups together were considered (See Figure 16).

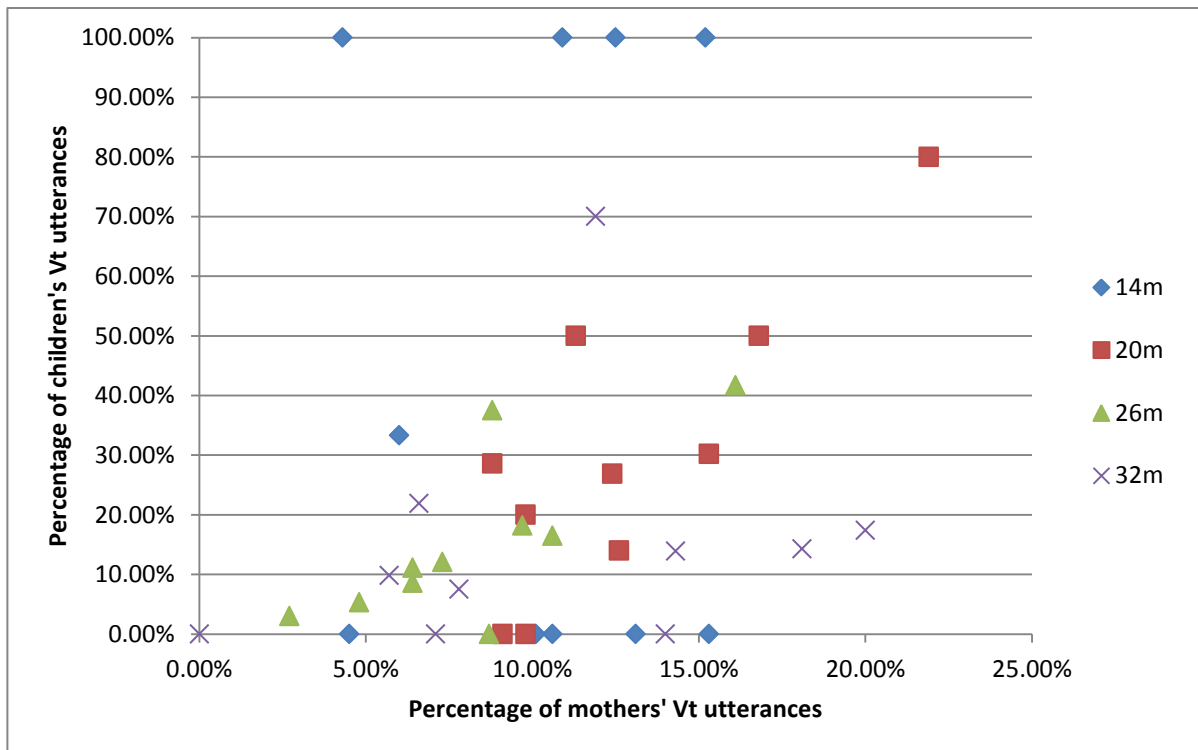


Figure 16 Scatterplot of mothers' and children's Vt utterances

As for the **Va frame**, there was a significant relation between mothers and their 26-month-olds. A significant relation was also found when the two older groups together were considered (See Figure 17).

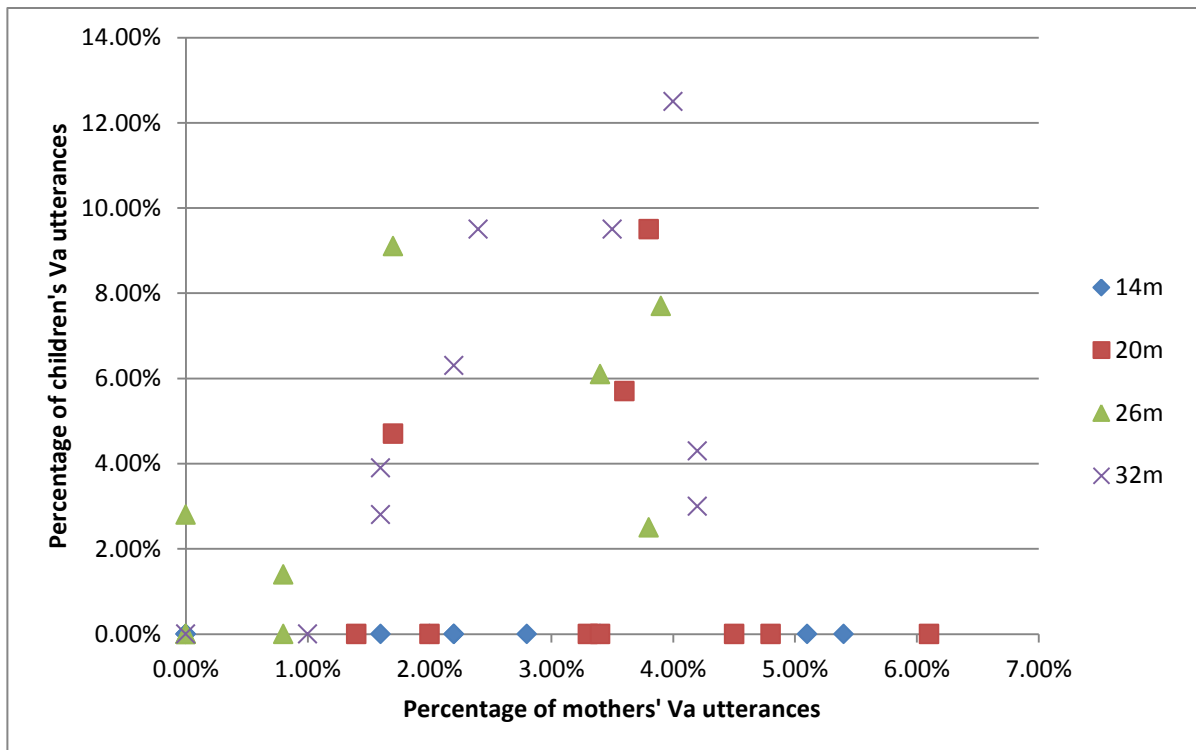


Figure 17 Scatterplot of mothers' and children's Va utterances

As for the **SVa frame**, there was a significant relation between mothers and their 20-month-olds and between mothers and their 26-month-olds. Significant relations were also found when the three older groups together and the two older groups together were considered. However, scrutiny of Figure 18 indicates that these correlations are actually based on just a few outliers, which inflated the correlation coefficients. Most mother-child dyads produced few and even no SVa utterances. Thus, these correlations regarding SVa frame cannot be considered valid.

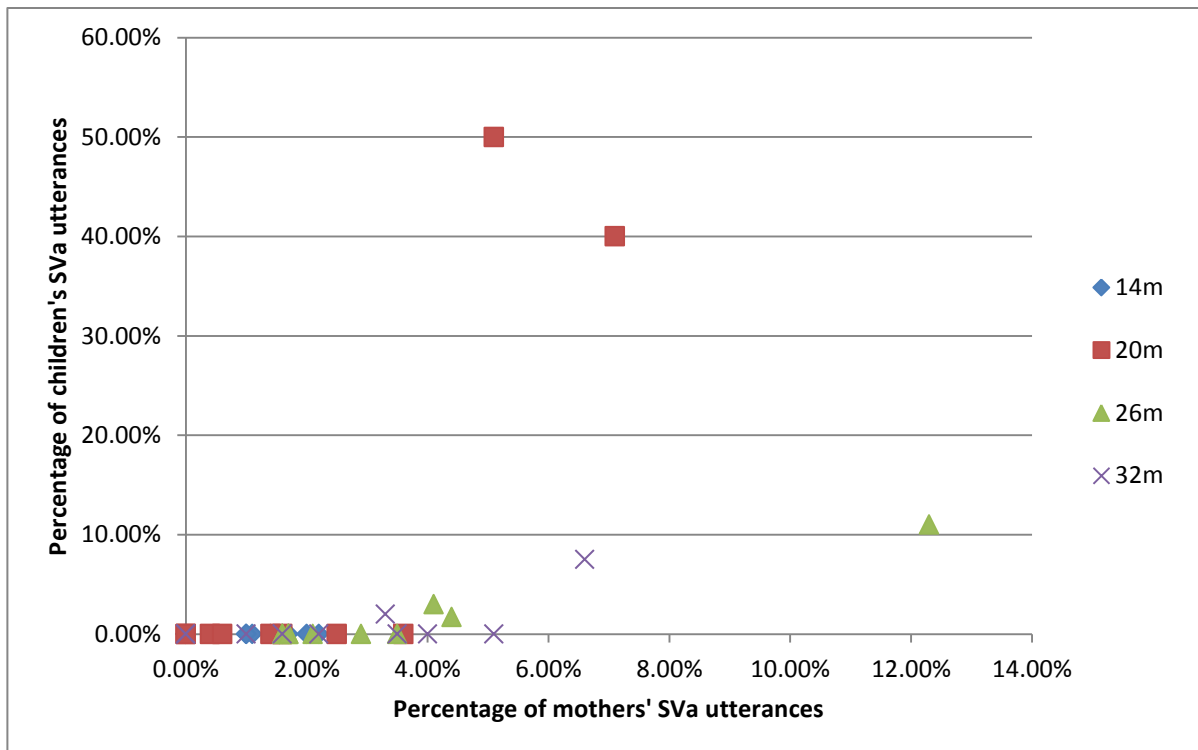


Figure 18 Scatterplot of mothers' and children's SVa utterances

As for the **SVtO frame**, there was a significant relation between mothers and their 26-month-olds. A significant relation was also found when the two older groups together were considered (See Figure 19).

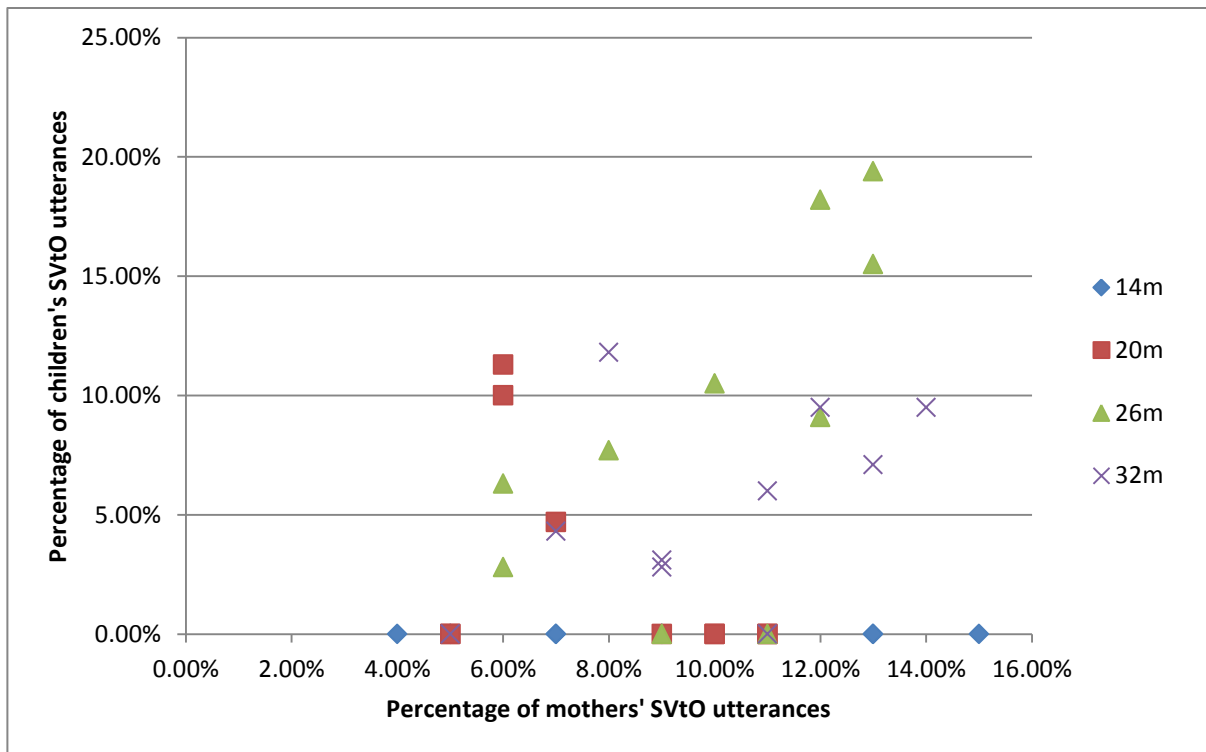


Figure 19 Scatterplot of mothers' and children's SVtO utterances



As for the **OSV frame**, there was a significant relation between mothers and their 32-month-olds. A significant relation was also found when the two older groups together were considered (See Figure 20). However, scrutiny of Figure 20 indicates that these correlations are actually based on just two outliers, which inflated the correlation coefficient. Thus, these correlations cannot be considered valid.

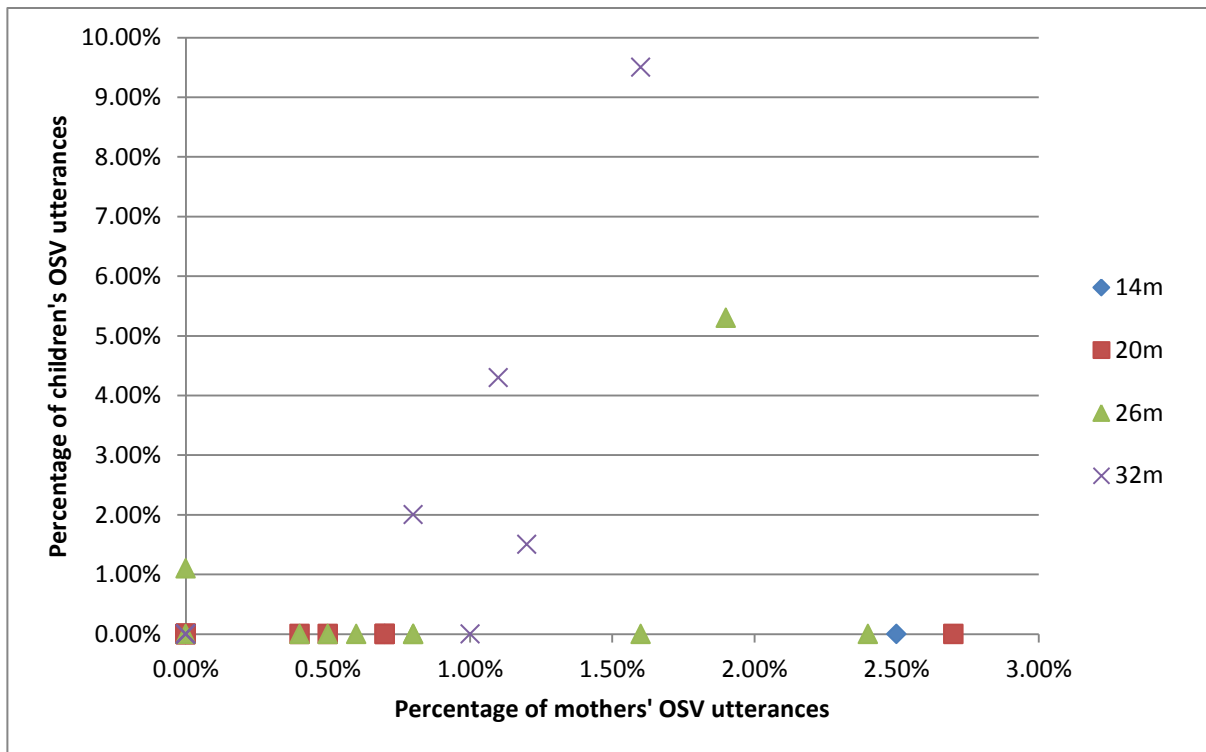


Figure 20 Scatterplot of mothers' and children's OSV utterances

As for the **SPnom frame**, there was a significant relation between mothers and their 26-month-olds. Significant relations were also found when the three older groups together and two older groups together were considered (See Figure 21).

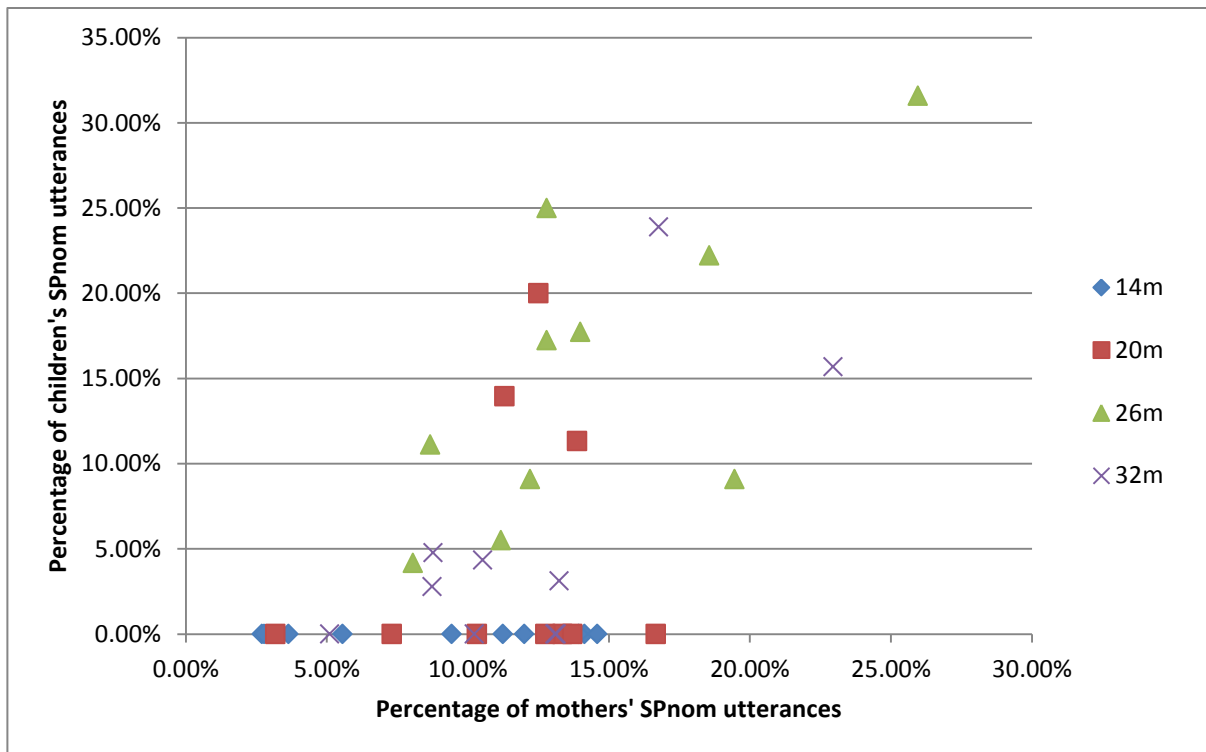


Figure 21 Scatterplot of mothers' and children's SPnom utterances

As for the **SPadj frame**, no relation was found with each age group alone. Only a significant relation was found when the three older groups together were considered. Most of the variance was from six dyads in the 26-month-old group. However, the 26-month-old group per se did not show significant relation. Thus, this correlation cannot be considered valid. (See Figure 22).

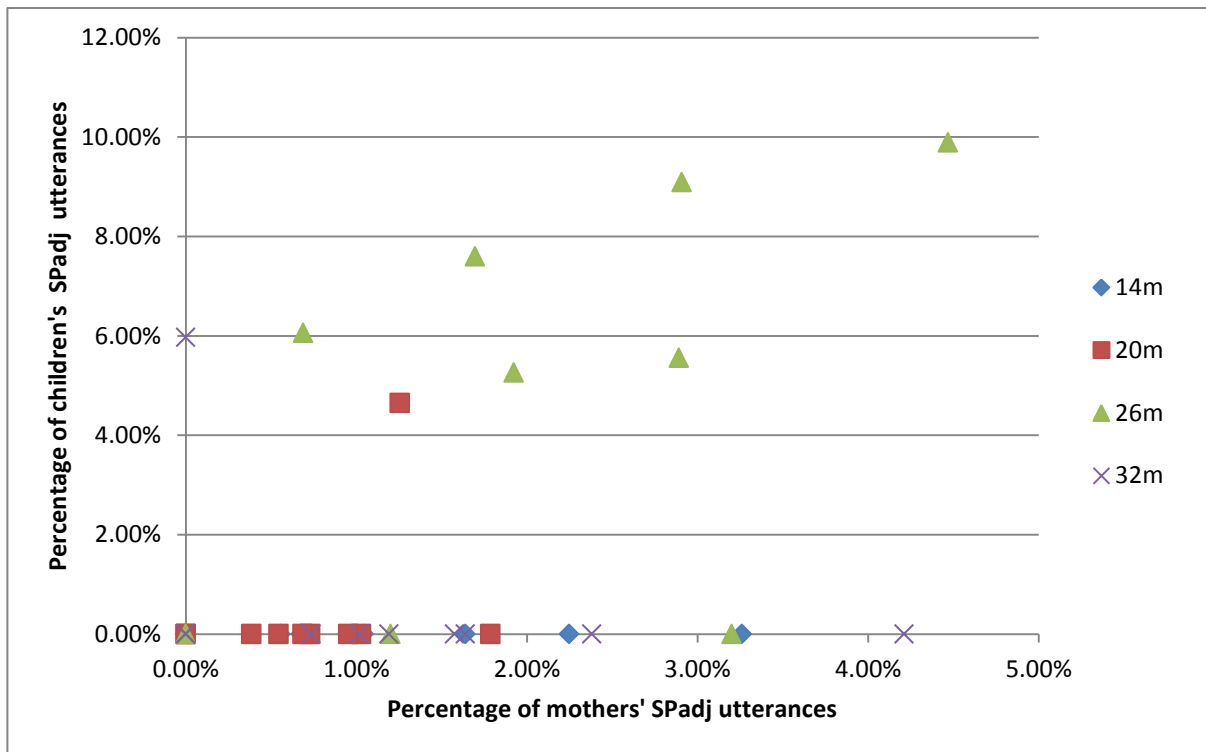


Figure 22 Scatterplot of mothers' and children's SPadj utterances





The purpose of the correlational analyses conducted in this section is to ask whether mothers who produce a specific word order frequently have children who do the same. The results show that, for most word orders, there was no relationship between mothers' and children' uses. Only five word orders showed a significant relationship within an age group. The dyads in the 20-month group were significantly related in their Vt utterances while those in the 26-month group were significantly related in their Vi, Vt, Va, SVtO, and SPnom utterances. However, none of these five word order uses showed a significant relationship in the 32-month group. When two or three older groups were combined, significant correlations between mother and children were found in all of these five word orders.

Why did most word orders fail to show a relationship between mothers and children?

There are several possibilities. First, mothers produced many word orders that their children have not produced (e.g., non-SVO word orders, copular, and multiple-verb utterances). Second, due to ellipsis of noun arguments allowed in Mandarin, a given word order does not always elicit the same word order in the ongoing conversation. For example, when a mother asks "Do you want juice?" in Mandarin, which is SVO word order, the child could answer "I don't want juice" (i.e., SVO word order). In everyday conversation, however, the frequent answers would be either "want" "don't want", or "I don't want" (i.e., V-alone and SVt word orders). This example illustrates that an SVO question is more likely to elicit verb-alone

and/or SVt answers than an SVO answer. Third, for a quantitative relationship to occur, there must be a certain amount of frequency in both mothers and children (Cameron-Faulkner et al., 2003). When some or most children in each age group failed to reach enough frequencies in their word order uses, this leads to low variability, making correlations impossible.

### ***Frequency Distribution of Utterance Types within Word Orders***

One of the purposes of the current study is to examine whether there is a specific utterance type more frequently used in mothers' and children's different word orders, respectively. After all qualified utterances were coded for utterance type (Declarative/Imperative/Question), the frequencies were recalculated as percentages for each different word order. The way the percentages were calculated in this part is different from that in the preceding parts. The percentages in this part are calculated by dividing the number of utterances in an utterance type by the total number of utterances in a specific word order. For example, one mother produced 10 Va utterances, of which there were 5 declaratives, 3 imperatives, and 2 questions. The percentages for these three utterances types would be 50% (5/10), 30% (3/10), and 20% (2/10) respectively. Figures 25-37 show the distribution of mothers' and children's declarative, and imperative, and question utterances in different word orders.

Because the focus of this section is not on age-related changes in utterance types, the

data were collapsed across age for Paired-Samples *t*-tests. The significance level for separate Paired-Samples *t*-tests was adjusted by dividing the alpha level by the number of tests that were conducted. With three utterance types: Declarative, Imperative, and Question, there were three Paired-Samples *t*-tests (i.e., Declarative vs. Imperative, Declarative vs. Question, and Imperative vs. Question). The adjusted significance level for each Paired-Samples *t*-tests is  $p < 0.017$  ( $0.05/3$ ).

The same procedures were applied to analyze children's utterance types in different word orders. Because 14-month-olds only produced Vi and Vt utterances, children's Paired-Samples *t*-tests were conducted with all the four age groups for Vi and Vt frames and with the older three age groups for the remainder of word orders.

Paired-Samples *t*-tests indicated that mothers did use different word orders for different utterance types. The high-frequency utterance types found in mothers' different word orders are generally either declaratives or imperatives. There are four patterns for utterance type distribution. (1) Declaratives were produced significantly more than imperatives and questions in the Va, SVa, and OSV frames (Figures 25-27). (2) Both declaratives and questions were produced significantly more than imperatives in the SVtO frame (Figure 28). (3) Imperatives were produced significantly more than declaratives and questions in the Vi, Vt, SVt, VtO frames, Ba construction, and Multiple-verb utterances (Figures 29-34). (4)



Declaratives, imperatives, and questions were used roughly equivalently in the SVi and OV frames (Figures 35 & 36). Figure 37 presents the utterance type distribution within Copular utterances. Due to the fact that copular constructions cannot be used as imperatives, only declaratives and questions were produced; these two utterance types appeared with roughly similar frequencies.

Unlike their mothers, children did not use different word orders for different utterance types. Instead, they showed a consistent distribution pattern in their utterance types. Children of all age groups produced significantly more declaratives (33.33%-100%) than imperatives (0%-66.67%) and questions (0%-16.67%) for all their word order uses. Taken together, the predominant utterance type in early years is the declarative, intermingling with a small number of imperatives and few questions.

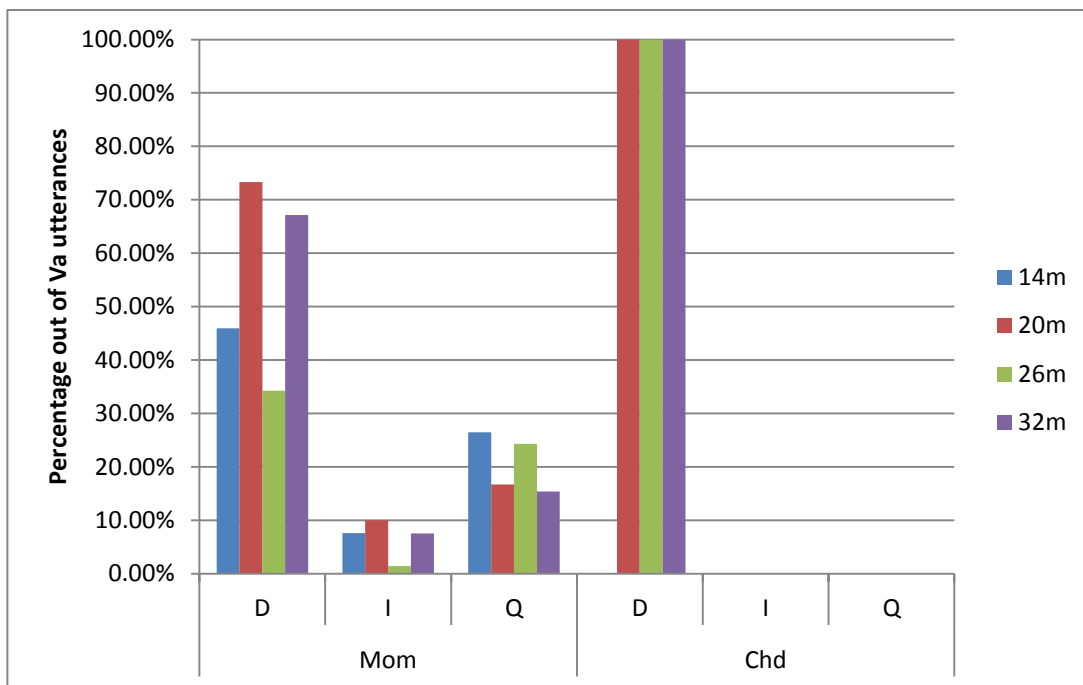


Figure 25 Utterance types in Va frame used by mothers and children of the four age groups

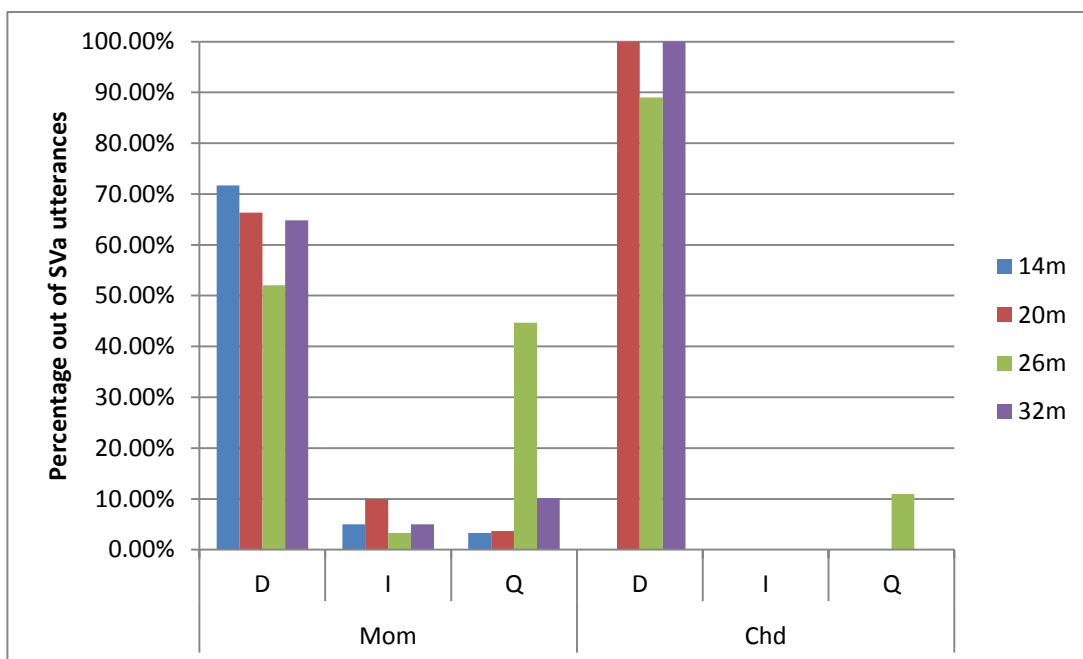


Figure 26 Utterance types in SVa frame used by mothers and children of the four age groups

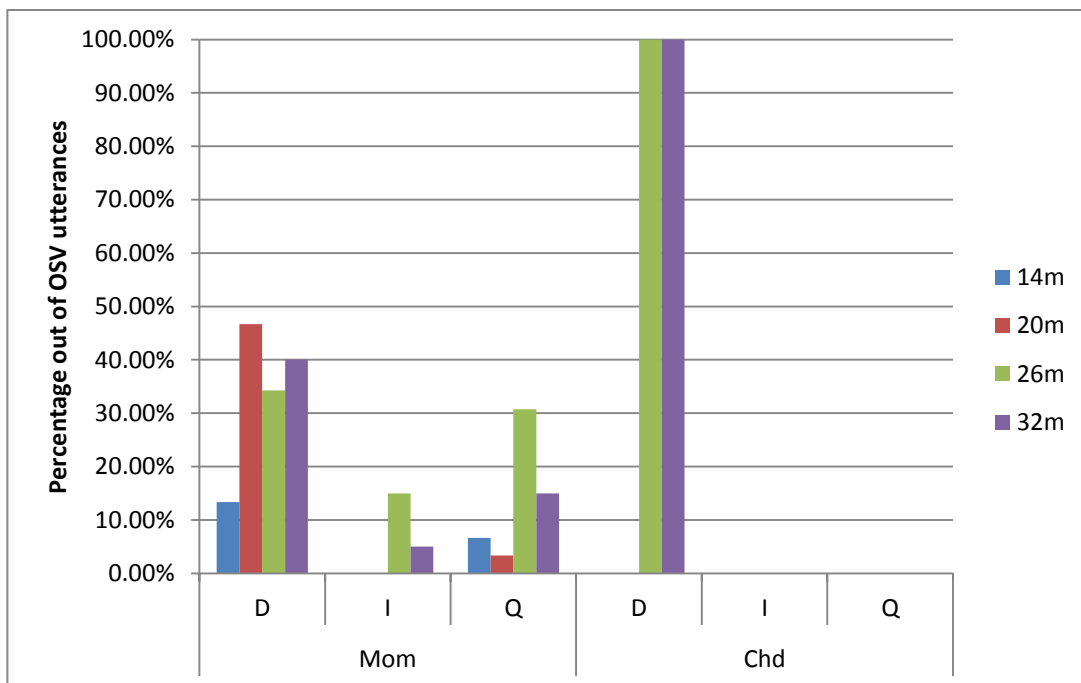


Figure 27 Utterance types in OSV frame used by mothers and children of the four age groups

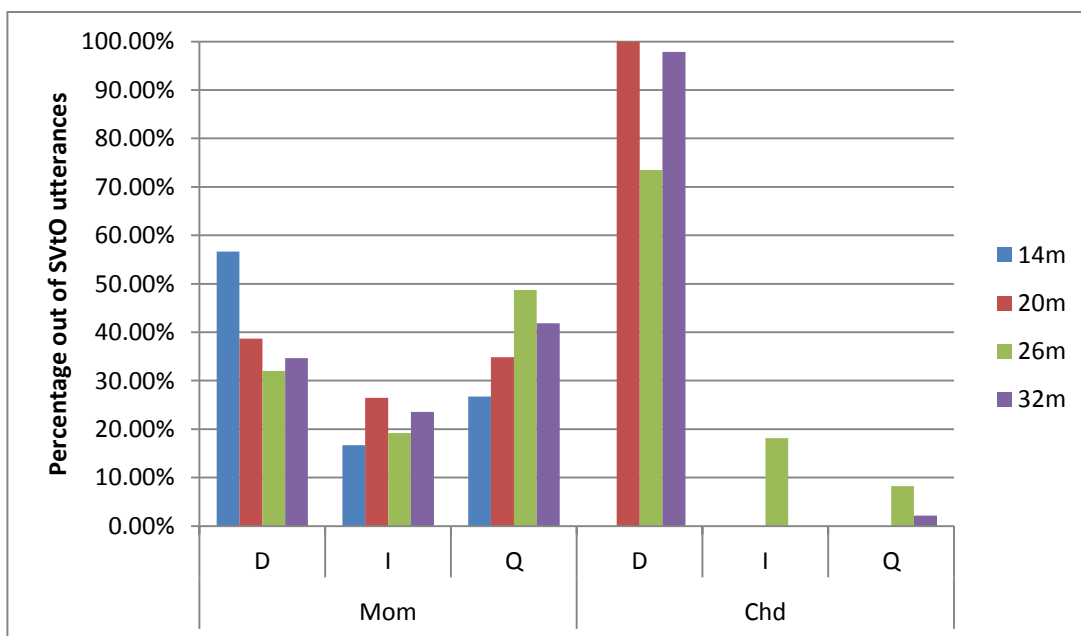


Figure 28 Utterance types in SVtO frame used by mothers and children of the four age groups

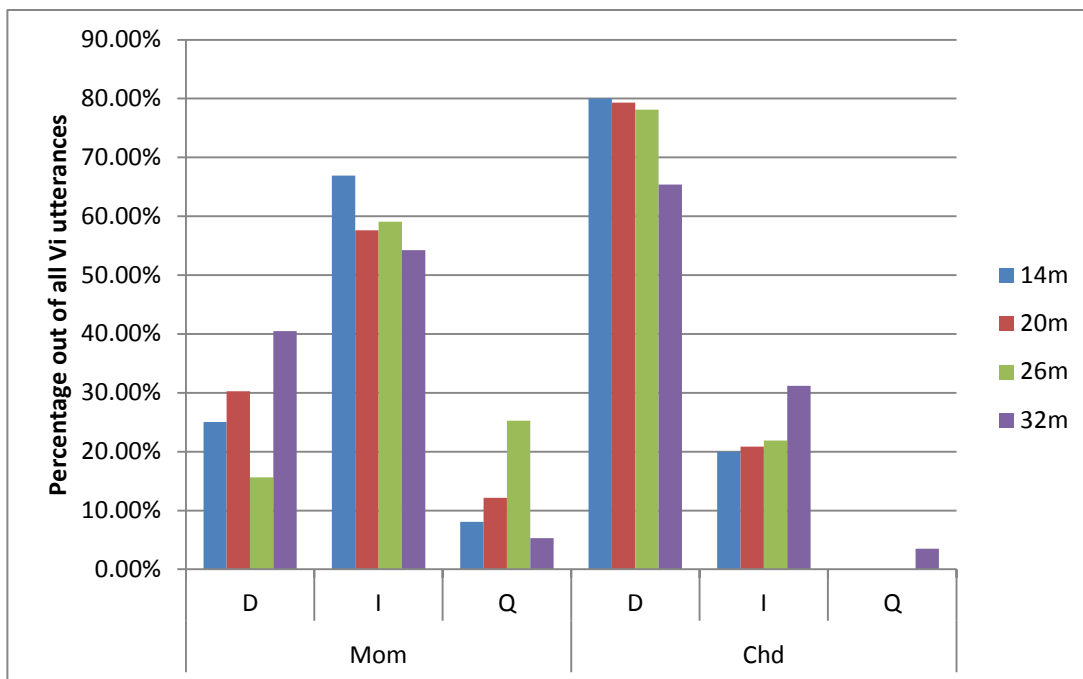


Figure 29 Utterance types in Vi frame used by mothers and children of the four age groups

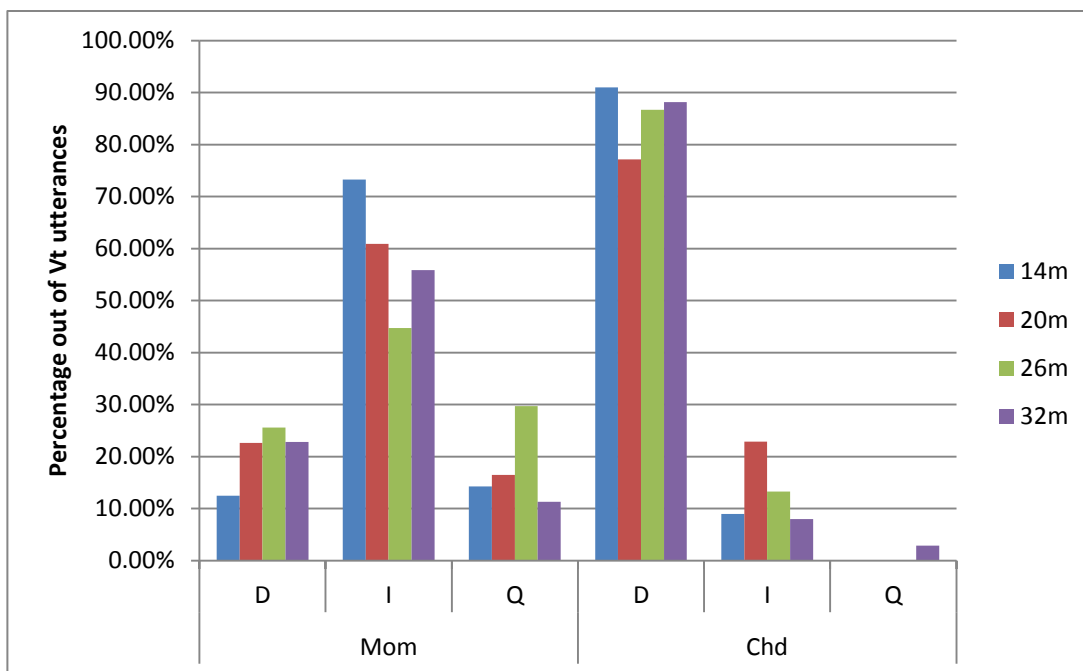


Figure 30 Utterance types in Vt frame used by mothers and children of the four age groups

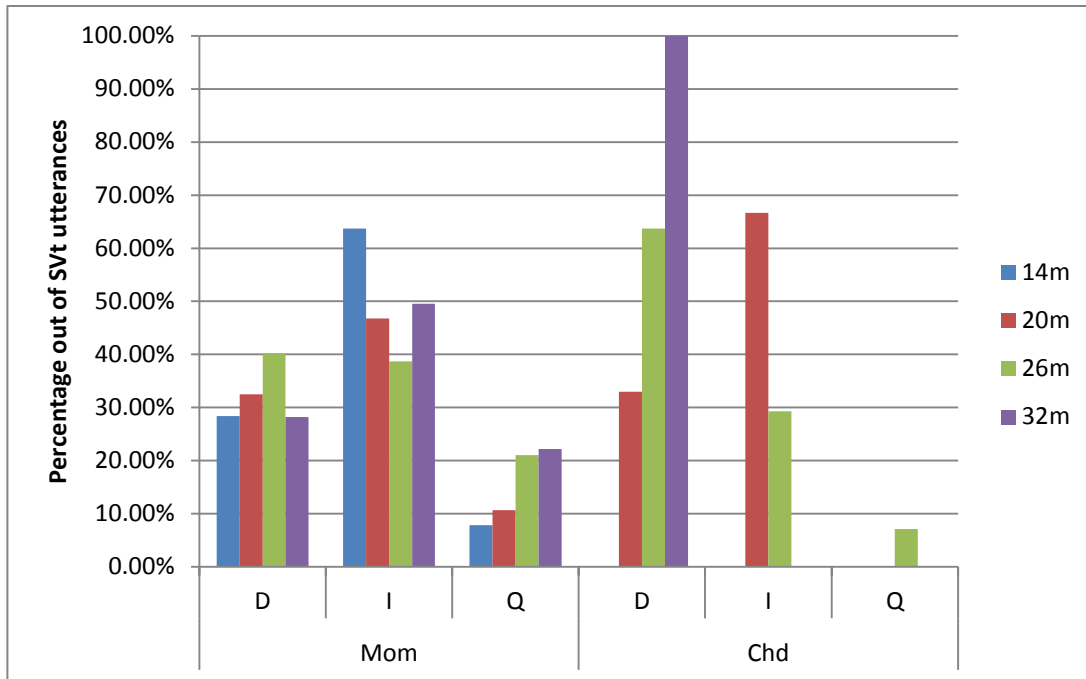


Figure 31 Utterance types in SVt frame used by mothers and children of the four age groups

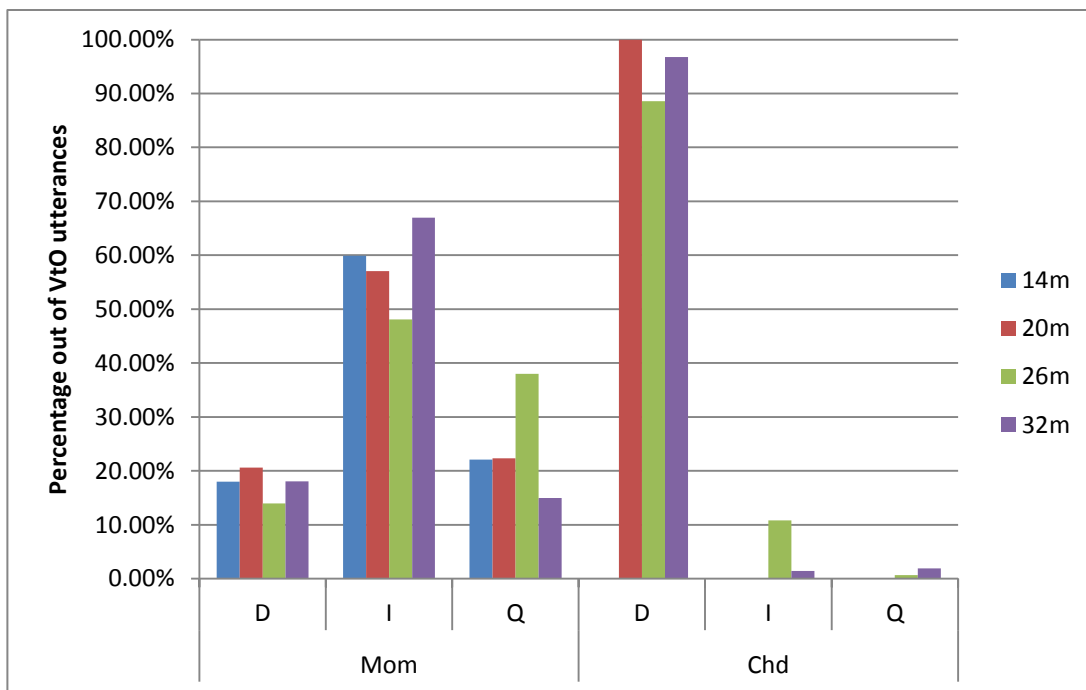


Figure 32 Utterance types in VtO frame used by mothers and children of the four age groups

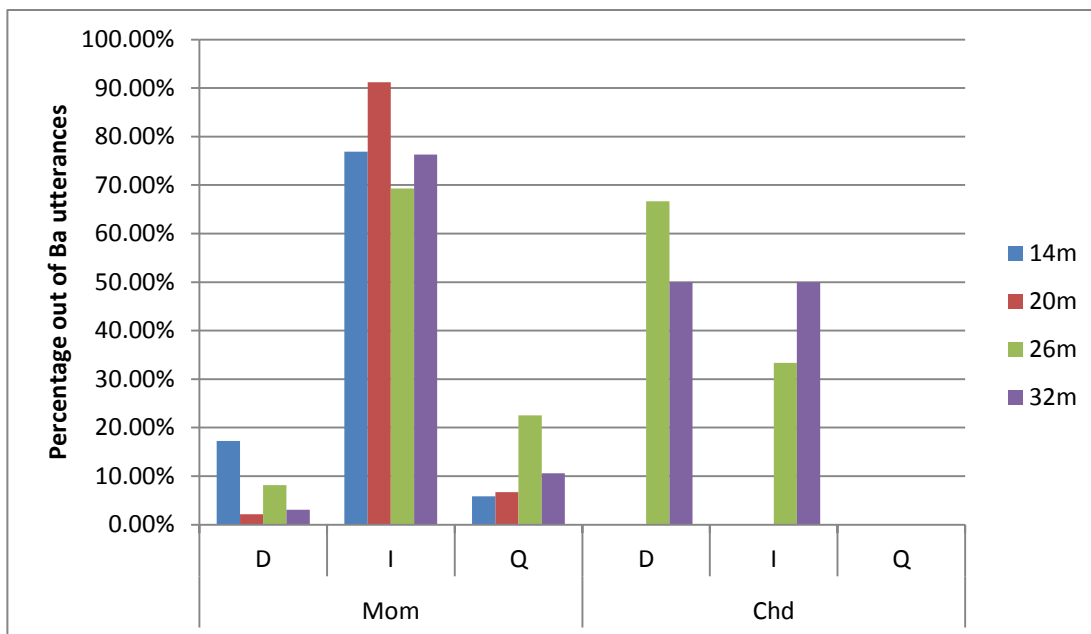


Figure 33 Utterance types in Ba construction used by mothers and children of the four age groups

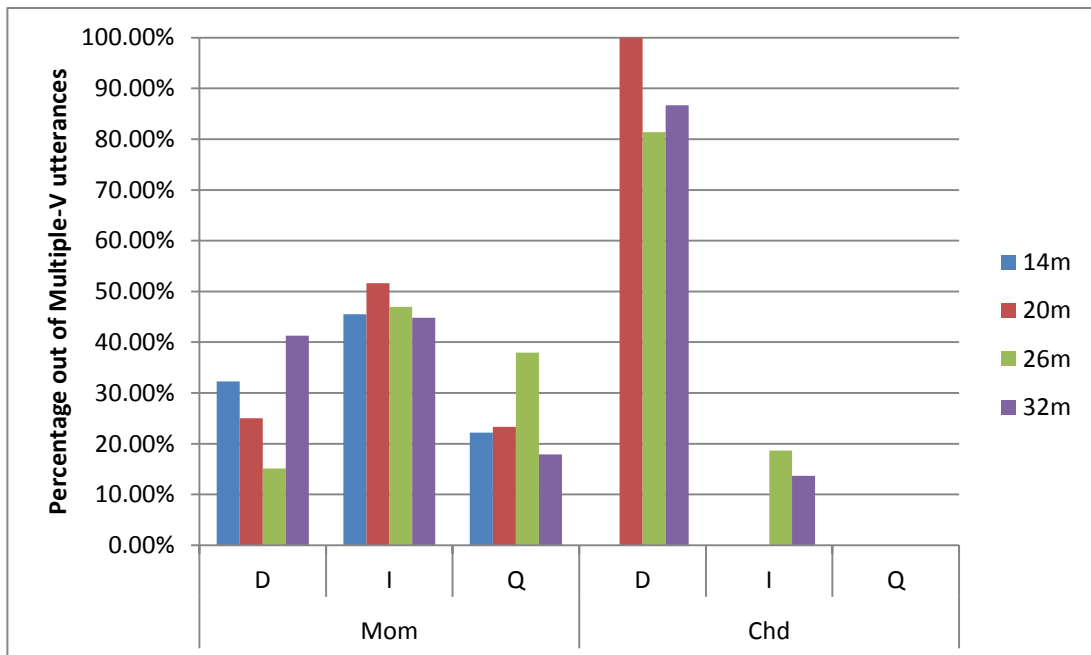


Figure 34 Utterance types in Multiple-verb utterances used by mothers and children of the four age groups

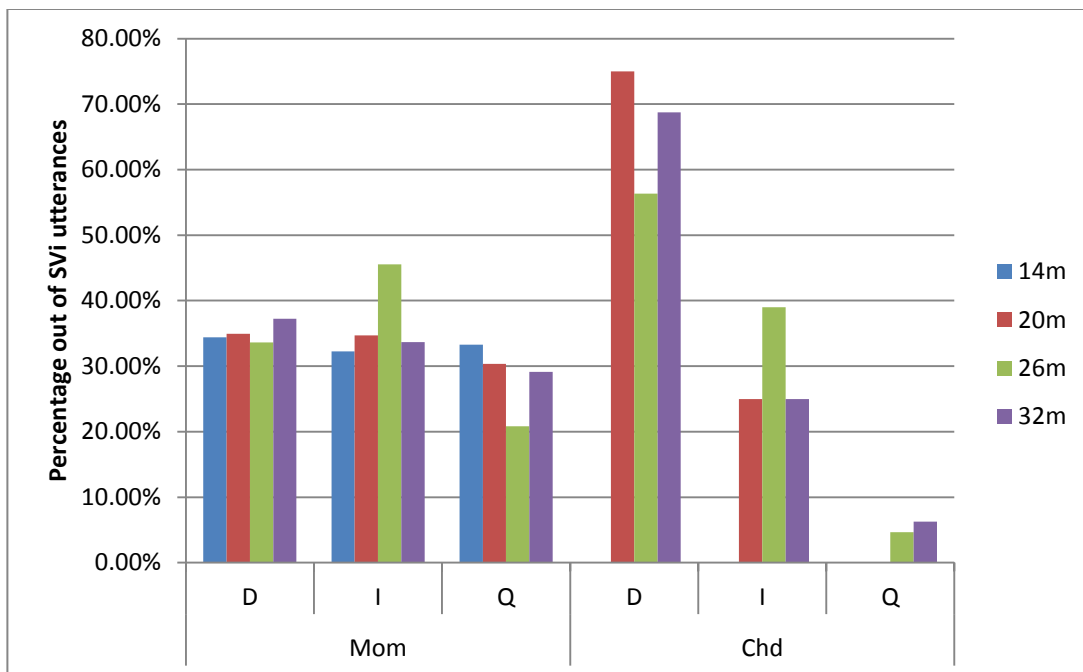


Figure 35 Utterance types in SVi frame used by mothers and children of the four age groups

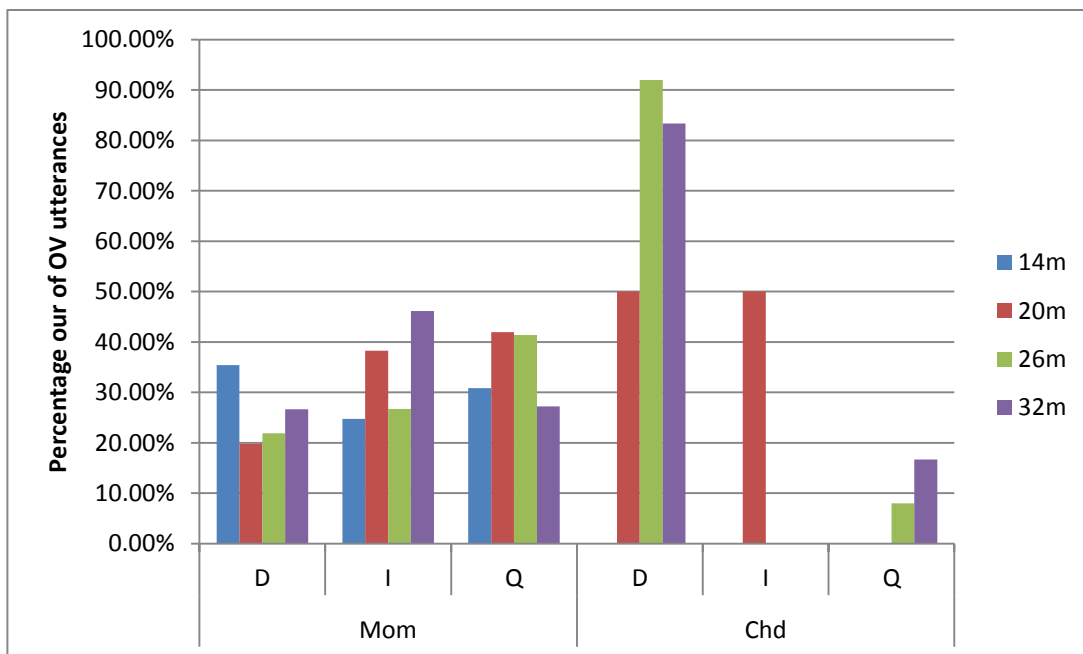


Figure 36 Utterance types in OV frame used by mothers and children of the four age groups

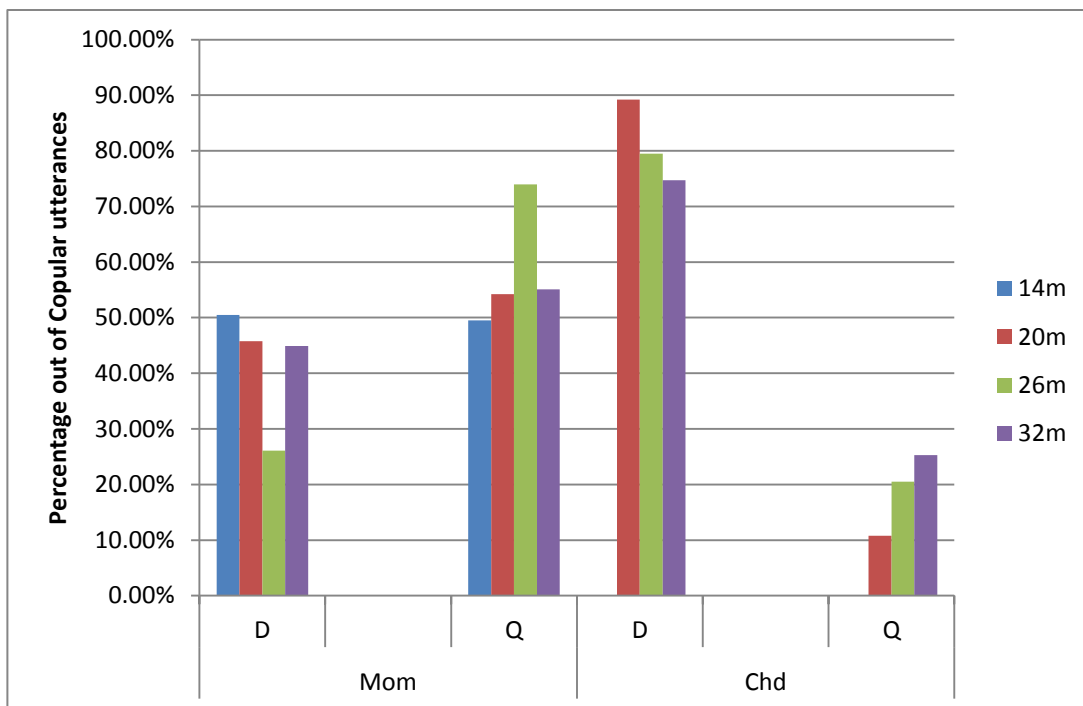


Figure 37 Utterance types in Copular utterances used by mothers and children of the four age groups



### ***Verb Diversity within Word Orders***

This section investigated how different verb classes occurred in mothers' and children's word order uses. As mentioned in the Method, analyses on verb diversity examined word orders that involved only intransitive (i.e., Vi and SVi) and transitive verbs (i.e., Vt, SVt, SVtO, VtO, BaOV, OV, and OSV; SOV was excluded due to extremely rare occurrences by mothers and no occurrences by children). All verbs used by mothers and children in the above word orders were classified into the 15 semantic classes that were described in the Method. The next step was to calculate how many different semantic classes in action verb and state verb categories were used in each word order. The more semantic classes that appeared in a specific word order, the greater verb diversity for that frame. Figures 38 and 39 present the distribution of semantic classes in action verb and state verb categories used by mothers and children.

As Figure 38 shows, the canonical transitive constructions (SVt, SVtO, and VtO) included more verb classes than the non-canonical transitive constructions (BaOV, OV, and OSV) and the intransitive construction (SVi). Because some state verb classes (e.g., possession verbs, relation verbs, etc.) must appear in transitive constructions, intransitive constructions typically included fewer state verb classes. Distribution of verb classes in mothers' Ba construction is strikingly different from those in other transitive constructions.

Only five action verb classes appeared in mothers' Ba construction and no state verb classes were found. Compared to mothers, children produced fewer verb types but their distribution shows a very similar pattern to their mothers' (See Figure 39). To examine whether verb diversity in child constructions reflects that in mothers', correlation analyses on mothers' and children's total numbers of and proportions of action and state verbs were conducted and both correlations were statistically significant ( $r = 0.923, p < 0.01$ ;  $r = 0.803, p < 0.01$ ).

To further examine whether verb diversity in a construction is related to age of acquisition (earlier vs. later), two biserial correlations were conducted for mothers and children respectively. Six transitive constructions (SVt, SVtO, VtO, OV, OSV, BaOV) were divided into two groups based on the age that children reached adult levels of frequency (See Table 4), which is the continuous dichotomous variable. And the other variable is the number of verb classes in each construction. Intransitive constructions were not included in this correlation analysis because verb diversity in intransitive constructions must be lower than that in transitive constructions due to the inability to co-occur with some transitive state verb classes as mentioned above.

The results showed that the relation between age of acquisition and verb diversity in maternal constructions is marginally significant ( $r = 0.808, p = 0.052$ ), suggesting that maternal constructions with greater verb diversity tend to be acquired earlier. The relation

between age of acquisition and verb diversity in child constructions is significant ( $r = 0.889$ ,  $p < 0.05$ ), suggesting that earlier acquired constructions in child production have greater verb diversity.

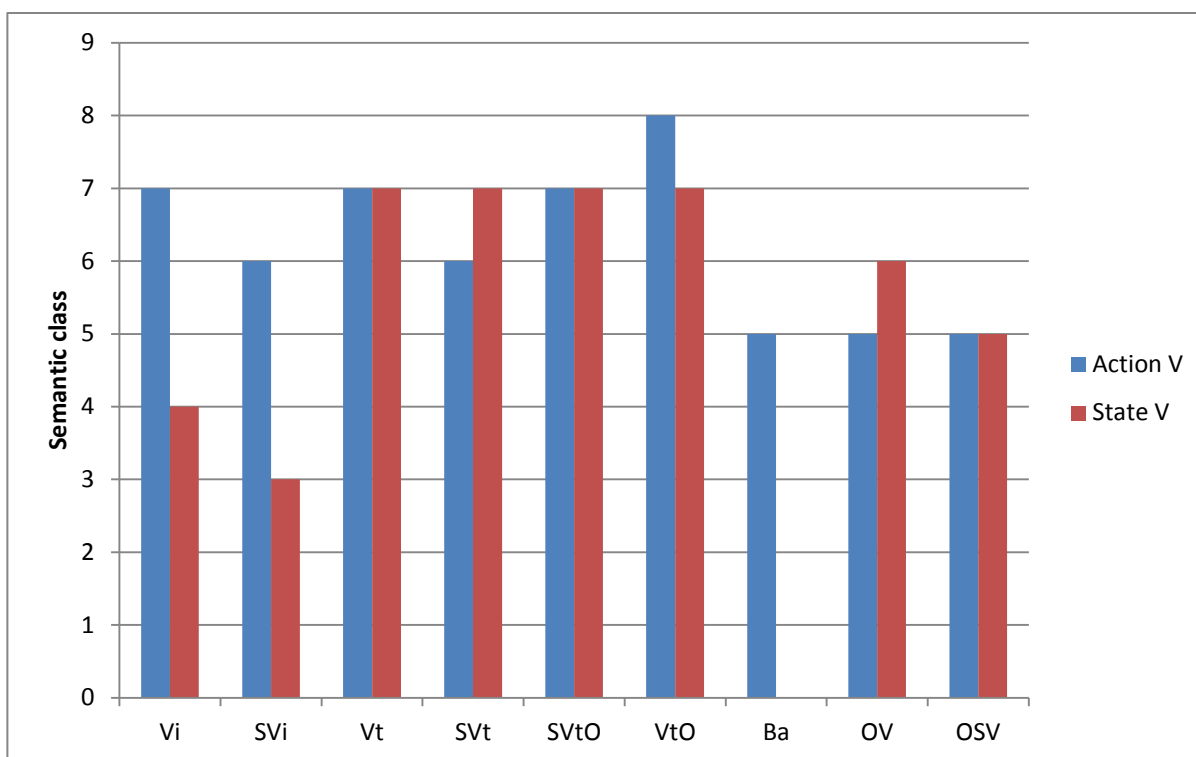


Figure 38 The distribution of verb class types in mothers' word order uses

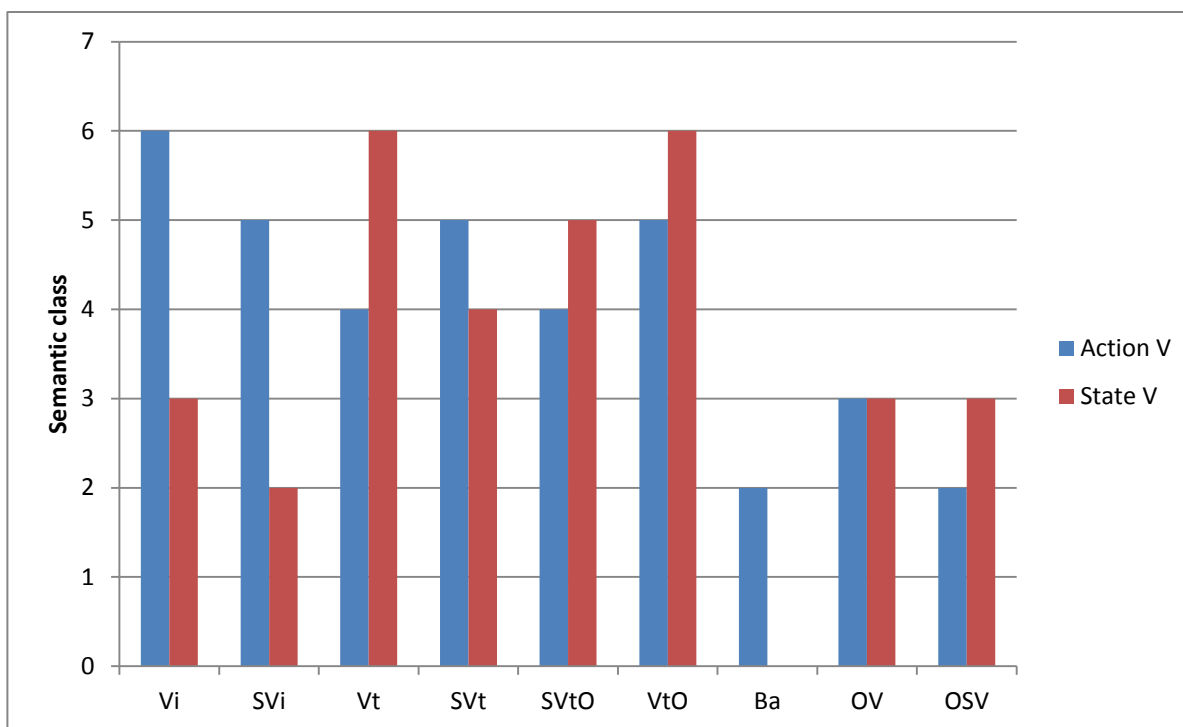


Figure 39 The distribution of verb class types in children's word order uses

## Discussion

This dissertation investigated the role of maternal input in word order acquisition of Mandarin-speaking children aged 14, 20, 26, and 32 months. Four questions about word order uses in maternal input were addressed in this dissertation: (1) whether there are frequency effects in the distribution of child word order uses and in the order of acquisition of different word orders, (2) whether there are age-related changes in maternal word order uses, (3) whether mothers use different word orders for different utterance types and whether these word order uses are related to acquisition of different word orders, and (4) how verb diversity in mothers' word order uses is related to acquisition of different word orders. By analyzing spontaneous speech of 40 mother-child dyads of the four age groups, this dissertation has four main findings. (i) Mothers across all four age groups produced a variety of word orders and constructions in their speech but no age-related changes were found in their word order uses. Frequency effects were found in child SVO and copular utterances, but not in the child Ba construction and different multiple-verb constructions. Most child word order uses reached adult levels of frequency at either 26 or 32 months. (ii) No significant relationships were found between mothers and children in most word orders. (iii) Mothers produced different word orders for different utterance types but children did not; instead, children mainly produced declaratives, along with some imperatives, and few questions across all word orders.

(iv) The distribution of verb diversity within maternal and child word orders shared a similar pattern. Word orders with greater verb diversity tended to be those acquired earlier. In what follows, I first provide a description of the nature of the input to Mandarin learners over the course of word order acquisition, and then discuss how information in and other than the input plays a role in word order acquisition. Finally, theoretical implications, study limitations, and future directions are discussed before the conclusion is made.

### ***The Nature of the Input to Mandarin Learners***

By documenting the full range of word order uses in early maternal and child speech, this dissertation provides distributional information about the input that Mandarin learners typically hear over the course of word order acquisition. In about 20-minutes of mother-child interaction, mothers produced a variety of word orders and constructions in their speech. For example, if a mother produces 100 verb-containing utterances, there would be about 23 verb-alone utterances, 13 SV utterances, 9 SVO utterances, 14 VO utterances, 5 Ba utterances, 4 OV utterances, 1 OSV utterance, 16 copular utterances in 5 different constructions, and 15 multiple-verb utterances in 6 different constructions. Similarly, many non-SVO word orders and copular constructions appeared in these multiple-verb utterances. All these different word orders and constructions found in mothers' single-verb and multiple-verb utterances illustrate and confirm that maternal input to Mandarin learners for their word order acquisition is full of

syntactic diversity. Furthermore, due to the lack of age-related changes found in mothers' word order uses, these findings suggest that Mandarin learners have been hearing such syntactically diverse input throughout the course of word order acquisition.

The analyses of age-related changes in mothers' word order uses revealed that, contrary to my prediction, mother did not adapt their word order uses in response to children's age and/or their linguistic competence. I conjecture that the lack of age-related changes in mothers' word order uses is rooted in that fact that word order in Mandarin Chinese cannot be freely permuted. As mentioned in the Introduction, Mandarin Chinese has no case-marking system and relies exclusively on word order to convey the idea of who does what to whom. Thus, how to arrange agent, patient, and action in order is critical. Different orders of the same set of agent patient, and action may result in grammatically unacceptable or semantically different sentences. Constraints on the choice of word order in Mandarin Chinese have been noted in previous studies. For example, Li and Thompson (1981) pointed out that the word order in an utterance is primarily determined by semantic factors rather than grammatical ones. Thus, preverbal position signals definiteness. Topics, subjects, and objects in preverbal position are interpreted as definite because these topics, subjects, and objects are already known to both the speaker and the hearer (See Examples 5-12). Additionally, in her elicitation task study on information focus in Mandarin sentences, Zhang (1994) found that pragmatic

factors determine word order to differentiate known and new information in the discourse context; the known information tends to appear in the sentence-initial position while the new information tends to be placed in the sentence-final position (See also Chu, 2010). Taken together, the importance of word order and constraints on word order suggest that word order is not a flexible choice in most situations. Thus, it is not surprising to find that mothers did not change their word order uses over time.

***Information in Input Used for Word Order Acquisition: Frequency vs. Verb Diversity***

If the input to young Mandarin learners is syntactically diverse, then such input has not been syntactically simple to them because all these word orders and constructions come mixed together early in development rather than being introduced one or two at a time to match their growing linguistic competence. Then, what information in input can guide Mandarin learners when learning different word orders and constructions? One source of information is frequency, which has been widely recognized as an important factor to explain the sequence of acquisition across lexicons and constructions (e.g., Ambridge et al., 2015). My findings suggest another possibility as well, though: verb diversity.

Generally speaking, the distributions of child word order uses reflected the input frequency in mothers' speech (Figures 1a and 1b), showing similar distributional patterns. High-frequency word orders in mothers' speech (e.g., SVi, SVt, SVtO, VtO, copular



constructions) tend to appear earlier and more frequently in child production while low-frequency word orders (e.g., non-SVO word orders) tend to appear later and less frequently. These findings suggest that children are sensitive to frequency distributions in the input and make use of those distributional patterns for their word order acquisition. Further comparison of mothers' and children's distribution revealed that word orders with higher input frequencies were those reaching adult levels of frequency at 26 months while word orders with lower input frequencies were those reaching adult levels at 32 months or later (See Table 4). Specifically, frequency effects are evident in the acquisition of SVO word orders and copular constructions.

However, some contradictory findings were observed in the acquisition of non-SVO word orders. While the Ba construction was relatively frequent in children's early input, it was rarely produced by children under three years of age. Instead, the OV frame, which matches the Ba construction in frequency in the input, increased significantly in child speech from 26 months to 32 months. Thus, Mandarin learners produce OV utterances much like adults before age three. This finding is consistent with Erbaugh's observation (1982) and suggests that frequency alone cannot completely explain the acquisition of the non-SVO orders. One of possible explanations for such inconsistency could be from observations of previous studies; young children hesitate to produce the Ba construction due to the vague

meaning of the *Ba* marker. It could be that young children have not yet grasped the meaning of the *Ba* marker so they do not use *BaOV* frequently (Cheung, 1992). Both the *Ba* construction and the *OV* frame can be used to denote how the state of the NP (i.e., the Object) is affected due to the Subject's action upon it. Compared to the *Ba* construction, however, the *OV* frame is simple and direct; thus, using a pure *OV* frame would make production more effortless for young children and further facilitate their *OV* occurrence. Review of all speakers' *OV* utterances found that fewer than half of the mothers' *OV* utterances (19%-38%) have potential to become *BaOV* utterances, while more than half of children's *OV* utterances (55%-67%) do. This suggests that children might tend to use the *OV* frame in situations when the *Ba* construction is preferred by adult speakers.

The current findings also suggest another possibility, namely the verb diversity occurring within a construction. Like the foregoing frequency distributions, the distribution of verb diversity in mothers' and children's transitive and intransitive utterances showed a similar distributional pattern (Figures 38 and 39). Word orders with greater verb diversity in mothers' speech were those reaching adult levels of frequency at 26 months while word orders with lower verb diversity were those reaching adult levels at 32 months or later. The analysis of verb diversity found a salient difference between the *Ba* construction and all the other transitive constructions: no state verbs were found in either mothers or children's *Ba*

utterances. It is noteworthy that, despite the lack of state verbs in the current maternal Ba utterances, some of state verbs (e.g., xiang3, ‘*think*’, kan4 ‘*look*’) are likely to occur in adult-to-adult Ba construction (Li & Thompson, 1981).

The difference in verb diversity between the Ba construction and the OV frame might help to explain the acquisition of these word orders. While both word orders occur with action verbs, only the OV frame is likely to occur with more different verb classes. If an utterance (or a proposition) requires Mandarin speakers to use such non-action verbs, then the OV frame would be more likely to be used instead of the Ba construction. This difference makes the OV frame more versatile and productive than the Ba construction. Thus, it is possible that the potential of OV frame to co-occur with more different verb types helps children abstract the frame itself. Furthermore, as mentioned in the Introduction, both the Ba construction and the OV frame can be used to describe how the state of the Object is affected due to the Subject’s action. The verb classes used for such descriptions are typically action verbs and need to follow the complexity constraint, which requires the verb to be morphologically complex, co-occurring with an appropriate verbal complement and/or an aspect marker. However, this complexity constraint does not exist for state verbs, making the OV frame less restricted when co-occurring with state verbs. For example, frequent state verbs in early input and production include yao4 ‘*want*’, zhi1dao4 ‘*know*’, and xi3huan1 ‘*like*’, which typically

appeared without any verbal complements and aspect markers (Examples 72 and 73). These examples illustrate the difference in the constraint on verbs used in the Ba construction and OV frame. Thus, fewer restrictions on state verbs occurring in the OV frame may help children master the OV frame earlier than the Ba construction.

(73) zhe4ge yao4 bu2 yao4

This want not want

‘(You) want this (item) or not?’ ‘Do you want this (item) or not?’

(74) zhe4 bu4 zhi1dao4 / xi3huan1

This not know/like

‘(I) don’t know/like this (item).’

### ***Possible Influences other than Input***

In addition to non-SVO word orders, the current findings indicate that multiple-verb constructions may not be acquired on a purely frequency-related basis. Although mothers across all four age groups produced a variety of multiple-verb constructions with varied frequencies in their speech, children’s multiple-verb production did not match the input frequencies. Mothers produced more S1V1(O)S2V2(O) utterances than SV1V2(O) whereas children produced more SV1V2(O) utterances than S1V1(O)S2V2(O) utterances (See Figures 3a and 3b). A possible explanation could be children’s linguistic competence. As shown in

Figure 3b, children's first two serial verb constructions, SV1(O)V2(O) and SV1V2(O), involve fewer grammatical elements (i.e., Subject, Object, and Verb) than all the other frames. These two constructions may even involve as few as three elements when all Objects are omitted or not required. It is possible that utterances with fewer elements could better match children's current MLU when they were at two- and three-word stages. Thus, they began with and focused on these two constructions rather than the other constructions involving more elements, which they were not ready to learn or produce.

Another possibility could be linguistic complexity. Both early/frequent multiple-verb constructions in the current child production, SV1(O)V2(O) and SV1V2(O), are structured similar to the SVO construction. It is possible that this similarity leads young Mandarin learners to build their multiple-verb production on their mastery of SVO. This explanation is supported by previous findings that acquisition of a form may rely on the previous acquisition of simpler related forms (e.g., Brown, 1973; Morris, Cottrell, & Elman, 2000; Abbot-Smith & Behrens, 2002). That is, simple constructions are typically acquired before complex ones and previously acquired knowledge can help young language learners learn new related constructions and move forward in their language development. As just mentioned above, child multiple-verb production did not fully reflect input frequency. Children's frequent multiple-verb constructions are not exactly the same ones in mothers' production. This finding

led me to further review child multiple-verb utterances in the current speech data. Although analyses of item-based constructions within different constructions is not the purpose of this dissertation, a quick review of children's early multiple-verb utterances revealed the existence of item-based constructions; that is, young Mandarin learners tended to use some specific verbs as the first verb when producing their early multiple-verb constructions. For example, more than 70% of the SV1(O)V2(O) utterances appeared as S+go/come+V2(O) while nearly 90% of the SV1V2(O) utterances were produced as S+want+V2(O). Similar findings have been reported in Erbaugh's (1982) longitudinal study. These findings suggest that Mandarin learners begin their multiple-verb production in the form of item-based constructions, supporting the constructivist claim that children begin with concrete pieces of language (e.g., words, fixed constructions) and acquire language on an item-specific basis (e.g., Lieven et al., 1997; Tomasello, 2003).

The analyses of the frequency distribution of utterance types within different word orders revealed a sharp contrast between mothers and children. That is, mothers used word orders distinctively for different utterance types while children produced overwhelmingly more declaratives than imperatives and questions in all their word order uses. This findings is contrary to my prediction that word orders used more frequently in a given utterance type in input, will be acquired earlier if that utterance type is produced earlier or more frequently by

children. It appears that how utterance types are distributed within different word orders has little to do with the order in which different word orders are acquired. Plausible explanations for this finding include the fact that word order does not change for declaratives, imperatives, and questions in Mandarin Chinese. Thus, the presence of different utterance types in input does not signal any informative differences in word order for Mandarin learners. Another possible explanation is that, due to pragmatic reasons, young children simply do not produce many imperatives and questions very frequently when talking to their mothers (Cameron-Faulkner et al., 2003, Newport et al., 1977). As a result, the majority of their utterances appeared as declaratives; it seems unlikely to find distinctive uses of word orders for different utterance types in their speech.

### ***Theoretical Implications: the Role of Input and Acquisition of Word Order***

This dissertation examined the role of maternal input in Mandarin learners' acquisition of word order. Based on the theories about the role of input and acquisition of word order presented in the Introduction, what the findings have to say about these theories is discussed next. First, this dissertation examined frequency effects in the distribution of child word orders and in the order of acquisition of different word orders. The results indicate that both mothers' and children's word order uses showed similar distributional patterns, suggesting that maternal input provides structure-revealing information and children pay attention to this

information. This finding supports the constructivist accounts that the structure of language is accessible through the input, and that input plays a major role in the language acquisition process (MacWhinney, 2004). Moreover, the results indicate that most child word orders reflected input frequency, suggesting that Mandarin learners acquire different word orders and constructions on a roughly frequency-related basis. It is noteworthy that even the strongest claim for frequency effects does not argue to be able fully to account for the order of acquisition of constructions. Thus, this finding can be considered partially supporting the constructivist claim. On the other hand, Mandarin-speaking mothers have produced SVO-related word orders more frequently (about 37%) than non-SVO word orders (about 10%) from their child's age of 14 months on. Likewise, when beginning to combine words (i.e., 20 months in the current study), Mandarin learners produced many more VtO utterances (11.40%-15.37%) than OV/OSV utterances (0.61%-3.63%) and SBaOV/SOV (0%-0.39%) across development. This finding supports the generativist claim that young language learners could set the relevant parameters early for the canonical word order in their language (e.g., Gibson & Wexler, 1994; Yang, 2012) and that non-canonical word orders would appear less frequently and be learned later than the canonical word order.

Second, an important finding in this dissertation is that no maternal adaptations that showed age-related changes were found when comparing word order uses in mothers' speech



to children moving from the one-word stage to multi-word/clause stage. This finding is contrary to the constructivist claim that mothers would adapt their language uses to meet their children's growing communicative competence. However, this does not mean that Mandarin-speaking mothers are not sensitive to their children's growing communicative competence. Instead, this finding implies that word order in Mandarin Chinese offers quite limited flexibility with which mothers can use to adapt their word order uses in speech.

Third, the results showed no utterance type effects because mother used different word orders for different utterance types, but child production did not reflect this tendency. This suggests that children did not slavishly imitate their mothers in their word order uses. This finding supports the generativist accounts that there is no utterance type effect on word order acquisition. Finally, the results showed that verb diversity may play a role in the order of different transitive constructions. That is, earlier acquired constructions (e.g., SVt, SVtO, and VtO) tend to have greater verb diversity while later acquired constructions (e.g., BaOV, OV, and SOV) tend to have lower. Because both generativist and constructivist accounts assume that verb diversity would help word order acquisition, this finding is considered supporting these two theoretical views.

### ***Study Limitations and Future Directions***

The purpose of this dissertation is to developmentally investigate word order uses in

Mandarin maternal input and child production. Although the findings broaden our understanding of word order acquisition of Mandarin learners, some limitations remain. The first limitation is concerned with the process of data collection. One issue is the relatively short duration in which the current speech data were recorded. Speech in such a short duration may represent a very small proportion of the language the child hears and produces. It is likely that about 20 minutes of mother-child interaction may elicit a considerable number of utterances in high-frequency constructions but may not be enough for low-frequency constructions (e.g., non-SVO word orders) (Tomasello & Stahl, 2004). Children may have produced additional low-frequency constructions at times when they were not being recorded. Thus, a speech corpus from such recording duration may result in an underestimation of child production of low-frequency constructions. Another issue is the context setting in which the current speech data were collected. All mother-child dyads in the four age groups were engaged in the same toys and activities. This may lead the participants to talk and behave similarly. As a result, identical utterances or similar utterances in the same constructions would be possibly produced, reducing diversity in their speech. Thus, future research might aim for a speech corpus that is collected in a variety of settings/activities for longer recording durations or on a frequent sampling basis when involving constructions with different frequencies.

Moreover, while investigating how the input influences acquisition of different word orders, this dissertation used cross-sectional data rather than longitudinal data. An important issue with cross-sectional data is that these data are typically collapsed across the participants in this dissertation, masking the real relation in the speech of mother-child dyads. Another issue is that, the nature of cross-sectional design kept this dissertation from exploring whether and how previous maternal word order uses (e.g., at Time 1) relate to/predict subsequent child word order production (e.g., at Time 2, 3 and so on), which may reveal more about the role of input in child word order acquisition (e.g., Naigles & Hoff-Ginsberg, 1998; Huttenlocher et al., 2010). Thus, to better examine the relation of maternal input to child word order acquisition, future research might look at longitudinal data for individual developmental patterns that highlight the role of input.

### ***Conclusion***

This dissertation set out to examine the role of maternal input in early word order acquisition of Mandarin-speaking children from the one-word to multi-word stages by addressing the issues of frequency effects, age-related changes, utterance types, and verb diversity within word orders. The findings that frequency effects and verb diversity effects were found in early word order acquisition support both generativist and constructivist claims. The lack of age-related changes and utterance type effects in maternal word order uses is

contrary to the constructivist view. The current analyses of maternal and child word order uses over the course of early language development suggest that maternal input may play a role when Mandarin-speaking children acquire different word orders and constructions.

Specifically, both frequency and verb diversity provided in the input may contribute to the acquisition of different word orders and constructions. In addition to frequencies of and verb diversity within word orders, factors that are not from input, such as linguistic complexity of constructions being learned and children's linguistic competence, may influence the order of acquisition of different word orders and construction in Mandarin Chinese.

The notion of age-related changes in maternal speech is not new in the field of child language development. To respond the issue about what aspect of maternal speech provides the best place to explore age-related changes, the results of this study indicate that Mandarin word order may not be the place to seek for such adjustments. Instead, the results suggest that Mandarin word order uses may be constrained by semantic and pragmatic factors, which are also part of word order acquisition of Mandarin-speaking children.

As the first study to document the full range of word order uses in early maternal input to Mandarin-speaking children and examine the relations between maternal and child word order uses through the perspectives of input frequency, age-related changes, utterance types, verb diversity within word orders, the results of this study broaden our understanding of the role of

maternal input in Mandarin word order acquisition. It is important to point out that, however, these findings are based on analyses of one speech corpus. To gain a complete picture of early word order acquisition in Mandarin Chinese, longitudinal studies investigating the relation between maternal word order uses at an earlier age and subsequent child production would provide insightful information.

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