

The Interpretation of Sentences with Disjunction by Child and Adult Speakers of Mandarin

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THESIS SUMMARY

It has been proposed that there is a gap between the linguistic data language learners are exposed to and the linguistic competence they achieve in just a few years. This has been called ‘Plato’s Problem,’ or the ‘poverty-of-the-stimulus.’ Noam Chomsky proposes that this gap is filled by linguistic knowledge that is not learned; knowledge that originates in the human mind itself. The present thesis investigates the degree to which Mandarin-speaking children’s understanding of sentences with disjunction is likely to be learned from adult input. Chapter 1 reviews the broad themes of the thesis, including the relevant theoretical foundations and a review of cross-linguistic empirical findings from studies of children’s interpretation of sentences with disjunction. Chapter 2 presents a study investigating how Mandarin-speaking children and adults interpret negative sentences with disjunction where the disjunction phrase appears in a preverbal position. The conclusion from this study is that children and adults exhibit different scope preferences in response to sentences with disjunction either preceding or following negation. To explain the differences between children and adults, we follow previous literature in supposing that adults analyze disjunction as a polarity sensitive expression, which cannot be interpreted as being inside the scope of negation. Chapter 3 reports the findings of a study examining how Mandarin-speaking children and adults interpret disjunction in sentences with a universal quantifier. The findings indicate that children ‘reconstruct’ the disjunction phrase, whereas adults do not. Chapter 4 introduces a linguistic structure that cancels the polarity sensitivity of disjunction in Mandarin. In addition, that study investigates the interpretations

assigned to disjunction by Mandarin-speaking children and adults in negative sentences with either overt or covert disjunction. The findings confirm that Mandarin-speaking adults, but not children, analyze disjunction as a polarity sensitive expression. The study reveals that children and adults generate the same scope assignments in VP ellipsis structures, which neutralize the polarity sensitivity of disjunction. Chapter 5 summarizes the conclusions of the three experimental studies. The thesis presents evidence that child speakers of Mandarin have acquired certain abstract knowledge of language that is unlikely to have been learned from the linguistic data available to them.

STATEMENT

I certify that the work in this thesis has not been previously submitted in whole or as part of requirements for a higher degree to any other university or institution other than Macquarie University. I also certify that the thesis is an original piece of research and it has been written by me. Any help and assistance that I have received in my research and the preparation of the thesis itself has been appropriately acknowledged. In addition, I certify that the information resources and literature used are indicated in the thesis. The research presented in this thesis has been approved by the Macquarie University Ethics Committee, reference number: 5201401129, on 3 February 2015.

Signed:

A handwritten signature in cursive script that reads "Na Gao".

Na Gao (Student Number: 42786029)

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CHAPTER 1

Introduction

1. Introduction

In one of Plato's dialogues, *The Meno*, the protagonist, Socrates, attempts to persuade Meno, an aristocrat in Athens, that a slave boy knows more about geometry than he could possibly have learned from experience. Based on this dialogue, the term 'Plato's problem' is often used to describe knowledge that is not learned through experience, including knowledge of language. The modern linguist, Noam Chomsky, is fond of quoting Bertrand Russell's description of Plato's Problem: "How comes it that human beings, whose contacts with the world are brief and personal and limited, are nevertheless able to know as much as they do know?" (Russell, 1948: p.524).

In the field of linguistics, arguments that children know more than they could have learned from experience are known arguments from the 'poverty of the stimulus' (e.g. Cook and Newson, 1996; Crain and Pietroski, 2001). To explain the significant gap, which Chomsky calls a 'chasm', between language users' linguistic competence and the data they encounter in the surrounding environment, Chomsky (1976, 1995, 2015) proposes a theory called Universal Grammar. Universal Grammar encompasses those aspects of linguistic knowledge that are innately specified in the human biological endowment for language and merely triggered by experience.

The findings from the series of studies presented in this thesis constitute arguments from the 'poverty of the stimulus' concerning children's understanding of disjunction words in Mandarin Chinese. Consider the English sentence (1).

(1) June ate apples or June ate oranges.

In classical logic, the logical expression corresponding to the English disjunction word *or* is a truth functional connective, which can be used to combine formulas that correspond to English sentences to form larger sentences (e.g. Crain, 2008; Smith, 2012). Sentence (1) is an English sentence composed of two sentences, *June ate apples* or *June ate oranges*, joined by the English disjunction word *or*. As in classical logic, sentence (1) is true if either one of these two sentences is true, or if both of them are true. This indicates that the disjunction word in (1) is assigned the full range of truth conditions that are associated with the logical connective for disjunction in classical logic, namely inclusive-disjunction.

However, as compared to the first two circumstances in which sentence (1) is true, the third circumstance – in which both disjuncts are true (i.e. *June ate apples* and *oranges*) – is not as easily accessed. This is because disjunction licenses an inference of ‘exclusivity’ in (1). The exclusivity inference is licensed due to the availability of another compound sentence, one with the conjunction word *and* in the position of the disjunction word *or*, i.e. *June ate apples and June ate oranges*. In the circumstance in which June ate both apples and oranges, the sentence with the conjunction word *and* unambiguously conveys what June ate. Whereas the sentence with *or* makes the sentence true in this circumstance, but in other circumstances as well – so it conveys the intended meaning less directly in a situation in which both disjuncts are true. The selection of linguistic expressions such as *and* and *or* is guided by pragmatic principles (‘Be cooperative’; ‘Avoid ambiguity’) which instruct speakers to choose sentences that convey their intended meaning as directly as possible (e.g. Grice, 1989).

Upon hearing a sentence with disjunction such as (1), therefore, people typically infer that the speaker was not in a position to select the corresponding sentence with conjunction. They are led, therefore, to exclude the truth condition according to which both of the disjuncts are true. This is a standard way to explain the inference of 'exclusivity'.

Previous studies have demonstrated that children accept sentences such as (1) in the circumstances in which both of the disjuncts are true, whereas adults reject them because adults license an exclusivity inference. This finding might appear to be evidence that children's judgments conform more closely to classical logic, as compared to the judgments of adults (e.g. Chierchia, Crain, Guasti, Gualmini and Meroni, 2001; Chierchia, Guasti, Gualmini, Meroni, Crain and Foppolo, 2004; Goro, Minai and Crain, 2005; Crain, 2008; Katsos and Bishop, 2011). The appearance that children are more logic is just an illusion, however. Children are simply less influenced by the conversational pragmatic principles that are invoked to license the inference of exclusivity.

The observation that children access truth conditions for disjunction that are not as readily accessed by adults is important. In light of the fact that adults do not accept sentences with disjunction in circumstances in which both disjuncts are true, it invites us to infer that adult productions are not likely to be the basis for children's acceptance of sentences with disjunction in these circumstances. This is one example of how disjunction has been involved in creating arguments from the 'poverty of the stimulus'.

The interpretation of sentences with disjunction, which is consistent with classical logic (i.e. inclusive-disjunction), can also be made by adult speakers in English, as long as the exclusive inference regarding the

interpretation of disjunction is suspended. A negative declarative sentence is one of the linguistic contexts in which the inferences of exclusivity do not arise and in which children and adults assign the same truth condition to sentences with disjunction. We will begin with considering example (2).

(2) June didn't eat sushi or pasta.

Suppose that, in the conversational context, June did not eat sushi, but she did eat pasta. Adult English speakers would judge sentence (2) to be false as a description of this context. This shows that, in English, the disjunction word *or* is interpreted to be within the scope of negation. When negation has scope over disjunction, as in (2), the sentence is judged to be true only if both of the disjuncts are false. This relationship between disjunction and conjunction in negative sentences is stated in one of de Morgan's laws in classical logic, represented in (3), where the symbol ' $\neg$ ' represents *not*, the symbol ' $\vee$ ' represents *or*, and the symbol ' $\wedge$ ' represents *and* (cf. Crain, 2008).

$$(3) \neg (A \vee B) \Rightarrow (\neg A \wedge \neg B)$$

The law in (3) states that a negative statement with disjunction entails two negative statements – one corresponding to each of the disjuncts. According to de Morgan's laws, the negative disjunctive statement in sentence (2) thus entails June did not eat sushi and June did not eat pasta. This entailment is also called the conjunctive entailment.

The relevant empirical evidence comes from studies conducted by Crain, Gardener, Gualmini and Rabbin (2002) and Gualmini and Crain (2005). These studies investigated whether or not children and adults adhere to this law. Specifically, these researchers examined how three- to five-year-old English-speaking children and English-speaking adults interpret disjunction when it appears in the scope of negation, using the Truth Value Judgment Task (Crain and Thornton, 1998).

The basic logic of the Truth Value Judgment Task (TVJT) follows the idea that “language consists of sentence/meaning pairs” (Wexler and Culicover, 1980; cf. Thornton and Wexler, 1999: p.132). The TVJT is a child-friendly experimental paradigm designed to access children’s understanding of sentence meaning. The task procedures include telling stories to children. Each story is acted out in front of the child and a puppet, using toy props and characters. The story represents the meaning component of a sentence/meaning pair. Immediately after the story, the puppet produces a test sentence, corresponding to the sentence component of a sentence/meaning pair. The participant’s task is to judge whether the puppet’s statement is right or wrong.

Two experimenters are usually involved in execution of the experiment. One of the experimenters acts out the stories, while another experimenter plays the role of the puppet. At the end of the story, the puppet is asked to say what it thinks happened in the story. Sometimes, the sentence produced by the puppet accurately describes the events that took place in the story. On other trials, the puppet’s statement does not accurately describe the events that took place in the story. In most cases, the test sentences are inaccurate descriptions of the stories. Whenever a child rejects the puppet’s statement, the experimenter then

encourages him/her to describe what really happened in the story. The child's justifications for rejecting the puppet's statements inform the experimenter whether or not the child understood the story as well as the test sentence.

For example, in the Crain, Gardener, Gualmini and Rabbin (2002) study, 15 four- to five-year-old English-speaking children and 15 adults were presented with sentences like (4).

(4) The girl who stayed up late will not get a dime or a jewel.

The sentence was presented to the participants following a story in which two girls were waiting for the Tooth Fairy to come to their house as they had both lost a tooth. They had been told that the Tooth Fairy would come at night and would leave them a reward in exchange for their tooth. One of the girls decided to stay up late in order to see the Tooth Fairy, while the other girl fell asleep. At this point in the story, a puppet (Merlin the Magician) produced the target sentence (4) as a prediction about what would happen next in the story. The story continued after Merlin the Magician's prediction and ended with the girl who fell asleep getting both a dime and a jewel, whereas the girl who stayed awake receiving only a jewel.

The experimental hypothesis was that, if the children conformed to classical logic (i.e. computing de Morgan's laws), they would interpret disjunction as being within the scope of negation. Consequently, they were expected to reject the sentence in this circumstance. However, by contrast, if the way children interpreted the target sentence did not conform to de Morgan's laws, they were expected to accept the sentence.

This was exactly what happened. The experimental results showed that child participants rejected test sentences like (4) 92% of the time, while adult participants rejected the same sentences 100% of the time in the same experimental situations. This is because both English-speaking children and adults assign a conjunctive entailment of disjunction to sentences like (4). They interpret the sentence as a statement that, *The girl who stayed up late will not get a dime and the girl who stayed up late will not get a jewel*. Sentence (4) does not describe what happened in the story.

The findings suggest that, in English, the inference of exclusivity in sentences with disjunction is not enforced in negative sentences. In response to negated disjunctions, both English-speaking children and adults assign disjunction the truth conditions associated with inclusive-disjunction, generating a conjunctive entailment for negative sentence with disjunction. At this point, in English, adult interpretation and child interpretation converge on the interpretation that is in line with de Morgan's laws described above in reference to (3).

However, regarding the interpretation of sentences with disjunction, inclusive-disjunction appears still to be masked in languages such as Mandarin and Japanese, even when the disjunction phrase occurs in negative sentences where the pragmatic inference of exclusivity is suspended.

A study by Goro and Akiba (2004a, 2004b) reported that children and adults assigned different scope relations to negated disjunctions. In the Goro and Akiba study, Japanese-speaking children and adults were presented with sentences such as (5).

(5) *Butasan-wa ninjin ka piiman-wo tabe-nakat-ta.*

Pig-TOP carrot or pepper-ACC eat-NEG-PAST

‘The pig didn’t eat the carrot or the pepper.’

Child and adult participants were also presented with a story in which the pig ate one of the two vegetables. The participants were expected to reject the test sentences if they analyzed negation as taking scope over disjunction. By contrast, they were expected to accept the test sentences if they assigned disjunction to take a wide scope. The results showed that Japanese-speaking adults accepted the test sentences 100% of the time, whereas three- to six-year-old children rejected the sentences 87% of the time.

This finding that indicates different scope assignments to negated disjunctions are made by children versus adults was replicated in Mandarin Chinese in a study by Jing, Crain and Hsu (2005). Child and adult participants were presented with a scenario in which Donald Duck only lifted up either the table or the TV. This scenario was followed by sentence (6).

(6) *Tanglaoya meiyou juqi zhuozi huozhe dianshiji.*

Donald Duck not lift-up table or TV

‘It is the table or TV that Donald Duck didn’t lift up.’

Mandarin-speaking adults accepted sentence (6) 100% of the time as a correct description of the story. By contrast, the child speakers of Mandarin rejected the same target sentences in the same situations over 95% of the time.

The findings revealed by the studies both in Japanese and Mandarin suggest that children and adults display different scope preferences to negated disjunctions. Preschool-aged children from these two languages consistently generate a conjunctive entailment for negative sentences with disjunction, consistent with de Morgan's laws. In contrast to the children who stick to classical logic when they are presented with negative sentences with disjunction, the truth condition assigned by adults in Japanese and Mandarin appears not to be associated with inclusive-disjunction. This again creates the illusion that child speakers of Mandarin and Japanese are more logic than adults.

Pragmatic principles apparently cannot account for this discrepancy in languages such as Japanese and Mandarin, because the emergence of inference of exclusivity has been blocked in negative sentences. It is thus worth asking, in responding to negative sentences with disjunction, why do young children have the same scope preference as adults in certain languages, and yet children exhibit non-adult-like interpretation in others? What makes adults' interpretation 'deviate' from de Morgan's laws?

It is also worth noting that a simple parsing principle based on word order cannot account either for language variations with respect to negated disjunction in adult languages or for different scope assignments by children versus adults in languages such as Japanese and Mandarin. For instance, in adult languages, Mandarin and English have the same word order but have different scope assignments. That is, disjunction precedes negation in the surface syntax in both languages, yet adults speaking these two languages assign distinguished scope relations to disjunction and negation.

The parsing principle also fails to apply when it encounters empirical data in Japanese. This is because the disjunction word *ka* ‘or’ appears earlier in the surface syntax than negation *nakat* ‘not’ in Japanese sentences like (5). Adult speakers of Japanese access a surface scope interpretation. They assign wide scope to disjunction that appears first, rather than to negation that appears later in the sentence. In contrast to their adult counterparts, Japanese-speaking children access the inverse scope interpretation, that is, they interpret negation as taking scope over disjunction, which provides evidence to counter the simple ‘linear word order’ parsing principle.

Therefore, language variations regarding the interpretation of negated disjunctions invoke the establishment of the Disjunction Parameter Account (Szabolsci, 2004; Goro and Akiba, 2004a, 2004b; Goro 2007; Crain, 2012). Based on the Disjunction Parameter Account, human languages are categorized into two classes. In one class of languages (including Japanese, Mandarin, Russian and Turkish), the value with disjunction taking scope over negation is designated as a positive polarity item (i.e. the [+PPI] value). However, in the other class of languages (including English, Korean and German), the value with disjunction being within the scope of negation is designated as not a positive polarity item (i.e. the [-PPI] value).

More importantly, the different settings of the Disjunction Parameter are only observed in adult languages. Crosslinguistically, young children initially interpret disjunction *in situ* in negative sentences. Children acquiring languages such as Japanese, Mandarin, Russian and Turkish might thus encounter learnability problems, because children from these languages accept sentences in different circumstances than adult speakers do. This suggests that these

children are not basing their initial hypothesis on the input from adults. That is, they rarely encounter the available language evidence indicating disjunction is designated as not a positive polarity item (PPI).

Furthermore, based on considerations of language learnability, the Semantic Subset Principle has been invoked to account for why children acquiring different languages initially select the [-PPI] value of the Disjunction Parameter (e.g. Berwick, 1985; Crain and Phillip, 1993; Crain, Ni and Conway, 1994; Goro, 2004, 2007; Crain, 2012). Children initially assign the value [-PPI] to disjunction, even in languages in which adults assign it the value [+PPI]. This is because the [-PPI] value of the Disjunction Parameter makes negative sentences with disjunction true in a narrower range of circumstances, as compared to the [+PPI] value of the Disjunction Parameter. The Semantic Subset Principle, therefore, entreats children to initially adopt parameter values that make sentences true in the narrowest range of circumstances in cases where one parameter value (the subset value) asymmetrically entails the other (the superset value). Adherence to the Semantic Subset Principle guarantees that children will encounter positive evidence for parameter resetting if adult speakers of the local language adopt the [+PPI] value (superset value) of the Disjunction Parameter. This is how young language learners avoid potential learnability problems in the course of resetting the value of the Disjunction Parameter from its initial state to the final state if the local adult language adopts the other value of the parameter.

As seen in previous literature on language speakers' interpretation of sentences with disjunction, there is always some gap between children's knowledge of language and the language environment they are exposed to,

either in affirmative declarative sentences or in negative sentences. It is difficult to reconcile this with the usage-based account of language acquisition, which views children's linguistic behavior as being driven by experience. Meanwhile, disjunction words, which operate as the counterpart of logical disjunctive connective, exhibit a diagnostic feature to reveal language speakers' language behaviors in certain linguistic contexts across languages. Taken these considerations together, we aim to adopt the Mandarin disjunction word *huozhe* 'or' as a diagnostic vehicle to review Mandarin speakers' language competence across various linguistic contexts. These contexts pose a challenge to the claim that children acquire knowledge of language entirely (largely) through their exposure to, and experience of, that language. This is where our study begins.

2. Theoretical background

The present thesis investigates how Mandarin-speaking children and adults interpret linguistic structures requiring certain abstract language knowledge that cannot be learnt from the linguistic data available in the surrounding environment. The linguistic structures under investigation contain the Mandarin disjunction word *huozhe* ‘or’, in combination with negation or with the universal quantifier *mei* ‘every’. Our study aims to utilize Mandarin speakers’ interpretation of disjunction in these structures as a diagnostic for assignment of scope relations. In responding to the sentence structures explored in this thesis, two types of linguistic operations are involved. These operations are called reconstruction and Verb Phrase (VP) ellipsis. These operations are described in the following subsections.

2.1 Reconstruction

The linguistic process known as ‘reconstruction’ explains how linguistic principles can apply to sentences in which constituents have been displaced from one position to another in the surface syntax, yet are required to be interpreted in the original position in order to generate the right scope assignments, for example. Essentially, reconstruction involves interpreting a constituent twice, once at its position in the surface syntax, and a second time at a reconstructed level, i.e., logical form. The process of reconstruction was invoked by Chomsky (1976) in part to explain the absence of an anaphoric link between a pronoun and a *wh*-phrase in sentences such as (7).

(7) *Whose_i mother does he_i love?

(8) *He_i loves John_i's mother.

Chomsky (1976) invoked reconstruction to explain why a sentence like (7) is unacceptable on an interpretation on which the pronoun *he* is anaphorically linked to the possessive *wh*-phrase, *whose mother*. Chomsky proposed that the same principle that explains the absence of this anaphoric relation in (7) also prevents the pronoun *he* from being anaphorically linked to the name, *John*, in (8). In both examples (7) and (8), the same principle of grammar prevents the pronouns from being co-indexed with the possessive NPs. The semantic reflex of co-indexation is anaphora, whereas contra-indexing would indicate the absence of anaphora.

The absence of anaphora in both examples was attributed by Chomsky to Principle C of the Binding Theory. Principle C governs the interpretation of referential-expressions, e.g. definite descriptions such as *the man*, and names such as *John*. According to Principle C, referential expressions must be free; a referential expression is free iff it is not c-commanded by another NP (see e.g. Chomsky, 1976; 1981; Huang, 1982, 1993; Haegeman, 1994).¹ In sentence (8), the name *John* in the possessive phrase, *John's mother*, is not free on the interpretation according to which the possessive phrase has been assigned the same co-index as the pronoun *he*. Co-indexation of the two NPs is prohibited

¹ The Binding Theory is the component of grammar that determines the interpretation of noun phrases, including anaphors, pronouns and referring expressions. The theory states the conditions under which these different kinds of noun phrases can or cannot be anaphorically linked to potential antecedents (Chomsky, 1981, 1995; Huang, 1982, 1993; Haegeman, 1994; Huang, Li and Li, 2008).

because the pronoun c-commands the possessive phrase. The only structural relationship that would be licensed is one in which the pronoun and the name are contra-indexed and, hence, are interpreted as having different referents.

Two features of sentence (7) are worth noting. First, this sentence is a *wh*-question, not a declarative sentence. Therefore, (7) does not appear to contain a referential-expression. Referentially expressions typically include a definite description or a name. Second, the pronoun does not appear to c-command another NP in sentence (7). Nevertheless, Chomsky (1976) proposed a linguistic analysis that unified sentences (7) and (8), as governed by the same linguistic principle, Principle C.

Two steps were required to bring the *wh*-question in (7) under the governance of Principle C. The first step is based on the observation that, although the possessive *wh*-phrase in (7), *whose mother*, is not c-commanded by the pronoun *he* in the surface syntax, this *wh*-phrase is clearly the direct object of the transitive verb *love*. This observation was the basis of the Trace Theory of movement. According to this theory, the possessive *wh*-phrase, *whose mother*, in (7) originated in the direct object position following the verb *love*, but subsequently moved to a different (higher) position in the surface syntax. To explain the intuition that the moved *wh*-phrase is the direct object, an empty category (= trace) of the moved *wh*-phrase was left behind at its site of origin (pre-movement position). This analysis is indicated in (9a). A more recent variant of the analysis is called the Copy Theory of movement. According to this analysis of *wh*-movement, a copy of the possessive *wh*-phrase occurs in two positions, as indicated in (9b). Only one copy of the *wh*-phrase is phonologically overt, at the level of Phonetic Form. The other is silent, as indicated by the

striketrough. Both of these analyses yield the semantic interpretation indicated in (10).

- (9) a. Whose mother does he love *e* ?
b. Whose mother does he love < ~~whose mother~~ >?

(10) Which person *x* is such that he loves *x*'s mother.

There is a second step in the unification of *wh*-questions like (7) and declarative sentences like (8). The second step is to classify empty categories as referring-expressions. According to Principle C of the Binding Theory, then, definite descriptions, names, and empty categories must be free; i.e., they cannot be co-indexed with antecedent NPs that c-command them. Because the pronoun in (7) c-commands the empty category, these NPs cannot be coindexed, according to Principle C. With these two amendments to the theory in place, it follows that the pronoun and the *wh*-phrase in (7) cannot be anaphorically linked for precisely the same reason that the pronoun and the name in (8) cannot be.

This is where reconstruction enters into the equation. Because Chomsky (1976) adopted the Trace Theory of movement, it was necessary to ensure that the empty category that was left behind by *wh*-movement is 'reconstructed' to its original position. Following reconstruction, the possessive *wh*-phrase in example (7), *whose mother*, is interpreted in its original position. This is shown in (11). On a more recent theory of *wh*-movement, the Copy Theory, reconstruction of a moved constituent is accomplished without adding this

further operation, since a copy of the moved constituent is already in the right position for determining the interpretation.

(11) * Whose_i mother did he_i love < whose_i mother >?



Although the reconstructed copy of the *wh*-phrase is not pronounced, it provides “the material for reconstruction”, according to Chomsky (2015, p. 185-186).

Several other linguistic phenomena have been classified as reconstruction effects, in addition to *wh*-movement. These phenomena involve the preposing of constituents, and clefting (Carnie, 2006: p.82). Sentence (12) is an example of preposing a prepositional phrase, and sentence (13) is an example of clefting.

(12) *Near June_i, she_i planted a tree.

(13) *It is near June_i that she_i planted a tree.

In both (12) and (13), the name *June*, which has been preposed in (12) and clefted in (13), is reconstructed to a position in the surface syntax where it is c-commanded by the pronoun. Therefore, Principle C applies to these sentences, preventing coindexation and, consequently, prohibiting coreference between the pronoun and the name.

Because reconstruction phenomena lack a transparent relationship between the surface syntax and the semantic interpretation, they represent candidates for the ‘poverty of the stimulus’ argument. This has led to experimental studies of reconstruction phenomena in literature on child language acquisition (e.g. Guasti and Chierchia, 1999/2000; Leddon, 2006; Kiguchi and Thornton, 2016; Thornton, Kiguchi and D’Onofrio, 2016). Researchers have investigated preschool children’s interpretation of a variety of reconstruction phenomena, including children’s understanding of cleft and pseudocleft sentences, and sentences with prepositional phrase (PP) preposing.

To take a representative example, Kiguchi and Thornton (2016) demonstrated that four-year-old English-speaking children performed with adult-like accuracy in responding to pseudocleft sentences like (14).

(14) A piece of coral or a plant is what nobody brought back.

(15) Nobody brought back a piece of coral and nobody brought back a plant.

Although the disjunction phrase, *a piece of coral or a plant*, precedes negation in the surface syntax, disjunction is typically interpreted within the scope of negation in English. Consequently, English speakers assign a conjunctive interpretation to disjunction in (14), such that it has the meaning indicated in (15). The finding from the Kiguchi and Thornton study was that the child participants they interviewed assigned a conjunctive interpretation to disjunction in responding to target sentences like (14), despite the mismatch between surface syntax and semantic interpretation. This finding was taken as

evidence that the child participants reconstructed the disjunction phrase, such that it was interpreted in the scope of negation at the level of logical form. Similar findings were reported by Guasti and Chierchia (1999/2000), Leddon (2006) and by Thornton, Kiguchi and D’Onofrio (2016).

In summary, reconstruction is a linguistic mechanism that generates sentence meanings that do not directly correspond to the surface syntax. From the perspective of child language, such phenomena pose a potential learnability problem, in the absence of children’s knowledge of reconstruction. Since reconstruction takes place covertly, at the level of semantic interpretation, children do not observe reconstruction effects in the primary linguistic data. As a consequence, it is not clear how children could use positive evidence (i.e. adult input) to acquire the interpretations that result from reconstruction. Based on these observations about language learnability in the absence of negative evidence, and based on the findings from previous research, the present thesis investigates another set of linguistic phenomena that are subject to reconstruction. The sentences we will test the scope assignments by Mandarin-speaking children who are presented with sentences that contain the negative marker *meiyou* ‘not’ and the disjunction word *huozhe* ‘or’. More details of the relevant empirical study are reported in Section 3.1.

2.2 Reconstruction in ambiguous sentences

Reconstruction is also invoked to account for sentence ambiguities in sentences involving no overt syntactic movement but scope assignments among scope-bearing expressions. (e.g. Gualmini, 2006; Musolino and Lidz, 2006; Zhou and Crain, 2009; Crain, 2012; Moscati and Crain, 2014; Crain, Koring and Thornton, 2016). Consider sentence (16).

(16) Every horse didn't jump over the fence.

Sentence (16) is ambiguous for adult speakers of English. This sentence can mean either, *None of the horses jumped over the fence*, or, *Not all of the horses jumped over the fence*. Since the universal quantifier *every* precedes negation *not* in the surface syntax, the former interpretation is referred to as the 'surface scope' interpretation, while the latter is referred to as the 'inverse scope' interpretation. Reconstruction has to be employed to access the inverse scope interpretation, that is, the inverse scope interpretation is generated by moving the universally quantified noun phrase, *every horse*, to a position within the scope of negation at the level of semantic interpretation. The derivation of the inverse scope reading (i.e. reconstruction) is represented in (17).

(17) Every horse did not < every horse > jump over the fence.



Investigations on ambiguous sentences such as (16) have shown young children's competence in solving sentence ambiguities by utilizing an abstract

linguistic operation, i.e. reconstruction (e.g. Gualmini, 2006; Musolino and Lidz, 2006). The same patterns of results were also documented in other languages such as Mandarin Chinese (Zhou and Crain, 2009). Consider sentence (18).

(18) *Mei-pi ma dou meiyou tiao-guo langan.*

Every-CL horse all not jump over fence

As the Mandarin translation of sentence (16), sentence (18) is unambiguous for adult speakers of Mandarin. The only interpretation that Mandarin-speaking adults access is the surface scope interpretation, i.e., *None of the horses jumped over the fence*. This raises an assumption that scope relations are determined by the isomorphism principle in Mandarin Chinese (e.g. Lee, 1991; Musolino, 1998). The isomorphism principle predicts that the scope-bearing expression that appears first in the surface syntax takes scope over one that appears later in the sentence. However, in responding to the same sentence, young Mandarin-speaking children exhibit their competence in accessing both the surface scope interpretation, which is also provided by the adult speakers of Mandarin, and the inverse scope interpretation, i.e., *Some of the horses jumped over the fence, while some did not*.

It is also worth noting that *dou* ‘all’ in the Mandarin sentence (18) is a focus-sensitive operator that leads Mandarin-speaking adults to interpret sentence (18) as a cleft structure such as *It is every horse that did not jump over the fence*. Consequently, the linguistic operation to access the inverse scope interpretation (i.e. reconstruction) will be blocked if a Mandarin speaker is aware of the focus sensitivity of *dou* ‘all’. Given the fact that this focus sensitivity

of the operator *dou* ‘all’ is a language-specific property, Mandarin-speaking children are expected to be less sensitive to this pragmatic inference. If the young children have not identified this focus-sensitivity of *dou* ‘all’, and they hence succeed in accessing the inverse scope interpretation of sentence (18), it will provide evidence against the isomorphism principle. This is exactly what the Zhou and Crain study (2009) revealed (see details in Chapter 3).

Based on previous research, we are interested in examining whether Mandarin-speaking children and adults exhibit different interpretative preferences to ambiguous sentences containing the universal quantifier and disjunction. We also intend to identify if adults tend to access the surface scope interpretations for pragmatic reasons, whereas children are able to access the inverse scope interpretation, given the appearance that children are less influenced by pragmatic principles. Details of the relevant experimental design are presented in Section 3.2.

2.3 Coordinate structures with VP ellipsis

The third type of linguistic structure explored in this thesis is Verb Phrase (VP) ellipsis structures. VP ellipsis structures include sentences having an elided predicate phrase, which typically has already occurred in the previous context and is elided in the subsequent structure (e.g. Sag, 1976; Williams, 1977; Lasnik, 1999). The elided constituent can be recovered from its current discourse context, generally based on a structural constraint that is called the parallelism constraint (e.g. Chomsky and Lasnik, 1993; Chomsky, 1995). Consider sentences (19) and (20).

(19) June bought flowers, but Gen didn't.

(20) June fed her cat, but Gen didn't.

The elided verb phrase (VP) in the second clause is easily recovered by replicating the overt VP in the first clause, either in sentence (19) or in sentence (20), with applying the parallelism constraint. However, the parallelism constraint appears to be violated in sentences in which the elided VP contains the existential expression *some*. *Some* is a well-known positive polarity item (PPI) in English, which cannot be within the scope of local negation (e.g. Szabolcsi, 2002). Consider sentence (21).

(21) June will try some sushi, but Gen won't.

If simply applying the parallelism constraint to sentence (21) and recovering the elide VP in the second clause as the identity of the overt VP in the first clause of the sentence, English speakers would be expected to interpret the second clause with the existential *some* taking scope over negation like, *Gen won't try some sushi*. This interpretation would be paraphrased as follows: *There is some sushi that Gen won't try*. This is clearly not the interpretation assigned by English speakers. Rather, the interpretation of (21) can be better paraphrased by replacing the PPI *some* with the negative polarity item (NPI) *any*, as in (22).

(22) June will try some sushi, but Gen won't < ~~try any sushi~~ >.

Given the appearance that polarity items such as *some* no longer operate their polarity sensitivity, when they are not phonetically realized in the surface syntax, VP ellipsis structures are regarded as a linguistic context that is predicted to cancel the polarity sensitivity of positive polarity items. Since the Mandarin disjunction word *huozhe* ‘or’ shares semantic commonalities with the English existential quantifier *some* (cf. Crain, 2012: p26-31), i.e., they are both positive polarity items that have to take scope over negation, at least for adults, we are interested in exploring whether the polarity sensitivity of *huozhe* ‘or’ is cancelled when it is contained in an elided VP for Mandarin-speaking adults, in the same way that of *some* is cancelled when it appears in a coordinate structure with VP ellipsis in English.

On the basis of previous research, the following questions arise. Are young Mandarin-speaking children able to interpret VP ellipsis structures containing the disjunction word *huozhe* ‘or’? Do Mandarin-speaking adults still analyze the disjunction word *huozhe* ‘or’ as a PPI when it is contained in an elided VP, and consequently interpret disjunction as taking scope over negation? An experimental design to answer these questions is briefly introduced in Section 3.3.

3. The interpretation of sentences with disjunction by Mandarin speakers across different linguistic structures

3.1 Differences in scope assignments for child and adult speakers of Mandarin

The first set of empirical work in this thesis (i.e. Chapter 2) investigates how Mandarin-speaking children and adults interpret negative sentences with disjunction when the disjunction phrase has moved from the object position to a preverbal position. An example is (23).

(23) *Nanhai-men mifeng huozhe xiaoshe meiyou zhaodao.*

Boy-PL bee or snake not find

Given the fact that movement brings about reorganization of word order, and the linear order of negation and disjunction has thus changed in sentences like (23), we are interested in exploring whether structural changes affect Mandarin speakers' scope assignments to negated disjunctions.

As noted in previous sections, Mandarin-speaking adults typically set the Disjunction Parameter as a positive polarity item (i.e. the [+PPI] value), and disjunction is interpreted as taking scope over negation. By contrast, children across different languages, including the ones who speak Mandarin, initially set the Disjunction Parameter as not a positive polarity item (i.e. the [-PPI] value). Disjunction is hence interpreted as within the scope of negation. Previous studies (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014) have confirmed the different scope preferences to negated disjunctions in both child

Mandarin and adult Mandarin, when these two scope-bearing expressions are presented in ordinary declarative sentences, as shown in sentences such as (24).

(24) *Nanhai-men meiyou zhaodao mifeng huozhe xiaoshe.*

Boy-PL not find bee or snake

Mandarin-speaking children are expected to interpret negation as taking wide scope. If so, the sentence would be assigned a conjunctive entailment of disjunction. For example, sentence (24) would have a meaning that can be paraphrased as follows, *The boys didn't find bees and the boys didn't find snakes*. Mandarin-speaking children would hence judge sentence (24) to be true only if the boys did not find either bees or snakes. By contrast, disjunction is designated as a positive polarity item (PPI) in adult Mandarin, taking scope over negation at the level of semantics. Mandarin-speaking adults would assign disjunctive truth conditions to the same sentence. Consequently, Mandarin-speaking adults would judge sentences like (24) to be true in three circumstances. It is true, first, if the boys did not find bees but snakes. It is true, second, if the boys did not find snakes but bees. It is true, third, if the boys did not find bees and the boys did not find snakes.

The critical testing stimuli such as (23) represent a mismatch between syntactic cue and semantic interpretation of the sentence, which is caused by overt syntactic movement (i.e. object preposing). For instance, in ordinary declarative sentences like (24), negation *meiyou* 'not' precedes the disjunction word *huozhe* 'or'. This relative position conforms to children's scope assignment

of negated disjunction. By contrast, in sentence (23), the disjunction phrase, *mifeng huozhe xiaoshe* ‘bees or snakes’, was preposed from the direct object position. Since the object preposing has already occurred, disjunction and negation are no longer in an isomorphic relationship, such that the scope assignment can be read off the surface syntax. The preposed disjunction phrase in sentence (23) is still expected to be interpreted as the direct object of sentences, since the preposed constituent should be interpreted in the position where it originated rather than the position where it is pronounced (e.g. Chomsky, 1995; Radford, 2004).

There are two objectives to these investigations of how Mandarin-speaking children and adults interpret negative sentences with a preposed disjunction phrase. First, we aim to confirm that the way Mandarin-speaking children assign scope relations to negated disjunctions is not simply based on the isomorphism hypothesis (e.g. Musolino, 1998; Lidz and Musolino, 2002). According to the isomorphism hypothesis, if one scope-bearing expression precedes another scope-bearing expression in the surface syntax, then the one that appears first has scope over the other that appears second at the level of semantic interpretation. Instead, as noted earlier, children acquiring all languages begin with the subset value of the Disjunction Parameter (i.e. the [-PPI] value of disjunction), which makes the relevant sentences true in the narrowest range of circumstances (e.g. the third circumstance in which the boys did not find either bees or snakes). Second, we aim to confirm that reconstruction is blocked for Mandarin-speaking adults when they are presented with sentences like (23). This is because the disjunction word *huozhe* ‘or’ is a PPI for adults. An illegitimate reading in adult grammar would be made

if adults reconstruct the preposed disjunction to generate a conjunctive entailment of disjunction. By contrast, reconstruction is permitted for Mandarin-speaking children because there is nothing blocking them.

To test these predictions, we interviewed 30 three- to five-year-old monolingual Mandarin-speaking children, and 15 Mandarin-speaking adults, using the description mode of the Truth Value Judgment Task (Crain and Thornton, 1998). Child and adult participants were presented with sentences such as (23) and (24). They were also presented with two experimental scenarios. In the first experimental scenario, for instance, all of the four boys found snakes, but they all failed to find bees. In the second experimental scenario, two out of the four boys found snakes, while the other two found snails that were not mentioned in the target sentence.

Based on previous research, it was expected that children acquiring Mandarin would reject the test sentences, in both experimental scenarios. By contrast, it was expected that Mandarin-speaking adults would accept the test sentences in the same experimental contexts. In the broader sense, we anticipated that Mandarin-speaking children and adults would still exhibit different interpretations for negative sentences with a preposed disjunction. This is because reconstruction would be blocked for the adults but not for the children. Consequently, different scope preferences to negated disjunctions assigned by Mandarin-speaking children and adults would still hold, regardless of the relevant position of these two scope-bearing expressions in the surface syntax. More details of this study are reported in Chapter 2.

3.2 The interpretation of the interplay of disjunction and universal quantification in Mandarin

Chapter 3 investigates how Mandarin-speaking children and adults assign the scope relations between disjunction and the universal quantifier *mei* ‘every’, when the phrase containing the disjunction word *huozhe* ‘or’ is in a preverbal position of the sentence. An example of the test sentences is (25).

(25) *Mei-ge nanhai yong daozi huozhe chazi chi-le chaodan.*

Every-CL boy with/use knife or fork eat-ASP omelet

Mandarin sentences such as (25) are ambiguous for two reasons. One source of the ambiguity is lexical. The disjunction phrase is preceded by the word *yong* ‘with/use’, which can either be interpreted as a verb or as a preposition. The other source of the ambiguity is the syntactic position where the disjunction phrase is inserted. The disjunction phrase appears in a preverbal position, which is a focus-sensitive position that usually contains the focus of a sentence (e.g. Ernst and Wang, 1995; Shyu, 1995; Huang, Li and Li, 2008; Badan, 2008).

Sentences like (25) are thus permitted with three types of interpretation. Briefly, if the word *yong* is analyzed as a verb, two types of interpretation are accessible. On the first interpretation, the disjunction phrase, *yong daozi huozhe chazi* ‘use a knife or a fork’, becomes the modifier of the subject phrase, *meige nanhai* ‘every boy’. The sentence thus means that every boy who used a knife or a fork ate an omelet. Since this interpretation resembles a sentence with a relative clause, we call this interpretation the relative clause interpretation. The second interpretation of sentence (25) takes the disjunction phrase to be a verb

phrase. Taking the other predicate phrase, *chi chaodan* ‘eat an omelet’, together, the sentence becomes a typical serial verbs construction (e.g. Huang and Liao, 1998). We call this interpretation the two-predicate interpretation. The third interpretation is accessed when the word *yong* is used as a preposition such as *with*. We call the third interpretation the reconstruction interpretation. This is because the disjunction phrase needs to be reconstructed to a lower position at the level of semantic interpretation to access the interpretation that is similar to an English sentence such as *Every boy ate an omelet with a knife or a fork*.

We utilized two theoretical mechanisms to examine whether the children and adults exhibit different interpretative preferences to the ambiguous sentence (25). The first theoretical mechanism is the asymmetrical semantic properties manifested by the two arguments of the universal quantifier. As a consequence of this asymmetry, a disjunction phrase is assigned different truth conditions when it appears in different arguments of universal quantificational sentences (e.g. Chierchia, Crain, Guasti, Gualmini and Meroni, 2001; Gualmini, Meroni and Crain, 2003; Zhou and Crain, 2009). This is because only the first argument (i.e. subject phrase) of the universal quantifier, and not the second argument (i.e. predicate phrase), is a downward entailing context that licenses a conjunctive entailment of disjunction. The second theoretical background we rely on, as noted in Section 2.2, is that Mandarin-speaking adults are more aware than young children of language-specific properties like focus sensitivity. In the target sentence, the position where the phrase containing disjunction appears is the preverbal position of the sentence. The constituent appearing in this position tends to be a focused constituent of the sentence (e.g. Ernst and Wang, 1995; Pan and Hu, 2000; Xu, 2004). An English cleft

interpretation is raised when a scope-bearing expression becomes a focused constituent for adults but not for children (e.g. Zhou and Crain, 2009). That is, the adults appear to interpret the focused scope-bearing expression in place, whereas the children move the focused constituent to a lower position at the level of semantic interpretation. Reconstruction that is used to solve sentence ambiguities would thus be blocked for adults, but not for children.

Using the description mode of the Truth Value Judgment Task (Crain and Thornton, 1998), we interviewed 15 four-year-old children, 15 five-year-old children, and 15 adults. Three types of scenario were constructed. These different scenarios were devised to distinguish the three types of interpretation, as well to examine the interpretative preferences by Mandarin-speaking children and adults. In responding to sentences like (25), the basic idea of the experimental design is that a Mandarin speaker will provide different patterns of responses in the three experimental scenarios based on the way she/he interprets the target sentences like (25).

In all three scenarios, the participants are presented with the target sentences like (26).

(26) *Mei-zhi tuzi yong daozi huozhe chazi chi-le pisa.*

Every-CL rabbit with/use knife or fork eat-ASP pizza

In one scenario, participants are presented with an experimental condition in which two of the four rabbits use a knife, one out of the four rabbits uses a fork, while the last rabbit uses a spoon. In addition, the rabbit who uses a knife eats pizza, the rabbit who uses a fork eats pizza, while the rabbit who uses a spoon

eats donut. First, if a participant accesses the relative clause interpretation, and analyzes the disjunction as modifying the subject phrase, *meizhi tuzi* ‘every rabbit’, sentence (26) would be assigned a conjunctive entailment of disjunction. This is because the subject phrase of the universal quantifier is a downward entailing context. The participant is expected to reject sentence (26) in this condition. Second, if a participant accesses a reconstruction interpretation, and analyzes the disjunction phrase as a prepositional phrase, the participant would reconstruct the disjunction phrase to a lower position and assign disjunctive truth conditions to the target sentence. This is because the predicate phrase of the universal quantifier is not downward entailing. The participant is expected to accept sentence (26) in this scenario. Third, if a participant accesses the two-predicate interpretation, she/he is expected to interpret the disjunction phrase in the same way as it would be interpreted if it were in the predicate phrase of the sentence. On this interpretation, sentence (26) would be assigned disjunctive truth conditions. However, on the two-predicate interpretation, the meaning of the sentence would also require that every rabbit has to eat pizza. Consequently, the participant is still expected to reject sentence (26) in this scenario.

It is also worth noting that participants who access either the relative clause interpretation or the two-predicate interpretation are expected to reject the target sentence in the current scenario. Other experimental scenarios thus need to be established to distinguish between these two interpretations. This is why we created three different types of experimental scenario in total.

Each participant was presented with sentences such as (26) across all three experimental scenarios. It is noted that there is no right or wrong

judgment for target sentences like (26), because this sentence is ambiguous in Mandarin. We thus collected participants' Yes/No responses in each experimental scenario, analyzed their response patterns and categorized these response patterns into the three types of possible interpretation for sentences like (26).

Based on previous research, firstly, we predicted that the reconstruction interpretation would be easily accessed for children but not for adults. This is because the syntactic position disjunction appears is a preverbal position of the sentence. The preverbal position is where the focused constituent of a sentence usually occupies (e.g. Ernst and Wang, 1995; Shyu, 1995). This would to some extent prevent adults from reconstructing the disjunction phrase, because a focus-sensitive constituent containing scope-bearing expressions easily gives rise to a cleft structure interpretation (e.g. Lee, 1991; Zhou and Crain, 2009). Secondly, since children, especially younger children, might not have learnt certain language-specific properties such as focus-sensitive constituent, the relative clause would be less accessed by children. This is because, to access the relative clause interpretation, the preverbal disjunction phrase needs to be interpreted in place, and subsequently becomes the modifier of the subject phrase in the sentence. More details of this study are described in Chapter 3.

3.3 The interpretation of disjunction in VP Ellipsis in Mandarin Chinese

The third set of empirical work in this thesis (Chapter 4) investigates Mandarin-speaking children's and adult's scope assignments to negated disjunctions in a novel linguistic context, i.e. VP ellipsis structures. In a VP ellipsis structure, as shown in (27), disjunction is elided from the second conjunct of a coordinate structure.

- (27) *Tubaba neng zhua-dao mifeng huozhe xiaoshe, danshi tubaobao bu neng.*
Papa Rabbit can catch-ASP bee or snake but Baby Rabbit not can

One of the theoretical basis of Chapter 4 states that Mandarin-speaking children and adults select different values of the Disjunction Parameter (e.g. Goro, 2004; Jing, Crain and Hsu, 2005; Crain, 2012). The Disjunction Parameter account predicts that Mandarin-speaking children and adults exhibit different scope assignments to negated disjunctions when both negation and disjunction are overt. This is because Mandarin-speaking adults analyze the disjunction word *huozhe* 'or' as a positive polarity item (PPI). By definition, a PPI takes scope over negation at the level of semantic interpretation. By contrast, Mandarin-speaking children ignore the adult input, and initially adopt the opposite scope relations, with negation taking scope over disjunction, which is the same way as English-speaking children and adults interpret the corresponding English sentences.

However, when negation is covert, the differences in scope preference between Mandarin-speaking children and adults are expected to be eliminated. One such linguistic environment is the predicate phrase of sentences having a pre-subject focus adverb *zhiyou* 'only'. This is illustrated in (28).

(28) *Zhiyou zhu'en chi-le shousi huozhe yimian.*

Only June eat-ASP sushi or pasta

'Only June ate sushi or pasta.'

In this linguistic structure, the focus adverb *zhiyou* 'only' introduces a covert negation, which indicates that nobody else (besides June) ate sushi, and nobody else (besides June) ate pasta. At this point, Mandarin-speaking adults and children converge on the interpretation of focus sentences with disjunction word *huozhe* 'or'. They both assign the conjunctive entailment of disjunction to sentences like (28) (Notley, Zhou, Crain and Thornton, 2009). This finding invites us to infer that, if a language-specific feature such as polarity sensitivity can affect sentence meaning, it would require both scope-bearing expressions to be phonologically realized in the surface syntax. The cancellation of positive polarity sensitivity would happen, if one of the scope-bearing expressions is covert at the level of Phonetic Form (i.e. surface syntax).

The other theoretical basis of Chapter 4 suggests that VP ellipsis structure is another linguistic structure that is predicted to cancel polarity sensitivity (e.g. Jayaseelan, 2001; Crain, 2012). Evidence comes from the different interpretative properties of the English PPI *some*, when it is overt in the second conjunct of a coordinate structure, and when it is covert in the same sentence structure. Being similar to the Mandarin disjunction word *huozhe* 'or', the English existential quantifier *some* cannot take scope beneath negation (e.g. Szabolcsi, 2002). Consider sentences (29) and (30).

(29) June will try some sushi, but Gen won't try some sushi.

(30) June will try some sushi, but Gen won't.

Sentences with VP ellipsis are governed by a parallelism constraint (Chomsky, 1995; Thornton & Wexler, 1999). This constraint requires the elided VP in the second conjunct to replicate the interpretation of the overt VP in the first clause. However, the parallelism constraint appears to be violated when the elided part involves polarity sensitivity items (PPIs) such as *some*. If the parallelism constraint is applied to (30), then one could expect the sentence to be interpreted in a way that *some* takes scope over negation, similar to what happens in (29). If this actually happens, the interpretation of the second conjunct in (30) would be paraphrased as *There is some sushi that Gen won't try*. This is obviously not the interpretation assigned by English-speakers. Instead, the interpretation of (30) can be better paraphrased by replacing the PPI *some* with the Negative Polarity item (NPI) *any*. For some reason, the polarity sensitivity of *some* is cancelled when it appears in an elided VP containing (overt) negation.

Taken the above theoretical analyses together, we aim to explore how Mandarin-speaking children and adults interpret coordinate structures containing an elided disjunction phrase. More specifically, we are interested in identifying whether young speakers of Mandarin are able to recover the elided disjunction phrase based on the parallelism constraint. We are also interested in checking whether Mandarin-speaking adults still analyze the disjunction word as a PPI when the phrase containing disjunction is not phonetically realized.

To answer these research questions, we interviewed 60 four- to five-year-old monolingual Mandarin-speaking children, and 40 Mandarin-speaking

adults. The present study adopted the Uncertainty Mode of the Truth Value Judgment Task (Crain & Thornton, 1998; Goro, in press) in order to reinforce the felicity conditions of using disjunction word *huozhe* 'or'.

Both child and adult participants were randomly divided into two groups to make a between-subjects design of the present study. Half of the children and half of the adults were presented with coordinate structures having an overt disjunction in the second conjunct, which is also called full VP sentences, such as (31). The other half were presented with coordinate structures having disjunction elided in the second conjunct, which is also called VP ellipsis sentences, such as (27), here repeated in (32).

(31) *Tubaba neng zhua-dao mifeng huozhe xiaoshe, danshi tubaobao bu*
neng zhuadao mifeng huozhe xiaoshe.

Papa Rabbit can catch-ASP bee or snake but Baby Rabbit not
can catch bee or snake

(32) *Tubaba neng zhua-dao mifeng huozhe xiaoshe, danshi tubaobao bu neng.*

Papa Rabbit can catch-ASP bee or snake but Baby Rabbit not can

For instance, each participant is presented with a story in which a rabbit family have moved to a new village. In the first telling of the story, Papa Rabbit becomes a master of snake catching, and a master of bee catching, and receives a gold star. Baby Rabbit becomes a master of snake catching, and receives a silver star. Mama Rabbit does not master either of the animal catching skills, so she receives a black cross. In the second telling of the story, the objects related

to the skills are removed. Based on the rewards that the three rabbit characters have received, a puppet, Kermit the Frog utters the target sentence.

Based on previous research, in responding to full VP test sentences like (31), it is expected that children and adults would assign different scope relations to negation and disjunction. In the experimental scenario illustrated above, the adults would accept the target sentences like (31). By contrast, the children would reject the same sentences by pointing out Baby Rabbit can catch one of the two animals mentioned in the target sentence. When disjunction is overt in negative sentences, it is a PPI for Mandarin-speaking adults, but not for children (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). In contrast to different scope assignments to negated disjunctions when the children and the adults are presented with full VP sentences, we predict that the polarity sensitivity of the disjunction word *huozhe* ‘or’ would be neutralized in VP ellipsis sentences like (32). At this point, the children and the adults would exhibit the same scope assignments to negated disjunctions. That is, both Mandarin-speaking children and adults would interpret negation as taking scope over disjunction, assigning a conjunctive entailment of disjunction to the coordinate structure having an elided disjunction phrase. More details of this study are presented in Chapter 4.

4. The structure of the thesis

This thesis investigates how Mandarin-speaking children and adults interpret sentences with the disjunction word *huozhe* ‘or’, when it is in combination with negation or with the universal quantifier *mei* ‘every’. The three experiments represent case studies of where children and adults have the same interpretation, and where they have different interpretations.

Chapter 2 reports a study on Mandarin-speaking children’s and adults’ interpretations of negative sentences with disjunction, when the disjunction word *huozhe* ‘or’ has preposed from the object position to a preverbal position of the sentence. Chapter 3 presents a study on Mandarin-speaking children’s and adults’ interpretations of sentences containing disjunction and a downward entailing expression *mei* ‘every’, when the disjunction word is embedded in a preverbal position of the sentence. Chapter 4 examines Mandarin-speaking children’s and adults’ interpretations of coordinate structures containing both negation and disjunction, when the disjunction phrase was elided in the second clause of the sentences. Finally, Chapter 5 summarizes the findings from the three experiments, concludes the thesis and presents general ideas for future research.

CHAPTER 2

Differences in Scope Assignments for Child and Adult Speakers of Mandarin

1. Introduction

The present study investigated whether changes in sentence structure lead to corresponding changes in the assignment of scope relations by Mandarin-speaking children and adults. In one condition of the study, negative sentences with disjunction were presented to participants in order to verify the claim that disjunction is a positive polarity item for adult speakers of Mandarin, but not for children (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). A second condition included a sentence structure that has not been investigated in previous research. This was also a negative sentence structure. However, in this structure, the disjunction phrase was positioned before the verb. This allowed us to compare the interpretation that Mandarin-speaking children and adults assign to disjunction phrases in two positions, i.e., preceding or following the negation marker.

A comparison of these interpretations made it possible to determine whether or not linear order contributes to the assignment of scope. If linear order determines scope assignment, then child and/or adult speakers of Mandarin would be expected to generate different interpretations depending on the position of the disjunction phrase. However, if it turns out that child and/or adult speakers of Mandarin assign the same interpretation to the disjunction phrase, regardless of its position in the surface syntax, this would thus constitute evidence that the disjunction phrase is ‘reconstructed’ to a position inside the verb phrase at the level of semantic interpretation. Following reconstruction of the disjunction phrase, it is assigned the same interpretation that is assigned to sentences in which the disjunction phrase actually appears in the verb phrase. As noted in Chapter 1, a disjunction phrase that is positioned in

the verb phrase following negation generates a ‘neither’ interpretation, so the sentence is true only if both of the disjuncts are false. For example, the English sentence, *June did not order rice or beans*, is true if June did not order rice and June did not order beans. Since the negative sentence with disjunction logically entails the negation of both of its disjuncts, this ‘neither’ interpretation is sometimes referred to as a conjunctive entailment.

The ‘neither’ interpretation, or conjunctive entailment, is assigned to disjunction phrase in the verb phrase of negative sentences in many languages, including English, German, and Korean. However, in many other languages, negative sentences with disjunction in the verb phrase do not generate a ‘neither’ interpretation. Instead, a disjunction phrase that is positioned in the verb phrase is interpreted as taking scope over the negation marker, at least by adult speakers. Languages in which disjunction is interpreted as taking scope over negation, regardless of its position in the surface syntax, include Mandarin, Japanese, Russian, and Italian, among others. It has been argued that disjunction takes scope over negation because disjunction is a positive polarity item (PPI) in these languages. By definition, a positive polarity item (PPI) must take scope over (local) negation at the level of semantic interpretation.

One of the most important discoveries in the acquisition of semantics in recent years is the finding that, regardless of the interpretation assigned to disjunction in negative sentences in adult languages, children generate the same scope assignment to negative sentences with disjunction (e.g. Goro and Akiba, 2004a, 2004b; Jing, Crain and Hsu, 2005; Verbuk, 2006; Lee, 2010; Geçkin, Crain and Thornton, 2016). Children’s scope assignment has negation taking scope

over disjunction, so children, across languages, generate the 'neither' interpretation.

The findings of the present study are consistent with previous research. Results suggested that, in responding to negative sentences with disjunction inside the verb phrase, children assigned the 'neither' interpretation, whereas adults assigned a different interpretation. The adult interpretation was consistent with the claim that disjunction is a PPI for Mandarin-speaking adults. Therefore, adults accepted the negative sentence with disjunction in circumstances in which at least one of the disjuncts was false. In contrast to children, adult speakers of Mandarin did not require both disjuncts to be false.

In the second condition of the study, the disjunction phrase appeared before negation, in a preverbal position. In response to these sentences, children also assigned the 'neither' interpretation. This finding suggests that child Mandarin speakers reconstruct disjunction phrases to a position inside the verb phrase. From this position, negation takes scope over the disjunction phrase, just as it does in a sentence in which disjunction appears inside the verb phrase in the surface syntax. In contrast to children, adult Mandarin speakers did not assign the 'neither' interpretation to negative sentences in which disjunction was positioned before negation, in a preverbal position. This finding is, again, consistent with the claim that adults analyze disjunction as a positive polarity item (PPI). Because disjunction is a PPI for adults, it is prevented from undergoing reconstruction at the level of semantic interpretation. In short, Mandarin-speaking children assigned the 'neither' interpretation to negative sentences with disjunction, regardless of the position of the disjunction phrase in the surface syntax. Adults failed to make the same scope assignment as

children, again regardless of the position of disjunction in the surface syntax. For adults, disjunction took scope over negation in both types of test sentences. The different pattern of linguistic behavior for children and adults is consistent with the biolinguistic approach to language acquisition, but such difference between children and adults is difficult to reconcile with a usage-based approach (e.g. Crain, Koring and Thornton, 2016). On the usage-based approach, general parsing strategies based on linear order are expected to govern the interpretations assigned by both children and adults. One general parsing strategy anticipates that scope assignments are dictated by linear order, such that if one logical expression precedes another, then the one that is encountered first has wide scope. This ‘isomorphism’ principle cannot explain the pattern of linguistic behavior in the present study, for either children or adults.

2. Theoretical background

Before moving on to the experimental design, the relevant theoretical background is presented in this section. This includes two approaches to scope assignment, how binding principles work in reconstructed contexts, the disjunction parameter, reconstruction in Mandarin and reconstruction in child language.

2.1 *Two approaches to scope assignment*

Consider sentence (1).

(1) None of the rabbits watched bees or wasps.

In sentence (1), the negative quantificational expression, *none of the rabbits*, takes scope over disjunction. Therefore, sentence (1) entails that none of the rabbits watched bees, and it entails that none of the rabbits watched wasps. Taken together, sentence (1) generates what we will refer to as a conjunctive entailment: *None of the rabbits watched bees and none of the rabbits watched wasps*.

A simple parsing principle based on linear order could account for this interpretation of sentences such as (1). The parsing principle would favour surface scope interpretations over interpretations that involve inverse scope relations. On the surface scope interpretation, there is an isomorphic mapping between the syntactic structure of a sentence and its semantic interpretation. Such a parsing principle was proposed by Musolino (1998), who calls it the

Observation of Isomorphism. In sentences with two scope-bearing expressions, the Observation of Isomorphism dictates that the scope-bearing expression that appears first in the surface syntax takes scope over one that appears later in the sentence (e.g. Musolino, 1998; Lidz and Musolino, 2002; Musolino and Lidz, 2003; Musolino, 2006; Conroy, Lidz and Musolino, 2009; Musolino, 2011).

Although the Observation of Isomorphism can account for the preferred interpretation of sentence (1), it does not predict the scope assignment that adult English speakers prefer for sentence (2).

(2) Bees or wasps are what none of the rabbits watched.

Sentence (2) is a pseudocleft. In this structure, the quantified noun phrase (NP), *none of the rabbits*, resides inside a *wh*- subordinate clause. Despite being ‘lower’ in the surface syntax, the quantified NP, *none of the rabbits*, takes scope over the disjunction phrase, *bees or wasps*, at the level of semantic interpretation (e.g. Thornton, Kiguchi and D’Onofrio, 2016). Notice that the disjunction phrase, *bees or rabbits*, would be assigned the correct interpretation if it were positioned inside the verb phrase, as indicated in (3).

(3) Bees or wasps are what none of the rabbits watched < bees or wasps >.

If the disjunction phrase were positioned as in (3), the result would be a conjunctive entailment (the ‘neither’ interpretation), as in sentence (1): *None of the rabbits watched bees, and none of the rabbits watched wasps*. That is, sentences (1) and (2) have the same scope assignment, despite the scope-

bearing expressions having different linear orders. Examples like sentence (2) thus undermine an account of scope assignment that is based on linear order, such as the Observation of Isomorphism.

Instead, the linguistic process known as ‘reconstruction’ accounts for semantic interpretations that require non-isomorphic anaphoric relations. Sentence (4) is a well-known instance of reconstruction (e.g. Chomsky, 1976, 1995; Huang, 1993; Haegeman, 1994), which motivates the subsequent relevant studies. The process of reconstruction was invoked by Chomsky (1976), as a way to explain the anaphoric relationships in *wh*-questions such as (4).

(4) *Whose_i mother does he_i love?

Sentence (4) is unacceptable on the interpretation on which the pronoun *he* and the *wh*-expression *whose* are taken to refer to the same individual. It has been proposed that the prohibition on anaphoric relationships between pronouns and *wh*-phrases in sentences such as (4) is governed by Principle C (Chomsky, 1976, 1981).

2.2 Principle C

Principle C is the third of the three principles of the Binding Theory. The Binding Theory is the component of grammar that determines the interpretation of noun phrases, including reflexives, pronouns and referring expressions (e.g. Chomsky, 1976, 1981; Huang, 1982, 1993; Haegeman, 1994; Huang, Li and Li, 2008). Principle C indicates that a referring expression and a

pronoun cannot be coindexed if the pronoun c-commands the referring expression.

Sentence (5) illustrates Principle C. Notice that the pronoun *he* in (5) cannot be anaphorically related to the referential noun phrase *John* in the possessive phrase, *John's mother*. It is instructive to note that coreference is also blocked in the strong crossover sentence (6) (cf. Haegeman, 1994: p.413-418). In (6), the possessive *wh*-phrase *whose* is not anaphorically related to the pronoun *he* just as the pronoun *he* cannot be anaphorically linked to the referring expressions *John* in (5).

(5) He_i said John_{*i/j}'s mother left.

(6) Whose mother_{*i/j} did he_i say < whose mother_{*i/j} > left?

It follows that sentence (6) does not have an interpretation similar to that of (7), which asks for the identity of someone who said that his own mother left. This interpretation is indicated in example (8).

(7) Who_i said his_i mother left?

(8) Which person(s) *x* said that *x*'s mother left?

Rather, the interpretation assigned to (6) is similar to that of (9). In (9) the pronoun *he* is not anaphorically related to the *wh*-phrase *who*, as indicated in (10).

(9) Who did he say < who > left?

(10) Which person(s) x are such that he said x left?

Based on these observations, Chomsky (1976) proposed that the copy of a moved *wh*-phrase (or the trace of a moved *wh*-phrase) has the same status as a referring noun phrase, such as *John*. Therefore, Principle C of the Binding Theory governs coindexation in sentences like (6). Because the pronoun *he* c-commands the *wh*-phrase, *whose mother*, in (6), coindexation between them is ruled out.

It remains to explain why anaphoric relations between the pronoun *he* and the possessive *wh*-phrase, *whose mother*, is prohibited in (4). Chomsky (1976) proposed that the moved *wh*-phrase, *whose mother*, undergoes reconstruction at the level of semantic interpretation. Following reconstruction, the possessive *wh*-phrase, *whose mother*, is interpreted in its original position, as shown in (11).

(11) *Whose_i mother does he_i love < whose_i mother >?



As (11) indicates, a copy of the expression, *whose mother*, is repositioned to the position where it originated. Although the copy was not pronounced in this position, the copy provided “the material for reconstruction” (cf. Chomsky, 2015: p. 185-186). The moved expression occurs twice in the sentence: once in

its position in the surface syntax, and a second time in the position in which it originated (e.g. Chomsky, 1995, 2015).

2.3 The Disjunction Parameter

Besides these mismatches between the surface syntax and semantic interpretation that have been accounted for by reconstruction, there is another example providing evidence against the Observation of Isomorphism. According to previous literature, linear order does not determine scope assignment in negative sentences with disjunction across languages. Consider sentence (12).

(12) June didn't eat sushi or pasta.

English speakers typically interpret negation *not* as taking scope over the disjunction word *or*, and assign a conjunctive entailment of disjunction to negative sentences with disjunction such as (12). Consequently, sentence (12) can be paraphrased as, *June didn't eat sushi and June didn't eat pasta*.

A set of empirical studies was reported by Crain, Gardener, Gualmini and Rabbin (2002) and Gualmini and Crain (2005). The researchers used the prediction mode of the Truth Value Judgment Task (Crain & Thornton, 1998) to examine how preschool English-speaking children assigned the scope relations to negation and disjunction. The prediction mode was adopted to make target sentences pragmatically felicitous. The target sentences were included in the predictions that were made by a puppet, 'Merlin the Magician', who made a guess about what would happen next in the story. For instance, in the Crain, Gardener, Gualmini and Rabbin (2002) study, 15 adults and 15 four- to five-

year-old children were presented with a story in which two girls had lost a tooth, and were waiting for the Tooth Fairy to come. One girl decided to stay up late to see what the Tooth Fairy looked like. At this point, Merlin the Magician (the puppet) uttered a target sentence like (13). The story continued following the puppet's statement. At the end, the girl who stayed awake got a jewel, but not a dime.

(13) The girl who stayed up late will not get a dime or a jewel.

The experimental hypothesis was that the participants would reject sentence (13), if they interpreted negation as taking scope over disjunction and consequently generated an entailment as: *The girl who stayed up late will not get a dime and the girl who stayed up late will not get a jewel*. This was exactly what happened. The results showed that both the children and the adults rejected target sentences like (13) over 90% of the time. This indicates that, in response to negative sentences with disjunction, English speakers including English-speaking children seem to follow the Observation of Isomorphism. This is because the scope relations assigned to the sentence by English speakers correspond to the relevant syntactic position of the two scope-bearing expressions. That is, negation takes scope over disjunction both in the surface syntax and at the level of semantics.

However, the Isomorphism Principle fails to operate in sentence (14), which is the Mandarin translation of English sentence (12).

(14) *Zhu'en meiyou chi shousi huozhe yimian.*

June not eat sushi or pasta

Mandarin-speaking adults assign a different interpretation to sentence (14), as compared to the interpretation assigned to sentence (12) by English speakers. The adult interpretation of the Mandarin sentence (14) resembles the English cleft structure *It is sushi or pasta that June didn't eat* (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). Mandarin-speaking adults interpret disjunction as taking scope over negation in sentence (14). This suggests that the disjunction phrase, *shousi huozhe yimian* 'sushi or pasta', is raised to a position above negation at the level of semantic interpretation. This results in the inverse scope interpretation, which cannot be explained by the Observation of Isomorphism.

In contrast to the scope assignments in adult Mandarin, Mandarin-speaking children interpret negated disjunctions as having the opposite scope relations. Mandarin-speaking children have the same scope assignment as English-speaking children and adults. In the Jing, Crain and Hsu (2005) study, the four-year-old child speakers of Mandarin rejected sentences like (14) over 90% of the time, following a description of a story in which June only ate one of the two dishes. The pattern of children's responses indicates that the children generated a conjunctive entailment of disjunction in response to sentences such as (14). The same pattern of results was documented in other languages including Japanese, Russian and Turkish (e.g. Goro and Akiba, 2004a, 2004b; Verbuk, 2006; Geçkin, Crain and Thornton, 2016).

These findings reveal that disjunction words are subject to language variation in adult languages. The findings also reveal that the Isomorphism Principle cannot account either for this language variation or for different scope assignments by children versus adults in languages like Mandarin. For instance, as shown in sentences (12) and (14), Mandarin and English have the same word order but have different scope assignments. By contrast, children who speak these two languages interpret negated disjunctions in the same way, i.e., with negation taking scope over disjunction, regardless of the position where disjunction appears in the surface syntax, and regardless of the interpretation assigned by adults.

A lexical parameter, called the Disjunction Parameter, has been proposed to explain both the observed variation across adult languages and the difference between child and adult language (e.g. Szabolcsi, 2004; Goro, 2007; Crain, 2012). The Disjunction Parameter proposes that languages are categorized into two classes, based on the parameter value with disjunction that is designated. In one class of languages, disjunction takes scope over negation. The disjunction parameter value is designated as the [+PPI] value. These languages include Hungarian, Japanese, Mandarin, Polish, Russian, Serbo-Croatian, Slovak and Turkish (e.g. Szabolcsi, 2002; Goro and Akiba, 2004a, 2004b; Verbuk, 2006; Geçkin, Thornton and Crain, 2016). In the second class of languages, negation takes scope over disjunction both in the surface syntax and at the level of semantic interpretation. These languages include Bulgarian, English, French, German, Greek, Korean and Romanian which have the parameter value with disjunction that is designated as the [-PPI] value (e.g. Szabolcsi, 2002; Crain, Gardener, Gualmini and Rabbin, 2002; Lee, 2010; Crain, 2012).

Therefore, Mandarin disjunction *huozhe* ‘or’ is a positive polarity item (PPI) for adults, but not for children. This accounts for the different scope preferences between Mandarin-speaking children and adults when they are presented with the same sentences such as (14), which is repeated here in (15), in the same contexts.

(15) *Zhu'en meiyou chi shousi huozhe yimian.*

June not eat sushi or pasta

Specifically, as predicted by the Disjunction Parameter account, the disjunction phrase has to be interpreted as having scope over negation in adult Mandarin, which causes the Mandarin-speaking adults to assign disjunctive truth conditions to sentence, despite the negation marker preceding the disjunction word in the surface syntax. This account also predicts that, crosslinguistically, children do not analyze disjunction as a PPI, so they are not compelled to interpret disjunction as taking scope over negation at the level of semantic interpretation. For children, disjunction is interpreted in its position in the surface syntax, i.e., *in situ*. If negation takes scope over disjunction in the surface syntax, then children generate a conjunctive entailment of disjunction to the relevant sentences.

More importantly, given the observations that young children are not governed by the value of parameters that the adults adopt in languages such as Mandarin, Japanese and Turkish, children’s initial setting of the Disjunction Parameter circumvents to raise learnability problems and guarantees that children can switch the parameter setting once they recognize that the local

adult language utilizes a different value of parameters. Specifically, in the Disjunction Parameter case, the [-PPI] value is the subset of the [+PPI] value. This is because disjunction with the [-PPI] value makes sentences like, *June didn't eat sushi or pasta*, true in a narrower range of circumstances than disjunction with the [+PPI] value does. In the absence of negative evidence, children are compelled to initially adopt the subset value of parameters.

These findings hence support the Semantic Subset Principle (Pinker, 1984; Berwick, 1985; Crain, Ni & Conway, 1994; Goro, 2007). The Semantic Subset Principle has been invoked given the fact that child grammars can only be added or modified on the basis of positive evidence in the input. The claims proposed by Crain and his colleagues account for how the child speakers of languages like Mandarin circumvent the learnability problem. The children who speak Mandarin or Japanese initially adopt the [-PPI] value of the Disjunction Parameter which asymmetrically entails the other value (i.e. the [+PPI] value): *"...if the interpretative component of Universal Grammar makes two interpretations, A and B, available for a sentence S, and if interpretation A makes S true in a narrower range of circumstances than interpretation B does, then interpretation A is hypothesized before B in the course of language development."* (Crain and Philip, 1993; cf. Crain, Ni and Conway, 1994: p.455).

2.4 Reconstruction in Mandarin

As a discourse configurational language (cf. É Kiss, 1995), Mandarin speakers are able to convey the same message using sentences with different surface syntactic structures (e.g. Huang, 1982; Yuan, 1996; Huang, Li and Li, 2008; Shi, 2008). For example, Mandarin permits three possible landing sites for the object of a sentence (e.g. Huang, 1982; Xu and Langendoen, 1985; Ernst and Wang, 1995; Xu and Liu, 1998; Pan and Hu, 2000). In ordinary declarative sentences (i.e. sentences with SVO word order) like (16), Mandarin allows a noun phrase that originates in the predicate phrase to be the direct object of a sentence.

(16) *Zhu'en chi-le pingguo.*

June eat-ASP apple

'June ate an apple.'

Mandarin also allows the noun phrase to be moved to a preverbal position (i.e. the focus position of a sentence), or to a pre-subject position (i.e. the topic position of a sentence), as shown in sentences (17) and (18) respectively.

(17) *Zhu'en pingguo chi-le.*

June apple eat-ASP

'June ate an apple.'

(18) *Pingguo Zhu'en chi-le.*

Apple June eat-ASP

'June ate an apple.'

It is worth noting that previous research has proved that the derivation of both sentence (17) and (18) is due to movement rather than base generation (e.g. Pan and Hu, 2000). For example, the representation of sentence (17) would be (19).

(19) *Zhu'en pingguo chi-le < pingguo >.*



June apple eat-ASP <apple>

‘June ate apples.’

In addition, compared to the ordinary declarative sentence (16), the derivation forms (17) and (18) need to meet more requirements with respect to verb types and discourse function. For instance, to utter a statement like (17) felicitously, a contrastiveness needs to be introduced (e.g. É Kiss, 1998; Molnár, 2006; Reeve, 2011). Briefly, the contrastiveness is usually represented by a presupposed set containing the focused element and other members of the same category. For example, the focused constituent *pingguo* ‘apples’ in sentence (17) indicates the member of the set that is contrasted with other members of the set (e.g. bananas, oranges). Other members are not mentioned in the current utterance that the speaker produced, but were mentioned in previous discourse context. To utter a statement like (18) felicitously, *pingguo* ‘apple’ has to be a piece of shared knowledge that the speaker and the hearer have known (i.e. old information). Preposing *pingguo* ‘apples’ to the topic position is to make it salient. This is because the topicalized constituent is what the speaker is most

interested in, and making it into the center of attention under the given discourse context (e.g. Zhu, 1982; Yuan, 1996).

The three sentences (16), (17) and (18) convey the same meaning despite their differences in linear word order. This is because *chi* 'eat' is a transitive verb, which requires a direct object as its argument. Instead of being positioned after the verb, as in (16), the object phrase *pingguo* 'apples' precedes the verb in (17) and (18). The verb then recovers its absent object by reconstructing the object Noun Phrase (NP) *pingguo* 'apple', in order to interpret it at the level of semantic interpretation. This derivation process resembles what occurs in the English cleft structure, e.g., *It is apples that June ate*.

The reconstruction of disjunction phrases is also permitted in Mandarin. An ordinary declarative sentence with disjunction is (20), which has the disjunction phrase in the direct object of the sentence.

(20) *Zhu'en chi-le pingguo huozhe juzi.*

June eat-ASP apple or orange

'June ate apples or oranges.'

However, the disjunction phrase can appear either in the preverbal position or in the pre-subject position, as in (21) and (22), where both Mandarin-speaking children and adults would reconstruct the disjunction phrase and interpret it as if in the direct object position.

(21) *Zhu'en pingguo huozhe juzi chi-le.*

June apple or orange eat-ASP

'June ate apples or oranges.'

(22) *Pingguo huozhe juzi, Zhu'en chi-le.*

Apple or orange June eat-ASP

'June ate apples or oranges.'

Mandarin-speaking children and adults have an identical interpretation of sentences (20), (21) and (22). This indicates that the disjunction phrase is interpreted in the direct object position for both adults and children, even when it is pronounced either in the preverbal position or in the pre-subject position. This is how reconstruction operates in affirmative declarative sentences with disjunction. In responding to sentences involving movement such as (21) and (22), the moved disjunction phrase is freely reconstructed to its original position to get interpreted both for Mandarin-speaking children and for adults. This leads us to question what happens to negative sentences with the moved disjunction phrase.

We saw earlier that disjunction is a PPI for Mandarin-speaking adults, but not for Mandarin-speaking children. As a consequence of their different settings of the Disjunction Parameter, Mandarin-speaking children and adults display different scope preferences when they interpret negative sentences with disjunction such as (15), which is repeated here in (23).

(23) *Zhu'en meiyou chi shousi huozhe yimian.*

June not eat sushi or pasta

Mandarin-speaking adults interpret *huozhe* 'or' as a PPI, the disjunction phrase is thus raised to a position above negation at the level of semantic interpretation. They assign sentence (23) an interpretation like *It is sushi or pasta that June did not eat*. By contrast, Mandarin-speaking children initially adopt the [-PPI] value of the Disjunction Parameter, and generate a conjunctive entailment of disjunction to sentence (23), i.e., *June did not eat sushi and June did not eat pasta*. This has interesting consequences for the interpretation of negative sentences with a moved/preposed disjunction phrase. Consider example (24).

(24) *Zhu'en shousi huozhe yimian meiyou chi.*

June sushi or pasta not eat

In sentence (24), the disjunction phrase, *shousi huozhe yimian* 'sushi or pasta', was preposed from the object phrase and precedes negation *meiyou* 'not' in the surface syntax. Given the fact that the disjunction word is designated to the [+PPI] value for Mandarin-speaking adults, reconstruction would become blocked for them. If the preposed disjunction phrase is reconstructed to the position within the scope of negation, an ungrammatical interpretation that suspends the positive polarity sensitivity of disjunction would be generated. However, reconstruction would be permitted for Mandarin-speaking children, since disjunction is not a PPI for them. That is, nothing blocks the emergence of

reconstruction that brings about a conjunctive entailment of disjunction to sentences like (24) for Mandarin-speaking children. Moreover, recall that, in ordinary declarative sentences, the way that Mandarin-speaking children interpret negated disjunction is consistent with the relevant syntactic position of these two scope-bearing expressions. That is, the parsing principle based on the Isomorphism Principle (e.g. Musolino, 2011) appears to account for children's interpretation in this case. Therefore, investigating how children interpret negative sentences with the preposed disjunction phrase could confirm that children's scope assignment to negated disjunctions is not simply based on the Isomorphism Principle. This investigation could also verify children's knowledge of reconstruction.

2.5 Reconstruction in child language

An important source of evidence that supports the existence of the reconstruction operation comes from language acquisition. The majority of previous research investigates young children's mastery of binding principles at the 'reconstructed' level.² One supporting argument is a study from Guasti and Chierchia (1999/2000). The Guasti and Chierchia study examined Italian-speaking children's competence in analyzing an anaphoric relationship between a pronoun and a universally quantified expression that is embedded in a prepositional phrase (PP). The anaphoric relationship was tested in two sentence type conditions. One condition was ordinary declarative sentences, as

² Traditionally, Binding Theory is a set of constraints governing the interpretation of noun phrases (including anaphors, pronouns and referring expressions), which are defined by the c-command relationship. A binds B only if A c-commands B, and A and B are co-indexed. More specifically, Binding Theory constitutes three principles. Principle A indicates that an anaphor is bound in its governing category. Principle B suggests that a pronominal is free in its governing category. Principle C denotes that a referring expression is free (Chomsky, 1981; Huang, 1982).

shown in (25). In this sentence, the coreference between the null pronoun and the referential expression, *un musicista* ‘the musician’, violates the constraint of Principle C, which indicates that the referring expression must be free in its governing category, i.e., the referring expression cannot be coreferred with the pronoun that co-occurs in the same c-command relationship (e.g. Chomsky, 1981; Huang, 1982; Lust, Eisele and Mazuka, 1992; Haegeman, 1994; Thornton and Wexler, 1999; Huang, Li and Li, 2008). The other condition was sentences involving topicalization. In the second condition, the phrase containing the universally quantified phrase, *ciascun pirata* ‘each pirate’, was preposed from its original position to the topic position, as shown in (26). In this sentence, the interpretation on which the pronoun *ha* ‘he’ and the phrase, *ciascun pirata* ‘each pirate’, are anaphorically linked is also ruled out for adults. However, this is not observed from the surface syntax, since *ha* ‘he’ does not c-command the prepositional phrase (PP), *Nel barile di ciascun pirata* ‘in the barrel of each pirate’, in the surface syntax. This meaning that violates Principle C is only available if the PP is reconstructed into its original position at the level of semantic interpretation.

(25) *Andava sul cavallo a dondolo, mentre un musicista suonava la tromba.*

Was riding a rocking horse while a musician was playing the trumpet
 ‘(He) was riding a rocking horse, while a musician was playing the trumpet.’

(26) *Nel barile di ciascun pirata con cura ha messo una pistol.*

In the barrel of each pirate with care he put a toy gun

‘In every pirate_i’s barrel, with care he_i put a toy gun.’

Using the Truth Value Judgment Task (Crain and Thornton, 1998), 16 Italian-speaking adults and 20 three- to five-year-old Italian-speaking children were tested with sentences like (25) and (26). The child participants ranged in age from 3;2 to 5;7, with an average age of 4;5. In a typical trial, child and adult participants were presented with sentence (25) following a story about a musician who played a trumpet and also rode a horse. The children rejected target sentences like (25) 80% of time, and the adults rejected the sentences 94% of the time. This indicated that the children, like the adults, did not allow the pronoun *ha* ‘he’ to co-refer with the referring expression, *un musicista* ‘a musician’, when these two noun phrases co-occurred in the same clause (i.e. in a c-command relationship).

The researchers also interviewed 18 young Italian-speaking children who ranged in age from 3;10 to 5;7, with a mean age of 4;6, as well as 16 adults to interpret sentences like (26). Sentences contained a PP, *nel baril di ciascun pirata* ‘in every pirate’s barrel’, that had been preposed to the topic position of a sentence. The participants were presented with a story about a ghost and three pirates. Each character had a barrel, a fish and a gun. The story ended with the ghost stealing all three fish from the three pirates, as well each pirate hiding his own gun in his own barrel. After listening to the story, the children also exhibited an adult-like interpretation when they provided judgments on

sentence (26). The children rejected sentences like (26) 90% of the time, while the adults rejected the same sentences 98% of the time.

The results from the Guasti and Chierchia study showed that children as young as 3;10 behaved like adults, when they interpreted binding relations in both sentence type conditions. This indicated that young children exhibited adult-like competence in processing the relevant binding principles, once they determined the lexical meaning of the relevant words. The results also showed that no difference was found between children's responses to each of the two conditions. This indicated children had no difficulty dealing with binding relations, in spite of the fact that adult-like interpretation for (26) is only obtained with applying reconstruction.

A later study by Leddon (2006) investigated children's knowledge of reconstruction with respect to binding principles in English *wh*-questions. Leddon studied how preschool English-speaking children comprehended sentences that are governed by Principle A, as shown in (27). She also investigated how these children comprehended the corresponding *wh*-questions such as (28), which were derived from sentences similar to (27) through an overt movement (i.e. *wh*-movement).

(27) Every dancer_i put up the white painting of herself_i.

(28) Which painting of herself_i did every dancer_i put up?

Based on Principle A, the reflexive anaphor *herself* in sentence (27) must be co-indexed with the referring expression, *every dancer*. This is because *every*

dancer c-commands *herself* both in the surface syntax and at the level of the semantic interpretation. In responding to its corresponding *wh*-question (28), if Principle A is required to be operated in this sentence, the anaphor *herself* must be reconstructed and be interpreted in its original position (i.e. the bottom of the hierarchical structure of the sentence).

The Truth Value Judgment Task (Crain and Thornton, 1998) was used to test how English-speaking children and adults interpreted ordinary declarative sentences that adhere to binding principles (e.g. sentence (27)). A combination of the Truth Value Judgment Task and the Questions after Stories Task (de Villiers & Roeper, 1996) was used to examine the same participants' interpretation of the corresponding *wh*-questions (e.g. sentence (28)). Twenty-four preschool-aged children (mean age: 4;6) and 24 adults were interviewed. The interpretation associated with the bound interpretation (i.e. co-reference between *every dancer* and *herself*) was expected to be the 'Yes' response.

The results showed that the preschool children accessed the bound interpretation of anaphoric reflexives over 70% of the time for both ordinary declarative sentences and *wh*-questions. That is, the children required the reflexives like *herself* to be bound by the referring expressions like *every dancer* in both sentence type conditions most of the time. In the same circumstances, the adults accessed the bound variable interpretation over 95% of the time. The child participants' performance appeared to not be at the same level as that of the adults. However, these children adhered to binding principles as often for *wh*-questions as they did for ordinary declarative sentences. This indicates that the young children begin to require the anaphor reflexive to be bound by its antecedent/referent in reconstructed context (e.g. *wh*-questions), as long as

they are competent at comprehending the binding relations in ordinary declarative sentences. The findings hence provide some support for the claim that children as young as four years old have exhibited their knowledge of reconstruction with respect to binding principles (e.g. Guasti and Chierchia, 1999/ 2000).

Another piece of developmental evidence was reported by Kiguchi and Thornton (2016). They investigated how four- to five-year-old English-speaking children interpreted Specificational Pseudoclefts (SPCs). SPCs typically consist of three parts: a *wh*-clause, a form of the copula, and a ‘counterweight’ (Heycock, 1994). For example, if the counterweight precedes the *wh*-phrase, the sentence is referred to as Type B SPCs, such as (29).

(29) A piece of coral or a plant is what nobody brought back.

It is worth noting that a prominent feature of Specificational Pseudoclefts (SPCs) is the connectivity effect.³ This feature thus predicts that the absence of the c-command relationship in the surface syntax has no effect on binding relations, as well as the licensing of negative polarity items (NPIs) (Heycock & Kroch, 2002). Specifically, in responding to sentences like (29), according to the theoretical literature, Type B SPCs have been analyzed as requiring reconstruction. The disjunction phrase, *a piece of coral or a plant*, is still interpreted within the scope of negation, despite disjunction preceding the negative universally quantified phrase *nobody* in the surface syntax.

³ The use of ‘connectivity’ and ‘reconstruction’ has been found to be interchangeable in previous work. From now on, the present study calls this phenomenon ‘reconstruction’.

In order to explore whether reconstruction operates when English-speaking children and adults interpreted Type B SPCs, the Kiguchi and Thornton study interviewed 17 English-speaking children who ranged in age from 4;2 to 5;2 (mean 4;8) and 14 adults served as controls, using the Truth Value Judgment Task (Crain and Thornton, 1998). The researchers presented sentences like (29) to the child and adult participants, and examined whether the participants assigned a conjunctive entailment to the disjunction phrase, *a coral or a shell*, in sentence (29). The participants were presented with sentences like (29) following a story where five underwater divers retrieved items from a coral reef. The story ended with three of the divers taking back a shell and a piece of trash, and the other two divers taking back a plant and a piece of trash. The context was designed to make sentence (29) false for both children and adults. This is because English speakers typically interpret disjunction as being within the scope of negation and they assign a conjunctive entailment of disjunction to negated disjunctions (e.g. Gualmini and Crain, 2002; Goro, 2004; Crain, 2012). The same participants were also presented with control sentences like (30), which were used to ensure that the children were able to assign disjunctive truth conditions to affirmative declarative sentences with disjunction.

(30) A piece of coral or a plant is what everybody brought back.

The results were as follows. In responding to target Type B SPCs like sentence (29), the children rejected the target sentences 96% of the time, while the adults rejected the sentences at all times. In responding to control Type B SPCs

like sentence (30), adult participants accepted the control sentences 100% of the time, while 9 out of the 17 child participants exhibited adult-like interpretation. The remaining eight children rejected the sentences by saying like “*Each diver should bring back the same item*”.⁴ The results showed that four-year-old English-speaking children were able to assign the conjunctive entailment of disjunction to sentences like (29). This indicated that children were able to reconstruct the moved disjunction phrase in Type B SPCs, despite the disjunction phrase preceding negation in the surface syntax. The children still exhibited adult-like competence, moving the disjunction phrase back to a position within the scope of negation at the level of semantic interpretation.

Thornton, Kiguchi and D’Onofrio (2016) also confirmed the emergence of reconstruction when English-speaking children interpreted two types of cleft structures, as shown in (31) and (32). In sentence (31), the noun phrase (NP) *Spot* has been moved to focus position, and in this position, it is no longer bound by the pronoun *he*. If *Spot* is assumed to reconstruct at the level of semantic interpretation, however, the pronoun now binds the referring expression, and Principle C is enforced. Thus, the sentence cannot mean that, *It was Spot that brushed himself*. Sentence (32) is also a cleft construction, but in this case, these researchers were testing whether children (and adults) would demonstrate a bound variable interpretation. The bound variable interpretation is only available under c-command, and therefore is only made available if the expression, *her pig*, is reconstructed to object position at the level of semantic

⁴ About half of the children exhibited non-adult-like interpretation when they were presented with control Type B SPCs. It indicates that children might not assign the same truth conditions as adults to affirmative sentences with disjunction. However, the way that the child participants interpreted control sentences is significantly different from the way they interpreted target sentences, which is enough to making the empirical point in the Kiguchi and Thornton study.

interpretation. If so, the sentence can mean that each of the girls carried her own pig. The sentence is, of course, ambiguous. There is another interpretation, in addition to the bound variable interpretation, that can be read off the surface syntax. We can call this the ‘deictic’ interpretation. On this reading, every girl carried the pig of some salient female not mentioned in the sentence.

(31) It was Spot that he brushed.

(32) It was her pig that every girl carried.

These two types of cleft sentences were used to assess young children’s competence in reconstructing the clefted constituent such as *Spot* and *her pig* at the level of semantic interpretation, when they interpreted sentences such as (31) and (32).

Twenty English-speaking children were tested using the Truth Value Judgment Task (Crain & Thornton, 1998). The child participants ranged in age from 4;0 to 5;5, with an average age of 4;9. Fifteen English-speaking adults were also recruited as controls. In order to test children’s command of Principle C at the ‘reconstructed’ level, test sentences like (31) were presented in a context that supported a reading violating Principle C (i.e. the pronoun *he* co-indexed the referring expression *Spot*). The same test sentences were also presented in a context that supported a reading not violating Principle C (i.e. *he* referred to someone else mentioned in the previous context). The experimental hypothesis was that, if child participants reconstruct the clefted constituent *Spot*, and consequently identify the constraint requiring lack of coreference between *Spot*

and *he* (i.e. Principle C), they would reject sentence (31). By contrast, children would accept sentence (31) if they do not have knowledge of reconstruction, or their grammar lacks Principle C.

In order to check whether child participants were able to access the bound variable interpretation at the ‘reconstructed’ level, sentences like (32), which contained a quantified NP, *every girl*, and a possessive pronoun *her*, were presented to the child and adult participants. As noted earlier, sentence (32) is ambiguous in adult English, between the ‘deictic’ reading and the ‘bound variable’ reading. On the ‘deictic’ reading, *her* referred to another female character who was not mentioned in the sentence, but was mentioned in the previous discourse context. The sentence meant that every girl carried another female’s pig. The ‘bound variable’ reading was represented as, *For every x, x carried x’s pig*. On this reading, sentence (32) meant that, *Every girl carried her own pig*. The participants were presented with sentence (32) following a story which corresponded to the ‘bound variable’ reading. That is, the story ended with every girl carrying her own pig respectively. The children would provide a ‘Yes’ answer if they accessed the bound variable reading. By contrast, the children would reject the puppet’s statement if they required the deictic interpretation.

The findings were as follows. For Principle C cleft sentences like (31), children rejected the target sentences 93.8% of the time, which largely replicated the adult controls’ responses (i.e. 98.7% rejection rate). These results are thus compatible with previous findings showing that children obey Principle C in linguistic contexts requiring reconstruction. For bound variable cleft sentences like (32), children accepted the sentences 65% of the time, while

adults accepted the sentences at 50%. Both for adults and for children, apparently the deictic interpretation is very salient, and neither children nor adults overwhelmingly opt for the bound variable interpretation, even when it is the ‘Yes’ response. However, both adults and children show the same linguistic behavior, so children are not responding in a way that is non-adult-like. In sum, these findings indicate that preschool children exhibit adult-like behavior when they interpret binding relations between noun phrases in cleft sentences, in the absence of c-command relationship in the surface syntax.

The findings from these developmental studies reveal that it is not always possible to use the surface syntax to determine the meaning of a sentence involving overt syntactic movement. Reconstruction is a mechanism that allows computation of the meaning permitted by speakers of the language. When syntactic movement takes place, a constituent moves to a higher position in the phrase structure hierarchy. The higher syntactic position is where the constituent is pronounced. When it moves, it leaves behind a ‘copy’ in the position where it originated. In order to access the interpretive properties, the moved constituent is ‘reconstructed’ to the place where it was originally generated at the level of semantic interpretation (e.g. Huang, 1993; Haegeman, 1994; Chomsky, 2015). From the perspective of child language, such cases pose a learnability problem. Since reconstruction takes place at the level of semantic interpretation, children have no opportunity to observe this abstract operation. As a consequence, it is not clear how children can use positive evidence (i.e. adult input) to acquire the interpretation that is obtained under reconstruction.

3. Experiment

The current study investigated changes in sentence structure that lead to corresponding changes in the assignment of scope relations by Mandarin-speaking children and adults. This was achieved by comparing the interpretations that Mandarin-speaking children and adults assign to disjunction phrases in two positions, i.e., preceding or following the negation marker.

3.1 Participants

Thirty monolingual Mandarin-speaking children ranging in age between 4;2 and 5;4 (mean 4;7) participated in the experiment. The children attended the Beijing Municipal Committee Organ Kindergarten. In addition, 15 Mandarin-speaking adults served as a control group. The adults were recruited from Peking University or from Beijing Language and Culture University. Two of the 15 adults were excluded from the analysis because they consistently said that the target sentences were unacceptable. No child participants were excluded.

3.2 Materials

The experiment included two types of target sentences. These sentences differed in the linear word order of disjunction and negation. In one sentence type, negation preceded disjunction which appeared inside the verb phrase. This sentence type is referred to as Disjunction in the Verb Phrase, or as ‘OR in VP’. In the second sentence type, disjunction preceded negation. This sentence type was created by preposing the direct object disjunction phrase to the

preverbal position. The second sentence type is referred to as Preposed Disjunction, or as ‘Preposed OR’. The two sentence types are illustrated in (33) and (34).

(33) *Nanhai-men meiyou zhaodao mifeng huozhe xiaoshe.* [OR in VP]

Boy-PL not find bee or snake

(34) *Nanhai-men mifeng huozhe xiaoshe meiyou zhaodao.* [Preposed OR]

Boy-PL bee or snake not find

The ‘OR in VP’ target sentences established a baseline for the present study. Sentences with this structure have been investigated in previous research (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). These sentences were included in the present study to ensure that the child participants assigned a conjunctive entailment to negative sentence with disjunction. There were also two control sentences. These control sentences contained disjunction in affirmative sentences. In these control sentences, as in the target sentences, disjunction either appeared in the verb phrase, as in (35), or in the preverbal position, as in (36).

(35) *Xiaoxiang-men juqi-le xiangzi huozhe xiaoche.* [OR in VP]

Elephant-PL lift up-ASP box or car

‘Elephants lifted up a box or a car.’

(36) *Xiaoxiang-men xiangzi huozhe xiaoche juqi-le.*

[Preposed OR]

Elephant-PL box or car lift up-ASP

‘Elephants lifted up a box or a car.’

3.3 Method

The present experiment used the description mode of the Truth Value Judgment Task (Crain & Thornton, 1998). The Truth Value Judgment Task requires two experimenters. One experimenter acts out stories with toys and other props, and the second experimenter manipulates a puppet, who watches the stories alongside the child participant. At the end of each story, the puppet is asked to explain to the child what happened in the story. The child’s task is to tell the puppet if its description of the story was right or wrong. Whenever a child participant rejects the puppet’s statement, the experimenter asks the child to tell the puppet what really happened in the story. The children’s justifications for their rejections are used to ensure that the child participants understand the sequence of events that took place in the stories, and to ensure that the child participants are rejecting the test sentences for the right reason.

The central theme behind all of the stories was for a set of characters to accomplish various tasks. Each story had four characters. These characters attempted to complete certain goals. More specifically, the themes for the test stories were created along the following lines: four boys who attempted to find bees and snakes, four kittens who attempted to make cakes and loaves of bread, four elephants who attempted to lift up heavy boxes and cars, and so forth.

Three features of the stories are worth noting. First, in order to make the target sentence felicitous, the puppet produced a positive lead-in sentence

before the target sentence was produced. The positive lead-in sentence and the target sentence had the same basic structure. The only difference between the positive lead-in and the target sentence is that the former is affirmative, while the latter is negative. For example, the positive lead-in sentence for the target sentence (34) is sentence (37). The target sentence (34) is repeated here in (38).

(37) *Nanhai-men xianhua zhaodao-le.*

Boy-PL flower find-ASP

‘The boys found flowers.’

(38) *Nanhai-men mifeng huozhe xiaoshe meiyou zhaodao.*

Boy-PL bee or snake not find

The first design feature is based on two considerations. The first consideration is to guarantee presenting the target sentences in a felicitous context. Specifically, it is appropriate to present a negative statement, only if the corresponding affirmative statement has been made. The presence of an affirmative statement must also be built into the story presented to children (cf. Crain, Thornton, Boster, Conway, Lillo-Martin and Wooddams, 1996; Zhou and Crain, 2009). The other consideration is to ensure that uttering the preposed sentence such as (38) is appropriate in the discourse (e.g. Reeve, 2011; Rizzi, 2014). As noted earlier, preposing an object to the preverbal position is typically accomplished in order to introduce contrastiveness. Compared to an ordinary declarative sentence like (33), sentence (38) requires a contrast set.

The sentence brings about an extra-linguistic meaning that there is an alternative set, consisting of something that the boys did find.

The second design feature of the experiment was to present both types of test sentences in contexts that made the conjunctive entailment of disjunction false, but contexts that made sentences with disjunctive truth conditions true. For instance, in a trial in which four boys attempted to find bees and snakes, the participant was presented with a story in which the boys found snakes but not bees. Then, the puppet uttered a target sentence such as, *Nanhai-men meiyou zhaodao mifeng huozhe xiaoshe* 'The boys didn't find bees or snakes'. If the participant interpreted the disjunction word as not a positive polarity item (PPI), the target sentence would be assigned the meaning on which the boys did not find bees and they did not find snakes, (i.e. the conjunctive entailment of disjunction). On this interpretation, the target sentence was false. By contrast, if the participant interpreted the disjunction phrase as a PPI, the participant was thus expected to assign disjunctive truth conditions to the target sentence. On this interpretation, the sentence was true, the participant would accept the test sentence.

A third noteworthy feature in the experimental design was based on an observation from previous work. The Boster and Crain study (1993) presented four-year-old children with universal quantification sentences such as (39). Four out of the 15 child participants accepted this sentence only if all of the ghostbusters chose the same animal. For example, they accepted the sentence (39) if all of ghostbusters chose a cat. If some ghostbusters chose a cat, but others chose a pig, then these four children rejected the test sentence. For English-speaking adults, the sentence is infelicitous in this situation, due to the

logical principle of Weakening. There is no point introducing two disjuncts if the corresponding sentence that mentions only one disjunct is true (i.e. Every ghostbuster chose a cat). This group of children was referred to by Boster and Crain as 'Egalitarian' children. This is because these children required every character in the stories to conform.

(39) Every ghostbuster will choose a cat or a pig.

Two types of experimental scenarios were constructed, in order to find out whether the child participants in our study wanted every character in the stories to conform. Scenario 1 is called the 'Mixed Scenario'. In this scenario, some of the characters accomplished only one of the two actions mentioned in the target sentence, and others accomplished an action that is not mentioned in the test sentence (e.g., catching snails; see Figure 1). Scenario 2 is called the 'Egalitarian Scenario'. In this scenario, all characters accomplished the same goal and failed to accomplish the other action that is mentioned in the target sentence. For example, all of the boys caught snakes, but none of them caught bees (see Figure 2).



Figure 1: Mixed Scenario



Figure 2: Egalitarian Scenario

3.4 Experimental Hypotheses

Based on previous research, Mandarin-speaking adults analyze the disjunction word *huozhe* ‘or’ as a PPI. In contrast to adults, *huozhe* ‘or’ is not a PPI for children (e.g. Goro, 2004; Jing, Crain and Hsu, 2005; Crain, 2012; Crain, Goro, Notley and Zhou, 2014). On this analysis, in the ‘OR in VP’ condition, children are expected to reject the test sentences in both experimental scenarios. The children are expected to interpret negation as taking scope over the disjunction phrase, and assign a conjunctive entailment of disjunction such as *The boys didn’t find either bees or snakes*, in responding to the target sentences like (33). In the same experimental scenarios, adults are expected to accept the test sentences because adults interpret disjunction as a PPI. Adults are therefore expected to generate the interpretation *It is bees or snakes that the boys didn’t find*, and the adults would accept the target sentence in all of the circumstances associated with inclusive-disjunction.⁵ We refer to these circumstances as ‘disjunctive truth conditions’.

In the ‘Preposed OR’ condition, children are expected to exhibit their knowledge of reconstruction in interpreting target sentences like (34). That is, the moved disjunction phrase is expected to be reconstructed, and to be interpreted in the direct object position for children at the level of semantic interpretation. However, Mandarin-speaking adults are expected not to

⁵ From the perspective of logic, a proposition ‘June ate sushi or pasta’ which is associated with inclusive-disjunction is true in three circumstances (i.e. disjunctive truth conditions): 1) June ate sushi. 2) June ate pasta. 3) June ate sushi and pasta. However, if a speaker uses ‘June ate sushi or pasta’ to convey the information that June ate sushi and she also ate pasta, the speaker’s utterance is apparently not pragmatically appropriate. This is because it violates Grice’s Principle of Cooperation (1989). This pragmatic principle requires a speaker to make a statement as informative as possible. When a statement ‘June ate sushi and pasta’ is more informative than a statement ‘June ate sushi or pasta’. The underinformative statement would be eliminated. This inference is called ‘the inference of exclusivity’ which would eliminate the ‘both’ truth condition of inclusive-or.

reconstruct the moved disjunction phrase because *huozhe* ‘or’ is a PPI for them. If disjunction is reconstructed into the verb phrase at the level of semantic interpretation, it would be interpreted within the scope of negation and consequently lose its polarity sensitivity. Sentence (34) would thus be assigned a conjunctive entailment of disjunction, which is illegitimate in adult grammar. Based on this analysis, reconstruction would be blocked for adult speakers of Mandarin.

3.5 Procedure

Child participants were tested using a between-subjects design. That is, the children were randomly and evenly distributed into two groups. One group was tested with the ‘OR in VP’ test sentences, and the other was tested with the ‘Preposed OR’ test sentences.

To familiarize child participants with the Truth Value Judgment Task, as well as to ensure that all of them understood the task, the children were presented with two pre-test trials. These trials were two simple negative sentences such as (40) and two simple sentences containing disjunction such as (41).

(40) *Xiaoxiong mei chi xiangjiao.*

Baby bear not eat banana

‘Baby bear didn’t eat banana.’

(41) *Xiaotu mai-le xianhua huozhe dangao.*

Baby rabbit buy-ASP flower or cake

‘Baby rabbit bought flowers or cakes.’

Each child was interviewed individually, and was presented with 12 stories. Eight out of the 12 stories corresponded to test sentences, and the other four stories corresponded to the four control sentences. Four of the test stories were presented in the Mixed Scenario and four were presented in the Egalitarian Scenario. Among the four control trials, two were presented in the Mixed Scenario, and two were presented in the Egalitarian Scenario.

The adult participants were tested using a within-subject design.⁶ The adult participants were interviewed individually by an experimenter, and they were asked to provide their judgments in responding to two types of test sentences during videotaped versions of the stories. Test sentences and the videotaped versions of stories were as the same as the ones that were presented to the children participants. Whenever the adult participants rejected the puppet’s descriptions of the stories, they were asked to provide justifications for their rejection. The experimenter wrote down the participants’ responses accordingly.

⁶ The current experiment used different designs to test child participants and adult participants, partially because of the length of formal testing session. To maintain the children’s concentration levels throughout the whole session, the children were randomly divided into two groups. Fifteen children in each group were presented with one type of target sentences. We presume that these two groups of children were homogenous based on two reasons. First, these children came from the same kindergarten, shared similar education and family background. Second, these children were randomly separated into two groups.

To illustrate, here is a typical trial in the ‘Preposed OR’ condition (i.e. sentences like (34)) with the Egalitarian Scenario (i.e. the outcome is shown in Figure 2).

There were four boys deciding to go to a forest to find some interesting things because they heard snakes, bees and other animals had moved into the forest. More importantly, they thought they were all great at finding things, and that they could find anything they wanted to. They came into the forest, and sensed the beautiful scent of flowers. By following the pleasant smell, they found the flowers immediately. ‘It is so easy to find those things, let’s do more’, one of the boys said. They marched further into the forest and tried to find something else. They looked around for a while, but found no trace of any animal. The sun was about to set. ‘Ouch’, a boy suddenly yelled because he fell onto a snake. ‘Hahaha’, the other boys laughed and thanked this boy because his fall made them find snakes. The boys ended with finding snakes across the forest. However, it became really dark and the boys had to stop looking. They then decided to go home.

To make use of disjunction felicitous, Kermit the Frog (the puppet) pretended to forget some parts of the story, and he uttered the target sentence as follows:

Kermit: “I know the boys found flowers, and they found one of the two fast-moving animals, but I don’t remember exactly which one, so my guess is,

“Nanhai-men, xianhua zhaodao-le. Danshi, nanhai-men, mifeng huozhe xiaoshe, meiyou zhaodao.

Boy-PL flower find-ASP but boy-PL bee
or snake not find

Was I right or wrong?”

As noted earlier, if children interpreted the ‘Preposed OR’ sentences like (34) based on the relevant syntactic position of negation and disjunction, they would interpret disjunction as taking scope over negation. Consequently, the children would analyze the target sentence as *It is bees or snakes that the boys didn’t find*, and they would judge the target sentence to be true. By contrast, if children moved the preposed disjunction back into its original position, then disjunction would be interpreted as being within the scope of negation. At this point, the target sentence would generate a meaning like *The boy didn’t find either bees or snakes*, which did not actually happen in the story. Therefore, if children reconstructed the preposed disjunction phrase, they would judge the sentence to be false.

Storylines similar to the example story above were also designed to test the control sentences. For example, following the above story, in control trials, Kermit the Frog would say,

“Nanhai-men, mifeng huozhe xiaoshe zhaodao-le.

Boy-PL bee or snake find-ASP

Was I right or wrong?”

The storyline used in the example is associated with one of the three disjunctive truth conditions of inclusive-disjunction.⁷ The illustrated story concluded with the boys finding only one of the two animals that were mentioned in the target sentence. Child and adult participants were both expected to judge the control sentence to be true.

⁷ The control sentence is true, first, if the boys found bees. The control sentence is true, second, if the boys found snakes. Third, the control sentence is logically true but pragmatically odd if the boys found both bees and snakes.

4. Results

All child participants passed the pretests and proceeded to participate in the main session. Recall that, the experimental hypotheses were as follows. For the ‘OR in VP’ sentences, different scope assignments between children and adults were expected. This is because the disjunction word *huozhe* ‘or’ is a PPI for adults, whereas it is not a PPI for children. Consequently, adults would interpret disjunction as taking scope over negation, whereas children would interpret disjunction *in situ*. For the ‘Preposed OR’ sentences, we predicted that the children and the adults would still have different interpretations. This is because reconstruction would evoke an ungrammatical interpretation for adult grammar. Reconstruction would hence be blocked for adults. By contrast, reconstruction would be permitted for child participants.

The experimental hypotheses were confirmed by the current experiment. Patterns of responses provided by the children and the adults largely conformed to our predictions. Testing with the control items indicated that both participant groups were able to access disjunctive truth conditions of disjunction in an affirmative declarative sentence. Both children and adults accepted control sentences such as (35) and (36) over 95% of the time, in a context where, for example, the elephants only lifted up one of the two target objects (i.e. either a box or a car).

In the ‘OR in VP’ condition, the child participants rejected the target sentences over 80% of the time, under both the Mixed Outcomes scenario and the Egalitarian Outcomes scenario. By contrast, the adults accepted the same

sentences 70% of the time in the same experimental scenarios.⁸ These findings are illustrated in Figure 3.

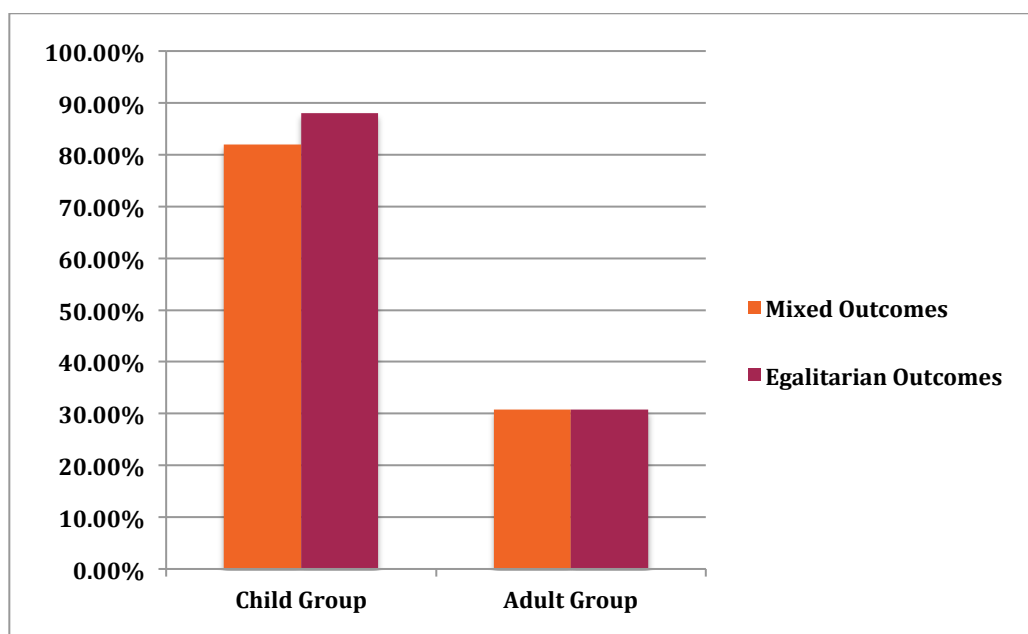


Figure 3: Proportion of rejection for OR in VP sentences in both scenarios

A Wilcoxon signed-rank test was used to check whether the participants provided different patterns of response when they were presented with the two different types of experimental scenario (i.e. the Mixed Outcomes and the Egalitarian Outcomes). Statistical analysis confirmed that there was no difference between the response patterns for the two scenarios which applies for both children and adults ($Z=-0.34$, $p=0.73$). Therefore, the data collected from these two scenarios are collapsed to perform further analyses.

⁸ As noted, two types of experimental scenario were created, in order to check whether the participants required the characters to perform the same actions. One scenario is called Mixed Outcomes in which two out of the four characters accomplished only one of the two actions mentioned in the target sentence, while the other two characters accomplished an action that is not mentioned in the target sentence (see Figure 1). The other scenario is called Egalitarian Outcomes in which four out of the four characters accomplished the same action and failed to accomplish the other action that is mentioned in the target sentence (see Figure 2).

After collapsing the data for the 'OR in VP' sentences, child participants (N=15) rejected the target sentences 85% of the time (i.e. 102 out of a total of 120 target sentences). By contrast, the majority of adults (N=13) consistently accepted the sentences, with a rejection rate of only 30%. A similar result was found in the 'Preposed OR' condition: another group of children (N=15) rejected the target sentences at a high rate (90%), and the same group of adults (N=13) provided the same responses as they did in the 'OR in VP' condition, rejecting the target sentences 30% of the time. The results are shown in Figure 4.

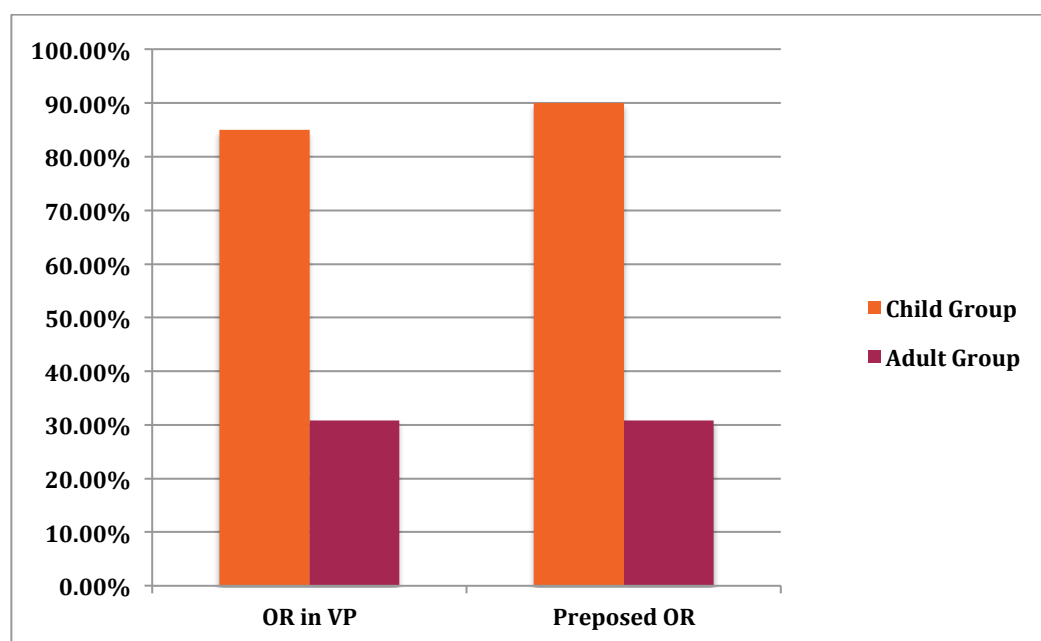


Figure 4: Percentage of rejection in both sentence type conditions

A Mann-Whitney test was performed to compare the response patterns of children and adults, using the rejection rate towards the puppet's statements in each condition as the dependent variable. As shown in Figure 4, significant differences between the two groups were found in the 'OR in VP' condition ($Z=-2.830$, $p=0.05$), as well as in the 'Preposed OR' condition ($Z=-3.178$, $p=0.01$).

5. Discussion and Conclusion

The results from the present chapter are exactly what we predicted, which showed that the majority of adult participants accepted the ‘OR in VP’ sentences such as (33), following a story in which the boys did not find bees, but found snakes. In contrast to the adults, the four-year-old children consistently rejected the same target sentences after they were presented with the same test stories. This demonstrated that Mandarin-speaking adults analyzed disjunction as a PPI, whereas disjunction was not interpreted as a PPI by child speakers of Mandarin. These findings replicated the findings of previous research (e.g. Jing, Crain and Hsu, 2005; Goro, 2007; Crain, 2012; Crain, Goro, Notley and Zhou, 2014).

In the ‘Preposed OR’ condition, the adults and children still exhibited different scope assignments to disjunction and negation. Specifically, the same adult participants accepted the target sentences such as (34) at the same rate as that of the ‘OR in VP’ sentences. By contrast, the children rejected the target sentences at a high rate (90%). This indicated that the children reconstructed the preposed disjunction phrase, and consequently disjunction was interpreted within the scope of negation. However, in responding to sentences with preposed disjunction, the majority of the adults interpreted the preposed disjunction in place. This indicated that, as predicted, reconstruction was blocked for Mandarin-speaking adults due to the parameter value (i.e. the [+PPI] value) they designated to the disjunction word *huozhe* ‘or’.

These findings suggest that Mandarin-speaking children and adults exhibit different scope preferences for negative sentences with disjunction across two conditions (i.e. the ‘OR in VP’ condition and the ‘Preposed OR’ condition). This finding is consistent with previous work showing that children

and adults adopt different settings of the Disjunction Parameter in languages such as Mandarin, Japanese and Turkish (e.g. Goro and Akiba, 2004a, 2004b; Jing, Crain and Hsu, 2005; Crain, 2012; Geçkin, Crain and Thornton, 2016). More importantly, the novel findings revealed by different interpretations to negative sentences with preposed disjunction by child and adult speakers of Mandarin provide evidence that children's initial interpretation of negative sentences with disjunction is not based on the adult input. Instead, the children initially adopt the [-PPI] value of the Disjunction Parameter, which makes sentences true in the narrowest range of circumstances. That is, Mandarin-speaking children consistently analyze negation as taking scope over disjunction, and they assign a conjunctive entailment of disjunction to sentence containing disjunction and local negation, regardless of the relevant position of these two scope-bearing expressions in the surface syntax. Given the fact that the [-PPI] value (the subset value) asymmetrically entails the [+PPI] value (the superset value), young children's initial selection of the subset parameter value (i.e. [-PPI]) ensures that they will encounter positive evidence for parameter resetting when adult speakers of the local language adopt the superset value (i.e. [+PPI]) of the Disjunction Parameter. This is exactly what the Semantic Subset Principle predicts (e.g. Berwick, 1985; Crain, Ni and Conway, 1994; Goro, 2007; Crain, 2012). For instance, in responding to negated sentences with disjunction such as *Zhu'en meiyou mai xianhua huozhe dangao* 'June didn't buy flowers or cakes', Mandarin-speaking children make an entailment such as *June did not buy flowers and June did not buy cakes*. This is because they initially select the [-PPI] value of the Disjunction Parameter. By contrast, Mandarin-speaking adults' interpretation resembles the English cleft structures such as *It is flowers or*

cakes that June did not buy. Since adult interpretation is the ‘superset’ of child interpretation, which indicates that, if child interpretation is true, adult interpretation then must be true, but not vice versa. This asymmetrical entailment thus enables children who initially select the subset value of the Disjunction Parameter to reset the parameter as long as they identify the local adult speakers select a different value of the parameter. In other words, when disjunction is not analyzed as a PPI by the children, negated disjunctions are assigned one truth condition (i.e. the conjunctive entailment), whereas the adults access three truth conditions (i.e. disjunctive truth conditions). What the children need is to make their interpretation for negated disjunctions less restricted and ‘bigger’.

In conclusion, the present study utilized the polarity sensitivity of disjunction in adult Mandarin, structural changes in Mandarin, as well as young children’s mastery of reconstruction, to investigate whether changes in sentence structure lead to changes in scope assignment. The overall results suggest that Mandarin-speaking children and adults have different scope preferences in interpreting negative sentences with disjunction, regardless of the surface syntactic position that disjunction occupies. The empirical findings invite us to infer that, firstly, linear order does not determine scope assignments for children or for adults. Secondly, preschool Mandarin-speaking children are able to reconstruct a moved constituent, in order to access interpretative properties that are guided by their settings for the relevant parameters. The observed reconstruction operation in child Mandarin is also in line with previous developmental studies, proving that preschool children exhibit knowledge of reconstruction when they process sentence constructions

involving preposed constituents in other languages (e.g. Guasti and Chierchia 1999/2000; Kiguchi and Thornton, 2016).

CHAPTER 3

Disjunction and Universal Quantification in Mandarin

1. Introduction

The present study investigates Mandarin-speaking children's and adults' interpretative preferences in sentences with a universal quantifier and disjunction in preverbal position in the surface syntax. An example is (1).

(1) *Mei-ge nanhai yong daozi huozhe chazi chi-le chaodan.*

Every-CL boy with/use knife or fork eat-ASP omelet

Sentence (1) is ambiguous. Mandarin permits three different interpretations for sentences like (1). One source of the ambiguity is lexical. The disjunction phrase is preceded by the word *yong* 'with/use', which can either be analyzed as a verb or as a preposition. If *yong* is analyzed as a verb, the disjunction phrase, *yong daozi huozhe chazi* 'use a knife or a fork', modifies the subject noun phrase (NP). In this case, sentence (1) means that every boy who used a knife or a fork ate an omelet. This interpretation of (1) is similar to one that is assigned to a sentence with a relative clause. In Mandarin, sentences with relative clauses would contain the overt marker of a relative clause *de*. This marker is absent in sentence (1). The sentence with a relative clause is given in (2).

(2) *Mei-ge yong daozi huozhe chazi de nanhai chi-le chaodan.*

Every-CL use knife or fork *de* boy eat-ASP omelet

'Every boy who used a knife or a fork ate an omelet.'

Mandarin relative clauses differ syntactically in several respects from English relative clauses such as (3) (e.g. Huang, Li and Li, 2008). The English translation of the Mandarin relative clause is (3).

(3) Every boy who used a knife or a fork ate an omelet.

As examples (2) and (3) illustrate, relative clauses in English and Mandarin differ in word order. In English, the modifier, *used a knife or a fork*, follows the head noun *boy*. In Mandarin, the modifier, *yong daozi huozhe chazi* ‘used a knife or a fork’, precedes the head noun *nanhai* ‘boy,’ and the relative clause marker *de* comes between the modifier and the head noun. Because this variant of the Mandarin sentence (1) is similar to that of the English sentence in (3), we call this the relative clause interpretation.

A second interpretation of (1) takes the disjunction phrase, *yong daozi huozhe chazi* ‘use a knife or a fork’, to be a verb phrase (VP). On this interpretation, sentence (1) has two verb phrases, so this is an example of a serial verbs construction (e.g. Huang and Liao, 1998). The serial verbs construction is formed by combining two consecutive VPs. The serial verbs attribute different properties to the subject NP. An example of a serial verbs structure is (4), where the first VP, *qiche* ‘ride bike’, denotes the manner in which the second VP, *qu xuexiao* ‘go to school’, was accomplished. The two VPs attribute different properties to the subject, *Yuehan* ‘John’. That is, the first VP indicates that John is someone who rides a bike, while the second VP indicates that John is someone who goes to school.

(4) *Yuehan qi che qu xuexiao.*

John ride bike go school

‘John rode a bike and John went to school.’

Mandarin speakers who interpret sentence (1) as a serial verbs construction would access the following interpretation: *Every boy used a knife or a fork and every boy ate an omelet.* We call this the two-predicate interpretation.

The third interpretation of sentence (1) (repeated here as example (5)) analyzes *yong* as a preposition, corresponding to English *with*.

(5) *Mei-ge nanhai yong daozi huozhe chazi chi-le chaodan.*

Every-CL boy with/use knife or fork eat-ASP omelet

On this interpretation, the disjunction phrase is interpreted as an adjunct modifier of the verb phrase. This interpretation makes sentence (5) similar in meaning to the English sentence (6).

(6) Every boy ate an omelet with a knife or a fork.

In Mandarin, an adjunct modifier (e.g. the prepositional phrase) is often positioned before the verb. In other words, it is usually positioned either in a topic phrase or in a focus phrase, as shown in sentences (7) and (8) respectively (e.g. Huang, 1982; Ernst and Wang, 1995; Xu and Liu, 1998; Pan and Hu, 2000).

(7) *Zai xini huozhe niukasou Zhu'en mai-le bieshu.*

At Sydney or Newcastle June buy-ASP house

'June bought a house at Sydney or Newcastle.'

(8) *Zhu'en zai xini huozhe niukasou mai-le bieshu.*

June at Sydney or Newcastle buy-ASP house

'June bought a house at Sydney or Newcastle.'

These two sentences generate the same interpretation, i.e., *June bought a house at Sydney or Newcastle*. Both disjunction phrases with a preposition and ones without a preposition are interpreted as if they had originated in the verb phrase, despite being in the preverbal position of the sentence in the surface syntax. We call this the reconstruction interpretation.⁹

A parallel language phenomenon has been reported, which also requires the abstract operation – reconstruction – to account for sentence ambiguities (e.g. Gualmini, 2006; Musolino and Lidz, 2006; Zhou and Crain, 2009; Moscati and Crain, 2014). The commonality of the ambiguous sentences explored in these studies is that no overt syntactic movement is involved but, rather,

⁹ One of the thesis examiners suggests an alternative account of why sentences (7) and (8) generate the same interpretation. On the proposed account, although the subject *June* in sentence (8) takes scope over the disjunction phrase, *at Sydney or Newcastle*, in the surface syntax, the subject NP *June* gets moved to the VP internal subject position in sentence (8). Although this account is a plausible derivation for the interpretation of sentence (8), we have provided independent evidence in earlier chapters that disjunction phrases are reconstructed by children – both in negative sentences and in affirmative sentences. The VP internal subject account, therefore, is limited to a subset of the findings, whereas the reconstruction account explains the entire set of findings.

requires reconstruction at the level of semantic interpretation.¹⁰ Consider the English sentence (9).

(9) Every horse did not jump over the fence.

Sentence (9) is ambiguous. English permits two interpretations for sentences like (9). Given the appearance that the universal quantifier *every* precedes the negative marker *not* in the surface syntax, one possible interpretation is that, *None of horses jumped over the fence*, which is called the ‘surface scope’ interpretation. The other possible interpretation is that, *Not all of the horses jumped over the fence*, which is called the ‘inverse scope’ interpretation. To access the inverse scope interpretation of sentence (9), reconstruction has to operate. That is, the universally quantified phrase, *every horse*, has to be ‘reconstructed’ to a position within the scope of negation at the level of semantic interpretation. This is the emergence of reconstruction in sentences without overt syntactic movement that motivates the study in this chapter.

The present study investigates whether Mandarin-speaking children and adults generate different scope assignments in comprehending sentences with the disjunction word *huozhe* ‘or’ and a downward entailing quantifier *mei* ‘every’. In particular, the goal is to establish the interpretations assigned by child and adult speakers of Mandarin to sentences such as (5) (repeated here as (10)), in order to identify whether the children reconstruct a preverbal disjunction phrase like, *daozi huozhe chazi* ‘a knife or a fork’, that is headed by a lexically ambiguous word *yong* ‘with/use’.

¹⁰ Previous research on the emergence of reconstruction involving overt movement has been reviewed and discussed in Chapter 2.

(10) *Mei-ge nanhai yong daozi huozhe chazi chi-le chaodan.*

Every-CL boy with/use knife or fork eat-ASP omelet

To confirm the interpretations that children and adults assign to sentences like (10), we conducted an experiment using the Truth Value Judgment Task (Crain and Thornton, 1998). In the experiment, the test sentences were presented to the child and adult participants in three types of experimental scenario. Briefly, participants' responses in each experimental scenario can be categorized into different response patterns, which correspond to three possible interpretations for sentences like (10) (see details in Section 4).

Based on previous research, we predict that children will reconstruct the disjunction phrase, and consequently access the reconstruction interpretation. By contrast, the reconstruction interpretation is expected to be blocked for adults. This is because the constituent occupying the preverbal position tends to be the focus of a sentence in Mandarin (e.g. Ernst and Wang, 1995; Shyu, 1995; Pan and Hu, 2000; Xu, 2004). Under this analysis, sentences with focus-sensitive constituent (e.g. *yong daozi huozhe chazi* 'with a knife or a fork') would be interpreted as the English cleft structure: *It is a knife or a fork that every boy used to eat an omelet* (e.g. Lee, 2005; Pan, 2006; cf. Zhou and Crain, 2009). The participants who access the focus sensitivity of the constituent appearing in the preverbal position will hence interpret the disjunction phrase in place. More specifically, the adults are expected to interpret the disjunction phrase in its position in the surface syntax, as a modifier of the subject NP, given the fact that Mandarin-speaking adults appear to be more sensitive to this language-specific property (e.g. Zhou and Crain, 2009).

This is exactly what we found. Firstly, over 90% of the four-year-old children generated the reconstruction interpretation. This interpretation required the disjunction phrase to be reconstructed to the bottom of the hierarchical sentence structure, and subsequently the disjunction phrase was positioned outside the scope of the subject NP, *meige nanhai* ‘every boy’. Secondly, the results also showed that none of the adults accessed the reconstruction interpretation. At the same time, two different interpretations were assigned by the adult participants. One group of adult participants interpreted the word *yong* ‘use’ as the modifier of the subject NP. Although relative clause marker *de* was absent, the disjunction phrase was interpreted by this group of adults as a relative clause. Another group of adult participants had the two-predicate interpretation. The test sentences were interpreted as a serial verbs construction involving two events.

Moreover, it is worth noting that, as children become older, they exhibit more adult-like language behavior. Access to available interpretations appeared to be a staged process across participant groups. More specifically, four-year-old children’s access appeared largely restricted to a single interpretation (i.e. the reconstruction interpretation), five-year-olds accessed all three interpretations, and adults accessed two of the three available interpretations. Differences across the participant groups may therefore represent a developmental trajectory towards exhibiting more adult-like scope preferences to the sentence structure explored in this chapter.

The remainder of the chapter is structured as follows. Section 2 describes the theoretical machinery that will be used in the experiment to assess Mandarin speakers’ interpretation of disjunction in sentences with the

universal quantifier. The critical theoretical notion of “downward entailment” will be introduced in that section. Then, Section 3 reviews the relevant literature, which includes young children’s understanding of universal quantification, as well as young children’s knowledge of reconstruction to solve sentence ambiguities. The fourth and fifth sections report the details and findings of the current experiment, which was designed to investigate the Mandarin speakers’ scope assignments for sentences with the universal quantifier and disjunction in preverbal position. Section 6 concludes the present chapter.

2. Downward entailment

By definition, downward entailing linguistic contexts validate inferences from sets to their subsets (e.g. Guo, 2006; Crain 2012). This is illustrated in (11), where the symbol ‘ $\longrightarrow$ ’ indicates that the first sentence entails the second sentence. If the first sentence is true, then so is the second.

(11) June did not eat fruit. $\longrightarrow$ June did not eat apples.

By contrast, affirmative statements are upward entailing. The affirmative declarative sentences license inferences from sets to supersets. For example, the statement *June ate apples*, entails the statement *June ate fruit*. Downward entailment reverses the direction of the inference, as shown in (11).

Another test of downward entailment is disjunction. In a downward entailing linguistic context such as negation, a disjunction phrase adheres to de Morgan’s laws in English. Consider sentence (12).

(12) June did not eat rice or beans.

In sentence (12), the phrase, *not eat rice or beans*, entails *not eat rice* and it entails *not eat beans*. So, this entailment can also be represented as in (13).

(13) Not [A or B] $\longrightarrow$ [Not A] and [Not B]

This is called a conjunctive entailment. Some variant of a conjunctive entailment is generated even in linguistic contexts that do not have a negative marker. For

example, the preposition *before* is downward entailing in English. Consider sentence (14).

(14) John left before Bill or Sue.

This sentence entails the following two ‘subset’ statements (15)a and (15)b, consistent with inferences from sets (e.g. the set of people including Bill and Sue) to subset (e.g. Bill). Therefore, the conjunctive entailment of disjunction is assigned in sentences with the preposition *before*, as shown in (15)c.

(15) a. John left before Bill.

b. John left before Sue.

c. John left before Bill and John left before Sue.

The conjunctive entailment to a disjunction phrase is also made in sentences with the universal quantifier. It is also worth noting that a disjunction phrase is assigned different truth conditions in the two arguments of the universal quantifier, i.e. the subject phrase and the predicate phrase (e.g. Boster and Crain, 1993; Meroni, Gualmini and Crain, 2000; Gualmini, Meroni and Crain, 2003; Su, Zhou and Crain, 2012; Su and Crain, 2013). For example, in sentence (16) the disjunction phrase is part of the subject phrase of the sentence, whereas it is part of the predicate phrase in sentence (17).

(16) Every boy who used a knife or a fork ate an omelet.

(17) Every boy who ate an omelet used a knife or a fork.

When disjunction is in the subject phrase (i.e. first argument, restrictor) of the universal quantifier *every*, the sentence generates a conjunctive entailment. So sentence (16) is judged to be true if every boy who used a knife ate an omelet and every boy who used a fork ate an omelet. By contrast, in sentence (17), the disjunction phrase is positioned in the predicate phrase (i.e. second argument, nuclear scope) of the universal quantifier, which is not a downward entailing linguistic environment. Sentence (17) does not generate a conjunctive entailment. Sentence (17) is true if every boy who ate an omelet used either a knife or a fork (or possibly both a knife and a fork). We will refer to these truth conditions as ‘disjunctive’ truth conditions. These examples indicate that assessing children’s judgments of truth values in responding to sentences like (16) and (17) enables us to establish children’s knowledge about the different semantic properties denoted by the two arguments of the universal quantifier such as English *every*.

3. Literature review

3.1 Young children's understanding of universal quantification

Evidence in support of children's knowledge of universal quantifications comes from young children's interpretation of universal quantificational sentences with disjunction. Several studies have been designed to determine the age at which English-speaking children exhibit their asymmetrical knowledge of universal quantification with the disjunction word *or* (Boster and Crain, 1993; Chierchia, Crain, Guasti, Gualmini and Meroni, 2001; Gualmini, Meroni and Crain, 2003).

A representative study was conducted by Boster and Crain (1993). This study examined how preschool children interpreted the disjunction word *or* when it appears in the predicate phrase of the universal quantifier *every*. As noted in Chapter 1, according to certain pragmatic principles such as 'Be cooperative and 'Avoid ambiguities' (e.g. Grice, 1989), affirmative declarative sentences with disjunction might be judged by language speakers to be infelicitous as descriptions of an event that has already happened. A prediction mode of a truth-value judgment task (Crain and Mckee, 1985) was adopted, in order to make target sentences pragmatically felicitous. In the prediction mode, one experimenter acts out a story in front of the child and a puppet, using characters and toy props. The story is ceased at some point, and the puppet utters the target sentence as a prediction about what will happen next in the story. The story resumes after the puppet's prediction. The child is asked to judge whether the puppet's prediction is associated with the outcome of the story.

In the Boster and Crain (1993) study, the researchers interviewed 15 English-speaking children who ranged in age from 3;6 to 6;0, with a mean age of 4;8. Twelve adult speakers of English participated in as controls.

The participants were presented with sentences such as (18). The test sentences were presented in the middle of a story in which three ghostbusters chose a pet animal. They selected from three types of animals, pigs, cats and lions. The story concluded with two ghostbusters each choosing a cat, and the last ghostbuster choosing a pig. The participants' task was to judge whether the puppet's prediction regarding the story was true.

(18) Every ghostbuster will choose a cat or a pig.

In this study, test stories were designed to make target sentences like (18) true. In the story, every ghostbuster chose either a cat or a pig. Therefore, if participants accessed disjunctive truth conditions for the disjunction phrase *a cat or a pig* in sentence (18), they would accept the sentence. As expected, the child participants accepted test sentences like (18) 90.1% of the time in this condition. The adult control group accepted the test sentences 91.7% of the time. The results indicated that, by age 4, English-speaking children assigned disjunctive truth conditions to disjunction *or* when it was positioned in the predicate phrase of a sentence with the universal quantifier *every*. The results suggest that young English-speaking children know that the predicate phrase of the universal quantifier is not downward entailing.

Two subsequent studies were conducted to assess whether young children know that the subject phrase of the universal quantifier, English *every*,

is downward entailing. Using the description mode of the Truth Value Judgment Task (Crain and Thornton, 1998), the Chierchia, Crain, Guasti, Gualmini and Meroni (2001) study interviewed 15 children who aged ranged from 3;7 to 6;3, with a mean age of 4;11. There was a control group of 11 adults.

As noted in Chapter 1, the inference of ‘exclusivity’ licensed by the English disjunction word *or* is suspended in certain linguistic contexts such as negative declarative sentences. This is because negative sentences with disjunction are assigned a conjunctive entailment, in line with de Morgan’s laws in classical logic. Downward entailing contexts such as the subject phrase of the universal quantifier are also one type of linguistic contexts where the inference of ‘exclusivity’ does not arise (e.g. Chierchia, Crain, Guasti, Gualmini and Meroni, 2001; Gualmini and Crain, 2002; Crain, 2008; Crain, Thornton and Khlentzos, 2008). The target sentences appear not to violate pragmatic principles and are thus natural when they presented in the description mode.

On a typical trial, the test sentence in (19) was presented to the participants following a story in which Snow White and four dwarves had a picnic. Three out of the four dwarves chose both a banana and a strawberry, while the remaining dwarf chose potato chips. The story ended with Snow White giving a jewel to all the dwarves who chose a banana, and giving a jewel to all the dwarves who chose a strawberry. At the conclusion of the story, the puppet produced the test sentence (19).

(19) Every dwarf who chose a banana or a strawberry received a jewel.

The four-year-old English-speaking children accepted the target sentences 91.6% of the time, while the adults accepted the target sentences 95.5% of the time. This indicated children as well as adults accessed the conjunctive entailment of disjunction when disjunction occurred in the subject phrase of the universal quantifier.

A related study by Gualmini, Meroni and Crain (2003) provided further evidence of preschool English-speaking children's knowledge that the subject phrase of sentences with a universal quantifier is downward entailing. Fourteen adults served as controls. There were 20 child participants ranging in age from 3;11 to 5;9, with a mean age of 5;1. The participants were presented with sentences such as (20). This test sentence was presented following a story in which one out of the five trolls got a hot-dog, two of the trolls ordered onion rings and got some ketchup, while the remaining two trolls ordered French fries and got some mustard.

(20) Every troll who ordered French fries or onion rings got some mustard.

In this study, the test stories were designed to make target sentences like (20) false. The children and adults who generate a conjunctive entailment when disjunction appears in the first argument of the universal quantifier are expected to reject the test sentences in this experimental condition. This is exactly what was found. The child participants rejected test sentences such as (20) 95% of the time as descriptions of stories that failed to satisfy the truth conditions associated with a conjunctive entailment of disjunction. In the same conditions, the adult controls also rejected the sentences 84% of the time. The

finding provides evidence that English-speaking children analyze the disjunction phrase as generating a conjunctive entailment when it appears in the subject phrase of the universal quantifier.

Taken together, the empirical findings allow us to reach several conclusions. First, preschool English-speaking children know that disjunction generates a conjunctive entailment when it appears in the scope of one downward entailing operator (i.e. the subject phrase of the universal quantifier). Second, children of similar age assign disjunctive truth conditions to sentences with disjunction, when disjunction is positioned in one non-downward entailing context (i.e. the predicate phrase of the universal quantifier). These findings invite us to infer that young children know different semantic properties denoted by the two arguments of the universal quantifier.

The finding from child English was extended to Mandarin in a study by Su and Crain (2013), with similar results. Twenty four-year-old Mandarin-speaking children and 15 adults participated in this study. The child participants ranged in age from 3;11 to 5;11, with a mean age of 4;10. Adopting a within-subject design, two types of test sentence were constructed to examine whether young children assigned different interpretations to the disjunction word *huozhe* ‘or’, when it was positioned in the different arguments of the universal quantifier *mei* ‘every’. More specifically, sentences like (21) were constructed to test whether Mandarin-speaking children were able to access disjunctive truth conditions of disjunction when a disjunction phrase like, *baoshi huozhe jiezhi* ‘a jewel or a ring’, occurred in the predicate phrase of sentences with *mei* ‘every’.

(21) *Mei-ge dai-zhe gou de gongzhu dou tou-le baoshi huozhe jiezhi.*

Every-CL carry-ASP dog *de* princess all steal-ASP jewel or ring

‘Every princess who carried a dog stole a jewel or a ring.’

The participants were presented with sentences such as (21) following a story in which one out of the five princesses had a magic bird, while four out of the five princesses each had a dog. The outcome of the story was the princess who had a bird stole a flower, two out of the four princesses who had a dog stole a jewel, while the remaining two stole a ring. In the Su and Crain (2013) study, the null hypothesis was that children would reject sentence (21), after they were presented with the above story. There were two possible reasons. The children would understand the disjunction word *huozhe* ‘or’ as the conjunction word *he* ‘and’, or they would exhibit a symmetrical response to the two arguments of the universal quantifier *mei* ‘every’, because children would analyze both arguments of *mei* ‘every’ to be downward entailing contexts. By contrast, the experimental hypothesis was that Mandarin-speaking children would have acquired the knowledge about the semantic property denoted by the predicate phrase of *mei* ‘every’, and they would assign disjunctive truth conditions to sentences with *huozhe* ‘or’ like (21). Consequently, they would accept the target sentences. The experimental hypothesis was verified by the experimental findings. The children accepted sentences such as (21) 95% of the time, and the adults accepted the sentences 97% of the time. This indicated that both children and adults assigned disjunctive truth conditions to sentence (21) when the disjunction phrase appeared in the predicate phrase of *mei* ‘every’.

The same child and adult participants were presented with sentences like (22), which were constructed to examine how Mandarin speakers interpret disjunction when it appears in the subject phrase of the universal quantifier.

(22) *Mei-ge mai-le feiji huozhe xiaoqiche de waixingren dou xuanze-le shu.*

Every-CL buy-ASP airplane or car de alien dou choose-ASP book

‘Every alien who bought an airplane or a car chose a book.’

The participants were presented with a story that was not associated with a conjunctive entailment of disjunction. For example, the story was about five aliens buying different vehicles to tour the earth. Two aliens bought airplanes, two bought cars and the remaining one bought a boat. The story ended with the two aliens who bought airplanes choosing stars as free gifts, the two aliens who bought cars choosing books, while the alien who bought a boat choosing a suitcase. The participants were then asked to make judgments on sentences like (22) based on the test stories. If children accessed an adult-like interpretation of sentence (22), that is, they identified the downward entailing property of the first argument of *mei* ‘every’, they would assign the conjunctive entailment of disjunction to sentence (22) with the disjunction phrase, *feiji huozhe xiaoqiche* ‘airplane or car’. Consequently, the children would reject the target sentences. If the children did not have the relevant knowledge, they would accept the target sentences. The results showed that child participants rejected sentences like (22) 91% of the time, and adult participants rejected the sentences 100% of the time. This indicated that both children and adults generated a conjunctive

entailment of disjunction to sentence (22) when the disjunction phrase was in the subject phrase of the universal quantifier.

The findings of these two experiments suggest that Mandarin-speaking children are aware of the asymmetrical semantic properties denoted by the different arguments of the universal quantifier *mei* 'every'. Mandarin-speaking children correctly accessed the test sentences in the same circumstances as adults.

3.2. The inverse scope interpretation

As noted in Section 1, the reconstruction interpretation is assigned by adults to sentences like (23) (earlier sentence (1)), when *yong* is analyzed as a preposition (corresponding to English *with*).

(23) *Mei-ge nanhai yong daozi huozhe chazi chi-le chaodan.*

Every-CL boy with/use knife or fork eat-ASP omelet

To access the reconstruction interpretation, the disjunction phrase is interpreted as if it has been lowered, so as to reside in the predicate phrase of sentence (23). This process is presented in (24).

(24) Every boy with a knife or a fork ate an omelet < with a knife or a fork >.



The manner in which the reconstruction interpretation in sentence (23) is generated resembles the procedure of the inverse scope reading is accessed in

universal quantificational sentences with negation. That is, reconstruction has been invoked to account for sentence ambiguities raised by different scope assignments in certain cases (e.g. Zhou and Crain, 2009; Moscati and Crain, 2014). Consider sentence (25).

(25) Every horse did not jump over the fence.

In English, sentence (25) has two possible interpretations. These two interpretations are shown in (26) and (27), which are labeled as ‘EVERY > NOT’ interpretation and ‘NOT > EVERY’ interpretation respectively.

(26) None of the horses jumped over the fence. [EVERY > NOT]

(27) Not all of the horses jumped over the fence. [NOT > EVERY]

The ‘EVERY > NOT’ interpretation is also called the ‘surface scope’ interpretation or ‘surface scope’ assignment, because the universal quantifier *every* precedes negation *not* in the surface syntax, and the scope relationship mirrors the surface word order. The ‘NOT > EVERY’ interpretation is also called the ‘inverse/reconstructed scope’ interpretation, because negation takes scope over the universal quantifier at the level of semantics, although their relevant syntactic position shows the opposite. To access the inverse scope interpretation, the universally quantified noun phrase, *every horse*, is moved back to a position within the scope of negation at the level of semantic interpretation (i.e. logical form). This derivation of the inverse scope

interpretation is created by reconstruction (cf. Crain, Koring and Thornton, 2016). The process of reconstruction is represented in (28).

(28) Every horse did not < every horse > jump over the fence.



In other words, at the level of semantic interpretation, an abstract linguistic operation – reconstruction – ‘lowers’ the scope-bearing expression like *every*, which comes first in the surface syntax, to a position beneath another scope-bearing expression like *not*, which comes second in the surface syntax. At this point, if young children succeed in accessing the reconstructed scope interpretation, this thus confirms that the children have acquired relevant knowledge of reconstruction. This also provides evidence to counter the claim that children assign scope relations among scope-bearing expressions based on their linear word strings (e.g. Musolino, 1998; 2011).

Previous research has also confirmed the assumption of young children’s competence of reconstruction regarding the interpretation of ambiguous sentences. That is, previous work has shown that both children and adults access two possible interpretations of ambiguous sentences containing the universal quantifier and negation (Musolino and Lidz, 2002, 2006; Gualmini, 2006). More specifically, once the felicity conditions of uttering sentences like (29) have been fulfilled,¹¹ young children would display their competence in

¹¹ Before the test sentence is produced, adding a positive lead-in clause greatly increases the rates of children’s and adult’s inverse scope interpretation for sentences such as (29). This change is predicted by the Condition of Plausible Dissent (Russel, 1948; cf. Crain, Thornton, Boster, Conway, Lillo-Martin and Wooddams, 1996). Following Russel’s observation, the Condition of Plausible Dissent states that it is appropriate to present a negative statement only

assigning the surface scope interpretation, i.e., *None of the horses jumped over the fence*, which is associated with the relevant linear word order of the universal quantifier *every* and negation *not*. They would also be able to access the inverse scope interpretation, i.e., *Some of the horses did not jump over the fence*, which is not observed in the surface syntax.

(29) Every horse jumped over the rock, but every horse did not jump over the fence.

Mandarin-speaking children's competence in accessing reconstructed scope interpretation was also revealed by Zhou and Crain (2009). Mandarin data provides more compelling evidence for young children's early mastery in accessing the inverse scope interpretation, in the absence of local adult input. This is because, in comparison with the sentence ambiguities in the second clause of English sentence (29), its Mandarin counterpart sentence (30) is usually assigned the surface scope interpretation by adult speakers of Mandarin.

(30) *Meipi ma dou mei-you tiao guo langan.*

Every-CL horse all not jump over fence

'None of the horses jumped over the fence.'

[Adult interpretation]

In the Zhou and Crain (2009) study, sentences like (31) were used to examine how Mandarin speakers assigned the scope relations between the universal

when the corresponding affirmative statement has been considered. This consideration is also included in the experimental design in the Mandarin study conducted by Zhou and Crain (2009).

quantifier *mei* ‘every’ and negation *mei-you* ‘not’. They interviewed 20 Mandarin-speaking adults, as well as 20 preschool Mandarin-speaking children ranging in age from 3;4 to 5;11, with a mean age of 4;3.

(31) *Mei-gei nvhai dou chi-le bingqiling, danshi meige nvhai dou meiyou chi yao.*

Every-CL girl all eat-ASP ice-cream but every-CL girl all not eat pill

Two experimental scenarios were established in this study. One corresponded to the surface scope interpretation like *None of the girls took pills*. This was called the ‘none’ scenario. Another scenario corresponded to the inverse scope interpretation like *Some of the girls took pills*. This was called the ‘some’ scenario. The target sentences like (31) were presented to the participants after they were presented with one of the two experimental scenarios. The experimental hypotheses were as follows. In the ‘none’ scenario that was associated with the ‘EVERY > NOT’ (i.e. the surface scope) interpretation, the participants were expected to accept the target sentences. In the ‘some’ scenario that was associated with the ‘NOT > EVERY’ (i.e. the inverse/reconstructed scope) interpretation, if the participants interpreted the scope relations between *mei* ‘every’ and *mei-you* ‘not’ based on their relevant syntactic positions, the participants would reject sentences like (31). By contrast, if the participants assigned the inverse scope interpretation to the target sentences, they would accept the sentences.

Data collected from this study showed that, in the ‘none’ scenario, both child participants and adult participants accepted target sentences such as (31) 100% of the time. This indicates that the surface scope reading of (31) is

accessible in both child Mandarin and adult Mandarin. However, child and adult participants displayed differences in the ‘some’ scenario. The adults rejected the sentences 100% of the time, whereas the children accepted the same target sentences 50% of the time. Within the child group, nine younger children (age 3;4 to 4;3) accepted the sentences 89% of the time, whereas 10 older children (age 4;5 to 5;11) rejected the sentences 90% of the time.

At this point, the Isomorphism Principle (e.g. Musolino, 1998) cannot account for the younger children’s data, which is in line with the inverse scope reading in Mandarin sentences like (31) that results from reconstruction. The Isomorphism Principle claims that, in a sentence containing two scope-bearing expressions, the scope relation between these two is determined by the relevant syntactic position. The interaction between the universal quantifier and disjunction in adult Mandarin appears to support the hypothesis. If children acquire Mandarin in a way that follows the Isomorphism Principle, they would learn from and adopt the adult’s scope assignment to the universal quantifier *mei* ‘every’ and negation *mei-you* ‘not’. However, the children, especially the younger children, were able to access both the surface scope interpretation (i.e. ‘EVERY > NOT’ interpretation) and the inverse scope interpretation (i.e. ‘NOT > EVERY’ interpretation), when they were presented with sentences like (31).

Taken together, the experimental finding suggests that, in adult Mandarin, the interpretation of the second clause of sentence (31) is based on the word order. For children, however, the preferred interpretation is not simply based on linear word order. Rather, the children assigned the reconstructed scope interpretation to sentence (31). In view of the fact that children and adults assign different interpretations to sentences like (31), it

seems reasonable to conclude that children do not base their interpretation on the adult input. In addition, as the children become older, they become more adult-like in interpreting sentences containing the universal quantifier and negation. By four years of age, Mandarin-speaking children have converged with adults on their interpretation.

There is another source of crosslinguistic evidence supporting the claim that young children have exhibited their knowledge of reconstruction. This evidence comes from a study conducted by Moscati and Crain (2014) on Italian-speaking children's interpretation of sentences containing modal expressions and negation. First consider the English examples in (32) and (33).

(32) June might not come.

(33) June can not come.

The modal expressions *might* and *can* in English both denote possibilities. They are also similar in expressing informative strength in affirmative declarative sentences. However, the negative sentence containing *might* (32) obviously carries less informative strength than the negative sentence with *can* (33) (e.g. Byrnes and Duff, 1989; cf. Moscati and Crain, 2014: p. 353-354). More specifically, sentence (32) presents a 'possible not' interpretation, which is weaker than the 'not possible' interpretation presented by sentence (33).

Since both of these two modal expressions precede negation in the surface syntax, the 'possible not' interpretation is thus consistent with the relative position of modal expression and negation in (32). By contrast, the 'not

possible' interpretation is the inverse scope interpretation in sentence (33). To access the 'not possible' interpretation, the modal *can* is reconstructed to a position lower than negation *not* at the level of semantic interpretation, as illustrated in (34).

(34) June can not < can > come.



English examples involving modal expressions and negation illustrate that English speakers' interpretation of a sentence containing two scope-bearing expressions is not simply based on the relative syntactic position of these scope-bearing expressions. Reconstruction operation that occurs at the level of semantic interpretation is necessary to access the correct sentence meaning.

In comparison to English, the scope relation between a modal expression and negation is more straightforward in adult Italian, where the relevant linear word order of these two scope-bearing expressions determines their scope relations. Consider sentences (35) and (36).

(35) *Gianni può non venire.*

Gianni mod neg come

'Gianni might not come.'

(36) *Gianni non può venire.*

Gianni neg mod come

'Gianni cannot come.'

When the Italian modal expression *può* precedes the negation marker *non* ‘not’, a weaker interpretation (i.e. possible not) regarding information strength is generated. When *può* follows *non* ‘not’, a stronger interpretation (i.e. not possible) is generated. It appears that linear word order determines scope assignments in negative sentences with modal expressions in adult Italian. Differing from the lexical approach that English adopts, Italian appears to utilize an Isomorphism Principle to express different scales of possibilities (i.e. information strength).

The Moscati and Crain (2014) study interviewed 20 Italian-speaking adults, and 25 five-year-old monolingual Italian-speaking children who ranged in age from 5;2 to 5;11, with a mean age of 5;4. The study used a Hidden Object Task (e.g. Hirst and Weil, 1982; Noveck, 2001) combining with the Truth Value Judgment Task (e.g. Crain and Thornton, 1998). The Hidden Object Task was developed by Hirst and Weil (1982) in order to evaluate children’s knowledge about the informative strength of modal expressions.

To investigate children’s interpretation of negative sentences with modals, two types of sentences were constructed. Sentences like (37) refer to negative strong sentences, which have negation *non* ‘not’ preceding the modal expression *può* ‘can’. These sentences can only be assigned the ‘not possible’ interpretation (i.e. the interpretation with strong information strength) by Italian-speaking adults. Sentences like (38) refer to negative weak sentences, which have negation *non* ‘not’ following the modal expression *può* ‘might’. These sentences can only be assigned the ‘possible not’ interpretation (i.e. the interpretation with weak information strength) by Italian-speaking adults.

(37) *Non ci può essere una fragola nella scatola.*

Not there possible be a cow in-the box

‘There cannot be a cow in the box.’

(38) *Ci può non essere una mucca nella scatola.*

There possible not be a cow in-the box

‘There might not be a cow in the box.’

On a typical trial of the Moscati and Crain (2014) study, for example, the participants were presented with two opened boxes and one closed box. There was a horse in one opened box, and there were a horse and a cow in the other opened box. The participants were also told that the content of the closed box was exactly the same as the content of one of the opened boxes. The participants’ task was to judge whether the puppet’s statement regarding the content of the closed box was right or wrong.

Specifically, the participants were presented with the target sentences such as (37) and (38), following an illustration of an experimental scenario (i.e. the ‘possible not’ scenario) in which it was possible that a cow was in the closed box, i.e. being associated with the ‘possible not’ interpretation. The adults were expected to reject sentences like (37) and to accept sentences like (38). This is because Italian-speaking adults typically assign the scope relations to negation and modal expressions based on an Isomorphism Principle. If the child participants’ interpretation of the target sentences was also determined by the relevant linear position of these two scope-bearing expressions, the children would exhibit adult-like interpretations for both sentence (37) and (38).

The experimental findings from this study are in the following. In the story in which a cow was possibly in the closed box (i.e. the ‘possible not’ scenario), the adult participants rejected negative strong sentences like (37) 100% of the time. The children also displayed adult-like interpretation when they were presented with negative strong sentences, that is, the children also rejected sentences like (37) 78% of the time in this condition. However, the child participants exhibited different scope preference in the condition in which they were presented with negative weak sentences. In the ‘possible not’ scenario, the child participants rejected sentences like (38) 64.3% of the time, whereas the adults consistently accepted them in this condition (95% of the time). These findings suggest that linear word order does not determine children’s initial scope assignment to negative sentences with modal expressions. The findings also reveal that young children are able to reconstruct a scope-bearing expression at the level of semantic interpretation, in order to access the inverse scope interpretation not being identified in the adult input. That is, young Italian-speaking children display their strong tendency to reconstruct a modal expression that comes first in the surface syntax, in order to access an interpretation carrying stronger information strength.

3.3 Interim summary

The crosslinguistic developmental studies reviewed in this section formed the basis for the current experimental design. Firstly, preschool-aged children exhibit their competence in identifying the asymmetrical semantic properties manifested by the two arguments of the universal quantifier. Only the subject phrase of the universal quantifier is downward entailing, the predicate phrase is not. Consequently, young children interpret sentences containing both the universal quantifier and disjunction in an adult-like way, either when disjunction appears in the subject phrase of the universal quantifier or when it appears in the predicate phrase of the universal quantifier. Secondly, young children have no difficulty reconstructing a scope-bearing expression at the level of semantics to access the relevant interpretative properties across different linguistic structures, despite the inverse scope interpretation not emerging in adult interpretations. Of particular significance, and as shown, in the Zhou and Crain (2009) study, the reconstruction operation that is required to access the inverse scope interpretation is blocked for the adults due to pragmatic reason. A scope-bearing expression appears to be interpreted in place, as long as it is identified as a focus-sensitive constituent.

Based on previous research, as well as given the appearance that the preverbal position usually contains the focused constituent, we aim to conduct an experiment investigating Mandarin-speaking children's and adults' interpretative preferences for sentences with a universal quantifier and disjunction in preverbal position. We also aim to confirm whether children who are less aware of the focus sensitivity of the preverbal position have a strong preference for reconstructing the disjunction phrase that is placed in the

preverbal position of the target sentences. By contrast, reconstruction would be blocked for Mandarin-speaking adults because they are expected to be sensitive to this language-specific property, i.e. the focus sensitivity of the constituent in preverbal position.

4. The Experiment

4.1 Participants

Thirty Mandarin-speaking children between the age of 4 and 6 were recruited from the affiliated kindergarten of Beijing Language and Culture University. Fifteen Mandarin-speaking adults were tested as the control group. Adult participants were postgraduate students from Beijing Language and Culture University. The four-year-old group included 15 children between 4;2 and 4;11 years of age, with a mean age of 4;7. The five-year-old group included 15 children between 5;3 and 6;2 years of age, with a mean age of 5;8.

4.2 Materials and method

The target sentence of the present study is in the form of ‘Every NP+ with/use A or B+ VP’, as shown in (39).

(39) *Mei-zhi tuzi yong daozi huozhe chazi chi-le pisa.*

Every-CL rabbit with/use knife or fork eat-ASP pizza

Three types of experimental condition were created, as shown in Figure 1, Figure 2 and Figure 3.



Figure 1: Condition 1



Figure 2: Condition 2



Figure 3: Condition 3

The description mode of the Truth Value Judgment Task (e.g. Crain & Thornton, 1998) was used in the present study. The experimental method involves two experimenters. One of them acts out the story with toys and props, while the other experimenter plays the role of a puppet that watches the stories alongside the participants. At the end of the story, the puppet is asked by the other experimenter to tell what happened in the story. The puppet sometimes utters the test sentence that corresponds to what happened in the story. To prevent the 'Yes bias' tendency and avoid child participants becoming distracted, the puppet also sometimes incorrectly describes the story.¹² When a child rejects

¹² 'Yes bias' tendency indicates a phenomenon that, in implementing tasks that explore children's comprehensive language competence, children tend to say 'yes' even when he/she does not fully understand the target sentences or the experimental tasks.

the puppet's statement, the other experimenter then encourages him/her to describe what really happened in the story. This provides the experimenters with important information to evaluate whether the child participant understands the stories and test sentences.

All test stories were about a set of characters using several types of instruments/tools/materials to accomplish various actions. The stories described the following situations: rabbits have dinner using different types of cutlery, smurfs draw animals with pens, girls make sculptures with clay, and so on.

As noted earlier, Mandarin permits three kinds of interpretations for sentence (39), and repeated here in (40).

(40) *Mei-zhi tuzi yong daozi huozhe chazi chi-le pisa.*

Every-CL rabbit with/use knife or fork eat-ASP pizza

Firstly, if *yong* 'with/use' is interpreted as a verb, two different interpretations are generated. One interpretation resembles the relative clause interpretation. This is because the disjunction phrase, *yong daozi huozhe chazi* 'use a knife or a fork', can be attached to the subject phrase, *meizhi tuzi* 'every rabbit', and subsequently the disjunction phrase modifies the subject phrase of the sentence. Another interpretation is called the two-predicate interpretation. This is because the phrases, *yong daozi huozhe chazi* 'use a knife or a fork' and *chi pisa* 'eat pizza', can also be comprehended as two different events happening consecutively. Secondly, if *yong* 'use/with' is interpreted as a preposition, the reconstruction interpretation is assigned to sentence (40). That is, the

disjunction phrase, *yong daozi huozhe chazi* ‘with a knife or a fork’, is moved back to a position following the object phrase of the sentence at the level of semantic interpretation. The sentence is assigned an interpretation that is similar to its English counterpart sentence i.e., *Every rabbit ate pizza with a knife or a fork*.

The establishment of the three experimental conditions attempts to distinguish the three types of interpretations from one another. Specifically, if participants access the relative clause interpretation, they would accept sentence (40) in Condition 1 and Condition 3, but reject the sentence in Condition 2. If participants access the two-predicate interpretation, they would reject sentence (40) in all of the three conditions. Finally, if participants access the reconstruction interpretation, they would accept sentence (40) in Condition 1 and Condition 2, and reject the sentence in Condition 3. Expected response patterns are displayed in Table 1.

Table 1: Expected response patterns based on different interpretations

	Condition 1	Condition 2	Condition 3
Relative Clause Interpretation	YES	NO	YES
Two-predicate Interpretation	NO	NO	NO
Reconstruction Interpretation	YES	YES	NO

4.3 Procedures

The experiment used a within-subject design. Each of the participants was asked to judge target sentences such as (40), in three experimental conditions as shown in Figure 1, Figure 2 and Figure 3. Both child and adult participants were presented with 10 target trials, of which four were presented in Condition 1, four in Condition 2 and two in Condition 3. In addition, 10 filler sentences such as (41) and (42) were also included in the 10 testing trials. The 10 test stories were presented to each participant randomly.

(41) *Hui tuizi yong chazi chi-le pisa.*

Gray rabbit with/use fork eat-ASP pizza

‘Gray rabbit ate pizza with a fork.’

(42) *Mei-zhi tuzi dou zai chaoshi.*

Every-CL rabbit all in supermarket

‘Every rabbit was in a supermarket.’

Child participants were tested individually in a quiet room. They were asked to watch the stories and provide their judgments on the target sentences. Before participating in the formal testing session, child participants were interviewed using two pretest trials, which consisted of simple universal quantificational sentences like (43) and simple affirmative sentences containing disjunction like (44).

(43) *Mei-zhi tuzi zai jia chi-le wanfan.*

Every-CL rabbit at home eat-ASP dinner

‘Every rabbit had dinner at home.’

(44) *Hui tuzi xuan-le chazi huozhe shaozi.*

Gray rabbit choose-ASP fork or spoon

‘Gray rabbit chose a fork or a spoon.’

Adult participants were tested collectively by an experimenter in a classroom. The adults watched videotapes of the same stories, and wrote down their Yes/No responses to the test sentences on a questionnaire. They were also asked to write down their justifications if they chose to reject the puppet’s statements.

To illustrate the experiment in detail, here is a typical trial in Condition 1.

There are four rabbits going out for dinner and they go to a Western style restaurant. Before starting to order dishes, they are asked to select their cutlery. This restaurant is funny because the waiter only allows them to select one type of cutlery. So, two of the rabbits select a knife, one rabbit selects a fork and the remaining one selects a spoon. And then they start to read the menu and ask the waiter whether he could recommend something. The waiter says pizza is the signature food of the restaurant, and highly recommends the rabbits to try it. All of the rabbits take his advice at the beginning. But the last rabbit decides to have a donut instead of pizza because he wants something sweet.

Well, this is the end of the story. Kermit, can you tell us what the story is about?

Kermit the Frog (the puppet):

"This is a story about four rabbits who are going out for dinner. I know what happened.

Mei-zhi tuzi yong daozi huozhe chazi chi-le pisa.

Every-CL rabbit with/use knife or fork eat-ASP pizza

Am I right?"

It is worth noting that there is no right or wrong judgment for the target sentences, because these sentences can be interpreted in three different ways. We thus collected the participants' Yes/ No responses across the three experimental conditions, and categorized the patterns of responses by the participants into different types of interpretations.

5. Results

As can be seen from Figure 4 that illustrates the acceptance rate of the target sentences provided by three groups of participants across three types of experimental scenarios, the response patterns of the two age groups of children were different from those of the adults. Since 3 of the 30 child participants were excluded from the analysis, the remaining 27 children proceeded to participate in the main session. The three child participants were excluded from the present study, because one child continually provided Yes answers to all of the puppet's statements, while the other two failed to pass the pretests.

After categorizing, the patterns of responses provided by the three age groups are shown in Figure 5.

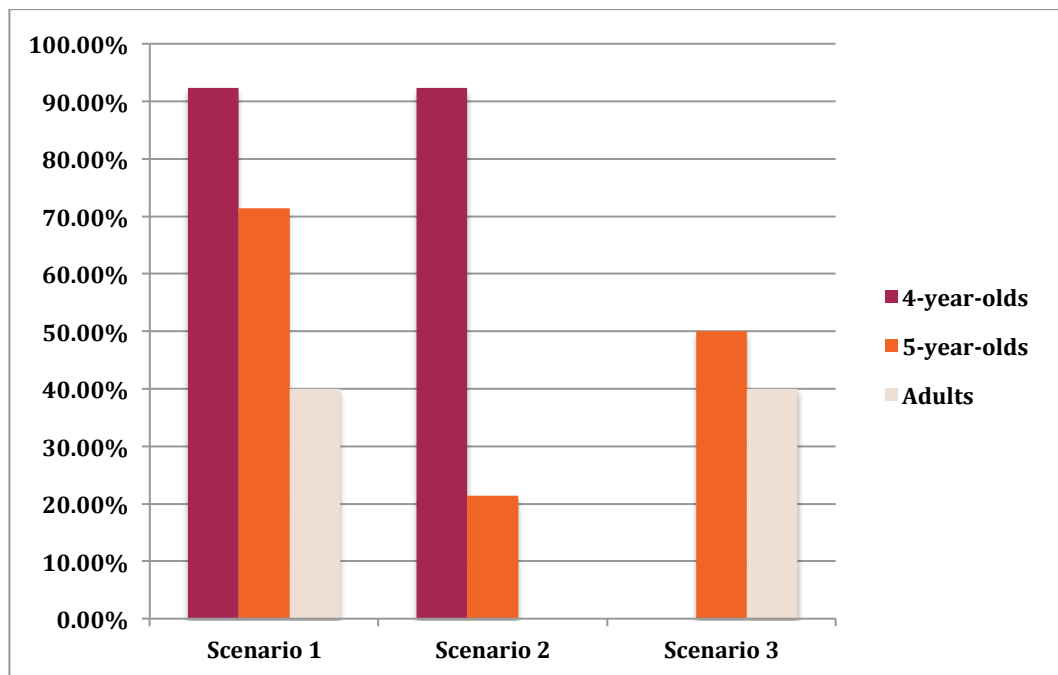


Figure 4: Acceptance rate across three types of scenarios

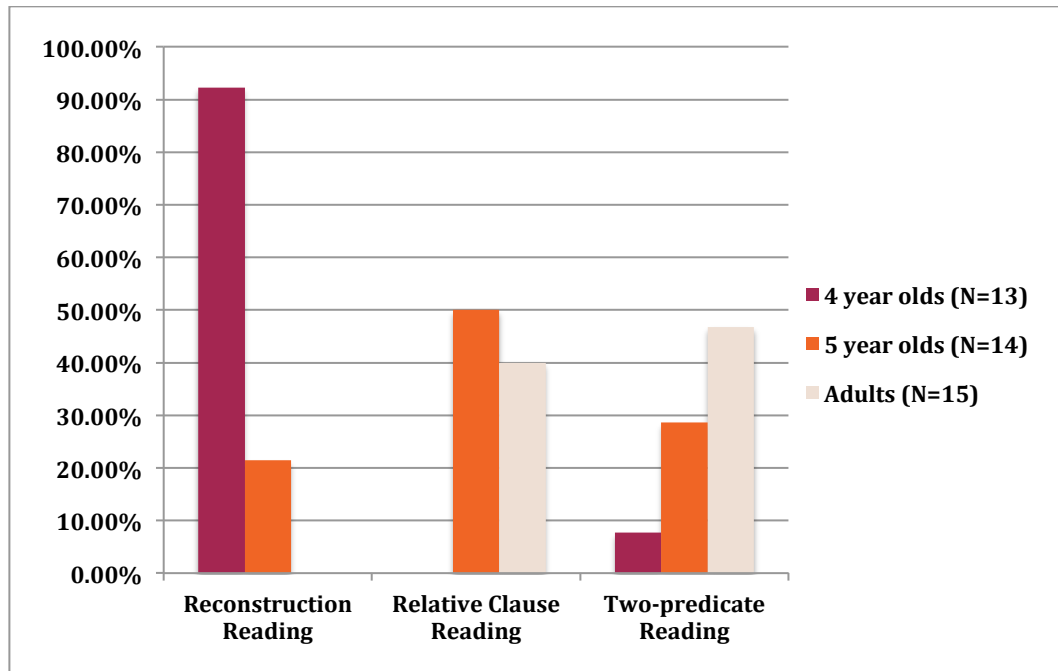


Figure 5: Response patterns of the three age groups

As illustrated by Figure 5, in the main testing session, within the four-year-old group, 12 out of the 13 children accessed the reconstruction interpretation that is generated by reconstructing the disjunction phrase at the level of semantic interpretation. In addition, one child in this group had the two-predicate interpretation, but no participant in this group accessed the relative clause interpretation. The five-year-old children displayed different response patterns. Compared to the younger child group, the five-year-old group had a smaller proportion of participants (3 out of 14) accessing the reconstruction interpretation, a larger proportion (7 out of 14) accessing the relative clause interpretation, and a larger proportion (4 out of 14) accessing the two-predicate interpretation. In the case of the adult group, instead of reconstructing the disjunction phrase when it was positioned in the preverbal position of the sentence, the adult participants interpreted the disjunction phrase in place. More specifically, their response patterns were as follows. None of the adults accessed the reconstruction interpretation, 6 out of 15 adults generated the relative clause interpretation, and 7 out of 15 adults assigned the two-predicate interpretation.¹³

We computed the proportion of the three types of interpretations in each group, and then compared the three age groups with respect to the proportions of the three types of response pattern. A Kruskal-Wallis H test shows that, at levels of the reconstruction interpretation and the relative clause interpretation, age groups' differences were significantly different, whereas no differences

¹³ Two of the 15 adult participants (approx. 13%) showed us an interpretation that was different from the three existing types of interpretations. These two adults accepted target sentences in Condition 1, but rejected target sentences in Condition 2 and Condition 3.

were found among the three age groups at the two-predicate interpretation level. The statistical results are shown in (45).

(45) Reconstruction interpretation level: $\chi^2(2) = 27.053$, $p = 0.00^*$

Relative clause interpretation level: $\chi^2(2) = 8.570$, $p = 0.01^*$

Two-predicate interpretation level: $\chi^2(2) = 5.060$, $p = 0.08$

Mann-Whitney U tests were also performed to examine the statistical results of the difference in each age group pair. Age group pairs included the pair that consisted of 4-year-old group and 5-year-old group, the pair that consisted of 4-year-old group and adult group, and the pair that consisted of 5-year-old group and adult group. The statistical results are demonstrated in Table 2.

Table 2: Statistical results of the difference in each age group pair

	Reconstruction Interpretation	Relative Clause Interpretation	Two-predicate Interpretation
4-year-old group vs. 5-year-old group	$Z = -3.63$, $p = 0.00^*$	$Z = -2.91$, $p = 0.04^*$	$Z = -1.37$, $p = 0.38$
4-year-old group vs. Adult group	$Z = -4.83$, $p = 0.00^*$	$Z = -2.53$, $p = 0.01^*$	$Z = -2.24$, $p = 0.03^*$
5-year-old group vs. Adult group	$Z = -1.86$, $p = 0.33$	$Z = -0.53$, $p = 0.65$	$Z = -0.99$, $p = 0.42$

The analyses in Table 2 indicate that, across all three types of interpretations, the 4-year-old group had significantly different results compared to the adult group. However, there were no significant differences between the 5-year-old group and the adult group for any interpretation. In addition, there were significant differences between the 4-year-old group and the 5-year-old group for the reconstruction interpretation and the relative clause interpretation, but not for the two-predicate interpretation.

6. Discussion and Conclusion

The experimental results indicated that the interpretative patterns of children exhibited significant disparities compared to that of adults. More specifically, the children started off with an interpretation that was not observed in the adult interpretations. Twelve out of the 13 four-year-olds accepted the sentences when every rabbit who ate pizza used either a knife or a fork (i.e. Condition 1 and Condition 2), but the same group of children rejected the sentences when some of the rabbits who ate pizza used a spoon (i.e. Condition 3). This suggests that four-year-old Mandarin-speaking children reconstruct the disjunction phrase to a lower hierarchical position, and consequently access the reconstruction interpretation.¹⁴ This is exactly what we predicted. As noted earlier, young children have demonstrated knowledge of reconstruction when they interpreted sentences involving scope ambiguities (e.g. Zhou & Crain, 2009; Moscati & Crain, 2014). Similar patterns of results were found in the present chapter, by examining how preschool Mandarin-speaking children interpreted universal quantificational sentences that have a disjunction phrase positioned in the preverbal position of the sentences.

¹⁴ One of the thesis examiners suggests an alternative account of the different scope interpretations that the child and adult participants assigned to the test sentences. On this account, disjunction phrases are raised by children to a position higher than the Subject NP, rather than being reconstructed to a lower position, as we propose. Both the examiner's raising account and our reconstruction account yield the same interpretations in the present study. However, the reconstruction account has a clear empirical advantage over the raising account, for two reasons. First, we documented in Section 2.4 that both adults and children reconstruct disjunction phrases in ordinary affirmative sentences. Second, the child participants in the earlier study were found to reconstruct disjunction phrases to a position lower than negation; therefore, children generated a conjunctive interpretation. If children had raised the disjunction phrases in that study, they would not have assigned the conjunctive interpretation to the disjunction phrases. Therefore, the examiner's proposal amounts to another less parsimonious claim than the alternative proposal, which amounts to the two-fold claim that children reconstruct disjunction phrases in negative sentences but raise them in sentences with a universal quantifier.

The five-year-old children accessed the entire range of three possible interpretations for the target sentences. More precisely, 3 out of the 14 five-year-olds accessed the reconstruction interpretation, seven of the children accessed the relative clause interpretation, and the remaining four children accessed the two-predicate interpretation. The patterns of responses provided by these children represent an interpretative ‘transition’ from the younger children to the adults. Moreover, half of the children in the five-year-old group interpreted the disjunction phrase in preverbal position as a relative clause. This suggests that children have acquired the asymmetrical properties denoted by the two arguments of the universal quantifier. Five-year-old Mandarin-speaking children know that the first argument of the universal quantifier *mei* ‘every’ is a downward entailing context, and consequently assign a conjunctive entailment of disjunction to the sentences if they interpret the disjunction phrase as part of the subject phrase of the sentences with the universal quantifier.

The adults had the relative clause interpretation and the two-predicate interpretation. On the relative clause interpretation, the adults interpreted the disjunction phrase as directly attached to the subject phrase of the universal quantifier, and consequently assigned a conjunctive entailment of disjunction to the target sentences. On the two-predicate interpretation, the adults analyzed the word *yong* ‘with/use’ as a verb and interpreted the preverbal disjunction phrase, *yong daozi huozhe chazi* ‘used a knife or a fork’, as the first predicate phrase of the sentence. The first predicate phrase then becomes the manner of accomplishing the event denoted by the second predicate phrase, *chi-le pisa* ‘eat pizza’. On both interpretations, the adults did not move the disjunction phrase

around. Instead, they interpreted disjunction in place. The reconstruction operation observed in child participants was blocked for adult speakers of Mandarin. This is because the constituent appearing in the preverbal position tends to be the focus of a sentence and the adults usually are more sensitive to this language-specific property than the children (e.g. Zhou and Crain, 2009). Consequently, some of the adults analyzed the phrase containing disjunction as the focused constituent and interpreted the disjunction phrase in place as the English cleft structure.

To conclude, the present study investigated Mandarin-speaking children's and adult's interpretation of sentences containing the universal quantifier and the disjunction word *huozhe* 'or'. The novelty of the present study was to position the disjunction phrase in a preverbal position. As a consequence, the sentence allowed three different possible interpretations of the disjunction phrase. This enabled us to investigate the possibly different interpretative preferences by children and adults in response to novel target sentences. Our findings reveal that the adults demonstrate a strong preference for the surface scope interpretations, whereas the children begin with an interpretation generated by reconstructing the preverbal disjunction phrase. This is exactly what was predicted. The reconstruction interpretation was blocked for the adults. This is because the constituent occupying the preverbal position tends to be the focus of a sentence in Mandarin (e.g. Ernst and Wang, 1995; Shyu, 1995; Pan and Hu, 2000; Xu, 2004). The adults who interpreted the disjunction phrase in its position in the surface syntax, as a modifier of the subject NP, apparently accessed the focus sensitivity of the constituent appearing in the preverbal position.

The findings also suggest that, as children become older, they exhibit more adult-like language behavior. Access to available interpretations appears to be a staged process across participant groups. This inference is made from the full range of interpretations for the target sentences provided the five-year-old children. Meanwhile, either the younger group of children or the adults only access part of the three types of available interpretations for the target sentences like, *Mei-zhi tuchi yong daozi huozhe chazi chi-le pisa* ‘Every rabbit with/use a knife or a fork ate pizza’. Differences across the participant groups hence represent a developmental trajectory towards exhibiting more adult-like scope preferences to the sentence structure explored in this chapter.

More importantly, younger children’s non-adult-like interpretation (i.e. reconstruction interpretation) does not mean that children fail to process the sentences or they do not understand the tasks. Instead, these young children demonstrate their knowledge of reconstruction, which is in line with previous research (e.g. Guasti and Chierchia, 1999/2000; Zhou and Crain, 2009; Moscati and Crain, 2014; Kiguchi and Thornton, 2016). Furthermore, it is unlikely that the younger children acquire the reconstruction interpretation from the local adult input. This inference is made based on two reasons. First, adult Mandarin does not provide positive evidence for the reconstruction interpretation, because adults appear not to reconstruct the disjunction phrase at all. Second, the reconstruction *per se* is an abstract operation that occurs at the level of semantic interpretation. This invisible operation cannot be learnt explicitly.

As a final point, children’s non-adult-like interpretation for sentences like (40) in Mandarin (i.e. reconstruction interpretation) is widely observed in English sentence like, *Every rabbit ate pizza with a knife or a fork*. This follows

the Continuity Hypothesis (e.g. Pinker, 1984; Crain, 1991; Crain and Pietroski, 2001). According to this hypothesis, child language differs from adult language in the same local environment, however child language should be similar to adult language in a different language environment. That is, the way that child language differs from the local adult language can only be the same way that different adult languages differ from each other. The interpretative discrepancies between child language and adult language revealed by the current experiment also present an argument for the Continuity Hypothesis. Specifically, when children exhibit ‘non-adult-like’ language behaviors (e.g. the reconstruction interpretation) in their surrounding environment, it is still possible that these ‘non-adult-like’ interpretations become ‘adult-like’ in other human languages.

CHAPTER 4

The Interpretation of Disjunction in VP Ellipsis in Mandarin Chinese

1. Introduction

Investigating children's interpretations of sentences with more than one scope-bearing expression has provided insights into children's acquisition of semantic principles, as well as principles of sentence processing. It is particularly revealing when children and adults generate different scope assignments. Children have been found to differ from adults in the assignment of scope to disjunction words in negative statements in one class of languages, but not in another. Languages in which children and adults differ in scope assignment include Mandarin, Japanese, Russian and Turkish. Languages in which children and adults generate the same scope assignments include English, German and Korean (e.g. Crain, Gardener, Gualmini and Rabbin, 2002; Goro and Akiba, 2004a, 2004b; Jing, Crain and Hsu, 2005; Verbuk, 2006; Lee, 2010; Spector, 2014; Geçkin, Thornton and Crain, 2016). When children and adults differ in scope assignment, the cause appears to be the polarity sensitivity of the disjunction word.

To illustrate, let us first consider the English sentences (1) and (2).

(1) June did not order rice or beans.

(2) June did not order rice, and June did not order beans.

Both child and adult speakers of English interpret sentence (1) in the same way. For both groups, negation takes scope over disjunction. Consequently both children and adults assign a 'neither' interpretation to (1), such that both

groups judge (1) to be true only if June did not order rice and she did not order beans. In English, then, a negated disjunction such as (1) is logically equivalent in truth conditions to a sentence that expresses the negation of both of its disjuncts, as in (2). It follows that English conforms to one of de Morgan's laws of classical logic.

Consider next the translation of the English sentence (1) into Mandarin. The more direct translation is given in (3), where the Mandarin word for negation is *meiyou* 'not' and the Mandarin word for disjunction is *huozhe* 'or.' Notice that the Mandarin sentence (3) has the same word order as the English sentence (1). In both sentences, negation precedes and has surface scope over the disjunction word. Nevertheless, adult speakers of Mandarin do not assign the same interpretation to (3) as English speakers assign to (1). For adult Mandarin speakers, sentence (3) expresses the same interpretation as the English cleft sentence: *It is rice or beans that June did not order*. That is, the Mandarin disjunction word *huozhe* 'or' takes scope over the negation word *meiyou* 'not' at the level of semantic interpretation, despite having the same surface scope relations as in English.

(3) *Zhu'en meiyou dian mifan huozhe douzi.*

June not order rice or bean

'It is rice or beans that June didn't order.'

It has been argued that the difference in interpretation between Mandarin and English is due to the polarity sensitivity of disjunction in Mandarin, but not in English. More specifically, the Mandarin disjunction word *huozhe* 'or' is a

Positive Polarity Item, whereas the English disjunction word *or* is not. By definition, a Positive Polarity Item must take scope over (local) negation at the level of semantic interpretation, regardless of the relative position of disjunction and negation in the syntactic structure.

Across all languages, children consistently interpret disjunction in the same way in negative sentence such as (1) and (3), where the negation marker takes scope over the disjunction word in the surface syntax. For children, negation takes scope over disjunction at the level of semantic interpretation in sentences like (1) and (3). It has been argued that disjunction is never polarity sensitive for children at the initial state of language acquisition (e.g. Goro, 2007; Crain, 2012).

It follows that children and adults make different scope assignments only in languages in which adults analyze disjunction as a Positive Polarity Item, which must take scope over negation at the level of semantic interpretation. This explains why children and adults generate different scope assignments in Mandarin, Japanese, and Turkish. In all of these languages, disjunction is a Positive Polarity Item for adult speakers, but not for children.

Clearly, children's hypothesis that disjunction is not a Positive Polarity Item in these languages is not based on the input from adult speakers. The source of children's hypothesis must lie elsewhere. It has been argued that the source of children's hypothesis is a subset principle that dictates children's initial hypotheses about certain lexical parameters, including a lexical parameter that pertains to disjunction words, called the Disjunction Parameter (Szabolcsi, 2002; Goro 2004; cf. Crain, 2012). On one value of the Disjunction Parameter, disjunction words are Positive Polarity Items; whereas disjunction

words are not Positive Polarity Items on the other value of the parameter. By definition, Positive Polarity Items (PPIs) take scope over negation, so disjunction words take scope over negation in languages that adopt the [+PPI] value of the Disjunction Parameter. By contrast, disjunction words are interpreted *in situ* in languages that adopt the [-PPI] value (Crain, Gardener, Gualmini and Rabbin, 2002; Goro and Akiba, 2004a, 2004b; Jing, Crain and Hsu, 2005; Verbuk, 2006; Goro, 2007; Lee, 2010; Crain and Thornton, 2015; Geçkin, Thornton and Crain, 2016). Across languages, children initially adopt the [-PPI] value of the Disjunction Parameter. The [-PPI] value of the parameter makes sentences true in a narrower range of circumstances than the [+PPI] value. By adopting the value [-PPI], therefore, children are ensured of encountering positive evidence if the local language favors the ‘superset’ value.

The finding that child and adult speakers of the same language sometimes generate different scope assignments for the same sentences, as in the Mandarin example (3), is difficult to reconcile with those accounts of language acquisition that view children’s linguistic behavior as either largely or entirely driven by experience (e.g. Tomasello, 2000, 2003; Croft, 2001). On the other hand, the observed differences between child and adult language are consistent with a biolinguistic approach (cf. Crain, Koring and Thornton, 2016). According to this approach, children’s initial linguistic hypotheses are sometimes constrained by principles of language learnability, such as the subset principle (Berwick, 1985; Crain and Phillip, 1993; Crain, Ni and Convey, 1994; Goro, 2007; Crain, 2012). The evidence to date strongly favors the biolinguistic approach.

Of course, the biolinguistic approach does not expect children to consistently differ from adults in generating scope assignments. In fact, this approach has led to several detailed predictions about where children and adults should generate the same scope assignments. The biolinguistic approach predicts that young children should generate the same scope assignments in all sentence structures where the polarity sensitivity of Positive Polarity Items is cancelled. Children assign the same range of truth conditions as adults do to disjunction words in certain linguistic environments.

One structure that cancels polarity sensitivity is in the antecedent clause of conditional statements. To see this, let us consider the interpretation of the English indefinite existential word *some* in the antecedent of the conditional, as shown in (4).

(4) If we do not see some koalas on the stage, then I get a coin.

Suppose that this statement is produced by a puppet, Kermit the Frog, who is predicting what he thinks will appear on the stage when the curtain is opened. Suppose, further, that there are some koalas on the stage, but there are some koalas that are not on the stage. In this circumstance, both children and adults would be expected to give Kermit the Frog a coin. The antecedent clause, *if we do not see some koalas on the stage*, is truth conditionally equivalent to the corresponding clause with *any*, namely *if we do not see any koalas on the stage*. Usually, the English indefinite existential word *some* takes scope over local negation, whereas negation (or its semantic equivalent) must take scope over

the English indefinite existential word *any*. This results in different truth conditions for the statements such as (5) versus the statements such as (6).

(5) I didn't eat some of the cake.

(6) I didn't eat any of the cake.

In the antecedent of a conditional statement, however, *some* and *any* do not make different contributions to the truth of the statement. This illustrates that the antecedent of a conditional cancels the polarity sensitivity of English *some*.

We are led to predict, then, that the polarity sensitivity of the disjunction word will be cancelled in languages in which disjunction words are Positive Polarity Items. To see if this is the case, consider the Mandarin translation of the conditional statement with disjunction in (7).

(7) *Ruguo nail bushi kaola huozhe xiongmao zai taishang, wo jiu dedao yige yingbi.*

If there not koala or panda at stage I then get one
coin

'If there is not a koala or a panda on the stage, then I get a coin.'

As predicted, speakers of languages such as Mandarin are not expected to give a coin to the puppet, Kermit the Frog, if there is either a koala, or a panda, or both, on the stage. This is evidence that Mandarin-speaking adults, like young children, assign a meaning to disjunction that corresponds to the [-PPI] value of

the Disjunction Parameter. This finding is exactly what the biolinguistic approach predicts, namely that child and adult speakers would also generate the same scope assignment for negated disjunction in linguistic structures where the polarity sensitivity of disjunction is cancelled.

Another linguistic structure that cancels the polarity sensitivity of disjunction in Mandarin is sentences with *zhiyou* ‘only’. Young children, again like adults, assign a conjunctive entailment of disjunction to the sentences when the disjunction phrase appears in the predicate phrase of a sentence that contains the focus adverb *only*. For example, consider the English sentence (8).

(8) Only June ordered sushi or pasta.

A two-step inference is involved when language speakers access the meaning of sentences like (8) (Horn, 1969, 2002; cf. Notley, Zhou, Crain and Thornton, 2009). Specifically, a focus operator like *only* divides the semantic structure of sentences into two components related to the sentence meaning. The two components are a presupposition and an assertion. According to Horn’s proposal (1969, 2002), the sentence presupposes that the property denoted by the predicate phrase of the sentence holds of the focused constituent. The *only*-sentence also presupposes the existence of a contrastive set, a set of alternatives of the focused constituent. The sentence asserts that the predicate does not apply to any members in the contrastive set. The meaning of sentence (8) can thus be represented as in (9).

(9) *Presupposition*: June ordered sushi or pasta.

Assertion: No one else (no members other than Julia in the known set of people) ordered either sushi or pasta.

Therefore, sentence (8) entails that no-one except June ordered either sushi or pasta, in accordance with de Morgan's laws of classical logic. Moreover, both child and adult speakers of Mandarin generate this 'conjunctive' entailment for the corresponding Mandarin sentence in (10).

(10) *Zhiyou zhu'en dian-le shousi huozhe yimian.*

Only June order-ASP sushi or pasta

'Only June ordered sushi or pasta.'

This is quite unexpected on the experience-based approach because, as noted earlier, Mandarin-speaking children and adults make different scope assignments in ordinary negative sentences with disjunction, such as (3), repeated here in (11).

(11) *Zhu'en meiyou dian mifan huozhe douzi.*

June not order rice or bean

Mandarin-speaking adults assign sentence (11) an interpretation that corresponds to the English cleft sentence *It is rice or beans that June did not order*. That is, disjunction takes scope over negation for Mandarin-speaking adults in many linguistic structures, whereas Mandarin-speaking children have

been found to consistently interpret disjunction *in situ*, such that disjunction generates a conjunctive entailment in child language.

Why do both Mandarin-speaking children and adults interpret disjunction *in situ* in the linguistic contexts like the antecedent clause of conditional statements and sentences with the focus adverb *zhiyou* ‘only’? One proposal is that the *in situ* interpretation of disjunction is enforced whenever negation is introduced covertly, as in sentences with *zhiyou* ‘only’ (e.g. Zhou and Crain, 2010). More specifically, the proposal is that disjunction is compelled to take scope over negation (i.e., disjunction is a PPI) for adult speakers only if both scope-bearing expressions are overtly realized in the surface syntax. When either negation or disjunction is phonologically null, the scope-bearing expression that is phonologically realized is interpreted *in situ*. This observation formed the basis of the present study.

The aim of the present study was to ascertain the interpretations that Mandarin-speaking children and adults assign to sentences in which disjunction is elided from a verb phrase in the second of two conjoined sentences, as in the example in (12).

(12) *Zhu'en neng dian shousi huozhe yimian, danshi Zhan bu neng.*

June can order sushi or pasta but Gen not can

‘June can order sushi or pasta, but Gen cannot.’

In sentences like (12), the first of the two conjoined sentences is a Free Choice sentence; it implies that June can order sushi and June can order pasta.¹⁵ Although negation is overt in the second conjunct, disjunction has been elided. Therefore, both children and adults are expected to interpret disjunction *in situ* in the second conjunct, i.e., within the scope of negation. So the second conjunct is expected to entail that Gen cannot order either food item. Suppose June can order sushi, and she can order pasta, but Gen is only permitted to order sushi. In this circumstance, both children and adults are expected to reject the test sentence. However, if disjunction is overt in the verb phrase of the second conjunct, then Mandarin-speaking children and adults are expected to make different scope assignments. The corresponding English example is sentence (13), while the Mandarin counterpart is (14).

(13) June can order sushi or pasta, but Gen cannot order sushi or pasta.

(14) *June neng dian shousi huozhe yimian, danshi Zhan bu neng dian shouyi huozhe yimian.*

June can order sushi or pasta but Gen not can order sushi
or pasta

When Mandarin speakers interpret sentences like (14), disjunction is expected to take scope over negation for adults, but disjunction is expected to be

¹⁵ This ‘conjunctive’ Free Choice interpretation of the first conjunct - *June can order sushi or pasta* - is an implicature and not an entailment. To see this, notice that the ‘freedom to choose’ meaning component is cancelled if the sentence is followed by a disclaimer, such as “But I don’t remember which.” In addition, this meaning component is cancelled if the disjunction phrase is converted into full propositions: *June can order sushi or June can order pasta*.

interpreted *in situ* by children. So, adults should accept the Mandarin sentence (14) if Gen is only permitted to order sushi. In contrast to adults, children are expected to reject it in such circumstances, based on the findings of previous studies (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notely and Zhou, 2014).

To summarize, the present experiment was designed to establish one of the boundary conditions on differences in scope assignments. When disjunction is elided from the verb phrase, children and adults in all human languages are expected to interpret it *in situ*, i.e., in the scope of negation. If this prediction holds, then VP ellipsis constructions can unmask a putative linguistic universal.

2. The interpretation of disjunction in child and adult language

Differences in scope assignments by children and adults were first revealed in a Japanese study by Goro and Akiba (2004a; 2004b). The Goro and Akiba study investigated Japanese-speaking children's interpretation of the disjunction word *ka* 'or' in simple negative sentences. In this study, child and adult participants were presented with sentences like (15).

(15) *Butasan-wa ninjin ka piiman-wo tabe-nakat-ta.*

Pig-TOP carrot or pepper-ACC eat-NEG-PAST

'The pig didn't eat the carrot or the pepper.'

In adult Japanese, *ka* 'or' takes wide scope than local negation *nakat* 'not', sentence (15) hence means *It is the carrot or the pepper that the pig did not eat*. To examine whether child speakers of Japanese assign the same scope assignment as adult speakers of Japanese, the Goro and Akiba study interviewed 30 monolingual Japanese-speaking children who ranged in age from 3;7 to 6;3 (mean 5;3), using the Truth Value Judgment Task (Crain and Thornton, 1998). They also interviewed 10 monolingual Japanese adults who had no linguistic background to serve as controls with the same methodology. The study also adopted the Uncertainty Mode of the Truth Value Judgment Task (Goro and Akiba, 2004a, 2004b; cf. Goro, in press) to make uttering target sentences like (15) pragmatically felicitous, which is to be explained in more detail below.

The theme of the experiment was an eating contest. The experiment consisted of going through a storybook about 12 cartoon animals, one on each

page. Each animal was given the opportunity to eat two vegetables, a carrot and a green pepper. There was also a piece of cake for each animal to eat, and all of the animals ate the cake. The question was whether or not each animal would eat the vegetables. A reward system was introduced to encourage the animals to eat their vegetables. Each animal received one of three kinds of reward, based upon the number of vegetables it ate. If an animal ate both of the vegetables, it received a gold medal. If an animal ate only one of the vegetables, it received a blue medal. If an animal did not eat either vegetable, it received a black cross. Of these 12 target sentences, four were target sentences with *ka* 'or' (two for animals with a blue medal, two for animals with a black cross), while the other eight sentences were with the conjunction word *...mo...mo* 'and' or served as fillers.¹⁶

After all of the animals had received their rewards, the food items were removed, but the rewards remained. At that point, the puppet was asked to tell the child what each of the animals had eaten, and the child's task was to judge whether the puppet was right or wrong. This introduced uncertainty into the equation. Because the food items had been removed, the truth or falsity of the puppet's statement had to be based on the reward it had received. If the food items remained visible, it would have been infelicitous to use disjunction to describe what the animals with a blue medal had eaten. Consider a situation in which an animal (e.g. the pig) had not eaten the carrot, but had eaten the pepper, and the puppet uttered the target sentence in (16).

¹⁶ We will not report the data from these eight target sentences since they are not critical for our study.

(16) *Butwasan-wa keki-wo tabeta kedo, ninjin ka piman-wo tabe-naket-ta.*¹⁷

Pig-TOP cake-ACC eat-PAST but carrot or pepper-ACC eat-NEG-PAST

‘The pig ate the cake, but didn’t eat the carrot or the pepper.’

On the surface scope interpretation of the second conjunct in sentence (16),¹⁸ a paraphrase of the test sentence is *The pig didn’t eat the carrot or the pig didn’t eat the pepper*. In the given situation, a speaker uttering just the first disjunct, i.e., *The pig didn’t eat a carrot*, would have made a statement that was informationally stronger and, hence, pragmatically more felicitous than someone who produced the test sentence (16).

The critical trials were the negative sentences with disjunction presented as a description of what an animal with a blue medal had eaten. An animal received a blue medal if it had eaten one of the two vegetables, but not both. A child or adult participant who analyzed the test sentences with negation taking scope over disjunction was expected to reject the test sentences in this condition, which we will call the blue medal condition. A child or adult participant who assigned disjunction wide scope was expected to accept the test sentences in this condition.

In the Goro and Akiba study, the participants were presented with four target sentences with *ka* ‘or’, as in (16). Two of the four target sentences were

¹⁷ C-command is a structural relationship, not one that can be determined by the surface position of two constituents (i.e., one preceding or following the other). In Japanese, the object of a verb precedes the verb. A proposal by Zwart (1992) is that, in languages in which the object precedes the verb, this order is derived by a leftward movement of the object. Therefore, the verb may still c-command the direct object in Japanese.

¹⁸ Japanese and English have different word orders and different scope assignments (at least in the adult languages). In adult Japanese, the disjunction work *ka* ‘or’ takes scope over *naket* ‘not’ both in the surface syntax and at the level of the semantic interpretation. Therefore, the interpretation assigned to disjunction by Japanese-speaking adults in negative sentences is called the ‘surface scope interpretation’.

presented following a story associated with the blue medal condition, while the other two were presented following a story associated with the black cross condition. Recall that the blue medal condition was the critical one in the experiment. If the children analyzed the disjunction word *ka* ‘or’ as taking scope over negation *naket* ‘not’, they would access the surface scope interpretation and accept the target sentences in this condition. By contrast, if the children analyzed negation as taking wide scope than disjunction, they would assign a conjunctive entailment of disjunction to the target sentences with *ka* ‘or’ and then reject the target sentences in the blue medal condition.

The main findings were as follows. In the blue medal condition (i.e. an experimental outcome in which an animal had only eaten one of the two vegetables, but not both), the 10 adult participants accepted the target sentences like (16) (repeated here as (17)) 100% of the time (20/20). In contrast to adults, the 30 child participants rejected the same sentences 75% of the time (45/60) in the same condition.

(17) *Butwasan-wa keki-wo tabeta kedo, ninjin ka piman-wo tabe-naket-ta.*

Pig-TOP cake-ACC eat-PAST but carrot or pepper-ACC eat-NEG-PAST

‘The pig ate the cake, but didn’t eat the carrot or the pepper.’

A closer look at the children’s data revealed that only 4 out of the 30 children provided adult-like responses. After excluding these four children, the remaining child participants displayed a rejection rate of 87%. These children were also able to justify their rejections of the target sentences. Most of the children explained their reasons for rejecting the target sentences by saying

“because the pig did eat one of the vegetables” or *“because it is only one of the vegetables that the pig didn’t eat”* (cf. Goro, 2007: p.233). The results indicated that the adult participants interpreted disjunction as taking wide scope and the adults assigned disjunctive truth conditions to sentences with *ka* ‘or’, whereas the children generated the conjunctive entailment for the same target sentences, accessing the inverse scope interpretation of sentences like (17).

Based on considerations of language learnability, Goro (2004) predicted that children would initially assign the value [-PPI] to disjunction, even in languages in which adults assign it the value [+PPI]. The [-PPI] value of the Disjunction Parameter makes negative sentences with disjunction true in a narrower range of circumstances, as compared to the [+PPI] value of the Disjunction Parameter. In making the prediction that children would initially assign the [-PPI] value, Goro invoked the Semantic Subset Principle (see Crain, 2012). The Semantic Subset Principle entreats children to initially adopt parameter values that make sentences true in the narrowest range of circumstances in cases where one parameter value (the subset value) asymmetrically entails the other (the superset value). Adherence to the Semantic Subset Principle guarantees that children will encounter positive evidence for parameter resetting if adult speakers of the local language adopt the [+PPI] (superset) value of the Disjunction Parameter.

Goro’s predictions, which were made based on the Goro and Akiba (2004a, 2004b) study, have been confirmed in subsequent studies. The finding was replicated in Mandarin Chinese, by Jing, Hsu and Crain (2005) using the Truth Value Judgment Task (Crain and Thornton, 1998). The Jing, Crain and Hsu study interviewed 21 Chinese children and adult controls to evaluate Chinese

children's interpretation of negative sentences with the disjunction word *huozhe* 'or'. The participants were presented with target sentences like (18), which means '*It is the table or the TV that Donald Duck didn't lift up*' in adult Chinese.

(18) *Tanglaoya meiyou juqi zhuozi huozhe dianshiji.*

Donald Duck not lift-up table or TV

The target sentence (18) was presented to the participants following a story about Mickey Mouse, Donald Duck and a Smurf who were trying to lift two heavy objects. The fourth character Elmo who was the judge promised to give the three characters rewards to encourage them to lift as many heavy objects as possible. The story ended with the following outcomes. Mickey Mouse lifted both heavy objects (i.e. the TV and the table) and he was rewarded with a gold medal. Donald Duck lifted the TV, but not the table, and he was rewarded with a silver medal. The Smurf lifted neither of the two heavy objects, and he received no reward. After the conclusion of the story, the three characters who participated in the lifting activity carried their medals (if received), while the TV and the table were displayed behind them. The puppet uttered the following statements, before uttering the target sentence (18): *"I wasn't paying attention just now and I can't remember exactly who lifted up what, but, I can guess from the kind of medals each of them has:..."* (cf. Jing 2008: p.96)

The test story was designed to be inconsistent with a conjunctive entailment of disjunction. That is, if participants assigned a conjunctive entailment of disjunction to sentences like (18), they would reject the sentence.

This is because Donald Duck did lift up the TV (i.e. one of the two heavy objects in the given context). By contrast, if participants assigned disjunctive truth conditions to the same sentences, they would accept sentence (18) after they were presented with the above test story. The experimental results showed that 20 out of the 21 child participants rejected the test sentences, following the story in which the critical character (e.g. Donald Duck) accomplished one of the two target actions (i.e. lifting up the TV and lifting up the table). By contrast, the adult controls accepted the same sentences in the same conditions. The results indicate that Chinese adults analyze the disjunction word *huozhe* ‘or’ as a Positive Polarity Item (PPI), whereas Chinese children initially analyze it as not a Positive Polarity Item.

Similar findings with respect to different scope assignments by adults and children have been reported in studies conducted in Russian and Turkish (Verbuk, 2006; Geçkin, Thornton and Crain, 2016). Recall that the critical targets in previous studies were the negative sentences with disjunction presented as a description of what the character with a blue medal/silver medal had accomplished. The experiments used the uncertainty mode of the judgment tasks, which ensured pragmatic felicity of using disjunction. In the condition in which the character mentioned in the target sentence received a blue/silver medal, 21 Russian-speaking children between the ages of 3;11-6;10 (mean 5;4) and six Russian-speaking adults were presented with sentences like (19). In the Turkish study, 22 monolingual Turkish-speaking children between the ages of 4;1-5;11 (mean 4;7) and 26 adult speakers of Turkish were presented with sentences like (20).

(19) *Koška ne našla ključik ili zerkal'ce.*

Cat not find-PAST key or mirror

'The cat did not find the key or the mirror.'

(20) *Bu hayvan-cık havuc-u veya biber-i ye-me-di.*

This animal-DET carrot-ACC or pepper-ACC eat-NEG-PAST

'This animal did not eat a certain carrot or a certain pepper.'

Here are the main findings of these two studies. Russian-speaking adults accepted sentences like (19) 100 % of the time, following a story in which the cat found only one of the two target objects (either the key or the mirror), but not both. By contrast, 16 out of 21 children acquiring Russian rejected sentences like (19) 98.9% of the time in the same condition. In the Turkish study, Turkish-speaking adults accepted sentences like (20) 77% of the time in the blue medal condition, whereas Turkish-speaking children rejected the same target sentences 98.8% of the time. These results revealed that both adult Russian speakers and adult Turkish speakers analyzed the disjunction word as a Positive Polarity Item (PPI), which takes scope over negation at the level of semantic interpretation, and consequently they assigned disjunctive truth conditions to the sentences with disjunction. The interpretations from child participants in these two studies were the opposite of those of the adults. Russian-speaking children and Turkish-speaking children initially analyzed the disjunction word as not a Positive Polarity Item (PPI) which is interpreted within the scope of negation. The children from these two languages consequently assigned a conjunctive entailment of disjunction to sentences such

as (19) and (20). Furthermore, these findings are in line with Goro's proposals, which predict children and adults should assign different scope relations to negative sentences with disjunction in languages in which disjunction words are designated to be the superset value (i.e. the [+PPI] value).

To summarize, it has been observed crosslinguistically that, regardless of the word order and the interpretations assigned to negated disjunctions by adults, young children consistently analyze negation as taking scope over disjunction in negative sentences with disjunction. Moreover, consistent with Goro's proposal, children from different language backgrounds initially select the subset value of the Disjunction Parameter (i.e. the [-PPI] value), which guarantees that they can switch away from their initial selection if it turns out that the adult speakers select the other value of the parameter.

3. Verb Phrase (VP) ellipsis

Verb Phrase (VP) ellipsis occurs in a variety of sentences. In addition to coordinate structures of the kind we investigate, sentences with a temporal adjunct sometimes have an elided verb phrase. This structure is illustrated in example (21). In addition, sentences which contain a main clause and a subordinate clause can contain an elided verb phrase, as illustrated in example (22) (Thornton and Wexler, 1999: p. 114).

(21) Clark Kent ripped off his shirt before Superman did.

(22) Clark Kent bared his chest to everyone that Superman did.

Sentences with VP ellipsis are governed by a parallelism constraint (Chomsky and Lasnik, 1993; Chomsky, 1995, 2015; Thornton & Wexler, 1999). This constraint requires the elided verb phrase in the second conjunct to replicate the interpretation of the overt verb phrase in the first clause. Many sentences conform to this constraint, as sentence (23) illustrates.

(23) June will try the sushi, but Gen won't < ~~try the sushi~~ >.

3.1 Young children's competence in interpreting sentences with VP ellipsis

Previous research has shown that four-year-old children interpret many types of VP ellipsis sentences in the same way as do adults (e.g. Guo, Foley, Chien, Chiang and Lust 1996; Thornton and Wexler, 1999; Syrett and Lidz, 2011; Li, Shi and Hu, 2012; Zhou, 2014). Children appear to have no difficulty recovering the syntactic structure of an elided VP, and accessing the sentence meaning that is governed by the parallelism constraint.

An early study conducted by Guo, Foley, Chien, Chiang and Lust (1996) aimed to investigate how Chinese-speaking children comprehended VP ellipsis structures containing pronominal expressions. For instance, 61 children (aged 3;5 to 6;11, mean 5;0) were presented with sentences like (24). The child participants were also asked to act out sentence meanings using dolls and toys that were provided by the experimenters.

(24) *DD yao-yi-xia ta-de shuili, SN ye shi.*

DD bite-one-time his pear SN also be

‘DD bites his pear and SN does too.’

Based on the parallelism constraint, the second conjunct containing the elided constituent should be recovered as ‘SN also bites his pear’. On the adult interpretation, sentence (24) is ambiguous. It can either mean *SN bites DD's pear*, or *SN bites his own pear*. The first interpretation can be regarded as a referential interpretation, which is also called the ‘strict’ reading. The second interpretation is a bound variable interpretation, which is also called the ‘sloppy’ reading (e.g. Hankamer and Sag, 1976; Fiego and May, 1994). The

results were that the 61 five-year-old Chinese-speaking children accurately recovered the elided constituent in the second conjunct of sentences like (24) 85% of the time. Among these 85% of responses from the children, the percentage of the sloppy reading responses (i.e. 62%) was larger than the percentage of the strict reading responses (i.e. 23%). The 16 adult controls also exhibited a strong preference for the sloppy reading of sentences like (24). The adult participants acted out the sloppy reading 81% of the time and the strict reading 18% of the time when they were presented with the target sentences like (24). The results indicate that preschool-aged Chinese-speaking children are able to recover the elided VPs, and access correct sentence meanings with adult-like preferences.

Similar findings were reported by Li, Shi and Hu (2012) and Zhou (2014). These studies revealed preschool Mandarin-speaking children's competence in interpreting sentences with 'plain' VP ellipsis (i.e. the elided VP not containing pronominal expressions). For instance, the Li, Shi and Hu (2012) study examined how young Mandarin-speaking children interpreted two types of coordinate sentence with VP ellipsis. In one type of target sentence, e.g. (25), the elided second conjunct was replaced by an auxiliary verb *shi* 'be'. In the other type of target sentence, e.g. (26), the elided second conjunct was replaced by a modal verb.

(25) *Baba xiu-le diannao, yeye ye shi.*

Papa fix-ASP computer grandpa also be

'Papa fixed the computer, grandpa did too.'

(26) *Baba hui xiu diannao, yeye ye hui.*

Papa can fix computer grandpa also can

‘Papa can fix the computer, grandpa also can.’

The Li, Shi and Hu study interviewed 16 four-year-old children (age ranged from 3;11 to 4;6, with a mean age 4;0) and 33 adult speakers of Mandarin, using the Truth Value Judgment Task (Crain and Thornton, 1998). According to the parallelism constraint, the elided VP in the second conjunct of target sentences such as (25) and (26) should be recovered under identity with the first conjunct in the target sentences. Mandarin speakers would judge sentences like (25) and (26) to be true as long as the grandpa accomplished the same action as papa did. For example, the participants were presented with a story in which the papa fixed the computer and the grandpa fixed a clock, which made sentences (25) and (26) true. Those participants were also presented with a story which made the same sentences false. The experimental results showed that the adults consistently accepted the two types of target sentences when the stories were associated with the meaning consistent with the parallelism principle. By contrast, they rejected the sentences if the accompanying test stories were not consistent with the sentence meaning that was determined by the parallelism principle. Four-year-old children’s interpretations in the two conditions largely resembled those of the adults. That is, the four-year-olds had already mastered the relevant knowledge required to interpret sentences with VP ellipsis.

Previous research in English has also confirmed young children’s competence in interpreting sentences with VP ellipsis by utilizing their early mastery of the parallelism constraint. Thornton and Wexler (1999) examined

whether four-year-old English-speaking children were capable of recovering the elided VP, as well as their knowledge of the parallelism constraint. Using the Truth Value Judgment Task (Grain and Thornton, 1998), Thornton and Wexler tested 19 native child speakers of English and six English-speaking adults. Seventeen out of 19 children ranging in age from 4;0 to 5;1 (mean 4;8) passed the pretests and proceeded to the formal testing session. Both child and adult participants were presented with sentences like (27) and (28).

(27) The caveman kissed the dinosaur and Fozzie Bear did too.

(28) Ariel touched the creature and every girl did too.

The results showed that the children, just like the adults, rejected sentence (27) 100% of the time, following a story in which the caveman kissed the dinosaur and Fozzie Bear kissed his own hand. In responding to sentence (28), the children correctly accepted the sentence 100% of the time when it followed a story in which Ariel and every girl had touched the creature. The same children also correctly rejected sentence (27) 79% of the time when it followed a story in which Ariel touched the creature and each girl touched herself.¹⁹ These results clearly demonstrated children's ability to recover an elided VP and correctly access the relevant interpretative properties. Furthermore, the researchers

¹⁹ The 21% of the acceptance rate was caused by experimental factors, that is, the background story tended to lead the participants to expect each girl to touch herself rather than the creature. The rejection rate was expected to reach 100% if these factors were eliminated. Nevertheless, the different patterns of responses for the two conditions (i.e. 79% rejection vs. 100%) are consistent with the relevant empirical conclusions.

presented sentences such as (29) and (30) to the participants in order to examine young children's knowledge of the parallelism constraint.

(29) The Incredible Hulk brushed his hair and every troll did too.

(30) The lizard man lifted him and the ugly guy did too.

Sentences (29) and (30) are no longer plain sentences with VP ellipsis, but rather sentences involving both VP ellipsis and binding relationships.²⁰ The binding relationship between noun phrases in the first conjunct of sentences (29) and (30) are constrained by Principle B. According to Principle B, the referring expression *The Incredible Hulk* cannot be co-referential with the possessive pronoun *his* in sentence (29), while *the lizard man* cannot be co-referential with *him* in sentence (30). Based on previous research demonstrating children's early mastery of binding relations among noun phrases (e.g. Crain and McKee, 1985), child participants were expected to be aware of the constraint on binding relations (i.e. Principle B) occurring in the recovered second conjunct of sentences (29) and (30).

The results showed that the 17 English-speaking four-year-olds tested rejected sentences like (29) 100% of the time, following a story in which Incredible Hulk brushed a rock star's hair, while each troll brushed his own hair. The children's justifications further confirmed their mastery of Principle B, as well as their success in recovering the relevant properties of the elided VPs. For

²⁰ As noted in Chapter 2, Binding Theory is a set of constraints that determine the interpretation of noun phrases, which include reflexives, pronouns and referring expressions (e.g. Chomsky, 1981; Huang, 1993; Haegeman, 1994).

example, one of the child participants (4;5) said that “*The trolls brushed their own hair and the Incredible Hulk brushed the rock star’s.*” (Thornton and Wexler, 1999: p.180). In responding to sentences like (30), about 80% of the children provided an adult-like response. That is, these children rejected sentence (30) following a story in which the lizard man lifted a Smurf, while the ugly guy lifted Mickey Mouse. This result indicated that 80% of the child participants were capable of recovering the elided VP in sentences like (30), based on the structural parallelism and consequently they excluded coreference between the referring expression *the lizard man* and the pronoun *him*. Moreover, these children required the recovered pronoun *him* in the second conjunct of sentence (30) to refer not to the individual mentioned in the target sentence but rather the individual mentioned in the story. The findings further illustrate preschool children’s full understanding of the ban on coreference between a pronoun and its antecedent (i.e. Principle B), whether the pronoun is phonetically realized or not.

Studies on whether preschool children are able to interpret another type of VP ellipsis construction, i.e., sentences with antecedent contained deletion (ACD) have also been conducted (e.g. Matsuo and Duffield, 2001; Kiguchi and Thornton, 2004; Syrett and Lidz, 2011). For instance, the Matsuo and Duffield study interviewed 12 children between the ages of 3;11-6;7 (mean 5;8) and 20 adult controls. The researchers tested how the English-speaking participants interpreted two types of VP ellipsis construction, using the Grammaticality Judgment Task (e.g. McDaniel and Cairns, 1990; Hiramatsu and Lillo-Martin, 1998). One type was the coordinate structures with VP ellipsis, like (31), and the other type was the sentences with ACD, such as (32).

(31) Cookie Monster travelled to a strange planet and Big Bird did too.

(32) Cookie Monster travelled to the same planet that Big Bird did.

Specifically, both child and adult participants were asked to judge whether sentences uttered by a puppet (a male fish Lulu) were good or bad. Lulu the fish came from the moon, so he would utter sentences with incorrect word order, such as *I came from moon the*, or morpheme reversals like *nut-dough*. The child participants were asked to reward Lulu with tasty food if they thought Lulu spoke English well, and to punish Lulu with watermelon if Lulu produced 'strange' sentences. Adults accepted both sentences like (31) and (32) 100% of the time, while the child participants accepted sentences like (31) 86% of the time and accepted sentences like (32) all of the time. The results demonstrate that child speakers of English as young as 3;11 show adult-like sensitivity to the structural parallelism when they are presented with different types of VP ellipsis construction.

Collectively, these developmental studies show that, crosslinguistically, adult speakers follow the parallelism constraint in the comprehension of various types of VP ellipsis sentences. The findings also show that children from different language backgrounds, as early as 4 years of age, exhibit adult-like language competence in interpreting different types of sentences with VP ellipsis. The parallelism constraint that determines the interpretation of VP ellipsis constructions is widely observed in both child language and adult language. It is conceivable that the parallelism constraint is part of the child's innate grammatical knowledge. This idea is supported by the fact that young

children from typologically different language backgrounds have no difficulty recovering the syntactic structure of elided VPs, and correctly interpreting different types of sentences with VP ellipsis, in spite of the fact that the parallelism constraint is abstract and invisible in the surface syntax. Therefore, it is unlikely children acquire this constraint based on the language evidence they encounter.

3.2 When VP ellipsis constructions involve polarity sensitive items

A large body of previous research has demonstrated that the parallelism constraint is the core principle governing language speakers' interpretation of sentences with VP ellipsis. The parallelism constraint appears to be violated, however, in sentences in which the elided VP contains a polarity sensitive item, including the English existential expressions *some* and *any*. First, consider example (33), containing the English existential expression *some*.

(33) June will try some sushi, but Gen won't < ~~try some sushi~~ >.

(34) Gen won't try some sushi.

(35) June will try some sushi, but Gen won't < ~~try any sushi~~ >.

The existential expression *some* is a Positive Polarity Item (PPI). By definition, a PPI cannot scope below negation (e.g. Szabolcsi, 2004). The PPI *some* is covert in the second conjunct in (33); it is understood to be part of the elided VP. If the parallelism constraint applies in (33), then we should expect native speakers to

interpret the second conjunct with the existential *some* taking scope over negation, as it does in (34). If so, the interpretation of the second conjunct of (33) would be paraphrased as follows: *There is some sushi that Gen won't try*. This is clearly not the interpretation assigned by English speakers. Rather, the interpretation of (33) can be better paraphrased by replacing the PPI *some* with the negative polarity item (NPI) *any*, as in (35). For some reason, the polarity sensitivity of *some* is cancelled when it appears in an elided VP that contains (overt) negation. In this structural position, negation takes scope over the existential *some*.

Sentence (33), then, appears to violate the parallelism constraint. A related challenge to the parallelism constraint appears in sentences with the negative polarity item (NPI) *any*. Example (36) illustrates what would happen if the verb phrase from the first conjunct, with *any*, is repeated in the elided verb phrase. Because the second conjunct lacks a (Downward Entailing) licenser for *any*, the output of the parallelism constraint appears to be ungrammatical.

(36) June will not try any sushi, but Gen will < ~~try~~ **any sushi* >.

Fortunately, there is a way to salvage the parallelism constraint. A solution was proposed by Klima (1964). According to Klima, the parallelism constraint can be maintained by introducing an abstract logical operator $\exists$, as a stand for the PPI *some* in (33) and for the NPI *any* in (36). The abstract logical operator $\exists$ is introduced into both conjuncts. This is what is elided in the second conjunct, rather than its lexical counterparts *some* or *any*. Essentially, Klima's proposal makes explicit the theoretical relationship between *some* and *any*, which are

allomorphs of the existential quantifier. The existential expression *any* is introduced when the logical operator is c-commanded by a Downward Entailing expression, and the existential expression *some* is introduced in most other linguistic environments.

The analysis of *some* and *any* as allomorphs is independently motivated. To see this, note that both *some* and *any* are licensed in certain linguistic environments. In such environments, the polarity sensitivity of *some* is neutralized, so either existential expression can be used *salva veritate*. One linguistic environment that licenses both *some* and *any* is the predicate phrase of sentences that contain the pre-subject focus adverb *only*. This explains why sentences (37) and (38) are both acceptable, and are both true in the same sets of circumstances.

(37) Only Gen is willing to try *some* sushi.

(38) Only Gen is willing to try *any* sushi.

Sentences with the focus adverb *only* introduce negation covertly as part of their interpretation. One meaning component of sentences with the focus adverb *only* pertains to individuals who are being contrasted with the element in focus. The focused element in (37) and (38) is the subject NP, *Gen*. Both sentences generate the assertion that every individual being contrasted with Gen did not eat sushi. Although both sentences (37) and (38) generate this assertion, negation is not expressed overtly in either sentence. This is further confirmation for the proposition raised in the introduction that inverse scope assignments require

both scope-bearing expressions to be phonologically realized in the surface syntax.

The experimental hypotheses about the interpretation of sentences with VP ellipsis build upon this requirement. Before we state these hypotheses, though, it will be useful to briefly sketch the solution Klima proposed to salvage the parallelism constraint. According to this proposal, the constraint is operative in the problematic sentences, which are repeated here as examples (39) and (40).

(39) June will try some sushi, but Gen won't < ~~try some sushi~~ >.

(40) June will not try any sushi, but Gen will < ~~try *any sushi~~ >.

First consider the derivation of VP ellipsis in (39), shown in the three steps in (41). At the first step in the derivation, both the first and second conjunct contain the abstract morpheme, $\exists$. The lexical realization of this abstract morpheme, i.e. *some*, is only inserted into the first conjunct, following VP ellipsis. At step 2, the VP of the second conjunct is elided. Since both conjuncts contain $\exists$, the parallelism constraint is satisfied at step 2. Then, at step 3, the abstract morpheme $\exists$ is phonetically realized in the first conjunct. The existential expression *some* is inserted.

(41)

Step 1: June will try $\exists$ sushi, but Gen won't try $\exists$ sushi.

Step 2: June will try $\exists$ sushi, but Gen won't < ~~try $\exists$ sushi~~ >.

Step 3: June will try *some* sushi, but Gen won't.

A similar derivation can be given for sentence (40), with the NPI *any*, as indicated in (42). The VP is elided at step 2. At this step, the parallelism constraint is satisfied because both the first conjunct and the elided VP contain the abstract logical operator, $\exists$; the second conjunct does not contain an unlicensed *any*. Sentence (40) would be ungrammatical if *any* were phonologically realized in the second conjunct, because it would lack a Downward Entailing licenser.

(42)

Step 1: June was not willing to try $\exists$ sushi, but Gen was willing to try $\exists$ sushi.

Step 2: June was not willing to try $\exists$ sushi, but Gen was < ~~willing to try $\exists$ sushi~~ >.

Step 3: June was not willing to try any sushi, but Gen was.

The experimental hypotheses for the present study were based on a proposal by Goro (2004), which was in turn based on a speculation by Szabolcsi (2002). Following Goro, we propose that adult Mandarin speakers analyze the disjunction word *huozhe* 'or' with the [+PPI] value, whereas children initially take it to be with the [-PPI] value. However, we propose that the polarity sensitivity of the disjunction word *huozhe* 'or' is cancelled for adults when it appears in an elided VP. One way to cancel the polarity status of *huozhe* 'or' is to

adopt Klima's derivational analysis of the English PPI *some*. More specifically, the disjunction word can be analyzed as another allomorph of the existential quantifier, $\exists$.

To see why this is justified, consider a conversational context with just two individuals, June and Gen. In this finite domain, a sentence with disjunction, *June or Gen laughed*, is logically equivalent to an existential statement, *Someone laughed* (Jayaseelan, 2001; Crain and Khrentzos, 2010). This logical equivalence justifies substituting the existential operator, $\exists$, to represent disjunction phrases in sentences that undergo VP ellipsis, similar to the derivation outlined for English *some*. As a consequence, the existential operator/disjunction phrase in the second conjunct will be interpreted *in situ*, so it will generate a conjunctive entailment in the scope of negation.

4. The Experiment

The current experiment investigated the interpretation assigned to disjunction by Mandarin-speaking children and adults in negative sentences, when disjunction is overt and when it is covert. The aim of the study was to evaluate the prediction that children and adults would interpret sentences with an elided VP with disjunction in the same way, but that they would interpret disjunction differently in sentences with a ‘full’ VP. At first glance, it might appear unlikely that children and adults would assign the same interpretation if disjunction is not phonologically realized in the second conjunct, because negative sentences with disjunction have been found to evoke different interpretations from children and adults in languages such as Japanese, Mandarin Chinese, Russian and Turkish. However, the experimental hypothesis we are pursuing is that both negation and disjunction must be overt for adults to generate an inverse scope interpretation. If disjunction is part of an elided VP, both children and adults are expected to interpret disjunction *in situ*; both groups should assign a conjunctive interpretation to the disjunction phrase.

4.1 Participants

The participants included 60 monolingual Mandarin-speaking children between the ages of 4;2-5;1, with a mean age of 4;7. The children attended the Beijing Municipal Committee Organ Kindergarten. In addition, 40 adult native speakers of Mandarin (ranging in age from 22 to 28) formed the adult control group. The adults were recruited from Peking University or from Beijing Language and Culture University.

4.2 Experimental stimuli

The experiment had two conditions. The difference between the conditions was the lexical content of the second conjunct. In one condition, the second conjunct of the target sentence contained an overt disjunction phrase, as in (43). In the second condition, the VP in the second conjunct of the target sentence was elided, as in (44).

(43) *Tubaba neng zhuadao mifeng huozhe xiaoshe, danshi tubaobao bu neng zhuadao mifeng huozhe xiaoshe.*

Papa Rabbit can catch bee or snake but Baby Rabbit not can catch bee or snake

‘Papa Rabbit can catch bees or snakes, but Baby Rabbit cannot catch bees or snakes.’

(44) *Tubaba neng zhuadao mifeng huozhe xiaoshe, danshi tubaobao bu neng.*

Papa Rabbit can catch bee or snake but Baby Rabbit not can

‘Papa Rabbit can catch bees or snakes, but Baby Rabbit cannot.’

The first conjunct was held constant in both conditions, and it repeated in (45). This sentence contains the disjunction word *huozhe* ‘or’, and is expected to license a Free Choice ‘conjunctive’ inference in sentence (45).

(45) *Tubaba neng zhuadao mifeng huozhe xiaoshe.*

Papa Rabbit can catch bee or snake

‘Papa Rabbit can catch bees or snakes.’

Both Mandarin-speaking children and adults have been found to interpret sentences like (45) to mean that *Papa Rabbit is able to catch bees and Papa Rabbit is able to catch snakes* (Zhou, Romoli and Crain, 2013; Tieu, Romoli, Zhou and Crain, 2016). The Free Choice inference is drawn because the disjunction phrase appears in the scope of the epistemic modal verb *neng* ‘can’.

The first conjunct was followed by one of two continuations. One continuation was a full sentence. In the other continuation, the disjunction phrase was elided from the VP. The full sentence continuation is illustrated in (46).

(46) ... *danshi tubaobao bu neng zhuadao mifeng huozhe xiaoshe*.

... but Baby Rabbit not can catch bee or snake

‘... but Baby Rabbit cannot catch bees or snakes.’

Child: ‘Baby Rabbit cannot catch bees and cannot catch snakes.’ ‘Neither’

Adult: ‘It is bees or snakes that Baby Rabbit cannot catch.’ ‘Not both’

Sentence (46) contains both a negation marker *bu* ‘not’ and the disjunction word *huozhe* ‘or’. Earlier we noted that Mandarin-speaking children and adults assign different interpretations to sentences like (46). Consider a situation in which Baby Rabbit cannot catch snakes, but can catch bees. In this situation, adults judge (46) to be true, whereas children judge it to be false. Children reject (46) in this situation because they adopt the default setting of the Disjunction Parameter, according to which disjunction is not a PPI (i.e. the [-PPI] value). According to this value, disjunction is interpreted *in situ*, as in English.

Therefore, (46) generates a conjunctive entailment for Mandarin-speaking children; it entails that Baby Rabbit cannot catch bees and that Baby Rabbit cannot catch snakes. In contrast to children, adult speakers of Mandarin are expected to accept sentences like (46) in the same contexts. For adults, the disjunction word has the [+PPI] value of the Disjunction Parameter. On this value of the parameter, disjunction is forced to take scope over negation at the level of semantic interpretation. This yields the ‘not both’ interpretation. So, for adults, (46) is true as long as Baby Rabbit either cannot catch bees or cannot catch snakes.

A second continuation followed sentence (45) in the experiment. This continuation is sentence (47). In this sentence, both the main verb and the disjunction phrase have been elided. That is, the VP in (46) was *bu neng zhuadao mifeng huozhe xiaoshe* ‘not can catch bee or snake’; in (47) only the negation marker and the modal verb remain: *bu neng* ‘not can’.

(47) ... *danshi tubaobao bu neng*.

... but Baby Rabbit not can

‘... but Baby Rabbit cannot.’

Child: ‘Baby Rabbit cannot catch bees and cannot catch snakes.’	‘Neither’
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Adult: ‘Baby Rabbit cannot catch bees and cannot catch snakes.’	‘Neither’
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Because the disjunction phrase has been elided in (47), we predicted that it no longer takes scope over negation for either children or adults. In responding to (47), both Mandarin-speaking children and Mandarin-speaking adults were

expected to generate a ‘conjunctive’ entailment, i.e. the ‘neither’ interpretation. Mandarin-speaking children and adults were expected to interpret such sentences in the same way as English-speaking children and adults. Speakers of both languages should reject (47) in a situation in which Baby Rabbit can catch bees, but cannot catch snakes. These are the critical trials for our experimental hypotheses.

4.3 Procedures

The experiment used the Truth Value Judgment Task (Crain and Thornton, 1998; Goro, 2007, in press). There were two experimenters. One experimenter told short stories. The second experimenter played the role of the puppet, Kermit the Frog. The puppet watched the stories alongside the child participant. At the conclusion of each vignette, the characters in the story received rewards, according to the powers it had received from the Fengshui Master (the toy character Kung Fu Panda). The experiment went through the stories a second time, without any props; i.e., the bees and snakes were removed. The puppet was asked to tell the child and the experimenter what powers each of the characters had received from the Fengshui Master, based solely on the reward it had received. The child participant’s task was to judge whether the puppet’s description was right or wrong. If a child rejected the puppet’s statement, the experimenter then encouraged the child participant to explain to the puppet ‘what really happened’ in the story.

There were three characters in each test story. One of the characters was given the power to accomplish two tasks. The target sentences produced by the

puppet mentioned the two skills that each of the characters attempted to master (e.g., catching bees), using the powers it had been given by the Fengshui Master. One character mastered both of the skills mentioned in the test sentences, and was rewarded with a gold star. A second character mastered only one of the skills, and received a silver star. The third character did not master either skill, and received a black cross. This procedure is roughly represented in Figure 1, while the actual outcome of a test story is illustrated in Figure 2.

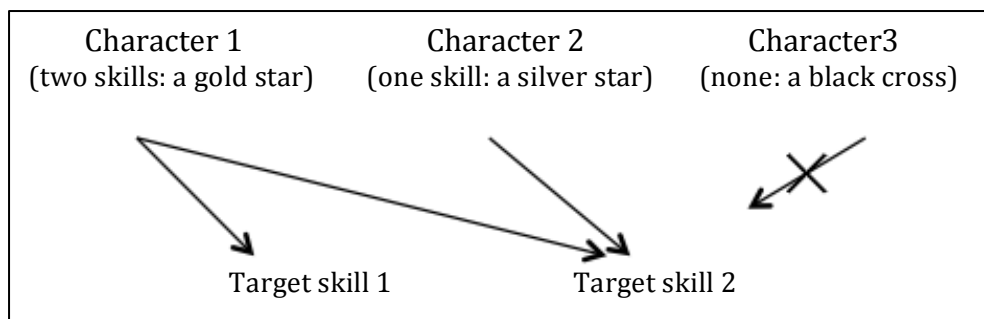


Figure 1: Outcomes of each character achieved in test stories



Figure 2: Actual outcomes of a typical trial

The experiment adopted a procedure that Goro (in press) refers to as the Uncertainty Mode. The Uncertainty Mode of the task is designed to satisfy the felicity conditions on the use of disjunction in the test sentences. The Uncertainty Mode requires the experimenter and the child participant to go through each trial twice. The first time, the three characters in each story were rewarded according to what they were able to accomplish. For example, one story was about catching animals, bees and snakes. On the second telling of the story, the bees and snakes had been removed, and the puppet tried to say what the animals had managed to catch solely based on the reward they had received. The three characters in each story attempted to gain magic powers from a Fengshui Master (the toy character Kung Fu Panda). The characters received rewards based on the powers they received, such as the power to catch bees or to catch snakes. In total, there were six trials. Each trial consisted of a filler sentence, a control sentence, and a target sentence.

As noted earlier, the first conjunct of each target sentence was designed to evoke a free choice interpretation, which explained why one of the characters were rewarded with a gold star. The free choice interpretation permitted the inclusion of disjunction in the test sentence to accurately refer to the gold star character. By introducing the modal verb *neng* 'is able to', it was possible to include disjunction in the first conjunct was able to describe the character that had been given powers to accomplish both of the tasks mentioned in the test sentences. A pre-test was conducted to ensure that the child participants in the present study were able to compute free choice inferences. Each child participant listened to sentences like (45), repeated below in (48). Both children and adults accepted the control sentences 100% of the time. It is unlikely,

therefore, that any of the child participants judged the test sentences to be false because they did not compute the free choice inference for the first conjunct.

(48) *Tubaba neng zhuadao mifeng huozhe xiaoshe.*

Papa Rabbit can catch bee or snake

‘Papa Rabbit can catch bees or snakes.’

To illustrate the stories presented to the participants in the main session, we will describe the story corresponding to sentence (43). The story was about a rabbit family that had moved to a new village. The Fengshui Master from the village attempted to teach the new rabbit family to become master animal-catchers. As part of their tuition, the Fengshui Master attempted to give the rabbit family the power to catch different kinds of animals. The Fengshui Master began by instructing the rabbit family in snail catching. All of the rabbits in the family quickly mastered the ability to catch snails, because snails move so slowly. Next, the rabbits tried to master the ability to catch two faster moving animals, bees and snakes.

The Fengshui Master set up the following reward system to encourage the rabbits to master each of the tasks set before them. Any rabbit that managed to become a master of snake-catching and a master of bee-catching was rewarded with a gold star. Any rabbit that became a master of either snake-catching or bee-catching, but not both, was rewarded with a silver star. Finally, any rabbit that did not master either skill received a black cross. At the end of the story, Papa Rabbit mastered both skills, and received a gold star. Baby

Rabbit mastered one of the skills, and received a silver star, and Mama Rabbit did not master either of the advanced skills, so she received a black cross.

In the second telling of the stories, the objects related to the skills were set to the side. The puppet, Kermit the Frog, was then asked to say what had happened in each of the stories, based on the rewards that each of the three characters had received. The progression of this trial is illustrated in Figure 3.

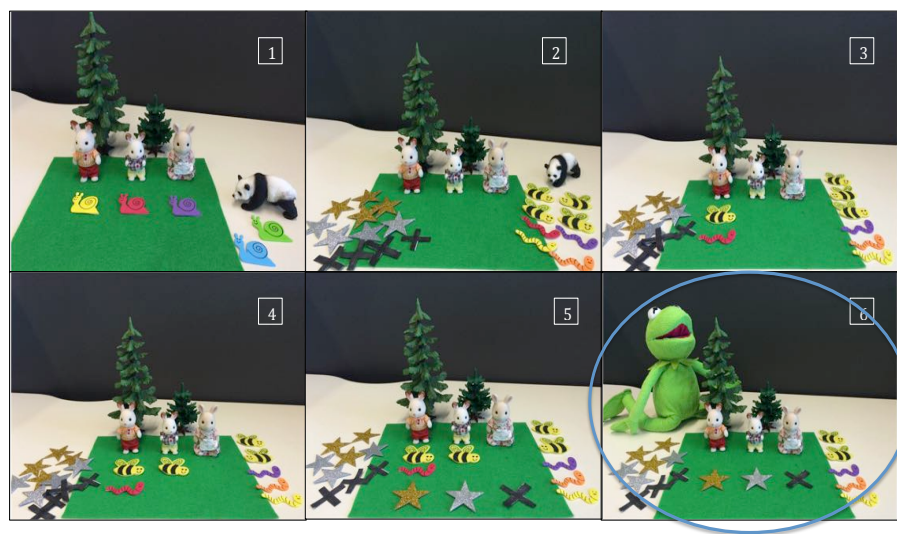


Figure 3: Progression of a typical trial

In the story about animal-catching, Kermit made the following comments, followed by the test sentence:

“In this story, the Fengshui Master gave the rabbits the ability to become a master at catching various animals. I don’t remember which abilities they were given. Let me see, Papa Rabbit has a gold star, and Baby Rabbit has a silver star. Let me guess,

*Tubaba neng zhuadao mifeng huozhe xiaoshe, danshi tubobao bu neng
zhuadao mifeng huozhe xiaoshe.*

Rabbit papa can catch-ASP bee or snake but rabbit baby not
can catch-ASP bee or snake

Was I right or wrong?"

5. Results

The critical test sentences were descriptions of the skills that had been acquired by the character with a gold star and the character with a silver star. Assuming that the participants accepted the first conjunct as a correct description of the gold star character, acceptances and rejections of the test sentences were based on the interpretation assigned to the second conjunct. As mentioned earlier, the experimental hypothesis was that adult participants would accept the test sentences with a full VP as a description of a character with a silver star, whereas children would reject these sentences. Adult acceptances were interpreted as evidence that adults adopt the [+PPI] value of the Disjunction Parameter, according to which disjunction takes scope over negation at the level of semantic interpretation. By contrast, since children initially assign the [-PPI] value of the Disjunction Parameter, the experimental hypothesis was that they would reject the test sentences, because they would interpret disjunction *in situ*.

This is exactly the pattern displayed by the child and adult participants. The results are summarized in Figure 4. In the full VP condition, children rejected the target sentences 83% of the time, whereas the rejection rate for adults was 35%. A Mann-Whitney U test revealed a significant between-group difference ($Z = 3.073$, $p = .02$). There was no significant difference between children and adults in the VP ellipsis condition: children rejected the test sentences 90% of the time; and adults rejected them 95% of the time.

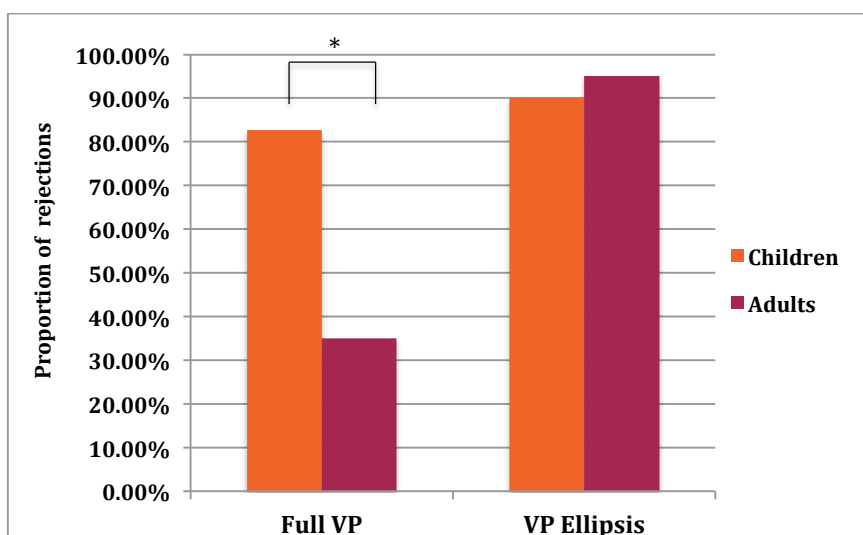


Figure 4: Proportion of rejections by children and adults

The justifications that children provided for their rejections reinforced the conclusion that they interpreted disjunction *in situ* in the test sentences. Children’s justifications consistently mentioned the character with the silver star, pointing out that this character had only been able to master one of the skills mentioned in the test sentences. Here are four examples of children’s justifications. One of the child participants (4;7) explained that “*Kermit is wrong because Baby Rabbit can catch either a bee or a snake.*” Another one (4;3) said “*No, what he said is wrong, he can catch one.*” Another child participant (5;1) said “*No, Baby Rabbit can catch one of them.*” And a fourth child (4;9) said “*Kermit can’t say Baby Rabbit can’t catch anything, because, because Baby Rabbit got a silver star.*” These justifications clearly indicate that children assign a conjunctive interpretation of disjunction under negation, as in one of de Morgan’s laws of classical logic. This is further evidence that the basic meaning of disjunction is inclusive-*or* for both children and adults, and it is revealed when the polarity sensitivity is cancelled in adult Mandarin.

6. Conclusion

The present study investigated how Mandarin-speaking children and adults interpreted disjunction in sentences with negation. The first conjunct of the coordinate structure was exactly the same in all of the test sentences. In one condition, both scope-bearing expressions were overt in the second conjunct, with negation preceding disjunction and taking scope over disjunction. In the other condition, although negation was overt, the disjunction phrase was elided from the second conjunct. As predicted, children and adults generated different scope assignments in the first condition, when both negation and disjunction were overt.

This finding is consistent with the previous literature showing that disjunction is a Positive Polarity Item (PPI) for adults, but not for children. Because disjunction is a PPI for adults, they assigned the inverse scope reading in response to sentences with a full VP. By contrast, because disjunction is not initially analyzed as a PPI for children, children interpreted disjunction *in situ* in both conditions. In both conditions, Mandarin-speaking children assigned a conjunctive interpretation to the second conjunct of the test sentences, whereas Mandarin-speaking adults only assigned this interpretation in the second condition, when disjunction was elided. The findings invite us to infer that, like the English PPI *some*, the polarity sensitivity of the Mandarin disjunction word *huozhe* ‘or’ is cancelled in certain linguistic structures. In these linguistic structures, both children and adults, across languages, are expected to assign the same interpretation, according to which disjunction has the truth conditions

associated with inclusive-*or*, as in classical logic (e.g. Crain & Khlentzos, 2010; Pietroski & Crain, 2012).

In addition, several follow-up experiments would be instructive to consider. For instance, what is the ‘invisible’ principle that governs language speakers’ interpretation when they encounter VP ellipsis constructions? When children start to display adult-like interpretations would be another question being worth investigating. Moreover, the verbs adopted in the present study were restricted to transitive verbs. If a polarity sensitive item such as Mandarin *huozhe* ‘or’ loses its polarity force when it is phonologically null, the same interpretative patterns uncovered by our study should be provided when both Mandarin-speaking children and adults encounter sentences like (49) and (50).

(49) June danced or sang, but Gen did not dance or sing.

(50) June danced or sang, but Gen did not.

CHAPTER 5

Conclusion

1. The main findings

This thesis presented a series of experimental investigations on how Mandarin-speaking children (and adult controls) interpret sentences with the Mandarin disjunction word *huozhe* ‘or’, in combination with negation or with the universal quantifier *mei* ‘every’. Chapter 1 reviewed the broad themes of the thesis. Of particular interest was how evidence from the experimental studies reported in the thesis could be used to create the kinds of ‘poverty of the stimulus’ arguments that have been discussed in the previous literature. In this sense, the three experiments were designed to be case studies of when Mandarin-speaking children and adults make the same scope assignments, but more importantly, when Mandarin-speaking children and adults generate different scope assignments. The following sections review the main findings of these three case studies.

1.1 Differences in scope assignments for child and adult speakers of Mandarin

The experiments reported in Chapter 2 investigated how Mandarin-speaking children and adults interpreted negative sentences with a disjunction phrase that preceded negation, as compared to sentences in which the disjunction phrase followed negation. These different sentence structures were constructed to examine whether changes in sentence structure resulted in changes in scope assignments by Mandarin-speaking children and adults. The two sentence types are shown in (1) and (2).

(1) *Nanhai-men meiyou zhaodao mifeng huozhe xiaoshe.*

Boy-PL not find bee or snake

(2) *Nanhai-men mifeng huozhe xiaoshe meiyou zhaodao.*

Boy-PL bee or snake not find

In sentences like (1), negation precedes disjunction inside the verb phrase (VP). This sentence type is referred to as the ‘OR in VP’ sentences. In sentences like (2), the disjunction phrase precedes negation. Assuming that the disjunction phrase originated inside the VP and was ‘preposed’ (or raised) to its position in the surface syntax in sentences like (2), these are referred to as the ‘Preposed OR’ sentences.

Previous research has shown the disjunction word *huozhe* ‘or’ is a positive polarity item (PPI) in Mandarin, at least for adults (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). Mandarin-speaking adults were thus expected to interpret disjunction as taking scope over negation, regardless of its position in the surface syntax. This led to one of the experimental hypotheses, i.e. the prediction that Mandarin-speaking adults would assign the same interpretation to sentences like (1) and (2), with disjunction taking scope over negation. If this prediction was upheld, then this would be taken as evidence that scope assignment for negative sentences with disjunction is not determined by the relevant linear sequence of the scope-bearing expressions for adult speakers of Mandarin.

The same prediction was made for children, with one important difference. In contrast to the adults, Mandarin-speaking children were expected

to generate the opposite scope assignments for sentences such as (1) and (2). For children, then, the experimental hypothesis was that negation would take scope over disjunction, again regardless of the relative position of these two scope-bearing expressions in the surface syntax. This experimental hypothesis was based on the Semantic Subset Principle (e.g. Berwick, 1985; Crain, Ni and Convey, 1994; Goro, 2007; Crain, 2012). According to this principle, children acquiring all human languages are expected to initially set the Disjunction Parameter to the [-PPI] value. On this value of the Disjunction Parameter, negation takes scope over disjunction (e.g. Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). Chapter 2 discussed the subset/superset scope assignments in detail, establishing that the subset value of the Disjunction Parameter is the [-PPI] value. This is because the [-PPI] value of the Disjunction Parameter makes sentences true in a narrower range of circumstances, as compared to the [+PPI] value.

Chapter 2 also reviewed the previous literature on young children's knowledge of reconstruction (e.g. Guasti and Chierchia, 1999/2000; Leddon, 2006; Kiguchi and Thornton, 2016). In order for negation to take scope over disjunction in sentences such as (2), the preposed disjunction phrase would have to be reconstructed. Because disjunction is a PPI for adults, reconstruction would be blocked when they were presented with sentences like (2); otherwise, disjunction would be interpreted within the scope of negation. Therefore, child and adult participants would still exhibit differences in assigning scope relations to negation and disjunction in the 'Preposed OR' sentence condition.

To test the experimental hypotheses, we interviewed 30 monolingual Mandarin-speaking children (age from 4;2 to 5;4) and 15 Mandarin-speaking

adults, using a Truth Value Judgment Task (Crain & Thornton, 1998). The 30 children were randomly divided into two groups. One group of 15 child participants was tested with the first sentence type, the 'OR in VP' condition, as illustrated in (1). The other group of 15 children was tested with the second sentence type, the 'Preposed OR' condition, as illustrated in (2). The adult controls were tested with both sentence types. The participants were presented with the same story in which four boys went into a forest to find animals, including snails, bees, and snakes. The story ended with the boys catching some snails and some snakes, but not bees.

The experimental hypothesis in Chapter 2 was that child participants would interpret negation as taking scope over disjunction in both conditions, assigning a conjunctive entailment of disjunction to sentences such as (1) and (2). Therefore, children were expected to reject the test sentences in both conditions. By contrast, the adults were expected to analyze disjunction as a positive polarity item (PPI), assigning disjunctive truth conditions to both sentence (1) and (2). Therefore, adults were expected to accept the same sentences in both experimental conditions.

The findings of the experiment conducted in Chapter 2 were largely as predicted. The child participants rejected the 'OR in VP' sentences 85% of the time and rejected the 'Preposed OR' sentences 90% of the time, following the story in which the characters indeed accomplished one of the two target actions mentioned in the target sentence (e.g. the above story in which the boys found animals). When asked to justify their rejections, the children pointed out that the boys in the story did find snakes. By contrast, the adult participants accepted both sentence (1) and (2) as a true description of the story 70% of the

time. The results suggest that, in both conditions, target sentences were assigned a conjunctive entailment of disjunction by children. However, the majority of the adult participants assigned disjunctive truth conditions to the disjunction phrase, *mifeng huozhe xiaoshe* ‘bees or snakes’, regardless of whether this phrase has been moved or not. Interpretations provided by the children and adults are illustrated in (3) and (4) respectively.

(3) It is bees or snakes that the boys didn’t find. [Adult interpretation]

(4) The boys didn’t find either bees or snakes. [Child interpretation]

It is worth noting the justifications that children produced for rejecting the ‘Preposed OR’ sentences. They rejected the target sentences because the boys found one of the two animals mentioned in the sentence, namely the snakes. This indicated that children interpreted negation as taking scope over disjunction in both types of sentences. This interpretation is called the conjunctive interpretation of disjunction in negative sentences. To generate the conjunctive interpretation, the preposed disjunction had to undergo reconstruction, such that it was positioned within the scope of negation at the level of semantic interpretation.

In contrast to the children, over two-thirds of the adult participants accepted the sentences. These acceptances indicated that the adults interpreted the preposed disjunction *in situ*, and consequently assigned disjunctive truth conditions to the target sentences. This supports the claim that Mandarin-speaking adults analyze disjunction as a PPI. If the disjunction phrase had

undergone reconstruction, adults would not have been able to analyze it as a PPI in the 'Preposed OR' sentences. The result would be an illegitimate interpretation for adults. Reconstruction was hence blocked for the adults.

There are other possible ways to account for the interpretation assigned by Mandarin-speaking children to the test sentences in which the disjunction phrase appeared inside the VP. Both the Isomorphism Principle (e.g. Musolino, 1998; Musolino and Lidz, 2003) and the Semantic Subset Principle (e.g. Berwick, 1985; Crain, Ni and Convey, 1994; Crain and Pietroski, 2001) could account for this scope assignment. However, the Isomorphism Principle cannot be used to explain children's interpretation for the 'Preposed OR' sentences like (2). Although reconstruction results in an 'inverse' scope assignment which is inconsistent with the Isomorphism Principle, this scope assignment is predicted by the Semantic Subset Principle. On this scope assignment, young children are selecting the subset value of the Disjunction Parameter (i.e. the [-PPI] value). In short, the Semantic Subset Principle explains children's behavior in two linguistic contexts, whereas the Isomorphism Principle only explains children's behavior in one. The experiment in Chapter 2 provides further evidence that young children initially adopt the subset value of the Disjunction Parameter. The experiment also provides evidence that disjunction is a PPI for the majority of adult speakers of Mandarin. This explains why adults were unable to reconstruct the disjunction phrase in the 'Preposed OR' test sentences.

1.2 Disjunction and universal quantification in Mandarin

Chapter 3 explored how Mandarin-speaking children and adults interpreted sentences with disjunction and the universal quantifier *mei* ‘every’. The test sentences are illustrated by example (5). In these test sentences, the disjunction phrase precedes the verb in the surface syntactic structure.

(5) *Mei-ge nanhai yong daozi huozhe chazi chi-le chaodan.*

Every-CL boy with/use knife or fork eat-ASP omelet

This sentence structure led to ambiguities for Mandarin speakers. The ambiguities arose for two reasons. First, the disjunction phrase, *yong daozi huozhe chazi* ‘with a knife or a fork’, can be interpreted in two different ways, because the word *yong* ‘with/use’ can be used either as a verb or as a preposition. Second, the position that the disjunction phrase occupied is neither a typical subject phrase, nor a typical object phrase. Instead, the disjunction phrase appears in a preverbal position, which usually contains the focused constituent of a sentence.

Mandarin permits three types of interpretation for sentences such as (5). If the word ‘*yong*’ is used as a verb, two different interpretations are accessible. On the first interpretation, the disjunction phrase, *yong daozi huozhe chazi* ‘with a knife or a fork’, modifies the subject. The sentence would mean that every boy who used a knife or a fork ate an omelet. This interpretation is similar to a sentence with a relative clause, despite there being no overt relative clause marker *de* appearing in sentence (5). On the second interpretation, the disjunction phrase would become a predicate phrase of sentence (5). The

sentence would mean that every boy used a knife or a fork and every boy ate an omelet. We call the first interpretation the relative clause interpretation, and the second interpretation the two-predicate interpretation. A third interpretation is accessed if ‘*yong/with*’ is used as a preposition. On this interpretation, the disjunction phrase is interpreted as an adjunct of the predicate phrase. Sentence (5) would be similar in meaning to the English sentence *Every boy ate an omelet with a knife or a fork*. We call this interpretation the reconstruction interpretation.

Previous research has shown that young children are successful in interpreting sentences with universal quantification (e.g. Gualmini, Meroni and Crain, 2003; Su and Crain, 2013). More specifically, children have been found to know the asymmetrical semantic properties denoted by the two arguments of the universal quantifier. The subject phrase (i.e. the first argument/restrictor) of the universal quantifier is downward entailing. Evidence for this is the fact that the subject phrase of the universal quantifier licenses the negative polarity items (NPIs) such as *any*. For our purposes, another fact is also important. When disjunction appears in the subject phrase of the universal quantifier, the sentence generates a conjunctive entailment. By contrast, the verb phrase (i.e. the second argument/nuclear scope) of the universal quantifier is not downward entailing, so it does not license NPIs, and does not generate a conjunctive entailment of disjunction. Based on these different semantic properties of the two arguments of the universal quantifier, we examined Mandarin speakers’ scope preferences in sentences with a universal quantifier and disjunction in preverbal position.

In the experiment conducted in Chapter 3, we tested 15 four-year-old children (age from 4;2 to 4;11), 15 five-year-old children (age from 5;3 to 6;2) and 15 adults, using the description mode of the Truth Value Judgment Task (Crain & Thornton, 1998). To distinguish the three possible interpretations for sentence (5), three types of experimental condition were created. We collected the participants' Yes/No responses to the target sentences in each experimental condition, and categorized the participants' response patterns into different types of interpretation.

The results showed that about half of the adult participants interpreted the disjunction phrase as the modifier of the subject phrase and accessed the relative clause interpretation. The other half interpreted the disjunction as the predicate phrase of the sentence, and they accessed the two-predicate interpretation. The results also showed that the five-year-old children accessed all three interpretations, including the one that was not provided by the adult participants (i.e. the reconstruction interpretation). Half of the five-year-olds interpreted the target sentences as sentences with a relative clause, about 30% of them accessed the two-predicate interpretation, while the remaining children generated the reconstruction interpretation. In the four-year-old age group, 12 out of the 13 children accessed the reconstruction interpretation, while one child assigned the two-predicate interpretation to the target sentences.²¹

These results indicated that the children accessed an interpretation (i.e. the reconstruction interpretation) that was not accessed by the adults. Moreover, the younger children (i.e. four-year-olds) displayed a strong

²¹ Three child participants were excluded from this study because they failed to pass the pretest trials. Thirteen four-year-old children and 14 five-year-old children proceeded to the formal testing session.

preference to reconstruct the preverbal disjunction phrase to a lower position at the level of semantic interpretation. This finding suggests that the younger children initially use a reconstruction analysis of the preverbal disjunction. In contrast to the children, this reconstruction operation is blocked for the adults. This is because adult speakers of Mandarin are aware of the focus-sensitive position that the disjunction phrase appears in the surface syntactic structure, and consequently interpret the disjunction phrase in place (e.g. Lee, 2005; Zhou and Crain, 2009). Therefore, it is unlikely that children base their interpretation on the adult input. It is also worth noting that, in the current experiment, access to available interpretations appeared to be a staged process across participant groups. More specifically, four-year-old children's access appeared largely restricted to the reconstruction interpretation, five-year-olds accessed all three interpretations, and adults accessed two surface scope interpretations. Differences across the age groups hence represent a developmental trajectory towards exhibiting more adult-like scope preference to the ambiguous sentences containing the universal quantifier and disjunction.

1.3 The interpretation of disjunction in VP ellipsis in Mandarin Chinese

The investigation in Chapter 4 involved a novel linguistic environment that is predicted to cancel polarity sensitivity, which is called Verb Phrase (VP) ellipsis structure. We examined how Mandarin-speaking children and adults interpreted coordinate structures, in which the second clause had negation and either overt or covert disjunction, as shown in sentences (6) and (7) respectively.

- (6) *Tubaba neng zhua-dao mifeng huozhe xiaoshe, danshi tubaobao bu neng*
Papa Rabbit can catch-ASP bee or snake but Baby Rabbit not can
zhuadao mifeng huozhe xiaoshe.
catch bee or snake

- (7) *Tubaba neng zhua-dao mifeng huozhe xiaoshe, danshi tubaobao bu neng.*
Papa Rabbit can catch-ASP bee or snake but Baby Rabbit not can

In Mandarin, the disjunction word *huozhe* ‘or’ is a positive polarity item (PPI) for adults, but not for children (e.g. Goro, 2004; Jing, Crain and Hsu, 2005; Crain, Goro, Notley and Zhou, 2014). Mandarin-speaking children and adults thus display different scope preferences when they interpret negated disjunctions.

Based on previous research, we predicted that children and adults would have different scope assignments to negation and disjunction when both of these scope-bearing expressions are phonetically realized (see sentence (6)). Suppose, for example, a situation in which Baby Rabbit can catch bees, but cannot catch snakes. Mandarin-speaking adults would judge sentence (6) to be

true, whereas children would reject the same sentence. This is, again, because of the different values designated by child and adult speakers of Mandarin to the Disjunction Parameter. More specifically, Mandarin-speaking children would interpret negation as taking scope over disjunction, and assign a conjunctive entailment of disjunction, i.e., *Baby Rabbit cannot catch bees and Baby Rabbit cannot catch snakes*, to sentence (6). By contrast, Mandarin-speaking adults would assign the scope relation to negation and disjunction in a different way. They would analyze disjunction as taking scope over negation, and interpret sentences like (6) as an English cleft structure *It is bees or snakes that Baby Rabbit cannot catch*.

In responding to the coordinate structures in which the second clause had negation and covert disjunction (see sentence (7)), a parallelism constraint needs to be followed (e.g. Chomsky, 1995; Thornton and Wexler, 1999). This constraint requires the elided verb phrase (VP) in the second clause to replicate the interpretation of the overt VP in the first clause. However, previous work has also demonstrated that elided VPs containing polarity sensitivity items appear not fully replicated. For example, the positive polarity of the existential quantifier *some* is cancelled when it appears in an elided VP that contains overt negation (cf. Crain, 2012). This invites us to infer that adults' inverse scope assignment to negation and disjunction in sentence (6) (i.e. disjunction taking scope over negation), which is caused by the positive polarity of the disjunction word *huozhe* 'or', requires both scope-bearing expressions to be phonologically realized in the surface syntax.

Therefore, in responding to VP ellipsis structures, we predicted that the polarity sensitivity of *huozhe* 'or' would be neutralized. Both children and adults

were expected to interpret negation as taking scope over disjunction. That is, both of them would assign the conjunctive entailment of disjunction, i.e., *Baby Rabbit cannot catch bees and Baby Rabbit cannot catch snakes*, to the target sentences with elided disjunction.

Using the Truth Value Judgment Task (Goro, in press; Crain & Thornton, 1998) and a between-subjects design, we interviewed 60 four-year-old Mandarin-speaking children (age from 4;2 to 5;1) and 40 adults. By going through the same experimental procedure, the sentences with overt disjunction were presented to 30 children and 20 adults, while the sentences with elided disjunction were presented to the remaining 30 children and 20 adults.

To satisfy the felicity conditions on the use of disjunction in the target sentences, the experiment adopted the Uncertainty Mode of the Truth Value Judgment Task (cf. Goro, in press). The Uncertainty Mode requires the experimenter and the participant to go through each trial twice. The first time, the three characters in each story were rewarded according to what they were able to accomplish. On the second telling of the story, the target objects (e.g. bees, snakes) had been removed. After the conclusion of six stories, the puppet uttered a sentence, which described what the target actions the characters had managed to accomplish. The participants were asked to provide judgments based on the reward the characters had received.

The results were in line with what had been predicted. In the full VP condition (i.e. coordinate structures with overt disjunction), the children rejected target sentences like (6) 83% of the time, whereas the adults accepted the same sentences 65% of the time. In the VP ellipsis condition (i.e. coordinate structures with covert disjunction), the children rejected test sentences like (7)

90% of the time, and the adults rejected them 95% of the time. Moreover, the justifications that the children provided for their rejections reinforced the conclusion that they interpreted the disjunction phrase *in situ* in the sentences both with the disjunction phrase and with the elided one.

The findings are thus in accordance with previous literature, which has demonstrated that the disjunction word *huozhe* ‘or’ is a positive polarity sensitivity item for adults, but not for children in Mandarin. Therefore, when the adults were presented with coordinate structures with overt disjunction, they raised the disjunction phrase outside the scope of negation at the level of semantic interpretation, and consequently assigned the inverse scope interpretation to negated disjunctions. However, when the disjunction phrase was elided, its positive polarity was subsequently cancelled. Mandarin-speaking adults interpreted the elided disjunction *in situ* and assigned a conjunctive entailment of disjunction to VP ellipsis structures. Similarly, this interpretation was also assigned by child speakers of Mandarin. Therefore, the novel finding that we can take from this chapter is that the polarity sensitivity of disjunction is cancelled in a coordinate structure with VP ellipsis. Child interpretation and adult interpretation for sentences having negation and disjunction converge when the disjunction word becomes not sensitive to positive polarity for adults. Both Mandarin-speaking children and adults analyze negation as taking scope over disjunction, as long as the language-specific feature (i.e. the positive polarity of disjunction) is no longer involved in semantic interpretation.

2. Concluding remarks

This thesis presented a detailed investigation of Mandarin, i.e. a discourse configurational language (e.g. É Kiss, 1995; Yuan, 2006; Huang, Li and Li, 2008; Shi, 2008), regarding the interpretations assigned by child and adult speakers of Mandarin to various structures with disjunction. We reviewed certain linguistic properties of Mandarin Chinese by using the disjunction word *huozhe* ‘or’ alongside another scope-bearing expression (either the negative marker *meiyou* ‘not’ or the universal quantifier *mei* ‘every’).

Recall the three linguistic structures explored in the present thesis, i.e. negative sentences with preposed disjunction, universal quantificational sentences with disjunction in preverbal position, and negative coordinate structures with elided disjunction. Each of these linguistic structures to some extent undergoes structural changes, which potentially give rise to new possibilities of assigning scope relations between the two scope-bearing expressions that co-exist in the same sentence.

Moreover, in responding to the three types of linguistic structures under investigation, certain language knowledge is required. The required knowledge of language cannot be learnt either from the adult input or by observing the surface syntax. Investigations into how Mandarin-speaking children interpret these linguistic structures may provide evidence for the claim that some part of the knowledge of language is innately specified in the human mind. That is, if young children succeed in processing these linguistic structures that involve the gap between the knowledge of language and the limited language stimulus, the only way to account for young children’s language knowledge seemingly having

no explicit source, is that this knowledge originates inside the human mind itself.

A key finding from the three experimental chapters (i.e. Chapter 2, Chapter 3 and Chapter 4) is that four-year-old Mandarin-speaking children exhibit non-adult-like interpretations across three types of linguistic structures. In cases where disjunction interacts with negation (Chapter 2 and Chapter 4), our studies largely replicated the findings of previous research, which has demonstrated that the disjunction word *huozhe* ‘or’ is designated to the [+PPI] value for Mandarin-speaking adults, whereas it is designated to the [-PPI] value for young children. A novel finding revealed by this thesis is that these interpretative differences still exist when Mandarin-speaking children and adults are presented with sentences involving movement, which makes disjunction precede negation in the surface syntax (Chapter 2). Given the finding that changes in sentence structure have no effect on the assignment of the scope relations for both children and adults, this suggests that reconstruction is permitted for children, whereas it is blocked for adults due to the positive polarity of disjunction in adult Mandarin.

It is also worth noting that all of these patterns of responses are in line with the prediction proposed by the Semantic Subset Principle (Berwick, 1985; Crain, Ni and Conway, 1994, among others). The way that Mandarin-speaking children initially designate the [-PPI] value to the Disjunction Parameter is the optimal choice to avoid potential language learnability problems. This initial parameter setting by children also guarantees that they encounter positive evidence and convert their parameter setting into the adult’s one if the local adult language adopts a different value of the relevant parameters. Another

novel finding to emerge from this thesis is that the different scope preferences to negated disjunctions assigned by child and adult speakers of Mandarin are eliminated in contexts where the polarity sensitivity of disjunction is cancelled (Chapter 4).

In regard to the interpretive disparities between the younger children and the adults when they interpreted universal quantificational sentences with a preverbal disjunction (Chapter 3), again, reconstruction that is invoked to account for sentence ambiguities appears to be blocked for Mandarin-speaking adults. This happens not because of the polarity sensitivity of disjunction, but because of the syntactic position where the disjunction phrase appears. Since the preverbal position is a position where the focused constituent typically appears (e.g. Ernst and Wang, 1995; Shyu, 1995), and Mandarin-speaking adults tend to generate a cleft-structure interpretation for the focus-sensitive constituent (e.g. Zhou and Crain, 2009), adult speakers of Mandarin thus regard the disjunction phrase headed by a preposition as a focus-sensitive constituent and interpret it in place. This finding is also consistent with previous research that has shown children are less influenced by pragmatic principles and certain language-specific features when they make judgments on conversational utterances, as compared to the judgments of adults (e.g. Goro, Minai and Crain, 2005; Crain, 2008; Katsos and Bishop, 2011). In addition, the younger children exhibit a strong preference to access the reconstruction interpretation that is not employed by the adult speakers of Mandarin, but is widely observed in English. This is in line with the Continuity Hypothesis, which claims that the way child language differs from the local adult language, can only be in the same

way that different adult languages differ from each other (e.g. Pinker, 1984; Crain and Pietroski, 2001; Crain, 2002).

To conclude, these young children's language behaviors observed in the present thesis cannot be accounted for by what they hear or see in the surrounding environment. That is, both the usage-based account and the Isomorphism Principle fail to explain Mandarin speakers' data presented in this thesis. In order for children to process these complicated sentences, there must be some degree of language knowledge embedded in the human mind (i.e. Universal Grammar). Taking our findings and previous research together, it is plausible to propose that abstract linguistic operations, which are used to interpret sentences involving movement and VP ellipsis such as reconstruction and the parallelism constraint, are part of innate knowledge. This is because the language stimuli are too impoverished to provide interpretative materials either for reconstruction or for recovering elided constituent. These materials can only be generated by the innate endowment of the human mind itself (e.g. Chomsky, 1995; Cook and Newson, 1996; Thornton and Wexler, 1999; Guasti and Chierchia, 1999/2000; Crain, 2008, 2012; Crain, Koring and Thornton, 2016, among others).

3. Remaining questions and future research

One of the remaining issues that arises in this thesis is the examination of Mandarin-speaking adults' responses to negative sentences with disjunction in ordinary declarative contexts. There is a slight disparity between the findings of our studies and what has been revealed by previous work. In Chapter 2, for instance, about one-third of the adult participants rejected negative sentences with disjunction such as, *Nanhai-men meiyou zhaodao mifeng huozhe xiaoshe* 'The boys didn't find bees or snakes', following a scenario in which the boys only found one of these two animals. This interpretation does not appear to be predicted by the Disjunction Parameter account, which claims that adult speakers of Mandarin assign the [+PPI] value to the disjunction word. This leads us to suspect that pragmatic implicature arises in the course of the adult participants' interpretation of these target sentences. It is possible that adults remembered what exactly had happened in the story, and believed that the puppet's statement is less than informative. Nevertheless, the difference in response rates by child participants versus adult participants — 85% rejection versus 30% rejection — has made the empirical point for our study. That is, it is unlikely that young children acquire the way interpreting negative sentences with disjunction from the local adult input.

Another issue to be considered in further research is how and at what age children's interpretations of sentences with disjunction and another scope-bearing expression converge on the local adult's interpretations of these sentences. To answer this question, it may be useful to conduct a corpus study (e.g. searching data in CHILDES database) to find out how often Mandarin-

speaking children hear the relevant utterances. It is also worth carrying out a follow-up study that examines how five- to six-year-old children (i.e. those who are older than the child participants recruited for the experiments conducted in this thesis) interpret the negative sentences with disjunction, which were assigned different interpretations by adults and four-year-olds.

As shown in previous chapters, changes in sentence structure provide a fertile ground to examine children's competence in assigning scope relations among scope-bearing expressions, as well as operating binding relations among noun phrases. This is because sentence structure changes usually bring about a gap between the surface syntax and the semantic interpretation. Future studies may continue to investigate whether structural changes give rise to new possibilities for binding relations between noun phrases (i.e. Binding Principles) in Mandarin Chinese. If Mandarin-speaking children are successful in identifying the binding constraints between noun phrases (e.g. anaphors, pronouns and referential expressions) in the absence of a c-command relationship in the surface syntax, it would add to the argument in support of young children's knowledge of reconstruction, as well as their competence in recovering elided constituent to access sentence meanings. Given the fact that interpreting sentences involving either reconstruction or recovery of elided constituents requires certain knowledge that cannot be learnt from postnatal input, further studies regarding children's mastery of binding principles either in 'reconstructed' contexts or in elided structures would provide additional evidence for arguments from the 'poverty of the stimulus'.

References

- Badan, L. (2008). Preposed object and low periphery in Mandarin Chinese. *Studies in Linguistics CISCL Working Papers* (Vol. 2, pp. 19-42).
- Berwick, R. C. (1985). *Acquisition of Syntactic Knowledge*. Cambridge, MA/London, England: The MIT Press.
- Boster, C. T., & Crain, S. (1993). On children's understanding of *Every* and *Or*. In *Conference Proceedings: the Early Cognition and the transition to language*, University of Texas, Austin.
- Carnie, A. (2006). *Syntax - A Generative Introduction* (2 nd.). Malden, MA, USA: Blackwell Publishing.
- Chierchia, G., Crain, S., Guasti, M. T., Gualmini, A., & Meroni, L. (2001). The acquisition of disjunction: Evidence for a grammatical view of scalar implicatures. In H.-J. Anna (Ed.), *BUCLD 25 Proceedings* (pp. 157-168). Somerville, MA: Cascadilla Press.
- Chierchia, G., Guasti, M. T., Gualmini, A., Meroni, L., Crain, S., & Foppolo, F. (2004). Semantic and pragmatic competence in children's and adults' comprehension of *or*. In Ira A. Noveck & D. Sperber (Eds.), *Experimental Pragmatics*. New York: Palgrave Macmillan.
- Chomsky, N. (1976). Conditions on rules of grammar. *Linguistic Analysis*, 2, 303-351.
- Chomsky, N. (1981). *Lectures on Government and Binding - The Pisa Lectures*. USA: Foris Publications.
- Chomsky, N., & Lasnik, H. (1993). The theory of principles and parameters. In J. Jacobs, A. Stechow, W. Sternefeld, & T. Venneman (Eds.), *Syntax: An International Handbook of Contemporary Research* (Vol. 1).
- Chomsky, N. (1995). *The Minimalist Program*. Cambridge, MA: MIT Press.
- Chomsky, N. (2015). A minimalist program for linguistic theory. In N. Chomsky (Ed.), *The Minimalist Program* (pp. 153-199). Cambridge, MA: The MIT

- Press.
- Conroy, A., Lidz, J., & Musolino, J. (2009). The fleeting isomorphism effect. *Language Acquisition*, 16(2), 106-117.
- Cook, V., & Newson, M. (1996). *Chomsky's Universal Grammar* (2 nd.). Oxford, UK: Blackwell Publisher.
- Crain, S., & Mckee, C. (1985). The acquisition of structural restrictions on anaphora. In *Proceedings of NELS 15* (pp. 94-110). GLSA, University of Massachusetts, Amherst.
- Crain, S. (1991). Language acquisition is the absence of experience. *Behavioral and Brain Sciences*, 14, 597-650.
- Crain, S., & Phillip, W. (1993). *Global semantic dependencies in child language*. Paper presented at the 16th GLOW Colloquium, Lund, Sweden.
- Crain, S., Ni, W., & Conway, L. (1994). Learning, Parsing, and Modularity. In C. J. Clifton, L. Frazier, & K. Rayner (Eds.), *Perspectives on Sentence Processing* (pp. 443-467). New York, USA: Psychology Press.
- Crain, S., Thornton, R., Boster, C. T., Conway, L., Lillo-Martin, D., & Woodams, E. (1996). Quantification without quantification. *Language Acquisition*, 5, 83-153.
- Crain, S., & Thornton, R. (1998). *Investigation in Universal Grammar—A Guide to Experiments on the Acquisition of Syntax*. Cambridge, MA: MIT Press.
- Crain, S., & Pietroski, P. (2001). Nature, nurture and Universal Grammar. *Linguistics and Philosophy*, 24(2), 163-183.
- Crain, S., Gardener, A., Gualmini, A., & Rabbin, B. (2002). Children's command of negation. In Y. Otsu (Ed.), *The Third Tokyo Conference on Psycholinguistics* (pp. 71-95). Tokyo, Japan: Hituzi Syobo Publishing.
- Crain, S. (2008). The interpretation of disjunction in universal grammar. *Language and Speech*, 51(1&2), 151-169.
- Crain, S., Thornton, R., & Khlentzos, D. (2008). The case of the missing generalizations. *Cognitive Linguistics*, 20(1), 145-155.
- Crain, S., & Khlentzos, D. (2010). The logic instinct. *Mind & Language*, 25, 30-65.
- Crain, S. (2012). *The Emergence of Meaning*. New York: Cambridge University Press.
- Crain, S., Goro, T., Notley, A., & Zhou, P. (2014). A Parametric account of scope in

- child language *Advances in language acquisition* (pp. 63-71). Newcastle: Cambridge Scholars Publishing.
- Crain, S., & Thornton, R. (2015). 3rd year grammar. In A. Gallego & D. Ott (Eds.), *50 Years Later* (pp. 71-84). Cambridge, USA: MIT Working Papers in Linguistics.
- Crain, S., Koring, L., & Thornton, R. (2016). Language acquisition from a biolinguistic perspective. *Neuroscience and Biobehavioral Reviews*, 9(004), 1-30.
- Croft, W. (2001). *Radical Construction Grammar*. Oxford, UK: Oxford University Press.
- de Villiers, J., & Roeper, T. (1996). Questions after stories: Supplying context and removing it as a variable. In D. McDaniel, D. Cairns, & C. Mckee (Eds.), *Methodology in Child Language Research* (pp. 163-188). Hillsdale, NJ: Erlbaum.
- Ernst, T., & Wang, C. (1995). Object Preposing in Mandarin Chinese. *Journal of East Asian Linguistics*, 4(3), 235-260.
- É Kiss, K. (1995). Discourse configurational languages introduction. In K. É Kiss (Ed.), *Discourse Configurational Languages* (pp. 3-20). New York & Oxford: Oxford University Press.
- É Kiss, K. (1998). Identificational focus versus information focus. *Language*, 74, 245-273.
- Fiengo, R., & May, R. (1994). *Indices and Identity*. Cambridge, Massachusetts: MIT Press.
- Fox, D. (1999). Reconstruction, binding theory, and the interpretation of chains. *Linguistic Inquiry*, 30(2), 157-196.
- Geçkin, V., Crain, S., & Thornton, R. (2016). The interpretation of logical connectives in Turkish. *Journal of Child Language*, 43(4), 784-810.
- Goro, T. (2004). *The emergence of Universal Grammar in the emergence of language: the acquisition of Japanese logical connectives and positive polarity*. (MA), The University of Maryland.
- Goro, T., & Akiba, S. (2004a). The acquisition of disjunction and positive polarity in Japanese. In V. Chand, A. Kelleher, A. J. Rodriguez, & B. Schmeiser (Eds.), *Proceedings of the 23rd West Coast Conference on Formal*

- Linguistics* (pp. 251-264). Somerville, MA: Cascadilla Press.
- Goro, T., & Akiba, S. (2004b). Japanese disjunction and the acquisition of positive polarity. In Y. Otsu (Ed.), *Proceedings of the 5th Tokyo Conference on Psycholinguistics* (pp. 137-162). Tokyo: Hituzi Shobo Publishing Company.
- Goro, T., Minai, U., & Crain, S. (2005). Two disjunctions for the price of only one. In A. Brugos, M. R. Clark-Cotton, & H. S. (Eds.), *Proceedings of the 29th Boston University Child Language Development Conference* (pp. 228-239). Somerville, MA: Cascadilla Press.
- Goro, T. (2007). *Language-specific constraints on scope interpretation in first language acquisition*. (PhD Dissertation), University of Maryland.
- Goro, T. (in press). Negation Uncertainty, and the Truth Value Judgment Task. In M. Nakayama & Y.-C. Su (Eds.), *Studies in Chinese and Japanese Language Acquisition: In Honor of Stephen Crain* (pp. 12-29): John Benjamins Publishing Company.
- Grice, H. P. (1989). *Studies in the Way of Words*. Cambridge, MA: Harvard University Press.
- Gualmini, A., & Crain, S. (2002). Why no child or adult must learn de Morgan's laws. In B. Skarabela, S. Fish, & A. H-J Do (Eds.), *Proceedings of the 26th Boston University Child Language Development Conference* (pp. 367-378). Somerville, MA: Cascadilla Press.
- Gualmini, A., Meroni, L., & Crain, S. (2003). Children's asymmetrical responses. In *Proceedings of the Fourth Tokyo Conference on Psycholinguistics* (pp. 135-158). Tokyo, Japan.
- Gualmini, A., & Crain, S. (2005). The structure of children's linguistic knowledge. *Linguistic Inquiry*, 36(3), 463-474.
- Gualmini, A. (2006). Some facts about quantification and negation one simply cannot deny: A reply to Gennari and MacDonald. *Language Acquisition*, 13(4), 363-370.
- Guasti, M., & Chierchia, G. (1999/2000). Backward versus forward anaphora: Reconstruction in child grammar. *Language Acquisition*, 8(2), 129-170.
- Guo, F., Foley, C., Chien, Y.-C., Chiang, C.-P., & Lust, B. (1996). Operator-variable binding in the initial state: A cross-linguistic study of VP ellipsis

- structures in Chinese and English. *Cahiers de linguistique- Asie orientale*, 25(1), 3-34.
- Guo, R. (2006). Entailment and negation. *Chinese Teaching in the World*, 2(76), 7-19 (in Chinese).
- Haegeman, L. (1994). *Introduction to Government and Binding Theory* (2 nd.). Oxford, UK & Cambridge, USA: Blackwell Publishers.
- Hankamer, J., & Sag, I. (1976). Deep and surface anaphor. *Linguistic Inquiry*, 391-428.
- Heycock, C. (1994). *Layers of Predication: The Non-Lexical Syntax of Clauses*. New York: Garland.
- Heycock, C., & Kroch, A. (2002). Topics, focus, and syntactic representations. In A. Mikkelsen & C. Potts (Eds.), *Proceedings of the 21st West Coast Conference on Formal Linguistics* (pp. 141-165). Somerville, MA: Cascadilla Press.
- Hiramatsu, K., & Lillo-Martin, D. (1998). Children Who Judge Ungrammatical What They Produce. In *Proceedings of the 22nd annual Boston University Conference on Language Development* (Vol. 1, pp. 337-347). Somerville, Massachusetts: Cascadilla Press.
- Hirst, W., & Weil, J. (1982). Acquisition of epistemic and deontic meaning of modal. *Journal of Child Language Acquisition*, 659-666.
- Horn, L. R. (1969). A presuppositional approach to *only* and *even*. *Chicago Linguistic Society*, 5, 98-107.
- Horn, L. R. (2002). Assertoric inertia and NPI licensing. *Chicago Linguistic Society*, 38(3), 55-82.
- Huang, B., & Liao, X. (1998). *Modern Chinese* (2 ed.): Higher Education Press (in Chinese).
- Huang, C.-T. J. (1982). *Logical relations in Chinese and the theory of grammar*. (PhD), MIT.
- Huang, C.-T. J. (1993). Reconstruction and the structure of VP: Some theoretical consequences. *Linguistic Inquiry*, 24(1), 103-138.
- Huang, C.-T. J., Li, Y.-H. A., & Li, Y. (2008). *The Syntax of Chinese*. Cambridge, UK: Cambridge University Press.
- Jayaseelan, K. A. (2001). Questions and question-word incorporating quantifiers

- in Malayalam. *Syntax*, 4(2), 63-93.
- Jing, C., Crain, S., & Hsu, C.-F. (2005). The interpretation of focus in Chinese: child vs. adult language. In Y. Otsu (Ed.), *Proceedings of the 6th Tokyo Conference on Psycholinguistics* (pp. 165-179). Tokyo: Hituzi Syobo Publishing Company.
- Jing, C. (2008). *Pragmatic computation in language acquisition: Evidence from disjunction and conjunction in negative context*. (PhD), University of Maryland, College Park.
- Katsos, N., & Bishop, D. V. M. (2011). Pragmatic tolerance: Implications for the acquisition of informativeness and implicature. *Cognition*, 120(1), 67-81.
- Kiguchi, H., & Thornton, R. (2004). Binding principles and ACD constructions in child grammars. *Syntax*, 7(3), 234-271.
- Kiguchi, H., & Thornton, R. (2016). Connectivity effects in pseudoclefts in child language. *Studia Linguistica*, 70(1), 34-65.
- Klima, E. S. (1964). Negation in English. In J. A. Fodor & J. J. Katz (Eds.), *The Structure of Language: Readings in the Philosophy of Language*. Englewood Cliffs, NJ: Prentice-Hall.
- Lasnik, H. (1999). On feature strength: Three minimalist approaches to overt movement. *Linguistic Inquiry*, 30(2), 197-217.
- Leddon, E. M. (2006). *Reconstruction effects in child language*. (PhD Dissertation), Northwestern University.
- Lee, T. H.-T. (1991). Linearity as a scope principle for Chinese: the evidence from first language acquisition. In D. Napoli & J. Kegl (Eds.), *Bridges Between Psychology and Linguistics* (pp. 183-206). Lawrence Erlbaum, Hillsdale, NJ.
- Lee, H.-C. (2005). *On Chinese focus and cleft constructions*. (PhD), National Tsing Hua University.
- Lee, O.-S. (2010). Acquisition of Korean disjunction under negation. *Working Papers in Linguistics. Department of Linguistics, University of Hawai'i at Mānoa*, 41(7).
- Li, R., Shi, D., & Hu, J. (2012). The acquisition of elliptical constructions in child language. *Zhongguo Yuwen*, 348(3), 211-224 (in Chinese).
- Lidz, J., & Musolino, J. (2002). Children's command of quantification. *Cognition*,

84(2), 133-154.

- Lust, B., Eisele, J., & Mazuka, R. (1992). The Binding Theory module: Evidence from first language acquisition for Principle C. *Language*, 68(2), 333-358.
- Matsuo, A., & Duffield, N. (2001). VP-ellipsis and anaphor in child language acquisition. *Language Acquisition*, 9(4), 301-327.
- McDaniel, D., & Cairns, H. S. (1990). The child as informant: Eliciting intuitions from young children. *Journal of Psycholinguistic Research*, 19, 331-344.
- Meroni, L., Gualmini, A., & Crain, S. (2000). A conservative approach to quantification in child language *Proceedings of the 24th Annual Penn Linguistics Colloquium* (pp. 171-182). PA, USA: UPenn.
- Molnár, V. (2006). On different kinds of contrast. In V. Molnár & S. Winkler (Eds.), *The Architecture of Focus* (pp. 197-233). Berlin: Mouton de Gruyter.
- Moscatti, V., & Crain, S. (2014). When negation and epistemic modality combine: then role of information strength in child language. *Language Learning and Development*, 10, 345-380.
- Musolino, J. (1998). *Universal Grammar and the acquisition of semantic knowledge: An experimental investigation of quantifier-negation interaction in English*. (PhD), University of Maryland.
- Musolino, J., & Lidz, J. (2002). Preschool logic: truth and felicity in the acquisition of quantification. In B. Skarabela, S. Fish, & A. H.-J. Do (Eds.), *Proceedings of the 26th Boston University Conference on Language Development* (pp. 604-416). Somerville, MA: Cascadilla Press.
- Musolino, J., & Lidz, J. (2003). The scope of Isomorphism: Turning adults into children. *Language Acquisition*, 11(4), 277-291.
- Musolino, J. (2006). Structure and meaning in the acquisition of scope. In V. Geenhoven (Ed.), *Semantics in Acquisition*. Dordrecht, The Netherlands: Springer.
- Musolino, J., & Lidz, J. (2006). Why children aren't universally successful with quantification. *Linguistics*, 44(4), 817-852.
- Musolino, J. (2011). Studying language acquisition through the Prism of Isomorphism. In J. d. Villiers & T. Roeper (Eds.), *Handbook of Generative Approaches to Language Acquisition* (Vol. 41, pp. 311-349): Springer.

- Notley, A., Zhou, P., Crain, S., & Thornton, R. (2009). Children's interpretation of focus expressions in English and Mandarin. *Language Acquisition*, 16(4), 240-282.
- Noveck, I. A. (2001). When children are more logical than adults: Experimental investigations of scalar implicature. *Cognition*, 78(2), 621-643.
- Pan, H., & Hu, J. (2000). *Head noun movement, focus, and topicalization in Mandarin Chinese*.
- Pan, H. (2006). Focus, tripartite structure, and the semantic interpretation of Mandarin *dou*. *Research and Exploration on Grammar*, 13, 163-184.
- Pietroski, P., & Crain, S. (2012). The language faculty. In E. Margolis, R. Samuels, & S. P. Stich (Eds.), *The Oxford Handbook of Philosophy and Cognitive Science* (pp. 361-381). New York: Oxford University Press.
- Pinker, S. (1984). *Language Learnability and Language Development*. Cambridge, MA: MIT Press.
- Radford, A. (2004). *Minimalist Syntax: Exploring the Structure of English*. Cambridge, UK: Cambridge University Press.
- Reeve, M. (2011). The syntactic structure of English clefts. *Lingua*, 121, 142-171.
- Rizzi, L. (2014). Syntactic cartography and the syntacticisation of scope-discourse semantics. In A. Reboul (Ed.), *Mind, Values, and Metaphysics—Philosophical Essays in Honor of Kevin Mulligan* (Vol. 2, pp. 517-533). Switzerland: Springer International Publishing
- Russell, B. (1948). *Human Knowledge: Its Scope and Limits*. London: Allen & Unwin.
- Sag, I. (1976). *Deletion and logical form*. (PhD), MIT.
- Sauerland, U., & Elbourne, P. (2002). Total reconstruction, PF movement, and Derivational order. *Linguistic Inquiry*, 33(2), 283-319.
- Shi, C. (2008). Derivational based analysis of constructions and the relevant theories. *Chinese Teaching in the World*, 2(84), 5-25 (in Chinese).
- Shyu, S. (1995). *The syntax of focus and topic in Mandarin Chinese*. (PhD), University of Southern California.
- Smith, N. J. J. (2012). *Logic: The Laws of Truth*. New Jersey, USA: Princeton University Press.
- Spector, B. (2014). Global positive polarity items and obligatory exhaustivity.

- Semantics and Pragmatics*, 7, 1-61.
- Su, E., Zhou, P., & Crain, S. (2012). Downward entailment in child Mandarin. *Journal of Child Language Acquisition*, 39(5), 957-990.
- Su, E., & Crain, S. (2013). Children's knowledge of disjunction and universal quantification in Mandarin Chinese. *Language and Linguistics*, 14(3), 599-631.
- Syrett, K., & Lidz, J. (2011). Competence, performance, and locality of quantifier raising: Evidence from 4-year-old children. *Linguistic Inquiry*, 42, 305-337.
- Szabolcsi, A. (2002). Hungarian disjunctions and positive polarity. In I. Kenesei & P. Siptar (Eds.), *Approaches to Hungarian* (Vol. 8): University of Szeged.
- Szabolcsi, A. (2004). Positive polarity-negative polarity. *Natural Language and Linguistic Theory*, 22(2), 409-452.
- Thornton, R., & Wexler, K. (1999). *Principle B, VP Ellipsis, and Interpretation in Child Grammar*. Cambridge, MA: The MIT Press.
- Thornton, R., Kiguchi, H., & D'Onofrio. (2016). Cleft sentences and reconstruction in child language. In J. Scott & D. Waughtal (Eds.), *Proceedings of the 40th annual Boston University Conference on Language Development* (pp. 391-402). Somerville, MA: Cascadilla Press.
- Tieu, L., Romoli, J., Zhou, P., & Crain, S. (2016). Children's knowledge of free choice inferences and scalar implicatures. *Journal of Semantics*, 33(2), 269-298.
- Tomasello, M. (2000). Do children have adult syntactic competence? *Cognition*, 74, 209-253.
- Tomasello, M. (2003). *Constructing a Language: A Usage-based Theory of Language Acquisition*. Cambridge, MA: Harvard University Press.
- Verbuk, A. (2006). The acquisition of the Russian *or*. In E. Brainbridge & B. Agbayani (Eds.), *Proceedings of the thirty-fourth Western Conference on Linguistics* (pp. 443-455). Department of Linguistics, California State University, Fresno.
- Williams, E. (1977). Discourse and logical form. *Linguistic Inquiry*, 8, 101-139.
- Xu, L., & Langendoen, D. T. (1985). Topic structures in Chinese. *Language*, 61(1), 1-27.

- Xu, L., & Liu, D. (1998). *The Structure and Function of Topic*: Shanghai Educational Publishing House (in Chinese).
- Xu, L. (2004). Manifestation of informational focus. *Lingua*, 114(2004), 277-299.
- Yuan, Y. (1996). Topicalization and its derivations. *Zhongguo Yuwen*, 253(4), 241-254 (in Chinese).
- Zhou, P., & Crain, S. (2009). Scope assignment in child language: Evidence from the acquisition of Chinese. *Lingua*, 119, 973-988.
- Zhou, P., & Crain, S. (2010). Focus identification in child Mandarin. *Journal of Child Language*, 37, 965-1005.
- Zhou, P., Romoli, J., & Crain, S. (2013). Children's knowledge of free choice inferences. In T. Snider (Ed.), *Semantics and Linguistic Theory (SALT) 23* (pp. 632-651). Santa Cruz, USA: Cornell University.
- Zhou, P. (2014). Children's knowledge of ellipsis constructions in Mandarin Chinese. *J Psycholinguist Res*, 43, 421-455.
- Zhu, D. (1982). *Yufa Jiangyi*. Beijing, China: Commercial Press (in Chinese).
- Zwart, J.-W. (1992). *SOV Languages are Head Initial*. Paper presented at the the 8th Comparative Germanic Syntax Workshop, Tromsø.

From: FHS Ethics fhs.ethics@mq.edu.au
Subject: RE: HS Ethics Application - Approved (5201401129)(Con/Met)
Date: 3 February 2015 11:40 am
To: Stephen Crain stephen.crain@mq.edu.au
Cc: Rosalind Thornton rosalind.thornton@mq.edu.au, Peng Zhou peng.zhou@mq.edu.au, NA GAO na.gao@students.mq.edu.au

FE

Dear Professor Crain,

Re: "Constraints in linguistic structures containing logical operators"(5201401129)

Thank you very much for your response. Your response has addressed the issues raised by the Faculty of Human Sciences Human Research Ethics Sub-Committee and approval has been granted, effective 3rd February 2015. This email constitutes ethical approval only.

This research meets the requirements of the National Statement on Ethical Conduct in Human Research (2007). The National Statement is available at the following web site:

http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/e72.pdf.

The following personnel is authorised to conduct this research:

Professor Stephen Crain
Associate Professor Rosalind Thornton
Dr Peng Zhou
Miss Na Gao

Please note the following standard requirements of approval:

1. The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Human Research (2007).
2. Approval will be for a period of five (5) years subject to the provision of annual reports.

Progress Report 1 Due: 3rd February 2016
Progress Report 2 Due: 3rd February 2017
Progress Report 3 Due: 3rd February 2018
Progress Report 4 Due: 3rd February 2019
Final Report Due: 3rd February 2020

NB. If you complete the work earlier than you had planned you must submit a Final Report as soon as the work is completed. If the project has been discontinued or not commenced for any reason, you are also required to submit a Final Report for the project.

Progress reports and Final Reports are available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

3. If the project has run for more than five (5) years you cannot renew approval for the project. You will need to complete and submit a Final Report and submit a new application for the project. (The five year limit on renewal of approvals allows the Sub-Committee to fully re-review research in an environment where legislation, guidelines and requirements are continually changing, for example, new child protection and privacy laws).
4. All amendments to the project must be reviewed and approved by the Sub-Committee before implementation. Please complete and submit a Request for Amendment Form available at the following website:

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/forms

5. Please notify the Sub-Committee immediately in the event of any adverse effects on participants or of any unforeseen events that affect the continued ethical acceptability of the project.

6. At all times you are responsible for the ethical conduct of your research in accordance with the guidelines established by the University. This information is available at the following websites:

<http://www.mq.edu.au/policy>

http://www.research.mq.edu.au/for/researchers/how_to_obtain_ethics_approval/human_research_ethics/policy

If you will be applying for or have applied for internal or external funding for the above project it is your responsibility to provide the Macquarie University's Research Grants Management Assistant with a copy of this email as soon as possible. Internal and External funding agencies will not be informed that you have approval for your project and funds will not be released until the Research Grants Management Assistant has received a copy of this email.

If you need to provide a hard copy letter of approval to an external organisation as evidence that you have approval, please do not hesitate to contact the Ethics Secretariat at the address below.

Please retain a copy of this email as this is your official notification of ethics approval.

Yours sincerely,

Dr Anthony Miller
Chair
Faculty of Human Sciences
Human Research Ethics Sub-Committee

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