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Master's Thesis

中文遞歸領屬「的」之第一語言習得

First Language Acquisition of the Recursive Possessive Marker *de* in Mandarin Chinese

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摘要

本研究旨在探討以中文為母語的兒童對中文遞歸領屬『的』之第一語言習得。主要包括四個面向：兒童對多層遞歸領屬的可行性，理解及產出多層『的』的表現程度，可能產出其它同質多層遞歸領屬的表達方式，以及年齡因素。本研究包含兩個測驗，一為真實價值判斷的理解測驗，另一為問答產出測驗。研究對象包含實驗組的四十八位幼稚園兒童，年齡層為三歲，四歲及五歲，並以此三個年齡分為三組，每組十六人，以及對照組的十六位成人。

研究結果顯示，遞歸領屬的階層對母語為中文的三歲和四歲兒童無差異的重要性，但對五歲兒童而言，不同階層的遞歸領屬是有其意義的。在理解能力及產出測驗方面，所有參與者在理解測驗的表現均明顯優於產出測驗，但針對產出測驗卻僅有五歲兒童得以有所表現，而且就其現階段的語言能力也僅單層遞歸領屬通過測驗。另外，在測試中以其他方式表達同義於遞歸領屬的產出中我們發現，三歲兒童最多以手指著答案（肢體語言）作答，四歲兒童以不同類型短語回覆，五歲兒童最多則是遺漏一個階層的主語或目標符號『的』為最常使用。最後，年齡是兒童習得多層中文遞歸領屬『的』之重要關鍵因素，三歲及四歲兒童則僅在理解階段，但尚無法適切地表達即使是單層的遞歸領屬，反觀五歲兒童則不僅可表現出和成人一樣的理解程度，並可以產出單層的遞歸領屬語句回覆問題。

關鍵詞：中文、第一語言習得、遞歸領屬、遞歸領屬符號『的』

ABSTRACT

The present study is aimed at investigating how Mandarin-speaking children acquire the recursive possessive marker *de* in four aspects: the feasibilities of RP levels, the degree of performance in cognition and competence, the age of availability and the variety of possible feedback. Two tasks – comprehension and production were conducted in a truth-value judgement for the former and a question-and-answer task for the latter. The participants were 48 preschoolers in a kindergarten in Taiwan at the age range from three to five. They were divided into three groups by their ages. Furthermore, 16 adults were recruited randomly in the campus of NTNU.

The investigation results showed that RP levels were only significant to 5-year-old Mandarin-speaking children, but not the 3- and 4-year-olds. As for the task effects, the comprehension task was obviously easier than production for all the subjects, which showed that all the subjects were without difficulty in comprehension with no significance. However, it was exclusively significant for the five-year-old in the production task. With regard to the diverse responses to multiple levels of RPs, it was revealed that most kinesics for the youngest, variant insertions of phrases for the four-year-old and omission for the five-year-old ones. Finally, the task results demonstrated that age effects were a critical effect for younger children to adopt RPs, which suggested that 3- and 4-year-old Mandarin-speaking children were only available for multiple levels of RP in comprehension but not production, while the five-year-old presented adult-like comprehension and availability to produce Level 1 RP.

Keywords: Mandarin Chinese, first language acquisition, recursive possessive, *de* marker

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CL	classifier
PM	possessive marker
RP	recursive possessive
TVJ	truth and value judgment

Chapter One

Introduction

1.1 Motivation

One of the faculties in the communication system of mankind is recursion that never occurs in other species, as recursive grammar is the sole cognitive mechanism that is unique to human languages (Hauser et al. 2002). Recursion is a self-embedding of a linguistic object (Huybregts 2019). It can be applied to numerous syntactic structures like nominal possessives (as in (1)), relative clauses (as in (2)), or even sentences embedded in another sentence (as in (3)) that embeds another to create endless sentences.

(1) Mama **de** pengyou **de** maozih
Mommy PM[1] friend PM hat
'Mommy's friend's hat'
(2) The man **who** saw the cat **which** chased the rat is my uncle.
(3) Eric thought **that** Tom said **that** he would come.

Expressing possession is one of the most fundamental aspects of human language and cognition (Aikhenvald 2013). Therefore, among the above recursions, nominal possessive might be acquired earliest by native speakers, since possessiveness in language denotes the relation between the possessor and possessee, which is a situation that younger children often come across in daily-life conversations. As for ways to express possession, possessive markers are often adopted as a means to bridge connections, such as the possessive *'s* and *of* in English (4), while only one - *de* is used in Mandarin Chinese (5):

[1] PM= possessive marker

(4) the swimming pool **of** Mary**'s** friend**'s** house

(5) Xiaoming **de** pengyou **de** fangzih **de** wuding
Xiaoming PM friend PM house PM roof
'the roof of Xiaoming's friend's house'

However, there is no difference between English as in (6a) and Mandarin Chinese as in (6b) when there is 1-level possession:

(6) a. Mommy**'s** hat
b. Mama **de** maozih[2]
Mommy PM hat

As for 2-level or above, it might be challenging since the possession recurs. English-speaking children may adopt either *'s + of* or *'s + 's* while Mandarin-speaking children can only use *de* twice – the requirement of adding another grammatical morpheme(s) might possibly lead to mistakes. For example, younger children might simply utter a 2-level RP sentence like (7a), as telegraphic speech as in (7b), or with a conjunction as in (7c):

(7) a. Lilie **de** linju **de** chezih hen da.[3]
Lilie PM neighbor PM car very big
'Lilie's neighbor's car is very big.'
b. *Lilie (+) linju (+) chezih hen da.
Lilie PM neighbor PM car very big
c. *Lilie **de** linju **han** chezih hen da.
Lilie PM neighbor Conj.[4] car very big

The situation in (7b) – the deletion of *de* marker - can be proved in some empirical studies. Li et al. (2020) showed that 25% deletion occurred for 4-year-old Mandarin-speaking children,

[2] An example of the present study
[3] An example of the present study
[4] Conj.=conjunction

while 6-year-olds were at 9.17% reduction. Similarly, Limbach and Adone (2010) found that deletion was a common strategy used by young children. For example, the 3-year-old English-speaking children in their study got 19% middle-drop (i.e., the deletion of the 2nd *'s* marker) and 6% first drop (i.e., the deletion of the first *'s*), while the 4-year-olds had both 4% for middle and first drops.

In addition to deletion, children may often make errors with conjunctions (i.e., 'and' in English or *han* 'and' in Mandarin) instead of the possessive marker *de* as in (7c), which shows that conjunctions (i.e., direct recursion in Roeper's (2011) term) emerge at the first stage of each recursive structure. For instance, in an empirical study by Gentile (2003), one third of three to four-year-old children chose the picture of Cookie Monster and his sister when they were asked, "Can you show me *Cookie Monster's sister's* picture?". A conjunctive reading was obtained, indicating that young children mistakenly replaced one of two 's markers with a conjunction in a 2-level recursive possessive phrase. As for Chinese, Li et al. (2020) pointed out that the type of conjunction error for 4-year-old Mandarin-speaking children was 11.67% and 16% for 6-year-olds. Therefore, both the deletion and conjunction strategies seem universal since they occur in the production data of both Mandarin-speaking and English-speaking children.

As a further matter, the discrepancy between children's comprehension and production has been a heated issue in the literature (Clark & Hecht 1982, Flynn 2007, Clark & Bernicot 2008, Hendrilks & Koster 2010). Comprehension precedes production (Clark 2016:434). In theory, a native speaker should develop the competence of their mother tongue and grow to be mature to produce the outcome of their comprehension (Clark 2016). Based on sufficient

stimuli and monitoring, children are able to utter their first word and two-word phrases or sentences.

Many prior studies (Matthei 1982, Roeper 2007 & 2011, Limbach et al. 2010, Perez-Leoroux et al. 2012, Crain et al. 2017, Giblin 2019, Li et al. 2020) pointed out that age effects have been a critical factor for the acquisition of RPs. From the theoretical or empirical studies, some found that 4 years old is a likely age for children to adopt recursive possessives no matter if it is for Mandarin, English or Japanese. For example, Li et al. (2020) proved that 4-year-old Mandarin-speaking children can comprehend 2-level RP. However, some suggested other ages of development. For example, Yang (2014) claimed that children cannot comprehend and produce it until they are 8 years old. Hence, age is a potential factor for the constraints in recursive possessive and also a triggering for the present study. Consequently, how the complete developmental pathways for both comprehension and production undergo is the focus of the present study.

1.2 Research Questions

In order to investigate how the recursive possessive *de* marker is acquired by Mandarin-speaking children in Taiwan, the research questions are addressed as follows:

1) How do Mandarin-speaking children perform on different recursive levels of Mandarin possessives?
2) Do Mandarin-speaking children correctly comprehend and produce recursive possessives?
3) Will Mandarin nominal recursive structures be replaced with conjunctions or in any other format(s) in children's production of Mandarin possessives?

4) Is age a crucial factor affecting the acquisition of the recursive levels in Mandarin possessives?

1.3 Significance of the Study

Whether recursion is an essential property of human language or not has been a sought-after topic for discussion (Shi et al. 2019). The present study is set to provide with experimental data to fill up the gaps of previous studies in four aspects, including levels of recursive possessive, the degree of performance in comprehension and production, the possibilities of variant responses except conjunctions, and the age effects.

With regard to the recursion levels, numerous studies have focused on 2-level RP (Roeper 2011, Giblin 2019) solely, while some have 3-level (Li et al. 2020) or 4-level (Fujimuri 2010). Though the most investigated were 2-level recursive possessive, each single level should be explored to monitor the developmental course to map the whole picture of it. Furthermore, most of the studies for 1- straight to 4-level RP are either for English or Japanese, but there were no experiments with the similar set-up for Mandarin. Hence, the outcomes of the present study are worth an exploration.

Moreover, age is an undeniable property that has an effect on the acquisition of RP for younger native speakers (Matthei 1982, Roeper 2007 & 2011, Limbach et al. 2010, Perez-Leoroux et al. 2012, Crain et al. 2017, Giblin 2019, Li et al. 2020). Most studies (Matthei 1982, Oshima-Takane 1993, Niu 2015, Li et al. 2020) claimed the acquisition age in terms of comprehension but seldom in production. Some proposed that age 4 is the critical age (Li et al. 2020) while some claim it cannot be obtained until their 6 years old (Roeper 2011) for a 2-level RP. They are either at different ages with different levels or the same level in distinct

languages for only comprehension or production but not both of them. Hence, the present study is designed to conduct both the comprehension and production tasks for 3- to 6-year-old Mandarin-speaking children in Taiwan to fill in the gaps in prior investigations.

1.4 Organization of the Thesis

This thesis is organized as follows: in Chapter Two, the introduction of recursive mechanisms and the possessive structures of possessiveness in Mandarin Chinese. The related literatures refer to both theoretical and empirical documentation. Chapter Three includes both the research design together with the summary. Chapter Four reports the task results of the formal studies. Finally, Chapter Five poses the substantial suggestions for the future investigation according to the limitations of the present study.

Chapter Two

Literature Review

In this chapter, the theoretical theses and empirical investigations on L1 acquisition of Recursive Possessives in Mandarin Chinese are explored. Section 2.1 reviews the internal structures of recursive possessives through Crain (1991) and Roeper (2011). In Section 2.2, three theoretical studies by Teng (1974), Partee (2006) and Niu (2015) on the categories of Mandarin Possessives are deliberated. In Section 2.3, four empirical studies including possessives, recursions and levels of recursive possessives are discussed respectively. Lastly, Section 2.4 provides a summary of this chapter.

2.1 Internal Structures of Recursive Possessives

Hierarchy is the essence of recursive possessive, which constructs the edifice in the manner of embedding. Crain (1991:611) suggested that younger children were able to comprehend phrases of hierarchical structures innately, while Roeper (2011:65) proposed that each kind of recursions is with the default mode of direct recursion – a conjunction interpretation, a flat structure.

2.1.1 Crain (1991)

Crain reinforced his thesis on the basis of poverty of the stimulus especially for language acquisition in syntactic knowledge for young children. He proposed that the knowledge which learners bring to some certain (or the designated) circumstances (or tasks) is called *language acquisition device* (LAD) and the input from their surroundings (parents as

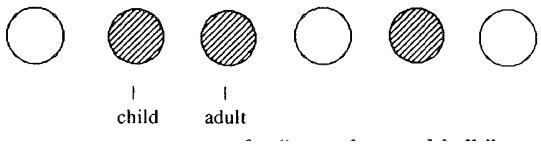
well as others) is called *primary linguistic data* (PLD). Children's language acquisition is built up from PLD to form the LAD and finally develops into the adult grammar – the *final state*.

What amazed linguists or even scientists is how do children in diverse languages almost converge to a similar final state of adult grammar. One of the solutions was by approaching the theory of constraints that were viewed as "filters" to prevent some options from thoughtfulness to certain extents and also function as a mechanism for coping with the overgeneration problems. Furthermore, most linguists support the theory that constraints are innate, domain-specific properties (Crain 1991:598). In addition, two critical treatments on maturation and parameter-setting were also attributed to properties of innateness, in terms of learnability as well. According to Borner and Wexler (1987) and Radford (1990), the innateness of some aspects of syntactic knowledge have not yet emerged at birth but need some years to develop to maturity. This is similar to human beings' physical growing – though they can stand and walk on their two feet but it does not mean they are readily able as soon as they are born. The language faculties seem dormant superficially but actually keep processing to reach maturation. According to Crain (1991), children learning Sesotho, an African language, can employ full passives with the equivalent constituent as *by*-phrase in English by the age 3 (Demuth 1989) in the situation of lacking input. Similarly, parameter-setting takes time as well for the readiness to fix it or them at the appropriate timing, which means that some of the faculties seem to be absent but are, in fact, virtually latent. However, children might change or abandon their initial parameter setting supposedly under the circumstances that they make it to fit the mode of the target languages.

Crain proposed that there are different prenominal modifiers between the distribution of

children's and adults' syntactic knowledge. While children were asked to point out the "second stripped ball", they were hypothesized to answer the second ball in the array (counting from the left), but not the second striped ball as shown in (1). The task result for children was explained by the *flat-structure hypothesis* (as in (2)), whereas adults would choose the third in the array - interpreted as a hierarchical structure (as in (3)).

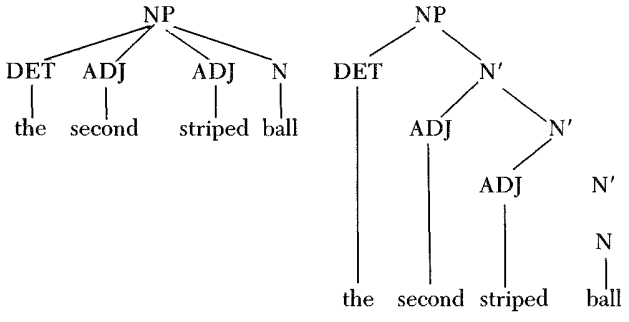
(1) Array for "second striped ball."



(Crain 1991:609)

Furthermore, Roeper (1972) and Matthei (1982) applied the flat-structure hypothesis to their investigation and concluded that children at 4-6 years of age have difficulty in understanding the phrases like *the second striped ball*. However, what happened in the process between LAD and the final state, which led to the satisfied Adult Grammar. Horstein and Lightfoot (1981) proposed an N' as syntactic constituents for children initial intermediate level, instead of N.

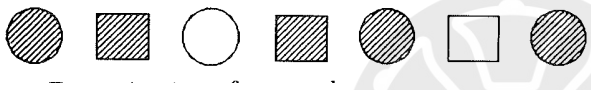
(2) Child's Analysis (3) Adult's Analysis



(Crain 1991:609)

Following the proposal of Horstein and Lightfoot (1981), Hambruger and Crain (1984) made two changes to the experiment – a pretask session and facilitating the planning aspects – drove a drastic difference from the previous ones. More than that, occasionally, children can even correctly point to the fifth object (as in (4)) upon hearing the instruction "point to the second **ONE**", after the pretask activity of "pointing to the first striped ball". One noteworthy aspect is that the idea of **N'** or **ONE** is not compatible with the *flat-structure*, which suggests that children employ preforms to corefer with intermediate level syntactic constituents like adults (Crain 1991:610).

(4) Array for one substitution experiment



(Crain 1991:610)

In sum, the innateness of human language faculties though seems to have gaps either between PLD & LAD, or LAD & final state. They are actually developing and undergoing while appearing as dormant superficially – which might be possibly interpreted as "being absent", but they are virtually latent for the soon coming-up debut.

2.1.2 Roeper (2011)

Roeper divided recursion into direct recursion, indirect recursion and generalized transformation with the pivot - direct recursion bearing a conjunction reading as the first stage of each recursion edifice. In the categorization, recursive possessive is a subordinate of indirect recursion. One of the distinctive features distinguishing direct recursion from indirect is

conjunction – the interpretation of connecting as *and* in English as shown in (5).

(5) Direct Recursion: X→ Y(X)

NP → NP ((and) NP)

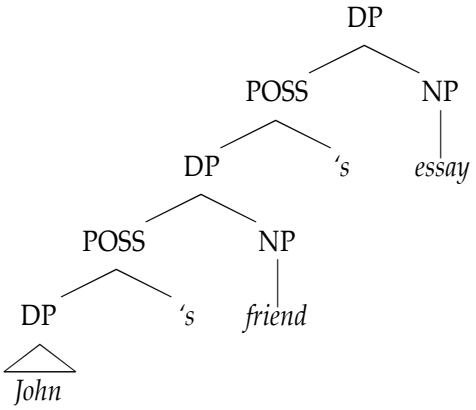
(6) John, Bill, Fred, and Susan arrived. (Roeper 2011:61)

Roeper claimed that a critical character of direct recursion is that there is no specific necessity to have a restrictive semantic ordering in the elements, so it is also interpretable to have (6) like *Bill, John, Susan, and Fred arrived,* because there is not syntactic relation among the thematic roles. In contrast, indirect recursion is with a particular position as illustrated in (7), (8) and (9). It is manifest that the meaning of (7) and (8) are different caused by the change of the ordering of the DPs. In addition, it is even more obvious from the tree diagram that demonstrates the hierarchy of the structure explaining the relations layer by layer. Each move impacts the precedent(s) or any constituent immediately following them, which explains why Roeper even argued that recursive possessives are difficult for younger children.

(7) John's friend's father's student's essay

(8) John's student's father's friend's essay (Roeper 2011:61)

(9)



(Roeper 2011:62)

From the naturalistic acquisition data (Roeper 2007), Roeper discovered children's resistance toward indirect recursion. With plausible or favored move while coming across – converting a recursive sentence into conjunctions as the task shown in Gentile's experiment in 2003 where the provided materials are shown as below in (10).

(10) A. Picture of Cookie Monster

B. Picture of cookie Monster and his sister

C. Picture of his sister

"Can you show me Cookie Monster's sister's picture?" (Roeper 2011:69)

With the 2-level recursive possessive question to the 3- to 4-year-olds, 33% of the participants chose the conjunctive reading – Picture B. Furthermore, Roeper claims that there is not much difference in the performance at 3- and 4-level by Fujimori (2010) – having English *'s* (apostrophe *s*) substituted by *no* in Japanese. The questions presented to the participants are *What is the color of Shiro's child's friend's dog's balloon*. The task resulted in 11 children out of 26 showing 80-100% correctness on the 1- and 2-level recursive possessives and 50-100% accuracy on 3- and 4-level. According to Roeper, a noteworthy perspective should be taken into account that recursive possessive is beyond a challenge in syntactic construction but each level of possessive is nominalized underlying the listeners' comprehension with case designation bearing different semantic roles. As the difficulty increases in recursive possessives, the optimality of Strong Minimalist thesis tends to work on the constituents by ellipsis or adopting conjunction for the most feasible outcome.

In sum, Roeper proved with experiments in different languages that direct recursion is the base of indirect recursion as recursive possessive by triggering substitution for conjunction while the embedded structures become critical and baffling.

2.1.3 Interim summary

The internal structures of recursive possessives based on direct and indirect recursions are hence summarized and compared as follows in Table 2-1.

Table 2-1. Major Findings and Limitations of the Previous Studies

	Major findings	Limitation
Crain (1991)	1. Hierarchical structure: Children are innate with it. 2. Recursion level: N' is suggested to substitute for N.	1. Various maturation for the development of language faculty 2. Universal principles of grammar formation are unnecessarily in line with the acquisition of language as the product of general cognitive growth.
Roeper (2011)	1. Hierarchical structure: Children are not innate with it. 2. Recursion level: There is no difference in children's ability to comprehend 3- and 4-level cases. 3. Age: Over 50% of children at different ages are capable of comprehending Level 2 in English. 4. Others: A default conjunctive interpretation (direct recursion) underlying the other recursions	1. the order of conjunction makes the final interpretation, which does affect and form the hierarchies 2. Is conjunction the only way to resolve possessive form in terms of thematic roles?

In sum, hierarchical structures – a critical element of recursive (indirect recursion) is innate in human being language, while direct recursion with conjunction reading (direct recursion) also exists. Crain's hierarchical structures of recursive possession and Roeper's conjunctive structure of possession are both ways to express recursive possession – children have inherent UG to yield RPs according to their PLD and LAD. However, younger children might adopt them in different orders, but they would ultimately possess them in the development of RPs.

2.2 Theoretical Studies of Mandarin Possessives

The expression of possession for young L1 learners starts very early where they might begin with double nominal, kinship possession, part-whole possession, and unconsciously adopt possessives with indefinite interpretation which is virtually a post-nominal expression as of-possession in English, or tell the distinction between alienability and inalienability – these most occurring utterances are to be reviewed in the section with three related studies.

2.2.1 Teng (1974)

The property of inalienable possession in double nominative in Chinese was discussed in Teng (1974) – the double nominative in the surface has been analyzed as transformed from possessive sentences in the underlying structure, where the possessive (or genitive) marker *de* exists but deleted in the surface structure. The capture of the quality of inalienability between the first and the second nominal yields the feature of pseudo-possessive marker (see Teng 1970) that the genitive marker *de* is optional which means either NP1 + NP2 or NP1 *de* NP2 is

identical without different interpretation as shown in (11a) and (11b) below:

(11) a. Ta duzi *e*.
he stomach hungry
'He is hungry.' (Teng 1974:60)

b. Tade duzi *e.*
his stomach hungry
'He is hungry.' (Teng 1974:61)

In (11a), the possessive nominal is topicalized and the possessive marker *de* is deleted in the surface. In here, Teng called the two nominatives higher patient and lower patient. The deletion can be applied under the situation that the lower patient is also a simple noun rather than a possessive NP.

Furthermore, the selectional rules applied to the higher and lower patients are contrastively critical – most cases that the semantic interpretation of 'inalienable possession' is the essence to constrain that relationship in-between grammatical or not. In addition, there are also restrictions for verbs – the predicate has been regulated as stative or process as examples (12) and (13), taken from Teng (1974) as shown below:

(12) *Zhang Xiansheng* (a) *nianji* *bu* *xiao* *le*
Mr. Zhang PARTICLE age NEG small ASP
'Mr. Zhang is rather old.' (Teng 1974:72)

(13) *Zhang Xiansheng* ***-de*** *nianji* *bu* *xiao* *le*
Mr. Zhang PARTICLE age NEG small ASP
'Mr. Zhang is rather old.' (Teng 1974:72)

In sum, Teng's arguments employed the two possessive formats (*'s*-possessive and *of*-possessive) in English and took the advantages of the gap by applying them to the double nominatives in Mandarin Chinese to demonstrate the path of transforming from the underlying structure to the surface. By the deletion of Mandarin possessive marker *de*, it proved that the double nominatives are actually one level possessive.

2.2.2 Partee (2006)

Probing the differences between the translations (or interpretations) of bare possessives or various possessives with demonstratives, numerals, classifiers in Mandarin and in English by employing the pre-nominal and post-nominal structures of possessives in English, the properties of Mandarin possessives are suggested to tend to be with specificity rather than definiteness in comparison to the counterparts in English. While it is a bare possessive as (14), the interpretations in Mandarin and English do not make too much distinction; however, in (15), additional elements as numeral and classifier that lead to the possibilities of more-than-one readings between Mandarin and English – the English translation suggests that Zhangsan has exactly three sweaters which entail the concept of definiteness or the property of presupposition but it is not the case for Mandarin – NO presupposition that Zhangsan has EXACTLY three sweaters in Mandarin interpretation.

(14) Bare Noun
Zhangsan de [masoxianyi]
Zhangsan DE*poss* sweater
'Zhangsan's sweater(s)'

(15) Possessor DE + [Numeral + CL + N]

Zhangsan de [san jian maoxianyi]

Zhangsan's DE*poss* three CL sweater(s)

'Zhangsan's three sweaters'

(16) Possessor DE + [Dem + (Numeral) + CL + N]

a. Zhangsan de [na jian maoxianyi]

Zhangsan DEposs that CL sweater

'lit. Zhangsan's that sweater'

b. Zhangsan de [na san jian maoxianyi]

(Partee 2006:02)

Partee argued that the possessor phrase in (15) "raised into a D position" (Partee 2006:08) and therefore being interpreted as definite resulting from the semantic reading of the syntactic position. Nevertheless, there seems to be no exact uniqueness/exhaustivity in Mandarin while there is in English. This also explains the existence of the definite article *the* in English but no counterpart in Mandarin. Except the assumption of the lack of definiteness interpretation in Mandarin, the readings of (16a) and (16b) – a demonstrative determiner and a post-nominal possessive - are suggested to be synonymous with the of- possessives. Furthermore, as for the demonstrative precedes the possessor as in (17) and (18) as illustrated below, the possessor acts as the restrictor with a reasonable inference – Zhangsan may have additional sweater(s) – but not confining the coverage of the presupposition or entailment. This again suggests the idea of partitive translation of postposed possessive construction in Mandarin as the counterpart in English – often inferring non-exhaustivity. The word orders of possessive marker, numeral, demonstrative make the interpretations in Mandarin Possessives with the property of partitivity.

(17) [Dem + CL + [Possessor DE] + N]

[na jian [Zhangsan de] maoxianyi] hen piaoliang

That CL Zhangsan DE*poss* sweater very pretty

'That sweater of Zhangsan's is very pretty.'

(18) [Dem + Numeral + CL + [Possessor DE] + N]

[na san jian [Zhangsan de] maoxianyi shi meiguo zhi de

that three CL Zhangsan DE*poss* sweater BE America make DE

'Those three sweaters of Zhangsan's are made in the US.'

(Partee 2006:02)

In sum, though there is only possessive construction in Mandarin – pre-nominal, unlike English with *'s*-possessive and *of*-possessive - with the different word order Mandarin delivering the meanings of partitivity. With language characteristics, English possessives feature in definiteness while Mandarin possessives feature in specificity pragmatically rather than syntactically.

2.2.3 Niu (2015)

Niu proposed the nominal possession in Mandarin Chinese is in the structure of determiner phrases (DP) instead of noun phrases (NP), where D functions in terms of syntax as being employed to make the bare noun act as an argument. Semantically it simultaneously features the referential property of the nominal; hence, turning a property into an entity (Niu 2015:17). However, as not all the languages have definite or indefinite articles like *the* and *a* in English, like Mandarin and Japanese, there are null determiner phrases which generate an indefinite reading contextually. Furthermore, via Niu, Logobardi (1994) had argued that Null-

D phrases are restricted to be posited in the subject or topic positions as illustrated in (19) & (20) as below.

(19) ?? San ge xuesheng hen congming.
three CL student very smart
Intended: 'Three students are very smart.' (Niu 2015:21)

(20) * San ge xuesheng, wo zhidao zai xueziao shoushang le.
three CL student I know at school hurt LE
Intended: 'Three students, I know were hurt at school.' (Niu 2015:21)

With the morpheme *de*, two types of possessives are *de* possessives and *de*-less adopting the 'separationist' approach that treats *de*-less structures as distinct from *de* constructions rather than 'reductionist' approaches arguing *de*-less structures derived from *de* structures by depriving the possessive marker *de* by proving with the examples below as in (21a) & (21b).

(21) a. Wo xihuan Zhangsan de maoyi.
I like Zhangsan DE sweater
'I like Zhangsan's sweater.'
b. *Wo xihuan Zhangsan maoyi.
I like Zhangsan sweater (Niu 2015:67)

As for the *de*-less possessives, three challenges arised – interrogative personal pronoun *shui* 'who', the plural form and the pronoun *zan* 'our' as illustrated in (22), (23), (24).

(22) Zhangsan xiang [shui *(de)] mama] ?
Zhansan resemble who (DEpossP) mother
'Whose mother does Zhangsan resemble?' (Niu 2015:68)

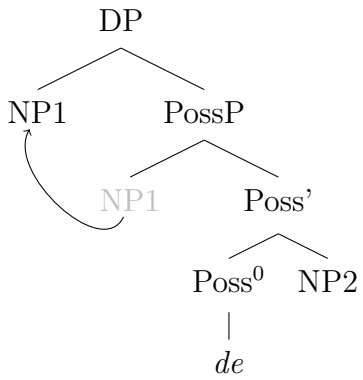
(23) a. Wo bu xihuan [ni-men de meimei]
I not like you-MEN DE younger-sister
'I don't like your younger-sister(s).'
b. ?? Wo bu xihuan [ni-men meimei]
I not like you-MEN younger-sister. (Niu 2015:68)

(24) a. zan ba/ma
our dad/mom
'our dad/mom'
b. *zan de ba/ma
our DE dad/mon (Niu 2015:69)

However, it explains why the *de*-less possessive constructions can only be implemented by singular 1st, 2nd and 3rd person pronouns for kinship nouns as a juxtaposed possessive (Deal 2012 via Niu 2015).

The basic possessive construction [NP1 + de + NP2] is with the tree diagram as shown in (25) below, where NP1 moves from the position of SpecPossP to the SpecDP position.

(25)



(Niu 2015:77)

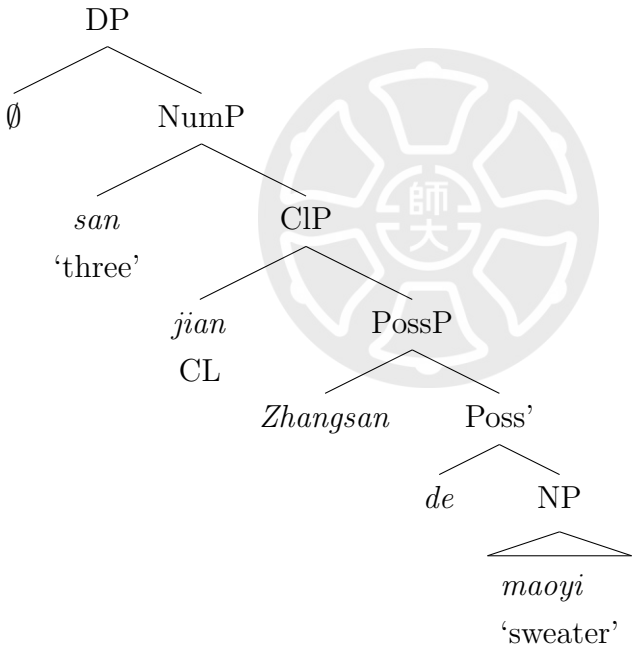
As for the demonstrative, numerals, and classifier elements in Mandarin nominal, there are low and high possessor phrases as illustrated in (26) and (27), where (26) presents a low possessor phrase and (27) a high possessor phrase in contrast.

(26) zhe san jian Zhangsan de maoyi.
This three CL Zhangsan DE sweater
'these three Zhangsan's sweaters'

(27) Zhangsan de zhe san jian maoyi.
Zhangsan DE this three CL sweater
'these three Zhangsan's sweaters' (Niu 2015:85)

With the illustration as in (28) as below, the high and low positions in contrast are analyzed as such:

(28)



(Niu 2015:85)

Niu suggested that the low possessor phrase as in (26) with an indefinite interpretation while the high possessor phrase as (27) a definite reading, which agree with what Partee proposed in 2006 – the readings with or without definiteness is a critical effect for the decisive factors of the subject or topic position in a sentence.

2.2.4 Interim summary

To sum up, there are traditionally two types of possessives in Mandarin – alienable and inalienable semantically, while two constructions syntactically as well – *de*-structure or *de*-less structure where the latter is not the deletion version of the former according to Niu (2015). As for double nominatives, they are actually a level-one possessive that the possessive marker *de* is deleted in the surface structure (Teng 1974). Lastly, unlike English with two forms to express possession, pre-nominal & post-nominal to deliver the sense of definiteness and indefiniteness, Mandarin expresses specificity with high-possessor-phrase (leftward) or low-possessor-phrase (rightward) instead.

2.3 Empirical Studies of First Language Acquisition of Recursive Possessive

In this section, four empirical studies on first language acquisition of recursive possessives are reviewed in terms of hierarchical structure, recursive level and age.

2.3.1 Shi and Zhou (2018)

The core of Shi and Zhou (2018) is how children's cognition of possession maps onto their language comprehension and production. To explore the mechanism, they designed two experiments to investigate how Mandarin-speaking children function with the input and output of DE construction in Mandarin. Although there are possessions categorized by alienable and inalienable, they focused on alienable possessives only by taking advantage of the contrast between "NP1 + DE + NP2" and "noun-noun compound" which younger children approximately aged 2 tend to adopt – interestingly enough is that it would be a distinctive

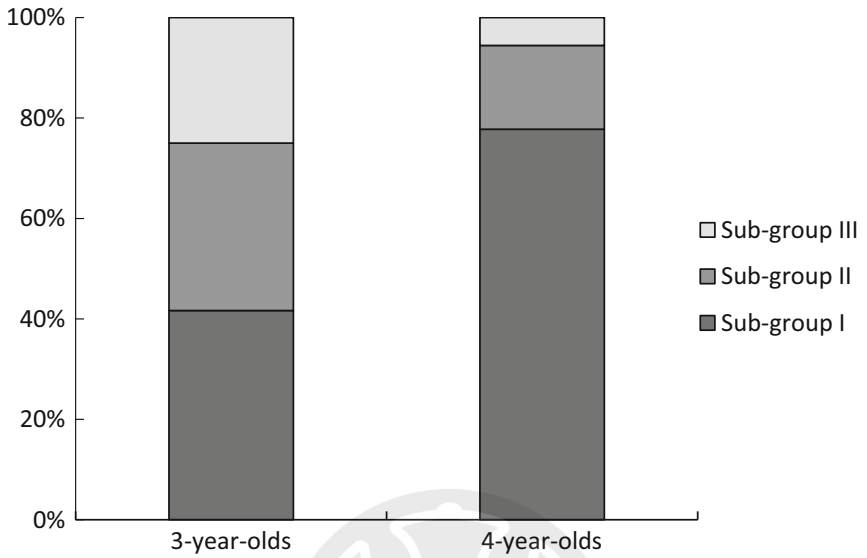
interpretation for countable entities and some objects with or without the possessive marker DE as (29) and (30) illustrated below. In addition, children aged 2 – 3 are discovered to have employed noun-noun compounds instead of DE possessive construction, so it would be an apparent comparison to counter-check whether the hypotheses of previous studies do as well.

(29) Xiaoxiong DE binggan
little bear DE cookie
Meaning:the little bear's cookie (Shi & Zhou 2018:05)

(30) Xiaoxiong binggan
little bear cookie
meaning: a cookie in the shape of a little bear (Shi & Zhou 2018:06)

From the two experiments – comprehension and production tasks, the results shed light on 4-year-old Mandarin-speaking children displaying their cognition of possession and expression of it; whereas three-year-olds are still at the developmental stage taking noun-noun compounds and DE possessive constructions alternatively. In experiment 1, the 4-year-old participants presented 82% correctness while the three-year-olds only had 56%, which suggested that 3-year-olds were not available and they were still in the developmental stage of RPs. However, Shi and Zhou took a deeper investigation into the task results – dividing them into three groups for the two age groups (3-year-old and 4-year-old): Group I - with the strongest preference toward the DE possessive construction, Group II – with a weaker preference to DE possessive and Group III with strong preference to noun-noun compound shown as in the following chart (Shi & Zhou 2018:11). From the chart, it can be easily told that there are almost 80% of 4-year-olds have a strong preference toward DE possessive

construction while there is only about 40% of 3-year-olds preferring the target structure and have a stronger tendency toward noun-noun compounds in contrast.



Mean proportion of each sub-group within each age group, Experiment 1

Figure 2-1. Mean proportion of each sub-group within each age group, Experiment 1

(Shi & Zhou 2018:11)

As for the experiment 2, Shi & Zhou took a story-telling task and made the participants to elicit the target DE-possessive construction and the non-possessive locative relations with the questions (as in (31)) and expected target elicitation (as in (32a) & (32b)) below:

(31) Ni neng gqosu wo, huangse de quingwa tiao dao le nali?
you can tell me yellow DE frog jump onto ASP where
"Can you tell me where the yellow frog jumped onto?"

(Shi & Zhou 2018:14)

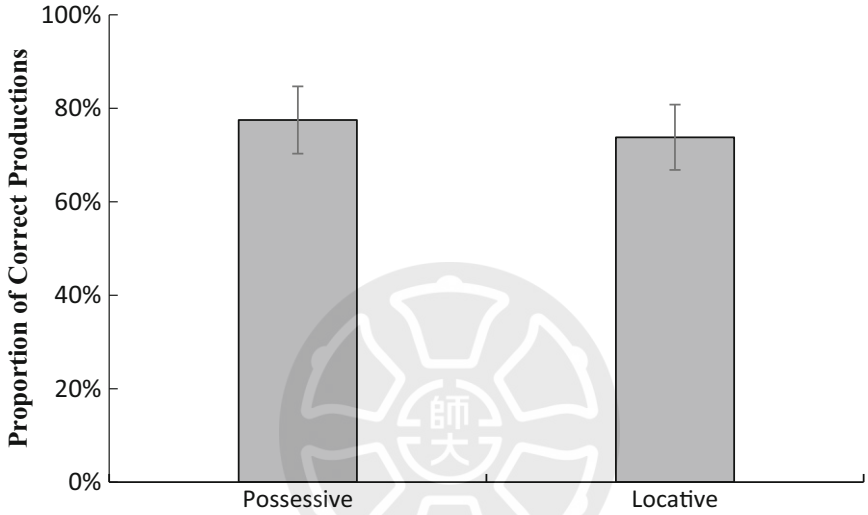
(32) a. Xiaomao DE yizi
Little cat DE chair
Meaning: the little cat's chair

b.Caodi shang DE yizi

grassland top DE chair

Meaning: the chair on the top of the grassland. (Shi & Zhou 2018:12)

The result of experiment 2 shows that children produced correct possessive DE construction at 78% and 74% for locative possessive as in Figure 2-2 below:



Mean proportion of correct productions of the two target constructions, Experiment 2

Figure 2-2. Mean proportion of correct production of the two target constructions

(Shi & Zhou 2018:15)

In sum, Mandarin-speaking children aged 4 are able to comprehend and produce DE-possessive construction, while 3-year-olds on average are at the developmental stage where they are likely to prefer noun-noun compounds over DE-possessive constructions.

2.3.2 Giblin et al. (2019)

Giblin et al. (2019) also proposed the spontaneous emergence of recursive possessive

proved by their empirical tasks to both Mandarin-speaking children and English-speaking equivalent peer.

Giblin et al. (2019) argued that Recursion, one of the core elements in human languages, emerges with a spontaneous springing-up rather than a transition phase bearing a conjunction alternative as what Roeper (2007, 2011) proposed. They raised doubts and analyzed their explanations toward three previous tasks proceeded by Gentile (2003, cited in Roeper 2011), Limbach and Adone (2010) and Perez-Lerous et al. (2012) – the first and second investigations were concluded with children's tendency toward coordinate structure while encountering difficulties in recursions, and the third experiment was ended up with children at 3 to 6 being incapable of generating Level 2 Genitives to a great extent.

One observation on the previous failures is that it was attributed to the inadequacy in human language property to implement recursion but not the design features of the experiments - which are virtually the critical factors leading to an acceptable or logical result from the task. According to Giblin et al. (2019), our daily life utterances do not occur in the way as shown in the tasks – literally, people do not communicate in the way illustrated in the experiments and so that some adult participants even just simply adopt certain sentence structures to convey the same meanings – the reaction would be judged as an unsatisfied outcome. Furthermore, the other noteworthy aspect is the emphasis on the paucity of the adult input to children that was a decisive factor affecting the tasks. However, in their investigation, Giblin et al. proved it untrue by conducting a search of three Mandarin corpora of parent-child interactions and discovered that there were no examples of employing recursive possessive marker *de* - implying the poverty of recursive possessive is virtually the norm in real life and so the few or lack of

stimulus cannot be responsible for the failure of the research.

What's more, Giblin et al. (2019) contended to agree upon the Strong Minimalist Thesis by conducting two experiments (in English and Mandarin respectively) that recursion, namely MERGE, is innate in human language faculty. Both of the experiments were designed to elicit Level 2 Genitive from the participants by story-telling and deliberately raising the wrong statements to yield questions for correction with the target constructions. The experiments are presented below.

Experimenter:	This is Gecko and these are his koalas. This is Catboy and these are his koalas.
Gecko:	It's dinner time and today we're having hotdogs for dinner with our pet koalas.
Catboy:	Let's eat our hotdogs by the side of the road.
Experimenter:	Oh no, here comes a motorbike and he's in a hurry. He nearly knocked over Gecko's hotdog, and then he swerves and knocks over this hotdog and it falls out of the bun and is ruined!
Question to puppet:	Which hotdog got knocked over?
Blindfolded puppet:	I can't see but let me guess. Gecko's hotdog got knocked over!
Target response:	No, Gecko's koalas's hotdog got knocked over!

(Giblin et al. 2019:276)

Both the tasks were designed in the same way in English and Mandarin respectively. The expected elicitation in Mandarin is DP1 + *de* + DP2 with the expression that DP1 is the possessor, *de* representing the genitive marker that immediately follows the possessor and DP2 being the possessee (Huang et al. 2009).

The Participants of English as their native language were at an average age of 4;7 while the Mandarin 4;5 with the tasks result 67% and 79% accuracy respectively. Giblin et al. (2019) hence concluded that children as young as 4 or even younger can successfully generate Level 2 Genitives - a counterevidence to Roeper's postulation of transitional phase of conjunction, corresponding to what Berwick and Chomsky proposed that MERGE does not occur via a step-wise pathway but a spontaneously evolving manner.

In sum, Giblin et al. claim that the emergence of recursion is analogous to the property between language acquisition and language evolution – that is spontaneous, not with a proto-grammar as a forerunner leading a step-by-step procedure to achieve recursion - an innateness underlying in human language faculty.

2.3.3 Li et al. (2020)

Recursion, the center of language production, develops on the basis of elementary Merge for human languages. Though with a variety of forms and content, human children generally acquire it at around 3 years old to 4 years old, but some of them even articulate it at 2 years old. For instance, children are able to have 2-level recursive performance as "Anne's Mum's dolly" or "Ellie's Daddy's" (Corpus of Manchester). Because of the various formats of recursive representation, 3-to-4-year-old children have a tendency to adopt conjunction interpretation instead of recursion or even drop it (Limbach & Adone 2010, Roeper 2011). However, children were reported to have difficulty while facing the shift from 2-level to 3-level, but were suggested to perform with no difference for 3-level and 4-level recursive possessives (Gentile 2003).

In terms of recursive possessive, Mandarin Chinese, English and Japanese share a contrastively similar phrase structure – N1 + possessive marker[1] + N2. As for Mandarin-speaking children, the only way to express recursive possessive is employing particle *de*, not like English with the option of PP compliment as post-nominal modifier (*of*-possessive).

In light of the sole expression for recursive possessive in Mandarin Chinese, Li et al. (2020) hence designed an experiment, recruiting 30 monolingual Mandarin-speaking children at two groups of 4-year-olds (N=10, M=4;0, range = 3;4 – 4;3) and 6-year-old (N=20, M=5;11, range = 5;4 – 6;4) to proceed an act-out task, which consisted of 2 phases – a pre-task and a task phase. In the pre-task phase, the experimenter would have the participants to get familiar with the characters by showing the pictures and expressing their relations with 1-level, 2-level, and 3-level recursive possessives as below and together with pictures as illustrated in Figure 2-3:

Experiment: "Look, there is a robot [point to the robot].
The robot has a snake [point to the snake].
So this is the robot's snake.
The snake has a lion [point to the lion].
So this is the robot's snake's lion.
The lion has a cookie [point to the cookie].
So this is the robot's snake's lion's cookie."

Figure 2-3. Sample picture for the familiarization phase2

(Li et al. 2020:300)

[1] possessive marker: Mandarin *de*, English *'s* and Japanese particle *no*

During the pre-task, children were asked to repeat the recursive possessive sentences whenever the experimenter uttered a new recursive possessive, which is also a target measurement in the task. However, the experimenters would not utter any recursive possessives in the task phase to avoid priming effect. The participants took the task alone and they were asked to act out according to the instruction in recursive possessives to leave a token (a leave) for the target Level of recursive possessive as shown in (33) and with the illustrated picture Figure 2-4 as follows:

(33) a. one-level possessive:

she-de shizi
snake-GEN lion
snake's lion

b. two-level possessive:

jiquiren-de shizi-de she
robot-GEN lion-GEN snake
robot's lion's snake

c. three-level possessive:

jiqiren-de she-de shizi-de binggan
robot-GEN snake-GEN lion-GEN cookie
robot's snake's lion's cookie (Li et al. 2020:301)

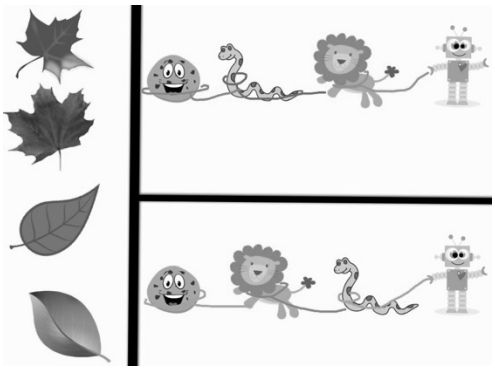


Figure 2-4. Sample picture for the test phase of recursive possessive task

(Li et al. 2020:301)

The task result was analyzed as recursion (correct), conjunction (error), reduction (error) and others (error) as in Table 2-2, and the task analysis is as illustrated below in Table 2-3.

Table 2-2. Coding of answers to 'Robot's line's snake'

Children's answer	Coding
robot's lion's snake	Recursion (correct)
robot, lion, and snake	Conjunction (error)
robot's snake	Reduction (error – dropping 'lion')
lion's cookie	Other (error)

(Li et al. 2020:302)

Table 2-3. Percentage of Types of answers

Participant group	Possessive level	Recursion (correct)	Conjunction (errors)	Reduction (errors)	Other errors
4-yrs	1	75%	5%	10%	10%
	2	54%	12%	26%	9%
	3	46%	14%	30%	10%
	All	64.17%	11.67%	25%	9.17%
6-yrs	1	80%	0	17.5%	2.5%
	2	76%	9%	11%	4%
	3	72%	16%	4%	6%
	All	75%	10.42%	9.17%	5.42%

(Li et al. 2020:302)

According to Li et al., there was a significant effect on answer type (**$p < .01$) but no effect of age ($p = .757$) by repeated-measure ANOVA (taken in the pre-task phase) and recursive structures are the most frequent answers for the 2 groups. For the 4-year-old group, their reduction-error rate was triple-twice higher than the other groups, while their conjunction error showed no such distinguishment. For all the error types, reduction-error was noteworthy,

especially for the 6-year-old group – the increasing recursive levels were in an opposite route with the reduction rate, while it was a parallel trend for 4-year-old group.

In sum, mono-Mandarin-speaking children tend to to perform with more accuracy on recursive possessives than native English-speaking children, which resulted from the alternatives of syntactic structures – the former got only pre-nominal possessive while the latter had another choice of post-nominal PPs (Limbach & Adone 2010). Furthermore, the older children show a tendency of conjunction as a grammatical representation as the recursion level increases which they also apply to adjectives (Matthei 1981), compounds (Hiraga 2010) and sentence complements (de Villers et al. 1990). However, the interaction between the sharp increase and decrease responses from the 2-level to 3-level on their conjunction-errors and reduction-errors is a noteworthy gray-area for further investigation.

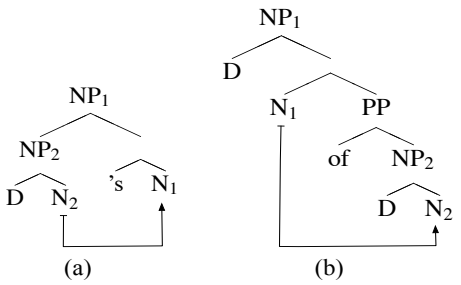
2.3.4 Li et al. (2021)

They argued that Recursion is not a self-embedding formalization but a structural substitution. On the basis of English, they proposed two structures of possessive – (34) '*s*-possessive and (35) *of*-possessive as illustrated in (a) and (b) below.

(34) '*s*-possessive N2⟼N1: nouns in N2 can also be used in N1

(35) *of*-possessive N1⟼N2: nouns in N1 can also be used in N2

(Li et al. 2021:473)



(Li et al. 2021:473)

A structure is recursive if N1 and N2 are *substitutable*. Take the noun *mother* as an example in two NPs as *mother's car* (*mother* as N2) and *the student's mother* (*mother* as N1). By discussing the realization of one-level possessive structures, Li et al. (2021) thereby claimed that the acquisition of recursion is actually practicing the generalization of the eligible lexicon that can be applied to the appropriate position of the designated format – though the domains of different languages vary to some extent. According to a corpus investigation from the CHILDES database (MacWhinney 2000) – 12.6 million words from American English-learning children and 1.7 million words of input from three-year olds' vocabulary from Chinese-speaking children - they focused on the most frequently adopted 20 nouns respectively.

Li et al. pointed out that *s*-possessive tends to favor animate nouns for N2 position at an incredible frequency, as high as 99% based on previous analysis data; however, it did not correspond to what they had found from their investigation – half of N2 in Table 1 is inanimate noun; furthermore, the almost same result occurred in Mandarin-Chinese – 9 out of 20 N2 are inanimate. After all, the discrepancy does not mean a failure since they thereby discovered that when an inanimate noun is located in N2 position, it is always regarded as an internal possession (an extension of inalienability and part-whole relations, e.g., *truck's name*) or anthropomorphic application (e.g., *car's eyes, cup's hat, train's school*). Additionally, as for

the N1 and N2 constraints, Mandarin Chinese is considerably free between N1 and N2. This means the relations between them is bidirectionality of substitutability, which can be shown from Figure 2. that the overlap of N1 and N2 is much higher than that of English in Figure 1. Lastly, an interesting observation proposed by Li et al. (2021) is that as the size of the lexicon, the intersection of N1 and N2 will become smaller in terms of proportion; therefore, they suggested that the optimal situation for children to acquire recursive possessives ***only*** if children have a very small vocabulary of most frequent nouns, which apply to Mandarin Chinese as well.

Table 2-4. The Distributional Properties of the English *'s*-possessive Structure

Construction	N (Count)	20 Most Frequent Nouns
s-possessive (N_2's N_1)	N_1 (42)	name, head, hair, nose, mouth, room, hat, house, car, bed, hand, chair, food, cup, mommy, juice, water, truck, daddy, school
	N_2 (22)	baby, daddy, boy, mommy, dog, girl, man, cat, bear, fish, truck, train, cup, name, door, day, way, hat, color, car

(Li et al. 2021:476)

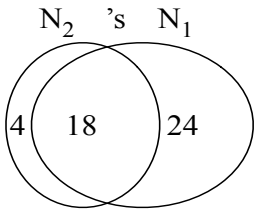


Figure 2-5. Set relations between the N1 and N2 nouns in the English '*s*-possessive.

(Li et al. 2021:476)

Table 2-5. The Distributional Properties of the Mandarin Possessive Structures

Construction	N (Count)	20 Most Frequent Nouns
with *de* (N_2 de N_1)	N_1 (40)	jiao (foot), yanjing (eye), tou (head), bizi (nose), yifu (clothes), tui (leg), lian (face), shou (hand), fan (rice), shui (water), baba (dad), qian (money), mao (cat), rou (meat), chuang (bed), baobao (baby), beizi (quilt), ya (tooth), cai (vegetable), yu (fish)
	N_2 (39)	baba (dad), mao (cat), nanhai (boy), baobao (baby), didi (brother), chuang (bed), jia (family), ji (chicken), gou (dog), zhu (pig), yu (fish), gege (brother), hua (flower), ma (horse), feiji (plane), yanji (eye), cai (vegetable), yifu (clothes), rou (meat), shui (water)

(Li et al. 2021:482)

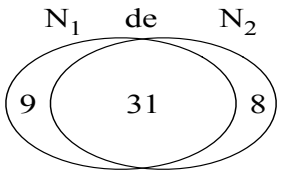


Figure 2-6. Set Relations between the N1 and N2 Nouns in the Mandarin Possessive

(Li et al. 2021:408)

2.3.5 Interim summary

Theoretically, there can be infinite recursions in human being languages in terms of syntax; however, it is practically impossible in the perspective of semantics – each single layer of recursion with a specific thematic role that makes the listener difficult to interpret and relate to the head of the DP. With regard to recursive possessive, the most adopted is Two Level shown in NP1 *de* NP2 *de* NP3 in Mandarin and NP1*'s* NP2*'s* NP3 in English; the relation between recursive levels and ages is provided in Table 2-6. Lastly, the major findings and limitations are illustrated and compared as shown in Table 2-7.

Table 2-6. The Level of Recursive Possessive

Level	**Age**	**Comprehensive / Productive**
Level One	Three years old	The bidirectionality of recursive possessive in Mandarin Chinese tends to have both N1 and N2 either animate or inanimate in their utterance (productive).
Level Two	Four years old	4-year-old Mandarin-speaking children are capable of comprehending and producing Level 2 recursive possessive.
Level Three	Four years old	4-year-old Mandarin-speaking children are able to comprehend Level Three Recursive Possessive.

Table 2-7. Major Findings and Limitations of the Previous Studies

	Major findings	Limitation
Shi and Zhou (2018)	1. Over 70% of Mandarin-speaking children at 4-year-old are capable of comprehending and producing possessive construction with the marker *de*, while the three-year-old is still at the developmental stage. 2. The ability to tell alienability from inalienability is also at age 4.	1. Participants: 1) Group 1 (N=30, M=3;5) 2) Group 2 (N=20, M=4;6) 3) No Control Group 2. Material: 1) Pictures recognition 2) Story-telling elicitation 3. Tasks: a comprehension and a production task
Giblin et al. (2019)	1. Hierarchical structure: Children are innate with it. 2. Age: Over 50% of 4-year-old children are capable of comprehending and producing Level 2 in English and in Mandarin. 3. Others: Children's acquisition of Mandarin and English nominals manifests recursive structures early in the absence of decisive input.	1. Participants: 1) English-speaking children (N=26, M=4;7) 2) Mandarin-speaking children (N=30, M=4;5) 3) Control Group: 33 Mandarin-speaking Adults 2. Materials: story-telling 3. Tasks: a production task

Table 2-7. (*continued*)

Li et al. (2020)	1. Hierarchical structure: Older children tend to respond with a conjunction but not with a reduction while the recursion level increases. 2. Recursion Level: Level 3 can be comprehended by 4-year-old Mandarin-speakers (46%) 3. Age: a negative effect of recursion level increased (*p=.023)	1. Participants: 1) 4-year-olds (N=10, M=4;0) 2) 6-year-olds (N=20, M=5;11) 2. Materials: Picture Act-out task 3. Tasks: A comprehension Task
Li et al. (2021)	1. Structure: the distribution of N1 & N2 is mostly bidirectional in Mandarin possessive (N2 de N1) 2. Constituent: the size of the lexicon increase, the intersection of the two sets will shrink as a proportion	1. Analysis of 56 nouns of three-year olds' vocabulary 2. Materials: CHILDES corpora (1.7 million words of input)

2.4 Summary of Chapter Two

Expressing possession is one of the most fundamental aspects of human language and cognition (Aikhenvald 2013) and children are inherent with natures to make their innateness while the mechanism is mature enough to be utilized. They first start with one word – isolated expression - and then noun-noun compounds at around 2-year-old. Gradually, they have alienable possession to express their relations with the surroundings, and were stimulated by the environment with the innate mechanism to drive them to adopt recursive to express the hierarchical relations among nouns. While they were getting familiar with both the possessive and recursive structures of their mother tongue, they further acquired far more

sentence patterns as well. It explains why older children at around 6 years old may adopt conjunctive structures while they facing multiple recursive possessives – they innately or unconsciously know that it is a better way to function, adjust their utterance rather than have 3-level or 4-level of recursive possessives – though it can be grammatically generated – an interesting self-language awareness to be explored in the present study.

Chapter Three

Research Design

The focus of this chapter is mainly to elaborate on the research design as to how L1 Mandarin-speaking children in Taiwan react to recursive possessives in terms of comprehension and production ability. In Section 3.1, the background information of the participants is described. In Section 3.2, the theoretical foundation and materials of the experiments are provided in detail. In Section 3.3, the procedures including the pilot study and the formal one are mentioned. In Section 3.4, a brief summary is presented.

3.1 Participants

Numerous previous studies showed that three to eight-year-old children were capable of comprehending and producing multiple levels of recursive possessives (hence RPs) (Shi & Zhou 2018, Giblin et al. 2019, Li et al. 2020), whereas Roeper (2007) pointed out that English-speaking children could not produce RPs before they were 6-year-old to yield 2 or 3 Levels of RP (Terunuma et al. 2017) or even 4 Levels (Fujimuri 2010). Moreover, some studies focused on levels of RPs, some aimed at age effect, and some of them might only have either comprehension or production tasks with different results for the same questions, so that there were possible gaps among the recursive levels, ages, and task effects.

In addition, most of the studies in recursive possessives of *de*-structure focus on children in Mainland China but rarely in Taiwan; therefore, the present study was set to investigate the critical ages and the levels of the recursive possessive construction for Mandarin-speaking children in Taiwan to provide a complete picture of the developmental path and fill in the gaps

for the previous studies.

Table 3-1. Participants' Background Information

Group	Age Range	Mean Age	Number
Group 1	3-4	3;5	16
Group 2	4-5	4;6	16
Group 3	5-6	5;5	16
Group 4 (native adults)	23-30	25;8	16

As Table 3-1 above, forty-eight participants in 3 groups were evenly grouped with 16 children in each group and Group 4 as the control group with 16 participants as well. The ages of the experiment groups ranged from 3 to 6, while the control group was from 20-30. The younger participants were all preschoolers from Taipei Xin-hai non-profit kindergarten. Participants of Groups 1-3 received instruction in Mandarin Chinese and had English classes 30 minutes a week. Additionally, sixteen graduate students from National Taiwan Normal University of ages 23 to 30 were recruited as the control group. Since this study was designed for first language acquisition research, Mandarin Chinese is the mother tongue of all participants and they have no history of speaking or hearing difficulties or cognitive impairment.

3.2 Materials and Methods

With regard to language acquisition, comprehension precedes production (Clark 2016:434) where there is asymmetry in between, even for adults. Especially for younger children, they use their comprehension to perceive their surroundings while they modify it at

the same time according to the feedback from the interaction with others. The asymmetry results in the back-and-forth mismatches and intention test before producing their utterance; therefore, the varying comprehension forms a developmental course to their production of what they intend to express. In order to investigate the route, both a comprehension task and a production task were designed to fill in the gap(s) from previous studies.

The present study focused on whether the participants were able to interpret and perform the target structures at different ages with distinct levels. A cross-sectional investigation is a better approach - the linguistic performance from a larger number of subjects is studied, and the performance data are usually collected at only one session (Larsen-Freeman & Long 1991), while the longitudinal approach is case-study oriented contrastively. Therefore, the present study adopts a quantitative methodology rather than a qualitative one, since the repertoire of generalizability; objective, verification-oriented, and outcome-oriented (Reichardt & Cook 1979) meets the requirements of the purpose.

With respect to recursive possessives, it is more feasible to conduct a comprehension task than a production one, since it is contrastively difficult to get the natural datum from a designed research concerning quantitative and qualitative. Therefore, in the present study, a truth-value judgement (TVJ) task and a question-and-answer (Q&A) task are designed with scenarios to elicit the target structure from the participants. The former assesses the children's comprehension of the recursive structure in Mandarin; the latter examines their production of the target structure.

According to Li et al. (2020), Mandarin-speaking children in China tend to adopt conjunction structure or deletion while facing the challenge of Levels 2-3 recursion in an act-

out comprehension task but no production task was employed in the same study to prove that they literally uttered phrases with conjunction to substitute an RP or RPs. Additionally, in a pilot study by Fujimori (2010), a 4-level recursive possessive task was conducted, but there were only 10 questions in total with one question for a 4 Level recursion – the samplings seemed not sufficient to conclude whether Japanese-speaking children were able to apply 4 Level recursion or not.

Therefore, in order to bridge the gap of the previous studies, no matter the POSS-level of the recursion, the age range, with comprehension or production only, it would be necessary to have tasks of both input and output with 4 Level recursion to see if it has the similar results for children in Taiwan as well.

Table 3-2. Types of Recursive Possessives in the Two Tasks[1]

Type	Example(s)	Comprehension task		Production task	
		No.	Question No.	No.	Question No.
Level 1	*Xiaomei de pengyou* 'Xiaomei's friend'	2	CQs1, 2	2	PQs1, 2
Level 2	*Xiaomei de pengyou de gou* 'Xiaomei's friend' dog'	2	CQs4, 5	2	PQs4, 5
Level 3	*Xiaomei de pengyou de guo de qiuqiu* 'Xiaomei's friend's dog's toy ball'	2	CQs7, 8	2	PQs7, 8
Level 4	*Xiaomei de pengyou de pengyou de fangzi de youyong chi* 'the swimming pool of Xiaomei's friend's friend's house'	2	CQs10, 11	2	PQs10,11
Distractor	*Qing wen zhe shi yi ge pingguo ma?* 'Is this an apple?'	4	CQs, 3, 6, 9, 12	4	PQs3, 6, 9, 12
Total		12		12	

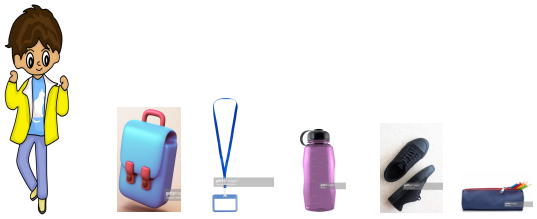
[1] CQ: comprehension Questions, PQ: production questions

As Table 3-2 shows, the present study consists of two sections – comprehension task and production task. Each section contains eight questions covering recursion level one to four for both tasks with two questions in each recursion level evenly. It is designed to have the participants respond to the comprehension task by judging a designated color as a token of the answer. Lastly, there are 4 distractors for each task – a filler question right after every two consecutive questions served as a judgement of the subject's cognition.

3.2.1 Comprehension Task: Truth Value Judgement Task

As for the comprehension of one's own language, some call it data on learner's competence (Fraser et al. 1980), while others defined it as metalinguistic judgement data (Chaudron 1983). Younger children first comprehend what the utterance around them, and then after all the maturation of both their cognition and physical parts, they would start to produce and interact with their surroundings. Therefore, a comprehension task of truth-value judgement was the first step of the present study to test whether younger Mandarin-speaking children in Taiwan were able to understand the recursive possessives at what ages and at what levels.

Table 3-3. An Example of Level Two Recursive Possessive for the TVJ Task

The participant saw:	The participant heard:
	*"Ta shi Xiaoming. Zhexie shi ta de shubao, mingpai, shuihu, qiuxie, gen qianbihe. Ta de mingpai de daizih shi lanse, dui bu dui?"* 'This is Xiaoming. These are his schoolbag, name card, water bottle, sneakers and pencil box. The strap of his name card is blue. Is it true?'

As shown in Table 3-3, the participants were asked like '*Xiaoming de mingpai de daizih shi lan, duei bu duei?"* (Is it correct or not that the color for Xiaoming's name-card's strap is blue?) – what the participant was expected to answer was "Yes" or "No", or even just nodding or shaking their head instead to show their comprehension of the experimentor's interpretation of the target picture. For more information about this task, please refer to Appendix A.

3.2.2 Production Task: Question and Answer Task

Conducting a question-and-answer session (with stimuli) is a fairly common means of eliciting language acquisition data (Larsen-Freeman & Long 1991) that meets the requirements of the present study. In theory, researchers preferring quantitative methods would choose to use instruments in their studies (Larsen-Freeman & Long 1991:76) rather than the spontaneous or natural data. Furthermore, learners will place limitations on the data themselves (Corder 1981),

so it is better to design a particular aspect of linguistic performance to immerse the participants in the circumstances than produce the target linguistic structures from all the settings.

Table 3-4. An example of Level Two Recursive Possessive for the Q&A Task

The participant saw:	The participant heard:
	*"Ta shi Xiaomei. Zhexie shi ta de dongshi. Ta shi Xiaoming. Zhexie shi ta de dongshi. Zhe chang tu li you shenme dongshi shi luse de ne?"* 'She is Xiaomei and these are her items for school. He is Xiaoming and these are his items for school. Is there anything green in this picture?'

For the production task, the participants were shown a picture of two main roles with the same items but in different colors and were asked questions as in Table 3-4 to elicit the recursive possessive *de*-structure. The participants were expected to make it clear by interpreting the possession of the target item, because both the roles had the same items but in distinctive colors. According to Giblin et al. (2019), deletion and conjunction would possibly emerge while the participants facing the challenge of level recursion – two critical reactions were expected from the present task. For more information about this task, please refer to Appendix B.

3.3 Procedures

3.3.1 Pilot Study

In this section, a one-on-one pilot study was conducted with four participants – two were an experiment group and the other two a control group. One participant of the experiment group was a 6-year-old (from Si-gao Kindergarten in Taipei), and the other was a 10-year-old (from Xi-zhi Elementary School in New Taipei City). As for the control group, they were both recruited from NTNU at the age of 23 and 27. Both of them were graduate students majoring in Linguistics in the National Taiwan University. The purpose of the pilot study was to control the validity and accurateness of the formal experiment to check if there were anything – the given instructions, the recognition of the presented pictures, and the description of the pictures was fully comprehended and to adjust prior to the formal task. The pilot study consisted of two sections – a comprehension task and a production one. The comprehension task included 16 recursive-possessive questions that ranged from Levels 1 to 4 and were conducted to the two participants of the experiment group first respectively. The roles of the task were first introduced to the subject with pictures as the order of their appearances in the task: Xiaoming, Xiaoming's friend, Xiaoming's friend's friends, Xiaoming's friend's friend's dog together with their possession respectively. Figure 3-1 below is as an example of how the task items were presented to the participants. As for the other main roles – Xiaomei, it was the same sequence as those of Xiaoming's. For more information about the details, please refer to Appendix A, B for the task questions and Appendix C for the task results of the pilot study.

After introducing each role and their relation, the experimenter checked whether the participant had questions about the pictures and their background information to

finish the familiarity time and then a pre-test would be given before the comprehension task was conducted. In addition to the comprehension task, a pre-test production task was also carried out as well.

The results showed that both participants responded with 100% correctness, which took them almost the same time to carry out. It was the same result as the control group but only with a shorter processing time by 15 seconds. As for the production task, both participants in the experiment group showed availability toward multiple levels of RPs. As the age effect, the elder participant performed better than the younger one with 87.5% vs. 68.75% correct, especially for Levels 3 and 4. However, no specific difference occurred for the adult group where they performed 100% correct for both the comprehension task and the production one. Furthermore, it showed a trend that the more level the recursive possessives it increased, the more deletion of *de* marker there occurred, which was mostly observed from the performance of Participant 2, who is the youngest in the pilot study. Additionally, an interesting performance between Participants 1 and 2 was that the deletion of *de*-marker was located in a distinctive position – the elder had the deletion in the 4th level by omitting the 4th noun phrase *Xiaomei de pengyou de pengyou de* ***fangzih*** *de youyong chi* 'the swimming pool of Xiaomei's friend's friend's **house**' as principles of economics (Mankiw 2015), since it was literally efficient without saying the word *fangzih* 'house' but with the same denotation. The younger participant deleted the first *de*-marker right after the first noun phrase. It showed that there were still noun-noun compounds in young children's noun phrase format.

According to the task result of the pilot study, there were some modifications in the formal study. First, there should be no description of the targeted structure *de* marker to the

participants in order to collect as natural datum as possible. Secondly, the distinctiveness of the instrumental pictures was to be more clear-cut to prevent any confusion among the questions. In question 22, the question 'In this picture, who has long legs?', might not be that manifested in some younger children. Or in question 16, the question asked 'Is the wall of Xiaomei's friend's friend's dog's doghouse red?', a question from a participant of the control group indicated that there was a grey frame between the red walls – which might confuse some younger children to make a true-value judgement accordingly. The limitation of the pilot study was the very few numbers of the sampling, so what had been observed in this section would be expected and checked from the formal study soon.

3.3.2 Formal Study

The process of the formal study was similar to the pilot study and conducted in three phases – the familiarization time, the comprehension task and the production task.

In this section, a consent form (Appendix D) to the parents in advance was required to inform them of the study goal, task materials and the expected results. Furthermore, it was a necessity to assure the parents that the personal information of the participants would be kept in confidential. As soon as all the consent forms were received, the formal study was conducted accordingly. One thing different from the pilot study was that the tasks were conducted in five weeks since the participants were 40 times more than for the pilot study.

At the time of conducting the tasks, the estimated time was about 10 minutes – the reaction time was also a critical observation to evaluate that the context of the task materials were reasonable or difficult for the participants. After the comprehension task,

a familiarization time was provided before preceding to the production task. During the task, the experimenter paid attention to the speaking speed and made sure that if she spoke too fast to make the participant lose track of the task contents, especially the task of recursion level more than one. The task was conducted in a quiet and separated room to avoid any interruption to the experiment.

3.3.3 Scoring

In this section, the scoring the participants' performances on the TVJ task and the Q&A task are discussed. First, with regard to the TVJ task, the answers to the questions were designed either Yes or No, so that the scoring was therefore either 1 or 0 accordingly. For example, when the participant was asked "*Xiaoming de mingpai de daizih shi hongse, dui bu dui?" (*'The strap of Xiaoming's name card is red. Is it true?') as shown in Table 3-3, he got 1 with the correct answer 'No' or 0 with the wrong answer 'Yes', since the strap of Xiaoming's name card was blue.

Secondly, for the Q&A task, the focus was on how the participants used the *de* marker in RP, so the omission of it was evaluated incorrect or incomplete, as shown in Table 3-5.

Table 3-5. Scoring on the Q&A Task

Example	The participant's answer	Score	Note
1-level RP *Xiaomei **de** pengyou* 'Xiaomei's friend'	*Xiaomei **de** pengyou*	1	Correct
	Xiaomei ø pengyou	0	1 *de*-omission
2-level RP *Xiaomei **de** pengyou **de** fangzi* 'Xiaomei's friend's house'	*Xiaomei **de** pengyou **de** fangzi*	1	Correct
	*Xiaomei ø pengyou **de** fangzi*	0.5	1 *de*-omission
	*Xiaomei **de** pengyou ø fangzi*		
	Xiaomei ø pengyou ø fangzi	0	2 *de*-omissions

The complete employed *de* marker(s) was scored 1 as the highest and 0 for zero adopting *de* as the lowest, while the omission(s) was scored 0.5 – one or two omission(s) of *de* both got scored 0.5 in a 3-level RP, as one, two or three omission(s) of the *de* marker in a 4-level RP was scored 0.5, respectively.

3.4 Summary of Chapter Three

In sum, this chapter reports the background of the participants, the methodology of the two respective tasks –comprehension and production, the result of the pilot study, and the scoring policy. In addition, it provides the data analysis for the modification in the formal study. For example, reducing the task items from 32 to 16 and adding 8 distractors are two major adjustments to fit the practice for the young participants.

Chapter Four

Results and Discussion

The present chapter is to present the results of the two tasks in response to the four research questions raised in Chapter One and further discuss the findings revealed in each investigation. Section 4.1 presents and discusses the performance of Mandarin-speaking children toward the different levels of the recursive possessives (RP hence) with the *de* marker. Section 4.2 examines children's abilities to comprehend and produce RP respectively and Section 4.3 focuses on the bring-out resulted from the age effect by Mandarin-speaking children. Section 4.4 analyzes the variant formats of reaction that occurred while the participants face RP in different levels. Lastly, a summary is presented for a brief interpretation of the outcomes of the experiments in Section 4.5.

4.1 Recursive Levels

The focus of the research question one is to investigate the performance of Mandarin-speaking children on different recursive levels of nominal possessives. It was observed that Level 2 RP in the previous studies was the most adopted for investigation methodologically. However, in the present study, both the comprehension and production abilities of a targeted RP level of Mandarin-speaking children were evaluated. The scores were combined as an index of their availabilities for the target level. In Section 4.1.1, the MEANs and SDs of the four levels in each group were listed and compared; furthermore, the performances of the tasks at the same level in the different tasks are elaborated in Section 4.1.2.

4.1.1 Overall Findings

As shown in Table 4-1, a two-way ANOVA with the participants' overall correct responses as the dependent variable and Age Group (G1, G2, G3, G4) and Levels (Levels 1~4) as factors revealed a main effect of Age Group ($F(3, 993) = 96.4647$, p <2.22e-16***), a main effect of Levels ($F(3, 993) = 7.5392$, p <5.4498e-05***), and an insignificant intersection between the two factors ($F(9, 993) = 1.3605$, $p = 0.20162$).

Table 4-1. Two-way ANOVA on Age Group and Levels

	Df	*F*	*p* value
Age Group	3	96.4647	< 2.22e-16 ***
Levels	3	7.5392	5.4498e-05 ***
Age Group*Levels	9	1.3605	0.20162
Residuals	993		

The task results suggested a tendency that the Means of levels were getting slightly lower along the gradual adding of the recursive levels by the way of combining the participants' comprehension and production abilities as a holistic. As shown in Table 4-2, the means of each level in the experimental groups presented the trend that Level 1 > Level 2 = Level 3 = Level 4, while there seemed no significant difference in the control group as Level 1 = Level 2 = Level 3 = Level 4.

Table 4-2. Subjects' Overall Performance on the Distinctive Levels of RP

	Level 1		Level 2		Level 3		Level 4	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Experimental	0.61	0.21	0.53	0.14	0.52	0.14	0.50	0.13
Control	1.00	0.00	1.00	0.00	0.98	0.05	0.98	0.05

Therefore, it suggested the developmental path of the acquisition of levels in Mandarin RP to be divided into two sections: Level 1 and levels beyond Level 1 (i.e., Level 2, 3, and 4 in the present study), since the only significant difference was between Level 1 and Level 2 (0.61: 0.53), but not Level 2: Level 3 (0.53:0.52), Level 2: Level 4 (0.53:0.50), or Level 3: Level 4 (0.52:0.50). As for the control group, with the proficiency of the target language, there showed no difference with all the scoring close to full accuracy.

Regarding the Ms, SDs, and *p* of each level in the groups are listed in Table 4-3 below.

Table 4-3. The Means of SDs of Groups in Different Levels

	Level 1		Level 2		Level 3		Level 4		*p*-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
G1	0.42	0.18	0.39	0.13	0.40	0.14	0.36	0.13	0.9106
G2	0.50	0.26	0.46	0.13	0.48	0.13	0.46	0.11	0.9685
G3	0.90	0.20	0.73	0.17	0.67	0.15	0.69	0.14	0.0004
Adults	1.00	0.00	1.00	0.00	0.98	0.05	0.98	0.05	0.1053

From the above data in Table 4-3, it indicates that RP levels showed no significance for the 3-year-old, 4-year-old Mandarin-speaking children and Adults with $p = 0.91, 0.96$ (>0.05) for G1, G2 and $p = 0.10528$ (>0.05) for the control group. The only group with a significance was G3, the 5-year-old group, where they showed performance of $p = 0.0004$ (< 0.01). Therefore, in terms of level effects, we might conclude that G1 and G2 were on the same degree since they both were not available to perform meta-levels of RP with significance, which suggested that Level 1 = Level 2 = Level 3 = Level 4 for them at this stage of cognitive development.

As for G3, the only group that made levels significant in RP, the comparison between levels was therefore critical as shown in Table 4-4 below, which demonstrated that Level 1 was different from Level 2 with p=0.0156*(<0.05), Level 3 and 4 with p=0.0012** (<0.01), suggesting that L1> L2, L1>L3, L1>4 for 5-year-old Mandarin-speaking children. Moreover, in Table 4-3, G3 also showed the similar availability degree on Level 2, Level 3 and Level 4, since all the p=1 (>0.05) implying that L2=L3=L4 to G3.

Table 4-4. *p*-values between Levels for G3

	L1: L2	L1: L3	L1: L4	L2: L3	L2: L4	L3: L4
G3	0.0156 *	0.0012 **	0.0012 **	1	1	1

Therefore, summarizing the information from Table 4-3 and 4-4, it suggests the availability or unavailability for G1, G2, G3 and Adults shown as below in Figure 4-1.

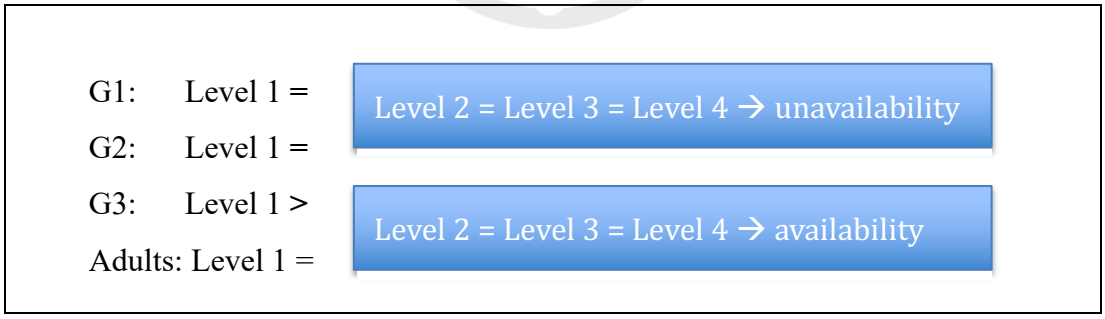


Figure 4-1. Each Group's Performance on Each Level

4.1.2 General Discussion

The first major finding from the present study appeared the levels of RP showed no significance for Mandarin-speaking children younger than 5, which was similar with what was proposed in the previous studies that children were contrastively late for comprehending and

producing Level 2 or more in their language development (Matthei 1982, Roeper 2007, 2011, Perez-Leroux et al. 2012, Giblin & Crain 2019). Though there were 4 levels in the task, it seemed that there were only 2 segments – Level 1 and levels beyond Level 1 (i.e., Level 2, 3 and 4). The finding echoed the previous studies that younger children's performance on different level(s) of RP was feasible for comprehending and producing 1-level (Brown 1973) while 2- or 3-levels of RP had difficulties (Roeper 2011) and 4-levels was even rarely achieved. Roeper even indicated that the time-course of each form of recursion may be a function of how much exposure is involved, as well as the derivation nature and the intersection with morphology (Roeper 2011:83). Furthermore, an important cutting-point dividing Level 1 from Level 2 was proposed at the timing when Mandarin-speaking children were 5 years old where they were able to employ RP levels one and two, which suggested that the 5-year-olds broke through the gap between Level 1 and Level 2 so that they were able to handle a hierarchical structure rather than a flat structure since then.

The second major finding was that levels were significant to 5-year-old Mandarin-speaking children, where there showed differences from those of the previous studies that Level 2 could be produced by four years old (Shi & Zhou 2018, Giblin et al. 2019, Li et al. 2020). We therefore re-checked the tasks in the previous studies and found out that maybe the easiness or complexity of the task design was one of the effects that led to different results of the tasks, which implies that different methodology accounts for the different results. For example, Giblin et al. (2019) adopted a story-telling task where there was a role in the story providing a hint with the target *de* marker in a complete sentence to the participant, where the participant could imitate the whole sentence by changing one of the noun phrases to get the correct target

structure accordingly. It might be worth another task to see if it was the same result without a puppet hinting the subjects. However, in the present study, there was no any implies with an open answer to an open question as shown below:

(1) *Qing wen zhe zhang tu li you shenme tongshi shi baise?*
please ask this CL picture inside have what thing be white
'Is there anything white in the picture?' (taken from the Q&A task Q1)

(2) *Qing wen zhe zhang tu li sei shou shan you yi ge baizhi?*
please ask this CL picture inside who hand up have one CL cup
'Who is holding a cup in the picture?' (taken from the Q&A task Q4)

Moreover, in the comprehension task from Li et al (2020), the participants were asked a three-level question as *jiqiren-de she-de sjizi-de binggan* 'robot's snake's lion's cookie', and the participants could just put a leaf before a flash card to get the score, whereas the comprehension task in the present study was as:

(3) *Qing wen Xiaoming de pengyou de gougou de qiuqiu shi luse duei bu duei*?
please ask Xiaoming RP friend RP dog RP toy ball be green yes no yes
'Xiaoming's friend's dog's toy ball is green, isn't it?' (taken from the TVJ task Q8)

4.2 Task Effect

The focus of research question 2 was to investigate if Mandarin-speaking children can correctly comprehend and produce RP respectively. As the sequence of language acquisition, children are expected to develop their comprehension ability earlier than production faculties (Clark 2016). Therefore, comprehension tasks for FLA in RP were the most adopted practice in previous studies, whereas production tasks were contrastively rare. However, the present

study covered both comprehension and production tasks and have the overall findings in Section 4.2.1 and further discussion in Section 4.2.2.

4.2.1 Overall Findings

As shown in Table 4-5, a two-way ANOVA with the participants' overall correct responses as the dependent variable and Age Group (G1, G2, G3, G4) and Tasks (comprehension + production) as factors revealed a main effect of Age Group ($F(3, 1001) = 510.08$, $p<2.22e\text{-}16$***), a main effect of Tasks ($F(1, 1001) = 736.72$, $p < 2.22e\text{-}16$***), and a significant intersection between the two factors ($F(3, 1001) = 190.08$, $p < 2.22e\text{-}16$***).

Table 4-5. Two-way ANOVA on Age Group and Tasks

	Df	*F*	*p* value
Age Group	3	510.08	< 2.22e-16 ***
Tasks	1	736.72	<2.22e-16 ***
Age Group*Tasks	3	190.08	<2.22e-16 ***
Residuals	1001		

The overall findings of task effects were reported as shown in Table 4-6 below, where it clearly demonstrated that all the subjects performed better on comprehension than on production at the Means 0.87: 0.20. Furthermore, there was also extreme significance for both of the tasks, because all the $p<0.01$ for the experimental group, where there was also significance shown for the task effect in the adult controls with $p=0.01308$ (<0.05).

Table 4-6. The Comparison between Children and Adults in the Tasks

	Comprehension		Production		*p* -value
	Mean	SD	Mean	SD	
Experimental	0.87	0.15	0.20	0.15	<2.22e-16***
Adults	1.00	0	0.98	0.03	0.01308

The information above shows that all younger Mandarin-speaking children were able to comprehend meta-levels of RP, even though it was in Level 4. Nevertheless, the task effect raised by production task seemed to address that the production ability for Mandarin-speaking children does not parallel with those of comprehension. Therefore, it was strongly suggested that in terms of comprehension and production abilities, younger Mandarin-speaking children significantly performed better on the comprehension task than on the production task.

Following the comparison between children and adults, the performances of each group in comprehension task were listed in Table 4-7 below. It reported that G1 showed the availability in the comprehension task, even with the Mean 0.72 for Level 4 – the most difficult items in the task. Furthermore, G2 even achieved as high as 0.91 in Level 4, not to mention that G3 was 100% correct for each level in the task, which suggested that 5-year-old Mandarin-speaking children are able to demonstrate adult-like performance in their comprehension for RP in Mandarin. Moreover, with all the $p>0.05$ (G1 $p=0.92839$, G2 $p=0.42386$, G3 $p=0.39531$, and Adults $p=0.395$), it suggested that in terms of the comprehension ability of RP that younger Mandarin-speaking children were adept at it, since it showed no significant distinction from the *p*-values in Table 4-7 below.

Table 4-7. Means & SDs of the Groups in the Comprehension Task

	Level 1		Level 2		Level 3		Level 4		*p*-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
G1	0.75	0.44	0.78	0.42	0.78	0.42	0.72	0.05	0.92839
G2	0.78	0.42	0.84	0.37	0.91	0.30	0.91	0.30	0.42386
G3	1.00	0.00	1.00	0.00	1.00	0.00	1	0	0.39531
Adults	1	0	1	0	1	0	1	0	0.395

Furthermore, there showed extreme significance for each level among groups in the comprehension task as shown in Table 4-8 below, where all the $p<0.01$ suggesting that in each single level of the task, there was extreme distinction among groups, where Level 4 presented the most difference.

Table 4-8. *p*-values of Each Level among Groups in the Comprehension Task

	Level 1	Level 2	Level 3	Level 4
p-value	0.0005	0.0024	0.002	0.0001

As long as there was an extreme significance in each single level among groups in the comprehension task, the comparison between groups in the same level were listed in Table 4-9 below for further investigation with their *p*-values. Form Table 4-9, it reported a surprising figure that all the $p=1$ between G3 and G4 no matter what level they took in the comprehension task, which showed that 5-year-old Mandarin-speaking children were very possibly equipped with the same proficiency as adults were. Furthermore, though $p=1$ for G1:G2 in Level 1 showed no significance for comprehension between them, it tended to show significance from $p=0.7457$ (>0.05) for Level 2, $p=0.2157$ (>0.05) for Level 3, but $p=0.027$ (<0.05) for Level 4, suggesting that Level 4 was a cutting-point to distinguish G2 from G1 in comprehension ability.

Table 4-9. *p*-values of Levels between Groups in the Comprehension Task

	G4:G1	**G4:G2**	**G4:G3**	**G1:G2**	**G1:G3**	**G2:G3**
Level 1	0.0079	0.0189	1	1	0.0079	0.0189
Level 2	0.0131	0.1085	1	0.7457	0.0131	0.1085
Level 3	0.0053	0.4401	1	0.2157	0.0053**	0.4410
Level 4	0.0004	0.5124	1	**0.0270**	0.0004	0.5124

As for the performance in the production task shown in Table 4-10 below, it indicated that there was no significance for G1 (p=0.0999035 (>0.05)), G2 (p=0.083879 (>0.05)) and adults (p=0.098822 (>0.05)), while it suggested that 5-year-old (G3) was the critical age for Mandarin-speaking children to perform RP correctly with the correctness rate 0.78 for Level 1 and 0.45 for Level 2. As for G1, they were barely able to produce RP with the Mean 0.028 (the average of L1, L2, L3 & L4) in the task. As for G2, though they performed better with the Mean 0.22 in Level 1, it showed not much distinction starting from Level 2 to Level 4. Therefore, it seemed that Mandarin-speaking children younger than 5-year-old were not available to produce RP orally. In contrast, those at 5 years old were able to produce Level 1 RP in Mandarin, but not for Level 2, Level 3 and Level 4 as shown in Table 4-11 below, where it suggested that the task result in Level 1 for G3 was better than those in Level 2, Level 3 and Level 4 with extreme significance p=0.00207 (<0.01), p=3.15e-05***(<0.01), and p=1.15e-04***(<0.01) respectively.

Table 4-10. Means & SDs of the Production Task by Each Group

	Level 1		Level 2		Level 3		Level 4		*p*-value
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	
G1	0.09	0.30	0	0	0.02	0.09	0	0	0.099035
G2	0.22	0.42	0.08	0.18	0.05	0.15	0.02	0.09	0.083879
G3	0.78	0.42	0.45	0.39	0.34	0.35	0.38	0.29	1.0693e-05 ***
Adults	1	0	1	0	0.95	0.15	0.95	0.15	0.098822

Table 4-11. The Comparison between Levels for G3 in the Production Task

	L1:L2	L1:L3	L1:L4	L2:L3	L2:L3	L2:L4	L3:L4
G3	2.07e-03**	3.15e-05***	1.15e-04***	7.00e-01	8.08e-01	8.08e-01	8.08e-01

Additionally, the participants' overall performance in the production task also showed extreme significance with $p < 2.22e\text{-}16$ (<0.01) for each single level among groups as shown in Table 4-12 below.

Table 4-12. *p*-values of Levels in the Production Task among Groups

	Level 1	Level 2	Level 3	Level 4
p-value	<2.22e-16	<2.22e-16	<2.22e-16	<2.22e-16

Furthermore, as for the comparison between groups in each level in the production task, the task results were presented in Table 4-13 below, which showed extreme significance with all the *p*-values <0.01 between groups of G4:G1, G4:G2, G1:G3, and G2:G3. G3 (5-year-old Mandarin-speaking children) performed better on Level 1, but not on Level 2, 3 and 4, which can be observed by the degree of significance between G4:G3 that p=0.0189 (<0.05) for Level 1, but p=2.52e-14 (<0.01)) for Level 2, p=6.53e-17 (<0.01)) for Level 3, and p=9.28e-20 (<0.01)) for Level 4. The figures indicated that their performance on Level 1 was far more

distinctive from those on Level 2, 3 and 4. Moreover, the comparisons between G1 and G2 are also worth mentioning, since it presented no significant distinction between the two groups with p=0.134 (>0.05) for Level 1, p=0.1 (>0.05) for Level 2, p=0.482 (>0.05) for Level 3 and p=0.661 (>0.05) for Level 4, which appeared that G1 and G2 were with the similar degree of unavailability for producing meta-levels of RP in Mandarin.

Table 4-13. *p*-values of Levels between Groups in the Production Task

	G4:G1	**G4:G2**	**G4:G3**	**G1:G2**	**G1:G3**	**G2:G3**
Level 1	4.30e-19	1.63e-15	1.89e-02*	1.34e-01	6.43e-13***	1.31e-09***
Level 2	1.07e-34	4.51e-31	2.52e-14	1.00e-01	5.09e-14	2.27e-10
Level 3	7.21e-33	2.35e-31	6.53e-17	4.82e-01	1.18e-09	2.55e-08
Level 4	1.85e-42	1.17e-41	9.28e-20	6.61e-01	1.48e-17	1.15e-16

4.2.2 General Discussion

There are three major findings in the present study in terms of task effects. First, younger Mandarin-speaking children performed significantly better in comprehension than what they presented in the production task. It echoes back to comprehension preceding production (Clark 2016:434), indicating that comprehension is not only ahead of production by far but asymmetrically exceeding - language-speakers might comprehend some rare structures but barely or never produce them (Clark 2016). It explains why Mandarin-speaking children as young as three years old were able to comprehend Level 4 RP but unable to produce a Level 1 RP with such asymmetry.

Secondly, another major finding was that 3-year-old Mandarin-speaking children actually had a similar degree of comprehension ability as the 4-year-olds, which were barely

found in the previous studies. They had suggested that 4-year-old was a critical age for Level 2 comprehension (Shi & Zhou 2018, Giblin et al. 2019, Li et al. 2020) but not the 3-year-olds. However, in the present study, G1 showed no significant distinction from G2 for Level 2 comprehension. Even for Level 3 there was still no significance shown between the 3-year-olds and the 4-year-olds.

In terms of production ability of RP in Mandarin, there was also a major finding in the present study. Both 3- and 4-year-old Mandarin-speaking children seemed unavailable to produce meta-levels of RP, which showed difference from the previous studies that 4-year-old children were able to produce Level 2 RP (Shi and Zhou 2018, Giblin et al. 2019, Li et al. 2020), but also demonstrated the similarity with those mentioned in Roeper 2011 and Yang 2014 that children between six and eight years old are able to make Level 2 RPs. We re-examined the production task and reasoned it as that the task design might be one of the attributions, since the participants in the present study could employ any strategies to answer the questions (in order to collect the data as authentic as possible, the experimenter did not give any hints or sample sentences to the subjects). Therefore, they either pointed at the correct answers on the screen, adopted determiners as in (4), or any other ways to answer the question without limitations. Furthermore, what was adopted in the present study were all open questions with the non-targeted responses; however, it was contrastively easy for the participants to score zero as long as there were 2 drops of *de* markers or noun phrases in an expected answer as *Xiaomei de pengyou de pengyou de fangzhi de youyoung chi* 'the swimming pool of Xiaomei's friend's friend's house'(1=completely correct, 0.5= one drop of either a *de* marker or noun phrase, 0=two or more drops of *de* markers or noun phrases), which gave the

performance a lower grade.

(4) E[1]: *Qing wen zhe zhang tu li you shenme shi hongshe*?
please ask this CL picture inside have what be red
'What is red in the picture?'
G2S4[2]: *Zhe ge*.
this CL
'This' (taken from the Q&A task Q2)

Following the above, 5-year-old Mandarin-speaking children appeared to be at a critical age to produce Level 1 RP in the present study, whereas 4-year-olds were at the decisive age for production ability (Shi and Zhou 2018, Giblin et al. 2018). Except the different degree of easiness or complexity of the task design leading to a distinctive result, a quantitative consideration raised in another task by Fujimori (2010), where she recruited (contrastively few) 10 children (but larger age-range) aged 2~6 with total 10 closed questions (3 questions for Level 1, Level 2, Level 3 respectively, 1 question only for Level 4) as 'What color is Mika's brother's friend's dog's ball? – Yellow.' (Roeper 2011:71). With uttering a single word as a correct answer as being recognized as availability of producing a Level 2 or Level 3 RP, the expected answers in the present study were far more difficult no matter in terms of wordy or the hierarchical structures. However, with the different results in distinctive research designs, it is worth pondering on how we judge the availability of performing a certain aspect in languages to a certain extent.

[1] E=experimenter;
[2] G2S4= participant 4 in Group 2

4.3 Error Analysis

Research question three was set to investigate that if Mandarin-speaking children would adopt conjunctions (Roeper 2011) or other formats of responses while facing multiple levels of RP. Section 4.3.1 reports the overall findings in the participants' errors and section 4.3.2 deals with the general analysis based on the results of the investigation.

4.3.1 Overall Findings

It was suggested that children would adopt conjunctions while coming across multiple levels of RP (Roeper 2011) and there was reduction as the other type of error that children tended to demonstrate in production task (Li et al. 2020). However, it was not the case in the present study with simply two types of errors but errors of great diversity as shown in Table 4-14, which reported three major types of errors – kinesics, insertion and omission, as kinesics was the most-made error-type by G1, insertion by G2, while omission by G3 and Adults. As for error-type kinesics, pointing to the correct answer (type-error coded as PA) in the present study, G1 made it as high as 97%, whereas with a steep drop to 20% for G2 and 5% for G3. It suggested that under the situation of unavailability to switch their comprehension into production, most 3-year-old Mandarin-speaking children adopted gestures as a strategy to substitute the target structure RP, but with contrastively low 3% in error-type insertion. As for the error-type insertion, G2 made 74% of their errors by inserting determiners (coded as Det), locative phrases (coded as Loc), pronouns (coded as Pron), while G3 27% further with another two sub-types relative clause (coded as RC) and sentence (coded as S) insertion. In addition to kinesics and insertion, omission was suggested to be the most-made error-type for G3 at 68%,

where they might either delete some of the noun phrases (coded as NP) or *d*e markers (coded as RP). Lastly, the controls seldom made errors in the task, but as there were errors – 91% of them was omission. Therefore, in terms of error-types in the present study, kinesics covered 40.2% of them, and most of them made by G1, while 34.1% of errors were insertion where G2 made them most, and omission the third that G3 and the controls made them most at 25.7%. As there were no specific instructions for the participants, they were free to utter the answers except remaining silent but many from G1 still persisted in pointing to the answers instead of speaking up even though they were encouraged to make a sound. Furthermore, G2, with possessing more lexicons than G1, made the best of what popped out to answer the questions. It appeared that both G1 and G2 showed their efficiency to fulfill the task by taking the most efficient linguistic items and giving up the costed alternatives (i.e., RPs) – unconsciously demonstrating one of the Principles of Economics – the cost of something is what you give up to get it (Mankiw 2015). Moreover, though G3 were more equipped to elicit the expected answers, they often reduced some of the noun phrases or *de* markers. They were still at the preoperational stage (2 to 7 years old) of cognitive development and were still struggling with logic and constancy (Paget 1964). Plus, *de* marker has the interpretation of distance (Xu 2013) which leads to the more *de* markers applied the more far-away it is to the specifier in terms of syntactic hierarchical structures. Last but not least, it was also observed that G3 omitted more *de* markers in the 1st noun phrase to form a noun-noun compound at 23% (9:39, Table 4-15) whereas the control made 0 reduction of *de* markers, which also echoes back to what had been found in the pilot study.

Table 4-14. Error-type Rate by Each Group

	Kinesics	Insertion	Omission
G1	**97.2%** (106/109)	2.8% (3/109)	0% (0/109)
G2	20.2% (22/109)	**74.3%** **(81/109)**	5.5% (6/109)
G3	4.9% (5/102)	27.5% (28/102)	**67.6%** (69 /102)
Adults	0% (0/11)	9.1% (1/11)	**90.9%** **(10/11)**
Total	**40.2%** **(133/331)**	34.1% (113/331)	25.7% (85/331)

Except for the error-type kinesics (only PA in the present study), the variant sub-types of errors made among groups would be listed in Table 4-15 with examples as shown below.

Table 4-15. Error Types of RPs by Each Group

Error Type			Interpretation	Type-Error in the Group			
				G1	G2	G3	G4
I	Kinesics	PA	pointing to the answer	106	22	5	0
II	Insertion	Det	determiners	3	56	17	0
		Loc	locatives	0	19	0	0
		Pron	pronouns	0	6	4	0
		RC	relative clauses	0	0	1	0
		S	sentences	0	0	6	1
III	Omission	NP	noun phrases	0	3	30	5
		RP	*de* marker(s)	0	3	39	5

First, the most verbally-made error-type was Det: representing a determiner being adopted to replace the target answer *de*- marker phrase as shown in (5), where the subjects were expected to elicit *Xiaomei <u>de</u> sheihu* ‘Xiaomei’s water bottle’ instead.

(5) An example of Error-type Det

E: *Qing wen zhe zhang tu li you shenme shi zise*?
please ask this CL picture inside have what be purple
'What's purple in this picture?'

G2S5: ***Zhe ge***!
this CL
'This one!' (taken from the Q&A Q1)

Secondly, the top-two error-types were Loc and Pron, recording the insertion of locative phrases or pronouns to replace RP instead. They were employed by G2 the most and with the examples as shown in (6) and (7) respectively. Without the expected answer for (6) as *Xiaomei de pengyou de pengyou de gougou* 'Xiaomei's friend's friend's dog', the subject avoided RP with a locative phrase. As for what was designed to elicit in (7) as *Xiaoming de pengyou de pengyou* 'Xiaoming's friend's friend', the subject used a pronoun to replace the hierarchical RP structure.

(6) An example of Error Coded L

E: *Qing wen zhe zhang tu li na yi zhi gou you hongse qiuqiu*?
please ask this CL picture inside which one CL dog have red toy ball
'Which dog has a red toy ball in the picture?'

G2S8: ***Shang mian de zei pangbian***.
Upper side RP most lateral
'the lateralmost one in the upper region' (taken from the Q&A task Q7)

(7) An example of Error Coded P

E: *Qing wen zhe chang tu li sei you zhang zhang de tui*?
Please ask this CL picture inside who has long long RP leg
'Who has long legs in the picture?'

G3S1: ***Ta***.
he
'He.' (taken from the Q&A task Q4)

Thirdly, as for the contrastively few error-type RC and S were interpreted as using a relative clause to replace RPs or adopting a sentence to elaborate the situation, where only G3 in the experimental group made the errors as shown in (8) & (9) below. In a form of substitution strategy, the subject used a relative clause to avoid a Level 2 RP as expected as *Xiaoming de pengyou de pengyou* 'Xiaoming's friend's friend' in (8). As for an expected answer as *Xiaomei de pengyou de pengyou de fanzih de youyong chih* 'the swimming pool of Xiaomei's friend's friend's house's' for (9), the subject rather answered the question in picture-describing way to replace a fewer-word but Level 4 RP, implying that there were actually alternatives for questions with open answers.

(8) An example of Error Coded RC

E: *Qing wen zhe chang tu li sei you zhang zhang de tui*?
Please ask this CL picture inside who has long long RP leg
'Who has long legs in the picture?'

G3S8: ***Shiouli che de na yi wei***.
fix car RP that one CL
'The one who fixes cars' (taken from the Q&A task Q4)

(9) An example of Error Coded S

E: *Qing wen zhe chang tu li you shenme shi yi ge da yuanxing?*
please ask this CL picture inside have what be one CL big round
'What is big and round in the picture?'

G3S10: *Xiaomei de pengyou de pengyou* ***ta de fangzih you yi ge***
Xiaomei RP friend RP friend she RP house has one CL

sheichih you yi ge da yuanxing
pond have one CL big round

'Xiaomei's friend's friend her house has a pond has a big round''

(taken from the Q&A task Q10)

Lastly, with the most-made error-type by G3 – omission – example (10) served as an example of an error-type NP representing a reduction of noun phrases in the expected RP phrases *Xiaoming de pengyou de pengyou de gougou de qiuqiu* 'Shiaoming's friend's friend's dog's toy ball', whereas example (11) as an error-type of RP coding as omission of *de* marker(s).

(10) Error Coded NP

E: *Qing wen zhe zhang tu. li you shenme shi yuanxing erqie shi huangse*?
please ask this CL picture inside have what be round and be yellow
'What is round and yellow in the picture?'

G3S15: ***Bai gougou*** *de qiuqiui*
white doggy RP toy ball
'The white dog's toy ball' (taken from the Q&A task Q11)

(11) Sample of Error Coded D

E: *Qing wen zhe chang tu li shei shou shang you yi ge beizih*?
please ask this CL picture inside who hand up have one CL cup
'Who is holding a cup in the picture?'

G3S11: *Xiaomei *(de) pengyou de* ***ta na ge pengyou***.
Xiaomei *(RP) friend RP she that CL friend
'Xiaomei friend's she that friend' (taken from the Q&A task Q5)

4.3.2 General Discussion

Two major findings were unfolded in the RP of Mandarin in terms of error-types. First, there was no conjunction found as proposed that direct recursion, which delivers a 'conjunction' reading (Roeper 2011:57). In comparison to the hierarchical structure of RP that consistently recurses, adopting conjunction as a flat structure (Crain 1991) seemed to be a more feasible way to achieve the goal of conveying the same expression. However, there was only one instance that might be close to conjunction as shown in (9) where there seemed to be two opaque conjunctions connecting the last 2 levels in the 4-level RP. Though there were longer phrases to form the same expression, it proposed that redundancy (Chomsky 1991) as a strategy to avoid making mistakes to overcome the challenge of multi-levels of RP.

Secondly, there were a variety of error-types, including adopting gestures, determiners, pronouns, locative phrases, relative clauses, or even sentences that were rarely suggested in the previous studies (Giblin et al. 2019, Li et al. 2020 and Li et al. 2021). There seemed a tendency among the numerous responses from the participants which demonstrated a developmental trajectory that younger Mandarin-speaking children started out with bare availability in RP, so that they dealt with it by gesturing the answers – that was what G1 showed in the task. As the degree of maturation in language grows, they adopted whatever they possessed in their language repertoire to cope with the challenges of producing a hierarchical structure of RP, which was what G2 mostly reacted to in the present study. From Table 4-15, it could be inferred that Mandarin-speaking children added complexity to their utterances to convey more information (Clark 2016). After adopting diverse ways to shape their expression, they grew to keep what was essential and tried to omit some constituents that seemed unnecessary, which

was what G3 presented. It can also be observed by Table 4-15 that G3 started to add RP with omission (from 6 at aged 4 to 69 at aged 5) and reduce the strategy of inserting phrases to replace RPs, in a way of developing from the telegraphic (Lightbown & Spada 2021) stage, to phrases, and adjusting for optimality.

4.4 Age Effect

It was proposed in the previous studies that 4 years old was a critical age for children on their FLA (Shi & Zhou 2018, Li et al. 2020) of RP in comprehension, while some even argued that 4-year-old for Level 1 but not until 8 years old (Yang 2014) were available for comprehending and producing a Level 2 recursive possessives. Nevertheless, there were seldom experiments carried out for the acquisition age of Levels 1-4 comprehension and production abilities Thus, what the exploration investigated in the present study was contrastively expected.

4.4.1 Overall Findings

The age effect would be elaborated in 2 aspects - in terms of Level or Task of RP. First, as for level aspect, age effect was suggested to be extremely significant for RP levels with all the $p < 0.01$ ($p <$ 2.22e-16 *** for Level 1 & 2, p =5.23e-14*** for Level 3, and p=7.14e-16*** for Level 4) in Table 4-16 below.

Table 4-16. *p*-values of Age Effects within Levels

LEVEL	Level 1	Level 2	Level 3	Level 4
***p*-value**	< 2.22e-16 ***	< 2.22e-16 ***	5.23e-14***	7.14e-16***

Furthermore, age effects appear to play an important role in how Mandarin-speaking children perform on levels, but the comparisons between different ages within a specific level shown in Table 4-17 were not the case. It recorded that the performance of G1:G2 on each level with no significance so that all the $p>0.05$ (=0.255 for Level 1, =0.399 for Level 2, =0.308 for Level 3 and =0.164 for Level 4). Moreover, no significance was demonstrated between G3 and G4 on Level 1 of RP with $p=0.223$ (>0.05), suggesting that 5-year-old Mandarin-speaking children had a similar proficiency to adults in producing Level 1 RP.

Table 4-17. *p*-values of Age Effect on Levels between Groups

	G1:G4	G2:G4	G3:G4	G2:G1	G3:G1	G3:G2
Level 1	1.52e-14***	1.89e-11***	2.23e-01	2.55e-01	2.35e-10***	9.91e-08***
Level 2	4.74e-15***	1.00e-12***	8.95e-05***	3.99e-01	7.57e-05***	1.04e-03**
Level 3	5.68e-13***	2.57e-10***	4.47e-05***	3.08e-01	2.21e-03**	3.46e-02*
Level 4	6.70e-15***	4.28e-11***	5.05e-05***	1.64e-01	1.63e-04***	1.44e-02*

To sum up the data shown in Tables 4-16 and 4-18, it suggests the conclusion that age effect is a critical effect for both tasks and levels for the FLA of RP in Mandarin Chinese.

Table 4-18. Age Effect on the Tasks

Group	**G1**		**G2**		**G3**		**G4**		***p*-value**
Task	M	SD	M	SD	M	SD	M	SD	
Comprehension	0.76	0.24	0.86	0.20	1.00	0.00	1.00	0.00	4.07e-14***
Production	0.03	0.08	0.09	0.11	0.49	0.26	0.98	0.03	<2.22e-16***

As for the production ability, Mandarin-speaking children at different ages performed distinctively, because all the comparisons between groups, except G2:G1, had an extreme significance at $p<0.01$, whereas G2:G1 had significance at $p<0.05$. Moreover, though G3 were

able to perform adult-like response to the questions in the comprehension task with p=1 (>0.05), 5-year-old Mandarin-speaking children were still not available to react as adults for RP as suggested by the p=2.02e-38*** at extreme significance for G3:G4 in Table 4-19. To sum up, age effect is clearly an indispensable effect on children's comprehension and production performance.

Table 4-19. *p*-values of Age Effect on the Tasks between Groups

	G1:G4	G2:G4	**G3:G4**	**G2:G1**	G3:G1	G3:G2
Comprehension	5.00e-11***	2.25e-04***	**1**	7.00e-03**	5.00e-11***	2.25e-04***
Production	1.02e-111***	1.09e-101***	2.02e-38***	3.45e-02*	2.56e-43***	3.35e-34***

4.4.2 General Discussion

Major findings were divided into 3 stages for Mandarin-speaking children as listed in Figure 4-2 below. First, as shown in Stage I, the task results of the present study proposed that 3-year-old Mandarin-speaking children were able to comprehend Level 4 RP, not as Level 2 or Level 3 in the previous studies resulted from the different methodology without covering the extended section. However, what is significant is that it proposed there was no question about 3-year-old Mandarin-speaking children in comprehending multiple levels of RP. Furthermore, though with the competence in comprehension, 3-year-olds seemed not to be available to produce RP and adopt kinesics instead of uttering it.

Secondly, though 4-year-olds showed availability and were often suggested to be the critical age in the previous studies, it was not the result in the present study, where they performed similarly with those 3-year-olds. However, they outperformed on Level 4 in comprehension. Furthermore, they demonstrated significantly distinction from G1 by adopting

diverse phrases to cope with the difficulties of producing hierarchical structures of RP. By the steep drop of gestures switching to uttering variant phrases, it is proposed that 4-year-old Mandarin-speaking children are actually moving forward to the next stage of hitting the goal. Though there were studies presenting 4-year-olds as the age of being able to produce Level 2 RP, it seemed to be a more monitoring or imitating stage rather than being capable of it.

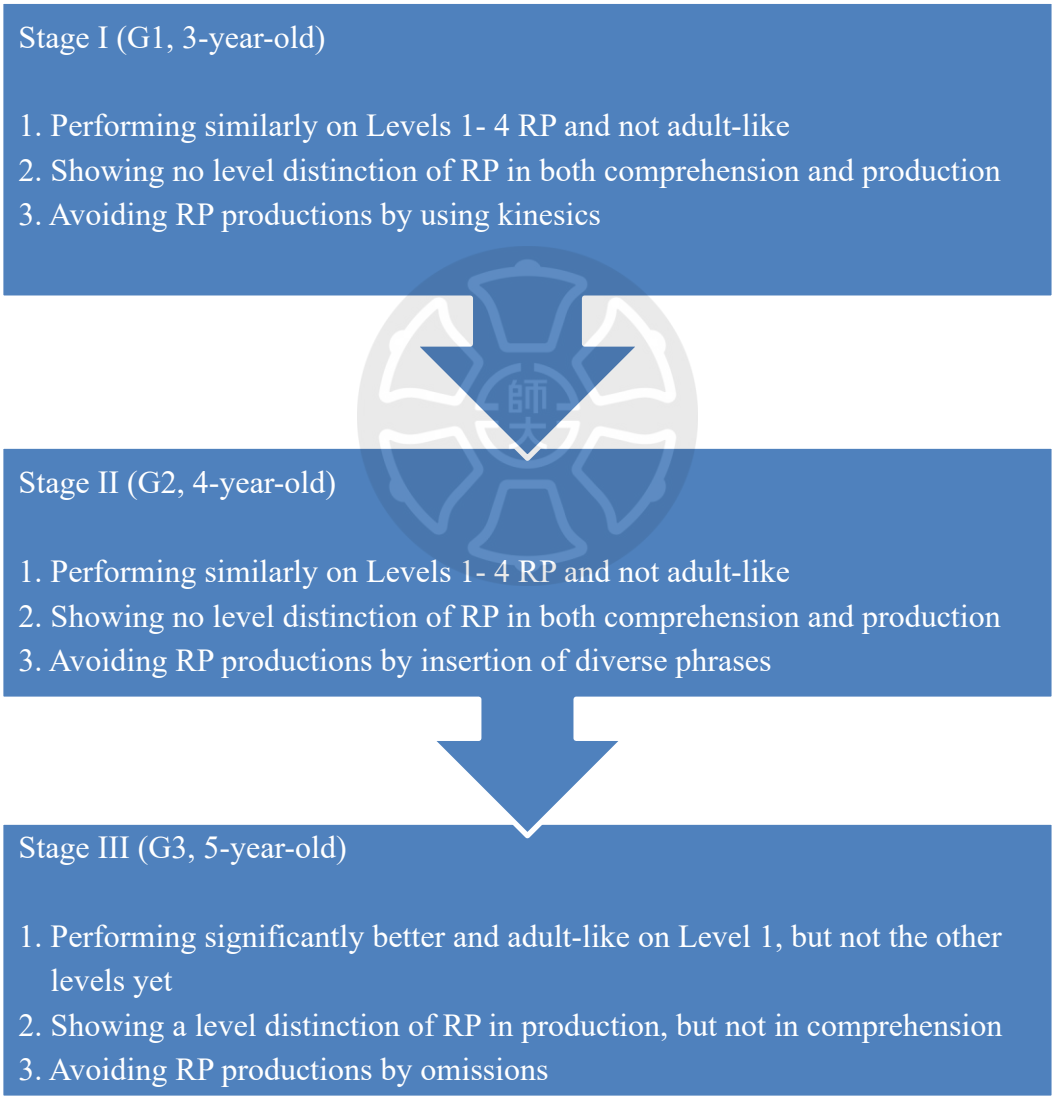


Figure 4-2. Mandarin-speaking Children's Developmental Stages of the Recursive Possessive *de* Marker

As to what had been mentioned earlier, if young children seem to repeat the same orders of words, it would be not be considered acquiring the language (Lust 2006:19). Numerous tasks designed with a puppet offering an obviously wrong answer (but in the target structure) and asked the participant to correct. What the participant needed to do was to copy the correct structure, withdraw the wrong one and place the correct one in the same position(s) – which was not what they spontaneously produced. That also explains why there were so many distinctive responses from the participants, because they are closer to real-life situations.

Third, age 5 appeared to be the critical age for the adult-like performance in comprehension and producing Level 1 RP. This was different from some of the previous studies, where 4 years of age was suggested. However, there were also similarities shown in the previous studies. For instance, Roeper (2007) proposed that English-speaking children were not able to produce a complete nominal recursive possessive until they were 6 years old, which echoed back to the major findings of the present pilot study that the 6;11 subject performed 70% correctness in the production task, there covering the 4 levels of RP. Furthermore, Pere-Leroux et al. (2012) suggested that 3-5-year-old English-speaking children had difficulties in nominal RP than their prepositional recursions (Shi et al. 2018:325). Hence, it is suggested that 5 years old a more possible age to execute multiple levels of RP rather than 4 years old accordingly.

4.5 Summary of Chapter Four

To sum up, Mandarin-speaking children from 3-4 years old seemed unavailable for producing RP at the high error frequency: 85% for G1 and 83% for G2, while 5-year-olds were contrastively equipped up for RP at the error frequency 26% (33 errors out of 128 questions), 30% half-correctness (39 out of 128; 9 “RP + D” and 30 “RP + O”) and 44% correctness in the production of RP. Though both G1and G2 were not answering the questions with the target RP, they actually responded in other formats of linguistic performance correctly, which proved the significance in comprehension task that 3- and 4-year-old Mandarin-speaking children were substantiating with competence of RP, but not well-developed orally for RP in response.

Chapter Five

Conclusion

The present chapter reports that major findings in the acquisition of recursive possessive marker *de* for Mandarin-speaking children in the study. Section 5.1 focuses on the main findings related to the four research questions from the two tasks. The limitations and suggestions for future studies are listed in Section 5.2.

5.1 Summary of the Major Findings

The major findings are to be presented in four aspects as levels, tasks, error types and age. First, as for the acquisition of levels of RP, it was surprisingly to find out that the levels of RP were only significant to Mandarin-speaking children at 5 years old (G3), where levels to them were as Level 1 > Level 2 = Level 3 = Level 4. However, there was not much distinction for 3- (G1) and 4-year-olds (G2) with levels to them as Level 1 = Level 2 = Level 3 = Level 4. The boundary between Level 1 and Level 2 was therefore suggested to be critical for Mandarin-speaking children - as long as they overcome Level 2, then Levels 3 and 4 would be proposed the same for them by the data from the tasks.

Second, as for the tasks, both comprehension and production tasks showed extreme significance to Mandarin-speaking children with all the $p<0.01$ for any groups and any levels, which presented younger Mandarin-speaking children performing differently in their input and output for multi-level RP, where they performed distinctively better in comprehension but not in production.

Third, age was suggested to be a significant effect for Mandarin-speaking children in RP, which showed in the results that G1 < G2 < G3 = G4 for comprehension, where 5-year-olds presented adult-like performance. Furthermore, the test results also proposed that G1 < G2 < G3 < G4 for production task, where G3 showed no adult-like performance in production.

Lastly, there surprisingly showed no conjunction substitution while facing challenges in producing multiple levels of RP for Mandarin-speaking children, where they adopted kinesics most, determiners second most and reduction (omission of subjects) the third in their production.

5.2 Limitations of the Present Study and Suggestions for Future Research

Some limitations together with suggestions are proposed as follows. First, it was found in the present study that our Mandarin-speaking children had a hard time producing four levels of RPs, and that there was a significant distinction between Level 1 and Levels 2 to 4 in their production. This indicates that young children only exhibit a two-level distinction, which appears to be the gap between a flat and a hierarchical structure corresponding to the preoperational stage of language development (2 to 7-year-old) where they are still struggling with logic (Piaget 1964). Hence, in terms of the complexity of RP levels, it is suggested that two or three levels of RPs (Li et al. 2020) should be adequate for Mandarin-speaking children in future studies.

Secondly, it was found our 3- and 4-year-olds were unable to produce multiple levels of RPs and that our 5-year-olds only demonstrated a two-level distinction in their production. Hence, it is recommended that future researchers may recruit 6-year-old schoolers to see if

there is a systematic development of the *de* marker in Mandarin and to piece together the puzzle of the RP acquisition of Mandarin-speaking children.

Third, in terms of methodology, a moderate complexity of the production task is called on for future research. For example, an error recognition and correction task used in Giblin et al. (2019) asked the participants to respond to a puppet by correcting their answers. Furthermore, test questions used in the task can be modified since tag questions used in the present study seemed to somehow confuse child participants. They unconsciously had the first word *dui* 'yes' of the tag questions *dui bu dui* 'yes or no' in the first place. Therefore, a particle question might be employed to collect the data as authentic as possible in the future.

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Appendix A

Test Items used in the TVJ Task

Level One

Picture	Question
Q1  	請問小明的書包是藍色，對不對？ （O）
Q2  	請問小美的水壺是綠色，對不對？ （X）
Q3 	請問這是一個冰淇淋，對不對？ （O）

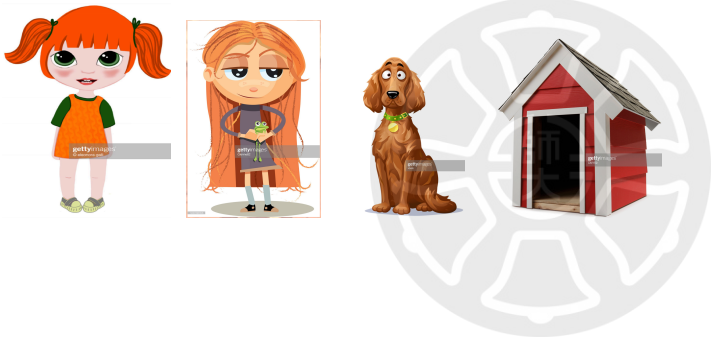
Level Two

Picture	Question
Q4 	請問小美的兔子的雨傘是粉紅色，對不對？ (O)
Q5 	請問小明的兔子的雨傘是紅色，對不對？ （X）
Q6 	請問這是一隻小鳥，對不對？ （X）

Level Three

Picture	Question
Q7 	請問小明的朋友的狗狗的球球是綠色，對不對？(O)
Q8 	請問小美的朋友的狗狗的球球是紅色，對不對？ (X)
Q9 	請問這是一個蛋糕，對不對？(X)

Level Four

Picture	Question
Q10 	請問小明的朋友的狗狗的狗屋的屋頂是紅色，對不對？（O）
Q11 	請問小美的朋友的狗狗的狗屋的屋頂是圓形，對不對？（X）
Q12 	請問這是一個蘋果，對不對？（O）

Appendix B

Test Items used in the Q&A Task

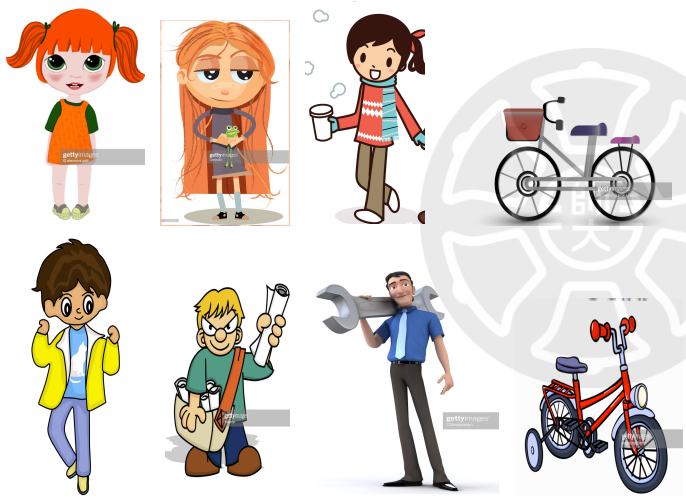
Level One

Picture	Question
Q1    	請問這張圖裡有什麼東西是白色？ （小美的鞋子）
Q2    	請問這張圖裡有什麼東西是紫色？ （小明的水壺）
Q3 	請問這是一杯果汁，對不對？ （對）

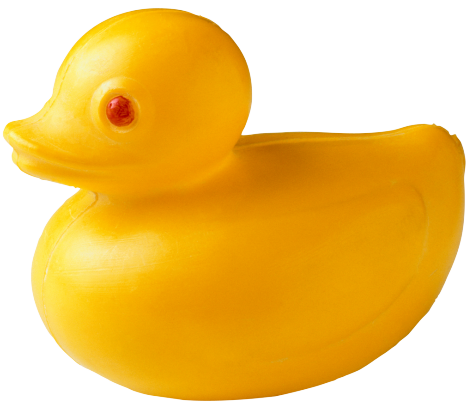
Level Two

Picture	Question
Q4 	請問這張圖裡誰有長長的腿？ （小明的朋友的朋友）
Q5 	請問這張圖裡誰手上有一個杯子？ （小美的朋友的朋友）
Q6 	請問這些是香蕉，對不對？ （不對）

Level Three

Picture	Question
Q7 	請問這張圖裡哪一隻狗有紅色的球球？ （小美的朋友的朋友的狗狗）
Q8 	請問這張圖裡哪一台腳踏車有紅色的把手？ （小明的朋友的朋友的腳踏車）
Q9 	請問這些是草莓，對不對？ （對）

Level Four

Picture	Question
Q10 	請問這張圖裡有什麼是一個大圓形？ （小美的朋友的朋友的房子的游泳池）
Q11 	這張圖裡有什麼是圓形而且是黃色？ （小明的朋友的朋友的狗狗的球球）
Q12 	這是一隻大象，對不對？ （不對）

Appendix C

Results for the Pilot Study

Table I. Correctness of the Comprehension and Production Tasks

Participant / Level of the task	**Participant 1**	**Participant 2**	**Participant 3**	**Participant 4**
Comprehension L1	1.00	1.00	1.00	1.00
Comprehension L2	1.00	1.00	1.00	1.00
Comprehension L3	1.00	1.00	1.00	1.00
Comprehension L4	1.00	1.00	1.00	1.00
CQ Average	1.00	1.00	1.00	1.00
Production L1	1.00	1.00	1.00	1.00
Production L2	1.00	0.625	1.00	1.00
Production L3	1.00	0.625	1.00	1.00
Production L4	0.50	0.5	1.00	1.00
PQ Average	**0.875**	**0.6875**	**1.00**	**1.00**

Table II. Result of the Pilot Study - Production Task

	Participant 1	Participant 2	Participant 3	Participant 4
17. PQ.L1	✓	✓	✓	✓
18. PQ.L1	✓	✓	✓	✓
19. PQ.L1	✓	✓	✓	✓
20. PQ.L1	✓	✓	✓	✓
21. PQ.L2	✓	✓	✓	✓
22. PQ.L2	✓	D1	✓	✓
23. PQ.L2	✓	D1	✓	✓
24. PQ.L2	✓	D1	✓	✓
25. PQ.L3	✓	D1	✓	✓
26. PQ.L3	✓	✓	✓	✓
27. PQ.L3	✓	D1	✓	✓
28. PQ.L3	✓	D1	✓	✓
29. PQ.L4	D1+OMS	D3+OMS	✓	✓
30. PQ.L4	D1+OMS	D3+OMS	✓	✓
31. PQ.L4	✓	D2	✓	✓
32. PQ.L4	✓	D2	✓	✓
Correctness	**0.875**	**0.6875**	**1.0**	**1.0**

Coding of the mistakes:

D1: one deletion of the recursive possessive marker *de*

D2: two deletions of the recursive possessive marker *de*

D3: three deletions of the recursive possessive marker *de*

OMS: the omission of one of the noun phrases

APPENDIX D

同意書

親愛的家長您好：

此為語言研究的同意書，本研究為國立台灣師範大學英語系語言組的碩士論文，研究目的在於了解兒童母語習得狀況。希望貴子弟能協助研究進行。此碩士論文為調查台灣兒童對於中文遞歸領屬「的」之第一語言習得能力。本研究將採一對一方式，在學生教室內進行，一切皆以不影響學生上課權益為原則。研究共包含兩部分，第一部分為是非題，第二部分為問答題，皆以讓學生看電腦內圖片，回答問題方式進行測驗。

第一個測驗，為 16 題是非題，小朋友需要依電腦圖片判斷聽到的問題之對錯。接下來，第二部分問答測驗，共 16 題，小朋友必須依電腦圖片回答問題。測驗答案將以錄音方式進行，學生無需手作回答問題。總測驗時間約需 10 至 15 分鐘。

為了感謝學生參與本研究計畫，兩次測驗完成後，將贈與學生一份精美小禮物。本研究結果僅供學術研究使用，任何關於學生的個人資訊絕不對外公開，所有答題資訊僅供本研究使用並會嚴加保密。若貴校家長與教師想了解學生之任務表現，亦可提供數據並加以說明，供教學參考。懇請家長的支持本語言研究的進行，希望能徵得您的同意。最後，在此獻上最深摯的感謝。

敬祝

萬事順心

國立台灣師範大學英語系語言學組

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指導教授： 陳純音教授

日期：民國一百一拾一年八月

學生姓名： _____

☐ 同意

☐ 不同意

家長簽名：_____

若您與小朋友同意參加此研究，請協助填寫以下問題：

小朋友生日：民國_____年_____月