Université d'Ottawa · University of Ottawa

PERMISSION DE REPRODUIRE ET DE DISTRIBUER LA THÈSE

PERMISSION TO REPRODUCE AND DISTRIBUTE THE THESIS

NOM DE L'AUTEUR / NAME OF AUTHOR:	Xuexin CAO
ADRESSE POSTALE / MAILING ADDRESS:	School of Languages & Translation Macao Polytechnic Institute Macau.
GRADE / DEGREE:	**ANNÉE D'OBTENTION / YEAR GRANTED**
Ph.D.(Linguistics)	2003
TITRE DE LA THÈSE / TITLE OF THESIS:	
The Acquisition of Double-gapped Relatives in Chinese: Grammar and Processing	

L'auteur permet, par la présente, la consultation et le prêt de cette thèse en conformité avec les règlements établis par le bibliothécaire en chef de l'Université d'Ottawa. L'auteur autorise aussi l'Université d'Ottawa, ses successeurs et cessionnaires, à reproduire cet exemplaire par photograhie ou photocopie pour fins de prêt ou de vente au prix coûtant aux bibliothèques ou aux chercheurs qui en feront la demande.

Les droits de publication par tout autre moyen et pour vente au public demeureront la propriété de l'auteur de la thèse sous réserve des règlements de l'Université d'Ottawa en matière de publication de thèses.

The author hereby permits the consultation and the lending of this thesis pursuant to the regulations established by the Chief Librarian of the University of Ottawa. The author also authorizes the University of Ottawa, its successors and assignees, to make reproductions of this copy by photographic means or by photocopying and to lend or sell such reproductions at cost to libraries and to scholars requesting them.

The right to publish the thesis by other means and to sell it to the public is reserved to the author, subject to the regulations of the University of Ottawa governing the publication of theses.

N.B. LE MASCULIN COMPREND ÉGALEMENT LE FÉMININ

12/19/02

DATE

(AUTEUR) SIGNATURE (AUTHOR)

Université d'Ottawa · University of Ottawa

Université d'Ottawa · University of Ottawa

FACULTÉ DES ÉTUDES SUPÉRIEURES ET POSTDOCTORALES

FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

CAO, Xuexin

AUTEUR DE LA THÈSE - AUTHOR OF THESIS

Ph.D. (Linguistics)

GRADE - DEGREE

Linguistics

FACULTÉ, ÉCOLE, DÉPARTEMENT - FACULTY, SCHOOL, DEPARTMENT

TITRE DE LA THÈSE - TITLE OF THE THESIS

The Acquisition of Double-gapped Relatives in Chinese: Grammar & Processing

Helen Goodluck

DIRECTEUR DE LA THÈSE - THESIS SUPERVISOR

EXAMINATEURS DE LA THÈSE - THESIS EXAMINERS

P. Hirschbuhler

T. Lee

J. Munoz-Liceras

M.-L. Rivero

T. Tardif

J.-M. De Koninck, Ph.D.

LE DOYEN DE LA FACULTÉ DES ÉTUDES SUPÉRIEURES ET POSTDOCTORALES

SIGNATURE

DEAN OF THE FACULTY OF GRADUATE AND POSTDOCTORAL STUDIES

The Acquisition of Double-gapped Relatives in Chinese: Grammar & Processing

Xuexin Cao

M.A. Carleton University

A Thesis Submitted to
The Faculty of Graduate and Postdoctoral Studies
In Partial Fulfillment of the Requirements for

The Degree of

Doctor of Philosophy

at the

The University of Ottawa

To Lian and Jenny

TABLE OF CONTENTS

ACKNOWLEDGEMENTS v

ABSTRACT vi

CHAPTER 1 Introduction: Overview 1

CHAPTER 2 Background & Goals I: Theoretical Motivation 7

2.1 The Binding Theory & Empty Categories in Chinese Syntax 7

2.1.1 The Binding theory: The Canonical version 7

2.1.2 The Empty category: A Binding-theoretic account 13

2.1.3 The Pro-Drop parameter: An Agreement-based account 18

2.1.4 Chinese as a Pro-drop language II: A Discourse-oriented language 20

2.1.5 Chinese as a Pro-drop language II: Subject-object asymmetry 24

2.2 The Relative Clause in Chinese **30**

2.2.1 Relativization in Chinese: An outline 30

2.2.2 Movement analysis of Relatives I: Operator-based account 32

2.2.3 Movement analysis of Relatives II: Head-raising account 37

CHAPTER 3 Background & Goals II: Empirical Justification **40**

3.1 Null Arguments in the Early Grammar 40

3.1.1 Naturalistic study: Wu 2000 40

3.1.2 Experimental study: Wang, Lillo-Martin, Best & Levitt 1992 43

3.2 Acquisition of Relative Clauses in Chinese 49

3.2.1 Production study: Chiu 1998 49

3.2.2 Comprehension studies I: Chang 1984 54
3.2.3 Comprehension studies II: Lee 1992 58
3.3 Summary: Background and Goals 62

CHAPTER 4 Hypotheses and Predications 63
4.1 Subject-object asymmetry: A Recapitulation 63
4.2 Covert- vs. Overt-binder RCs: A Characterization 65
4.3 Covert- vs. Overt-binder RCs: Two Assumptions 66
4.4 Predictions 67

CHAPTER 5 Experiments: Design & Results 70
5.1 Design and Procedure 70
5.1.1 Sentence types tested 70
5.1.2 Organization of questionnaires 78
5.1.3 Procedure 80
5.1.4. Subjects 84
5.2 Results 86
5.2.1 Screening test: Questionnaire I 86
5.2.2 Experiment One: Questionnaire II 86
5.2.3 Experiment Two: Questionnaire III 90

CHAPTER 6 Discussion: Grammar & Processing 92
6.1 Preference for Object Construal: Competence & Processing 93
6.2 Pragmatic Effect: Acquisition & Processing 106

CHAPTER 7 Conclusion: Summary 110

REFERENCES 115
APPENDIX Sentences Tested 119

ACKNOWLEDGEMENTS

It is a pleasure to acknowledge the intellectual as well as financial support for my studies at the University of Ottawa. First and foremost, I am in great debt to Helen Goodluck for her confidence in my potential as a linguistic student, and for her efforts to have made me a linguist. I am grateful to her for her meticulous suggestions about the content and presentation of this thesis, as well as for her financial assistance. Furthermore, I would like to acknowledge the partial financial support of the Graduate School of the University of Ottawa for the past four years.

I owe special thanks to the following people under whom I have studied while working toward my doctoral degree. Maria-Luisa Rivero instilled in me the beauty and elegance of syntactic argumentation. Paul Hirschbuhler has been putting up with my gibberish and ignorance with endless patience, never reluctant to offer help. Furthermore, both of them were on my dissertation board, joined by Drs. Juana Munoz-Liceras and Twila Tardif and, to whom I feel deeply indebted for their encouragement and insightful comments.

I am also in debt to the following people in China and Macau. Prof. Shan Xingyuan of the University of Helongjiang provided me with a draft of the experimental sentences for Questionnaire II, the authorship of which should indeed be shared between us. My colleagues at the University of Macau, John Barns and David Mennier, were always there for me when my English got "wild and untamable". Chen Mei-lan exempted me from my daily household choirs for the last 3 months of my stay at the University's hostel in May through July of 2002, sharing the joys and sorrows of my writing without even asking for an explanation.

Finally, love and thanks to Lian and Jenny, who are the foundation of my existence in Canada and China, and to whom this work is dedicated.

The Acquisition of Double-gapped Relatives in Chinese: Grammar & Processing

ABSTRACT

This dissertation is an acquisition study of double-gap relatives in Chinese, developed under the thesis of subject-object asymmetry as postulated in Huang (1984). Two sets of act-out experiments were conducted. The first experiment tested covert-binder relatives, i.e. double gap relatives with the binder of their non-head EC unmentioned in the sentence. This type of relative was presented in two contexts: pragmatically neutral vs. biased conditions. Assuming that in the absence of pragmatic bias there is a requirement for the head of a double gap relative to be construed as the object of the relative, it was speculated that the provision of a topic NP might produce a swing towards the head of the relative being construed as the relative subject. Under this speculation, it was predicted that there would be a higher proportion of subject interpretation of the relative head in the pragmatically enriched condition than in the neutral condition. The second experiment is a follow-up, testing overt-binder relative, i.e. double gap relatives with either an overt matrix subject or topic as a potential binder of their non-head EC of the relative. The prediction here was that while a subject interpretation of the head for a subject-binder relative should be linguistically blocked, the head of a topic-binder relative was allowed to be interpreted either as the null subject or as the null object of the relative. The main result is that there is a general preference for construing the head as the null object for

both covert- and overt-binder relatives. An additional finding is that the younger children, but not the older children, show some sensitivity to context, giving more object construals under the enriched condition. Huang's account is not supported by the data. The general preference for the head as null object is explained in terms of an independently attested principle of sentence processing: empty categories are always identified as soon as possible in on line coreference assignment (e.g. Nicol & Swinney, 1989; Gibson, 1998). Young children's sensitivity to the enriched context calls for future work in the field of acquisition and processing.

Chapter One

Introduction: Overview

Chinese is a language that is exceedingly generous with null elements in its grammar. Not only can it, for example, leave empty either subject or object, but it also can drop both of them all at once. In spite of this, however, the language does not leave much room for grammatical ambiguity. Consider the following sentence:

1. Zhangsan shuo [e bu xihuan e]
   Zhangsan say not like
   'Zhangsan said [he] did not like [him/her/it]

Here both the subject and object in the embedded clause are missing. Surprisingly, the sentence is not ambiguous in the following sense: it is possible for the embedded subject only, but not the object, to referentially depend on the matrix subject for its antecedent, as shown by the following referential indexing.

2. Zhangsan_i shuo [$e_{i/j}$ bu xihuan $e_{i*/k}$]

Binding-theoretically (in the sense of Chomsky 1981, see Chapter 2), the indexing in (2) can be paraphrased as follows: the subject EC may be either A-bound by the matrix

subject or locally free, whereas the object EC must be A-free. This amounts to saying that the object EC must be analyzed as a variable that is A'-bound. This analysis is derivable from the fact that Chinese is a discourse-oriented language that not only admits multiple topics but also makes extensive use of null topics, which can serve as a potential binder of the null object. Seen in this light, a proper representation for (2) can be either (3) or (4). In both representations the null object is analyzed as a variable bound by a topic that is itself null, whereas the null subject can be interpreted either anaphorically or deictically, exactly like an overt pronoun in the same position that has the same dual interpretations.

3. When the null subject is interpreted anaphorically:

   $_{Top}e_k$ [Zhangsan$_i$ shuo [e_i bu xihuan e_k]]

4. When the null subject is interpreted deictically:

   [$_{Top}e_k$] [$_{Top}e_i$] [Zhangsan shuo [e_i bu xihuan e_k]]

The subject-object asymmetry as identified above originates from Huang (1982, 1984, 1989 and 1991), who sees Chinese as a pro-drop language that falls in with the general picture of the pro-drop parameter: null pronominal is cross-linguistically excluded from the object position except for those languages that have object agreement marking. Thus, the null object in Chinese, in spite of its extensive use in the language, is restricted to a category with the features [-Anaphoric, -Pronominal] in Chomsky's (1982) paradigm of NP typology.

Reasoning within the conceptual framework adopted here, the restriction on null objects provides a principled analysis of double-gapped relatives in Chinese, a type of relative with both its subject and object phonetically null. In particular, the thesis that an object EC must be A-free requires us to interpret the relative head as referring to the object, rather than the subject. The following relative is an example of a double-gapped relative:

5. Li Xiaojie hai zhao-bu-dao [$_{NP}$[$_{CP}$ **e** xinzhong xihuan **e** de] nanren]
   Miss Li still can't find in heart like DE man

Unlike (3)/(4) in which one of the ECs is to be recovered from the discourse, both of the ECs in (5) are bound within the sentence. Thus, the sentence seems to be open to two interpretations: either the subject EC is A-bound by the matrix subject *Li Xiaojie* (Miss Li), and the object EC A'-bound by the relative head *nanren* (man), as in (6a):

6a. 'Miss Li still cannot find a man who she loves in her heart'
   (i.e. Li Xiaojie$_i$ hai zhao-bu-dao [**e**$_i$ xinzhong xihuan **e**$_j$ de] nanren$_j$)

or, conversely, the subject EC is A'-bound while the object EC A-bound, as in (6b):

6b. * 'Miss Li still cannot find a man who loves her in his heart'
   (i.e. Li Xiaojie$_i$ hai zhao-bu-dao [**e**$_j$ xinzhong xihuan **e**$_i$ de] nanren$_j$)

However, sentence (5) is not ambiguous: that is, only the (6a) reading is available. This lack of ambiguity lends support to the claim that an object EC in Chinese cannot be a pronominal but only a variable.

This asymmetrical thesis has however been challenged in the literature. For example, Xu (1986) observes that the head of the double-gapped relative in (7) is interpreted as subject of the relative, with the object position referring to the subject of the main clause, contrary to the analysis of the null object as a variable.

7. Li xiaojie$_i$ zhao bu zhao [e$_j$ ken qu e$_i$ de] nanren$_j$
Li Miss find not Asp will take-as-wife DE man
'Miss Li can't find any man who will take her as his wife'

On Xu's analysis, Chinese syntax uses a type of empty category, or Free Empty Category, that is not equivalent to any of the empty categories in the typology of Chomsky (1982). This empty category is subject to pragmatic interpretation.

Leaving aside the theoretical plausibility of Xu's Free Empty postulation, I however note that unexplained in Xu's analysis is why in pragmatically neutral cases such as (5) the head of the relative cannot be constructed as referring to the subject position of the relative. The lack of the (6b) reading for (5) and the grammaticality of (7) prompt the thought that the ungrammaticality of (6b) may be rooted in factors outside the competence grammar. As a step towards finding a resolution of the debate, this thesis

examines the psychological reality of null objects in Chinese, testing double-gapped relatives that are identical in predication but contrast in neutral vs. pragmatically-biased conditions, in an attempt to disentangle grammar from processing.

The results of my experiments indicate that there is a general preference for treating the null object as the head noun. However, this is only a bias at best, since it does not categorically block an interpretation of the relative head as the null subject. This finding can be accounted for by an independent processing principle:

8. Empty categories are always identified online as soon as possible in coreference processing.

My results are not conclusive, but the study provides some new food for reflection on the relation of grammar and processing: to what extent can processing be dissociated from competence? -- a question that has received less attention than the question of to what extent processing depends on grammar for efficient execution. My data suggests that processing can be an independent force that results in a strong parsing preference that creates the illusion of a competence rule of the kind I have seen in Huang's theorizing on the subject-object asymmetry. Reasoning along this line, the subject reading of (6b) for the relative head in (5) is thus ruled out by a processing force, but not by a syntactic rule. Furthermore, the relative in (7) is ruled in because a processing principle, independent as it is, is eventually subject to a final semantic/pragmatic influence in sentence comprehension.

The dissertation begins with a review of the theoretical (Chapter 2) and empirical (Chapter 3) literature, setting out the motivation and goals of this research program, and providing justification for my experimental design. Chapter 4 spells out my hypotheses and predictions, and Chapter 5 proceeds to the details of the experimental design, followed with a report on the experimental results. Chapter 6 is devoted to a discussion of the results, and Chapter 7 concludes the dissertation with a summary.

Chapter Two

Background and Goals I: Theoretical Motivation

This chapter outlines the theoretical motivation behind my experimental work and the goals of this study. The chapter is organized in two sections. Section 2.1 deals with the Binding Theory and empty categories in the context of Chinese. Section 2.2 turns to some theoretical works on Chinese relative clauses in the generative tradition, where two schools of movement-based analyses of Chinese relatives are compared.

2.1 The Binding Theory & Empty Categories in Chinese Syntax

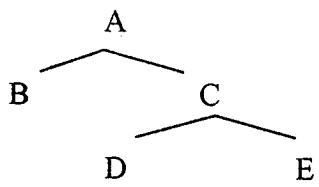
2.1.1. The Binding Theory: The Canonical Version The Binding Theory is a subtheory of Government and Binding theory (Chomsky, 1981). The theory deals with syntactic conditions on indexing relationships between various nominal expressions, both covert and overt. In this subsection, I use overt nominal categories to illustrate the core idea of the Binding Theory. Covert nominal categories will receive a treatment in the next subsection.

1. The binding theory
   - Principle A: An anaphor is bound in its governing category
   - Principle B: A pronominal is free in its governing category
   - Principle C: A R-expression is free

An *anaphor* is a type of pronoun that lacks independent reference, for which there must be a co-referential NP in the sentence. In English, for example, anaphors include reflexives such as 'himself' and reciprocals such as 'each other'. As opposed to an anaphor, a pronominal is a category that may be referentially independent or may be dependent on an NP for its reference. Thus, a pronominal refers to the class of pronouns that can be used deictically or anaphorically. A *R-expression,* or referential expression, is referentially independent, including all other type of nouns such as 'John', 'the boy', and ' a man in the hat'.

The word '*bound*' is interpreted as A(argument)-bound, i.e. c-commanded by an element in argument position, the position of subject or object. *Free* means 'not A-bound'. The term c-command is a short term for 'constituent-command'. The following diagrammatic tree illustrates the notion of c-command, based on Reinhart (1976):

2.



The node B in (2) is said to c-command C if and only if the first branching node above B dominates C and neither B nor C dominates the other. When α is bound to β, it is said to be referentially coindexed with β; when α is free with respect to β, the two elements are disjoint in reference.

The term *Governing category* provides the space in which the binding principles operate. For expository ease, I take the governing category of an element to be the S/IP node immediately above that element (i.e. anaphor or pronominal).

Let me first take English for example. The sentences in (3) illustrate how Principle A works, in which the governing category is bracketed and signaled with a letter D, standing for local domain.

3. a. [$_D$ The men$_i$ saw themselves$_i$ /each other$_i$.]
   b. *The men$_i$ said that [$_D$ themselves$_i$/each other$_i$ would come.]
   c. *The men$_i$ said that [$_D$ I saw themselves$_i$ /each other$_i$.]

(3a) is well-formed as the anaphor 'themselves/each other' is co-indexed to the c-commanding subject NP 'men' in the same local domain. Both (3b) and (3c) are ill-formed because the anaphors thereof are not bound by an antecedent in their local domain.

Assuming that the local domain for a pronominal is exactly as that for an anaphor, Principle B tells us that the positions in which anaphors are bound are precisely those positions in which pronouns are free. This is known as complementary distribution of anaphors vs. pronouns, as shown in (4a) through (4c).

4. a. *[$_D$ The men$_i$ saw them$_i$]
   b. The men$_i$ said that [$_D$ they$_i$ would come]
   c. The men$_i$ said that [$_D$ I saw them$_i$]

(4a) is ill-formed because the pronoun is bound in its local domain, as much as (3a) is well-formed where the anaphor is bound. Similarly, (4b) and (4c) are well-formed whereas (3b) and (3c) are not. Thus, a pronoun must be disjoint in reference in its local domain; it may refer to an entity that is specified outside of its local domain in the same sentence, or to an entity that is somewhere in the discourse, whether mentioned or unmentioned.

Turning to Principle C, R-expressions are simply said not to be coindexed with any c-commanding nominal expression in an argument position, no matter how distant it is. (5a) is not allowed because the R-expression 'the man in the hat' is bound by the subject pronoun which is within the local domain. (5b) is excluded for the same reason, though the R-expression in this case is bound outside of the local domain.

5. a. *[$_D$ He$_i$ saw the man$_i$ in the hat]

   b. * He$_i$ said that [$_D$ I saw the man$_i$ in the hat]

The Binding Theory as illustrated above is supported by all the Chinese counterparts in (6), except for (6b), in which the anaphor is bound outside its local domain, a situation that can be accepted only if it were treated as a pronoun within the framework of standard binding theory, as indicated in (6c).

6. a. [$_D$ ta$_i$ kanjian ziji$_i$]

he see self

'He$_i$ saw himself$_i$'

b. Zhangsan$_i$ shuo [$_D$ ziji$_i$ hui lai]

zhangsan said self will come

'*Zhangsan said that himself would come'

c. Zhangsan$_i$ shuo [$_D$ ta$_i$ hui lai]

Zhangsan said he will come

'Zhangsan said that he will come'

d. *[$_D$ ta$_i$ kanjian dai maozi ren$_i$]

he see with hat man

*'He saw the man in the hat'

e. *ta$_i$ shuo [$_D$ wo kanjian dai maozi ren$_i$]

he say I see with hat man

*'He said that I saw the man in the hat'

Sentences such as (6b) and (6c) present a problem for the classic binding theory: both 'self' and 'he' are acceptable in Chinese, as shown by the translations[1]. These counterexamples from Chinese have led to a proposal that the local domains for anaphors and pronominal should be disjoint (Huang 1982), a theoretical issue that does not concern us and thus is dropped here, since the sole purpose of the above presentation of the Binding Theory is to build up a springboard for a binding-theoretic account of empty categories in the following subsections.

---

[1] As in many other languages, the reflexive in Chinese can have an antecedent outside its local governing domain, and can even be bound across sentence boundaries into discourse. The phenomenon, known as long-distance (LD) anaphora in the literature, poses non-trivial problems for the standard binding theory as presented here. Various efforts, of both syntactic and non-syntactic natures, have been made to tackle the issue (see Huang 2000 for a detailed review). A strictly syntactic treatment is Reinhart and Reuland (1993) who both build on and reconceptualize standard binding theory by directing parametric variation of binding principles to morphological properties of reflexives, a view that accords very much with the current minimalist treatment of parameters (Chomsky, 1995). One of the basic ideas in R& R is a morphologically-based split of reflexives into SE as simplex anaphor, and SELF as complex anaphor. The simplex SE allows LD binding and thus is not in complementary distribution with pronouns, whereas the complex SELF is a local reflexivizer and thus is in complementary distribution with pronouns. This three-way partition of anaphora can be illustrated by a Dutch example in (i):

i. Willem$_i$ bewondert zichself$_i$ /*zich$_i$ / *hem$_i$
Willem$_i$ admires himself$_i$ /self$_i$/ him$_i$.

Here the SELF anaphor is *zichself* and the SE is *zich*. Grouping the simplex SE reflexive with pronouns can handle examples from many languages that permit LD reflexivization, with which the standard binding theory has difficulty. However, this work has yet to penetrate research on Chinese, since the bare reflexive *ziji* in Chinese, for example, does not seems to fit readily in the proposed dichotomy of reflexives, as demonstrated in (ii):

ii Zhangsan$_i$ renwei [Lisi$_j$ hai le ziji$_{i/j}$]
Zhangsan think Lisi hurt Asp self
'Zhangsan (m.) thinks Lisi (f.) hurt {him/her}self.'

The example above shows that the bare reflexive *ziji* in Chinese seems to be capable of functioning as both SE and SELF in R & R's system. For the most recent research on reflexivization on Chinese, see Huang & Liu (2001) and Pollard & Xue (2001).

2.1.2 The Empty Category: A Binding-theoretic Account The above brief examination of binding has shown that there are three types of NPs: anaphors, pronouns and R-expressions. Since Chomsky 1982, these three types of NPs have however been thought not to be syntactic primitives. Rather they can be broken down into two binary features, namely [Anaphor] and [Pronominal]. A standard charter of NP typology in terms of feature combination is presented in Table1 below:

Table 1

Typology of NPs

Type	Overt	Non-overt
[+Anaphor - Pronominal]	anaphors	NP-trace
[- Anaphor +Pronominal]	pronouns	pro
[- Anaphor - Pronominal]	R-expression	Wh-trace
[+Anaphor +Pronominal]	Lacking	PRO

What the chart tells us is that a term such as anaphor is shorthand for a type of NP with the feature combination [+ Anaphor, - Pronominal], which is shared by NP-traces, or the traces of movement to subject position as involved in passive or subject raising. Wh-traces are traces generated by movement to CP, as in topicalization or relativization. They share the feature matrix of [-Anaphor] and [-Pronominal] with the lexical R-expression: they are neither anaphor nor pronominal. Since non-overt NPs are treated on a par with overt NPs, NP-traces are subject to Principle A, and Wh-traces subject to Principle C. Similarly, *pro* is treated on a par with the full pronoun and should thus be

predicted to demonstrate the same distributional pattern as overt pronouns under Principle B. I will return to the distributional issue of *pro* immediately after providing some illustrations of NP traces and Wh-traces in English and Chinese, and a brief discussion of PRO. Sentences in (7) illustrate NP-traces, and the sentences in (8) Wh-traces:

7. a. [$_D$ the man$_i$ was seen t_i]

   b. *The man$_i$ was said that [$_D$ t_i would come]

   c. *The man$_i$ was said that [$_D$ I saw t_i]

8. a *The man, [he$_i$ saw t_i]

   b. *The man, he$_i$ said that [I saw t_i]

   c. *The man who [he$_i$ saw t_i] came

   d. *The man who he$_i$ said that [I saw t_i] came

Like (3a), (7a) is well-formed, in which the NP trace is bound in its local domain. (7b) and (7c) are ill-formed because their trace-NPs are not bound in their local domain, on a par with (3b) and (3c). The sentences in (8) involve topicalization or relativization, in which the Wh-traces are treated as R-expressions. Since all these traces are A-bound and contradict Principle C, none of the sentences is allowed. Chinese counterparts of NP trace are given in (9a) and (9b), and the Chinese counterparts of Wh-traces are given in (9c) through (9e). (9b) is prohibited by Principle A, with the NP-trace bound out of its local

domain. Sentences in (9c) through (9-e) are not permitted by demonstrating the same properties with respect to Principle C, with all their Wh-traces A-bound.

9. a. [Zhangsan$_i$ bei wo kanjian le t_i]
Zhangsan by I see Asp
'Zhangsan was seen by me.'

b. *Zhangsan$_i$ bei shuo [ni kanjian le t_i]
Zhangsan by say you see Asp
'*Zhangsan was said that you saw.'

c. *Zhangsan, ta$_i$ shuo [ni kanjian le t_i]
Zhangsan he say you see Asp
'*Zhangsan, he$_i$ said that you saw t_i.'

d. *[[ta$_i$ kanjian t_i de] neige ren]lai le
he see RC-MK that man come Asp
'* The man who he$_i$ saw t_i came.'

e. *[ta$_i$ shuo [ni kanjian t_i de] neige ren] lai le
he say you see RC-MK that man come Asp
'*The man who he$_i$ said you saw t_i came.'

RC-mk: relative clause marker

Asp: aspect marker

The feature combination of [+ Anaphor] and [+ Pronominal] presents a paradox: if an element is anaphoric, it must be bound in its local domain; if it is pronominal, it must be free in its domain. If it is both, it must be both bound and free in its local domain. It is impossible for an overt NP because it will be excluded by the Case Filter that stipulates:

Every NP must be assigned Abstract Case if it is phonologically realized.

This accounts for non-existence of overt NP with the feature matrix of [+ Anaphor] and [+ Pronominal]. For a non-overt NP with this feature matrix, it is however a different case. A non-overt NP would not be subject to the Case filter which applies to overt NPs. This null NP, both ungoverned and Caseless, is labeled PRO.

Since it is both anaphor and pronominal, PRO is subject to both Principles A and B, a hypothesis that has been called PRO Theorem. This theorem predicts that PRO is in complementary distribution with lexical NPs, allowing the former to occur as the subject of an infinitival and gerundive clauses, but prohibits its occurrence as the subject of a finite clause or as a complement to verb, noun, adjective and preposition. (10a) and (10b) illustrate the occurrence of PRO as the subject of non-finite clause in English and

Chinese, and the exclusion of PRO as a prepositional complement in English and Chinese is illustrated in (11a) and (11b).

10. a. John tried PRO to go with you

b. Zhangsan zhunbi [PRO gen ni qu]
Zhangsan prepare with you go
'Zhangsan plans to go with you

11. a. *John will go with PRO

b. *Zhangsan gen PRO bu shou
Zhangsan with not familiar
'Zhangsan is not familiar with PRO'

While the occurrence of PRO is thought to be universal across languages, *pro* is not available to every language. Consider the sentences in (12):

12. a. *John said [e saw Mary]

b. John said [he saw Mary]

The empty category in (12a) is surely not a PRO, since it is in the subject position of a finite clause. It could be a *pro*, but *pro* is not available to English and thus the sentence in (12a) is ungrammatical. The evidence of unavailability of *pro* to English becomes clear

when the empty category is replaced by an overt pronoun in (12b). Thus, though *pro* is binding-theoretically treated on a par with pronoun, it is not universal across languages. This hypothesis has come to be known as the pro-drop parameter in the literature, which describes languages in terms of availability of pro: a pro-drop language is a language to which *pro* is available as an alternative to the overt pronoun, whereas a non-pro-drop language is a language where pro is prohibited.

2.1.3 The Pro-Drop Parameter: An Agreement-based Account As suggested by the title, this subsection is devoted to a fuller description of availability of *pro* across languages. Consider the following paired sentences in (13):

13. a. Jose sabe que [pro ha sido visto por Maria]
Jose know that has been seen by Maria
' Jose knows that [he] has been seen by Maria.'

b. *John knows that [e has been seen by Maria]

The comparative data show that English is a non-pro-drop language, where null subjects are prohibited, and that Spanish is a pro-drop language, where null subjects are permitted.

The question arising at this point is then: why is pro-drop allowed in one particular language but not another? The answer to the question has tied the parameter to a cross-linguistic difference in the richness of agreement markings on the finite verb. In a

language like Spanish or Italian, the subject pronoun may drop because the agreement markings on the verb are sufficiently rich to recover or identify the content (say, being a third person, singular and masculine pronoun) of the missing subject. In English, on the other hand, pro-drop is impossible because the agreement marking on its finite verbs are too meager to recover the pronoun's content.

This agreement-based analysis of pro drop also explains why object pronouns cannot drop even in Spanish-type languages, where the finite verb is marked only for agreement with the subject but not with the object. Furthermore, the theory correctly predicts that if a language has a way of marking the verb with sufficient features of agreement with the object, pro-drop may also occur with the object. This prediction is borne out by the data from Pashto in Huang (1984), a language that uses a split ergative system of agreement, requiring the finite verb to agree with the subject in some sentence, and with the object in others. Thus, the agreement-based theory provides a plausible account not only of the distribution of pro-drop across languages, but also of the distribution of *pro* in pro-drop languages. I can sum up the above discussion on pro-drop theory in two simple points. The first point is that languages drop subjects because of the rich agreement marking of their finite verbs; the second point is that pro-drop is generally limited to the subject position because of a cross-linguistic lack of object agreement.

2.1.4.Chinese as a Pro-drop Language I: A Discourse-oriented Language With the above two observations on pro-drop facts in mind, I am turning to Chinese, a language that extensively drops object as well as subject. In all appearances, Chinese poses a serious problem for the pro-drop theory as stated in the previous subsection. First, on the one hand Chinese uses null subjects apparently in much the same manner as Spanish-type languages, but on the other the language has no agreement marking whatsoever at all, flying in the face of the agreement-based account of recovery of subject pronoun's content. Second, Chinese allows null objects as much as null subjects; a point that also apparently falsifies the cross-linguistic observation that *pro* is essentially limited to subject position. Consider the following data from Chinese:

14 a. Zhangsan shuo [e hen xihuan Lisi]
Zhangsan say very like Lisi
'Zhangsan said that [he] liked Lisi.'

b. Zhangsan shuo [Lisi hen xihuan e]
Zhangsan say Lisi very like
'Zhangsan said that Lisi liked [him].'

As is evidenced by (14a) and (14b), Chinese drops both subject and object. In this subsection, I discuss subject drop in (14a), and object drop in (14b) will be taken up in the next subsection.

In (14a), the null subject in the embedded sentence behaves exactly like an overt pronoun under the binding-theoretic account: it may refer anaphorically to the matrix subject Zhangsan, or deictically to some other person whose reference is understood in discourse. The referential uncertainty is expected if the null subject is interpreted as a pronominal, comparable to an overt pronoun in the same position that would be capable of the same dual interpretations, as is illustrated by indexing in (14'a), which is a reproduction of (14a) with the null embedded subject replaced by an overt pronoun:

14' a. Zhangsan$_i$ shuo [ta$_{i/j}$ hen xihuan Lisi]
Zhangsan say he very like Lisi
'Zhangsan said that he liked Lisi.'

Based on the comparative data from (14a) and (14'b), it is clear that Chinese is a pro-drop language which permits null subjects in a manner pretty much comparable to that of a Spanish-type language: subject *pro* and overt pronoun can freely substitute one for the other. At the same time, however, it is also clear that Chinese allows *pro* subjects in the complete absence of agreement, a challenge to the agreement-based analysis of pro-drop.

To solve the problem, Huang (1984, 1989) generalizes the control theory of PRO to *pro* by treating PRO and *pro* as two variants of one single [+pronominal] empty category:

15. The Generalized Control Rule

> Coindex an empty pronominal (PRO or pro) with the closest potential antecedent,

In (15) the term antecedent may be either Agr or an NP. This generalized rule provides a plausible explanation for the occurrence of *pro* subject in Chinese, in which the content of the null pronoun is recovered not by Agr, but by an antecedent NP in a manner a PRO is controlled in an infinitival clause. In (14a), it has been seen that the content of the null subject can be recovered by coindexing it with the matrix subject NP *Zhangsan*, the closest potential NP antecedent. In this way, the null subject in (14a) is defined as a pronominal, i.e. *pro* in this case.

To sum up, the occurrence of null subject pronouns is permitted when there is a potential antecedent rich enough in content, which could be either Agr or an overt NP. Thus, the phenomenon of subject pro-drop can occur in two different cases: it can occur either when there is a rich agreement element or when there is no agreement at all. The first case occurs in languages like Italian and Spanish. The second case occurs in languages without Agr at all, such as Chinese and Japanese, in which case the null subject pronoun is identified by an NP in a superordinate clause.

What may complicate the picture is that Chinese is a discourse-oriented language, as opposed to English-type languages that are sentence-oriented. One of the basic natures of the former type language is that they have a rule of topic-chaining, by which the

discourse topic is grammatically linked to a null sentence topic. The latter in turn identifies a null argument. This null argument is a variable left from the movement of the empty topic to sentence topic position. Reasoning in this way, I find the sentence in (14a) is in fact grammatically ambiguous: the null subject can be either a pronominal or a variable, binding-theoretically. More precisely, when it is A-bound by the matrix subject NP, it is a pronominal. On the other hand, it can also be interpreted as a variable A'-bound by a zero topic ($_{Top}$ e_i), as schematically illustrated in (16)[2]:

16. Discourse topic$_i$ ... [$_{Top}$ e_i [$_{IP}$ e_i [VP]]]

With the introduction of the notions of zero topic and discourse topic, the dual interpretations of (14a) can be represented respectively in (17a) and (17b):

17. a. When the subject EC is A-bound:

Zhangsan$_i$ shuo [e_i hen xihuan Lisi]

b. When the subject EC is A'-bound:

Discourse topic$_i$ ... [Zhangsan shuo [$_{Top}$ e_i [e_i hen xihuan Lisi]]]

This mode of interpretation of the subject EC in (17) is closely in line with the algorithm Chomsky (1981: 330) proposes for identifying ECs in terms of their functions, rather than their intrinsic nature:

[2] See example (23) on page 27 for a further explanation of zero topic.

18. a. An EC is a pronominal if and only if it is free or locally bound by an element with an independent thematic role, and a nonpronominal otherwise.

b. A nonpronominal EC is anaphor if and only if it is locally A-bound and a variable if locally A'-bound.

(18) provides us with an account of the grammatical ambiguity of (14a) by identifying an EC locally as either pronominal or nonpronominal. When an EC is locally bound by an argument NP which has an independent thematic role it is a pronominal. This is the case with (17a). On the other hand, when this EC is locally A'-bound by a topic it is a variable, as indicated in (17b).

2.1.5 Chinese as a Pro-drop Language II: Subject-object Asymmetry In this subsection, I turn to object drop in Chinese as illustrated in (14b) in the previous subsection. The most striking finding is that while the embedded subject EC in a sentence like (14a) is open to dual grammatical interpretations, as already explained in (17a) and (17b) above, the object EC in a sentence like (14b) is not. This contrast can be seen clearly when (14a) and (14b) are reproduced as (19a) and (19b) below, and impose a pronominal interpretation on each of the ECs by indexing them with their closest potential antecedent, namely the matrix subject NP:

19 a. Zhangsan$_i$ shuo [e$_i$ hen xihuan Lisi]

Zhangsan say very like Lisi

'Zhangsan said that [he] liked Lisi.'

b. *Zhangsan$_i$ shuo [Lisi hen xihuan e$_i$]

Zhangsan say Lisi very like

'Zhangsan said that Lisi liked [him].'

What (19) indicates is that the object EC cannot referentially depend on the matrix subject as its antecedent, though the subject EC can. This suggests that the null object cannot be treated as a *pro*, as evidenced by (20), where each of the ECs in (19) is replaced by a lexical pronoun:

20. a. Zhangsan$_i$ shuo [ta$_i$ hen xihuan Lisi]

Zhangsan say very like Lisi

'Zhangsan said that [he] liked Lisi.'

b. Zhangsan$_i$ shuo [Lisi hen xihuan ta$_i$]

Zhangsan say Lisi very like

'Zhangsan said that Lisi liked him.'

The original contrast in (19) disappears in (20). This suggests that a subject pronoun can freely drop, but an object pronoun cannot, a phenomenon that has been observed across most pro-drop languages that have so far been studied (Huang, 1984, 1991).

The grammatical restriction on the object EC in Chinese arises from the fact that it must be interpreted as an A'-bound variable, as evidenced by (21):

21. neige ren_i, $Zhangsan_j$ shuo [Lisi kanjian $e_{i/*j}$]
that man Zhangsan say Lisi see Asp
'That man, Zhangsan said Lisi didn't know e'

For a sentence without a lexical topic such as in (14b), we can represent it exactly in a manner like (16)/(17b) by appealing to the notion of zero topic:

22. Discourse $topic_i$ ...Zhangsan shuo [$_{Top}$ e_i [Lisi hen xihuan e_i]
Zhangsan say Lisi very like
'Zhangsan said that Lisi liked [him].'

What (22) indicates is that the object EC refers to someone whose reference is understood from the discourse. It is then clear that, within the conceptual framework adopted here, the representation of (22) is grammatically treated on a par with that of (21): the object EC in both cases is an occurrence of A'-bound trace, generated by movement. In (21), the movement by topicalization is self-evident. In (22), it is not unreasonable to imagine that

the object is topicalized first before it is deleted from the topic position (Huang, 1982). Chinese offers ample examples that can be analyzed in light of what is often called topic NP deletion (e.g. Huang 1984), as illustrated in (23):

23. [$_{\text{Disc Top}}$ Zhongguo, difang hen da.] [$_{\text{Top}}$ e_i , renkou hen duo,]
China place very big population very many
[$_{\text{Top}}$ e_i, tudi hen feiwo.] [$_{\text{Top}}$ e_i, qihou ye hen hao.] [$_{\text{Top}}$ e_i , women dou
land very fertile climate too very good we all
hen xihuan e_i.]
very like
'(As for) China, its land area is very large. Its population is very big. Its land is very fertile. Its climate is also very good. We all like [it].'

To sum up, in contrast to the subject EC that can be interpreted as a pronominal or a variable, the object EC must be construed as a variable. The unbalanced distribution of argument ECs in Chinese has been known as the subject-object asymmetry in the literature, an insight that has been forcefully defended in Huang 1984 and 1989. For Huang, the thesis of subject-object asymmetry is held as support for a pro-drop theory that makes a cross-linguistic prediction that *pro* is generally not available to the object position except for a language with rich object agreement.

This thesis provides me with a null hypothesis for a comprehension study on double-gapped relative clauses in Chinese, a type of headed relative with both its subject and object phonetically null, as illustrated in (24) (Huang 1984's (38)):

24. Li Xiaojie hai zhao-bu-dao [$_{NP}$[$_{CP}$ **e** xinzhong xihuan **e** de] nanren]
Miss Li still can't find in heart like DE man
'Miss Li still cannot find a man she loves in her heart'

The embedded relative clause in (24) is a double gapped relative, since both its subject and object are empty. Under the hypothesis of the subject-object asymmetry, the empty object as a variable must be A-free. This amounts to saying that the relative head noun must be construed as the relative object, but not as the relative subject, as demonstrated in the English translation. Put another way, an interpretation of the head as the relative subject is prohibited, as illustrated by the following unacceptable gloss of the sentence in English:

'*Miss Li still cannot find a man who loves her in his heart'

The limited interpretation of the head noun in a double-gapped relative provides a testing ground for Huang's hypothesis of null object as a variable. In the theoretical literature, this hypothesis has been challenged by Xu (1986), who gives counterexamples and argues that null object positions are not grammatically restricted in the way proposed by Huang, but their interpretation in Chinese is influenced by lexical and pragmatic factors. Xu's counterexample is presented in (25b):

25. a. *Li Xiaojie zhao bu zhao [e_i keyi qu e de] $nanren_i$
Li Miss find not Asp can take-as-wife DE man
'Miss Li can't find any man who can take her as his wife'

b. Li xiaojie zhao bu zhao [e_i ken qu e de] $nanren_i$
Li Miss find not Asp will take as wife DE man
'Miss Li can't find any man who will take her as his wife'

The contrasting pair (25a) and (25b) have the same structure. The ungrammaticality of (25a) can be argued to follow from the supposed block on a pronominal interpretation of the null object, but in (25b) the head of the relative is construed as the subject of the relative, with the object EC referring to the matrix subject, contrary to Huang's analysis. Xu proposes a type of empty category, or Free Empty Category, as an addition to Chomsky's classic inventory of empty categories. This free empty category is subject to pragmatic interpretation.

Unexplained in Xu's account above is, however, why the head of the relative in (24) cannot be construed as referring to the subject empty category in the relative clause, in which the relative verb *xihuan* (like) is obviously less prone to a lexically/pragmatically-biased interpretation than those relative verbs such as in (25a) and (25b), i.e. *qu* (take as wife). Motivated by this theoretical debate on the identity of the null objects in Chinese, this research was designed to look into how Chinese-speaking children and adults would process the double-gapped relatives in their language, with a view to providing empirical data for interpretation of null objects in Chinese.

2.2 The Relative Clause in Chinese

2.2.1 Relativization in Chinese: An Outline The Chinese language has a fairly simple life for the relative clause. First, it is strictly placed before the head noun, and invariably marked by the particle *de* on its very right margin. Second, it does not use any relative pronoun, simply either leaving the relativised gap as it is if it is a subject or a direct object position, or spelling out, without fail, the gaps elsewhere with a full pronoun, as illustrated below:

26. a. [$_{CP}$e baozhe xiaoxong *de*]nezhi baitu (SBJ*)
hug bear DE that rabbit
'The rabbit that hugs the bear'

b. [$_{CP}$xiaoxong baozhe e (ta) *de*] nezhi baitu (DO*)
bear hug 3sg DE that rabbit
'The rabbit that the bear hugs'

c. [$_{CP}$xiaoxong gei ta hua *de*] nezhi baitu (IO*)
bear give 3sg flower DE that rabbit
'The rabbit that gives the flower to the bear'

d. [CP xiaxong gen ta wan *de*] nezhi baitu (OBL*)

bear with 3sg play DE that rabbit

'The rabbit that the bear plays with'

e. [CPtade muqin jian gu xiaozhan de]neiwei tongxue (GEN*)

whose mother meet PAST headmaster DE that student

'The pupil whose mother met the headmaster '

f. [CP Zhangshan bi ta ai *de*] neige nuren (OCOMP*)

Zhangshan compare 3sg short DE that woman

'The woman that Zhangsan is shorter than'

* The bracketed capital letters indicate relativization sites:
SBJ: subject relativization;
DO: direct object relativization;
IO: indirect object relativization;
OBL: oblique relativization;
GEN: genitive relativization;
OCOMP: comparative relativization

As indicated in these examples above, it is clear that, typologically speaking (Keenan & Comrie, 1977), Chinese like English is one of the rare languages in the world, which is capable of a full range of relativization, all the way downward from the subject

(26a) through direct object (26b), indirect object (26c), oblique (26d), genitive (26e) and comparative object (26f). On the other hand, the language is radically different from English in that, among other things, the resumptive pronoun is extensively required except for subject relativization (Chao, 1968). In direct object relatives, the resumptive is optional, as indicated by the parentheses in example (26b).

All the relatives in (26) are headed. However, Chinese also has free relatives, parallel to 'what you saw' in English. This type of relative in Chinese is formed in two ways. One is by *de*-relativization with an empty head, and the other by use of wh-quantifiers. Free relatives in Chinese do not concern us, but for completeness, I illustrate headless de-relatives and wh-quantifier relatives respectively in (27a) and (27b):

27. a. wo chi [$_{NP}$ [$_{CP}$ ta zuo de] ϕ]
I eat he cook DE
'I eat what he cooked.'
ϕ = zero head

b. ni yao shenme, wo dou gei ni
you want what I all give you
'Whatever you want, I will give you.'

2.2.2. Movement Analysis of Relative I: Operator-based Account In the generative literature, two different analyses have been proposed for the formation of

Chinese relative clauses. Both of the analyses involve a movement derivation, but one is operator-based while the other is in the spirit of head-raising. This subsection deals with the operator-based account and the head-raising analysis will be taken up in the next subsection.

The operator-based analysis originates from Chomsky (1977), in which relative constructions are conceived of as a CP structure adjoined to the head noun, derived through what is known as wh-operator movement. This movement results in operator-variable binding. The relative operator can be either overt or non-overt. For example, English is a language that possesses both overt and non-overt relative operators, and an alternation between the two forms of operator is just a surface variation. Consequently, an English equivalent of a Chinese object relative clause in (26b) can assume one of the following two forms, depending on which kind of relative operator comes into play:

28. a) The rabbit who the bear hugs

The rabbit $_i$ [$_{CP}$ who$_i$ [$_{IP}$ the bear hug t_i]]]

b) The rabbit (that) the bear hugs

The rabbit $_i$ [$_{CP}$ Op$_i$ (that) [$_{IP}$ the bear hug t_i]]]

Op = operator

In (28a) the overt relative operator is employed to form a relative clause in English. As an alternation to (28a), sentence (28b) uses the non-overt operator instead.

Chinese is a language that does not employ any overt wh-operator. Thus conceivably, a Chinese object relative can be represented only in a form comparable to that of (28b) in English. Secondly, the relative construction in the language is invariably of head-final format. Thirdly, it is obligatorily marked by the particle *de*, as pointed out earlier. With these three linguistic traits in place, the key point then is how to put them together in the framework of an operator-based analysis as illustrated in (28b). The organizing concept, as I can see it from the literature (for a review see Ning, 1993), is to visualize the relative marker *de* as a Chinese counterpart of the English complementizer *that*. However, *de* is head-final, taking an IP complement to its left. With the grammatical function of the particle *de* identified in this way, a Chinese object relative clause such as in (26b) should be assigned the following structure, in which the operator under Spec CP is assumed to precede the head C^0 on analogy with topicalization[3].

29. xiaoxong baozhe de nezhi baitu

$[_{CP}\ Op_i\ [_{IP}$ xiaoxong baozhe $t_i\ ]\ C^0$ de] nezhi $baitu_i$

bear hug that that rabbit

'the rabbit that the bear hugs'

(The relative marker '*de*' in this instance is glossed as 'that' for ease of exposition).

[3] To my knowledge, the question of whether Spec CP position precedes or follows head C has not been addressed in the literature. I will return to this question briefly toward the end of this subsection.

Treating the particle *de* as a functional head, i.e. C^0 head, on a par with English complementizer *that* is not unreasonable, since it can also introduce, like *that* in English, verbal and nominal complement clauses that are gapless. Example (30) is a *de*-construction as a nominal complement clause , and (31) a *de*-construction as a verbal complement clause:

30. [$_{CP}$ xiaoxong baifan baitu *de*] xiaoxi

bear visit rabbit *that* news

'The news that the bear paid a visit to the rabbit'

31. [$_{CP}$ xiaoxong baozhe baitu pao *de*] man shen da han

bear hug rabbit run *that* full body big perspire

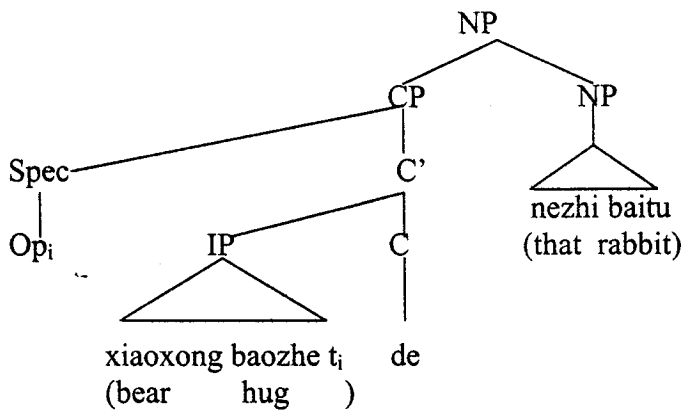
'The bear hugs rabbit and runs so that he becomes wet all over'

To account for the difference between the relative clause in (29) on the one hand and the nominal/ verbal complement clauses in (30) and (31) on the other, Ning (1993) argues that the C^0 head in a relative has a feature different from that on the C^0 head in a nominal or verbal complement clause. In the latter case, the C^0 head selects a proposition and closes its projection without the Spec CP. In the former case, however, the C^0 head selects a proposition with a gap and must expand until the Spec position is created to accommodate the relative operator. The end result is then the formation of operator-

variable binding in the relative construction, as illustrated in (29), which is not available for a nominal or a verbal *de*-construction in (30) or (31).

One remaining question for the above operator-based analysis is whether the null relative operator is moved out from the original position of the variable within the IP or is simply base-generated under the Spec CP. As to this point, authors in the literature are divided. Huang (1982), for example, takes the position that the null operator is base generated. Ning does not commit himself (1993:36) to any concrete proposal by arguing "when we attribute the operator-variable construction in a relative clause to the properties of the C^0 head *de*, it makes no difference whether the operator is originated from the position occupied by the variable, or is based-generated." I leave this issue open. For ease of reading, the relative construction of (29) is reproduced in the tree form of (32) by taking a functional, rather than a derivational, view of the null operator:

32.

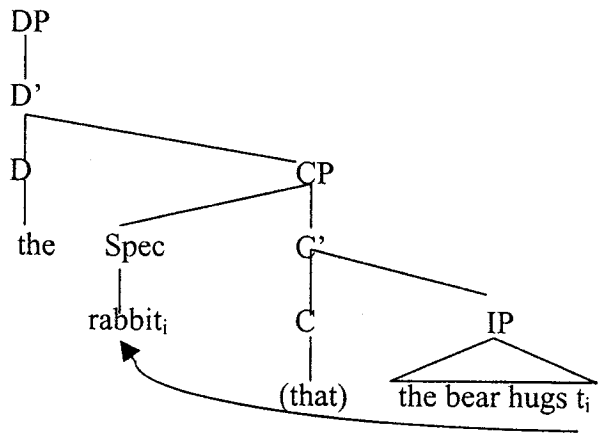


The representation in (32) epitomizes the 'standard' thought in the literature on Chinese relative constructions (e.g. Cheng, 1986; Chiu, 1998; Hung, 1982; Ning, 1993),

which has entrenched itself in one tacit, X-bar theoretic based assumption. That is, the representation in (32) takes it for granted that the specifier in Chinese branches uniformly leftward (see Chiu 1998; Wu, 1998). For that matter, classic X-bar theory cannot but acquiesce in this assumption, since it has no theoretical power to 'control', so to speak, the relative order between head and its specifier, though it does have that over the linear sequence between head and its complement by evoking the notion of head parameter. Recently, Kayne (1994) has made some efforts to make the X-bar theory explicit as to the linear order of head and its specifier, an issue that would lead me far afield. For this reason, I have to leave open the question of whether Spec CP position precedes or follows C^0 in Chinese relatives.

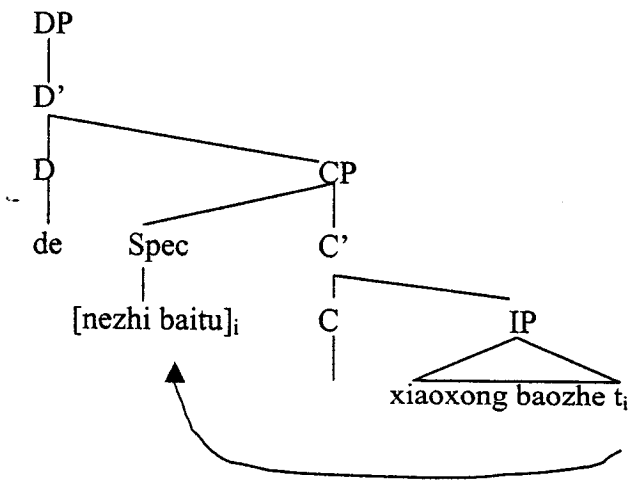
2.2.3 *Movement Analysis of Relatives II: Head-raising Account* An alternative movement analysis of Chinese relatives is in the spirit of head-raising, in which the particle *de* is taken as DP head, but not as a complementizer as in the operator-based analysis. This work is represented by Simpson (1997) and Wu (1998), who follow Kayne's (1994) head-raising hypothesis of relative formation in English. In particular, Kayne proposes that the relative clause in English be derived through a two-stage process such that it starts with the D^0 selecting a CP complement, and then raises the head noun from within the relative IP into the Spec CP. This proposal yields the head-initial relative construction in English in (33):

33.



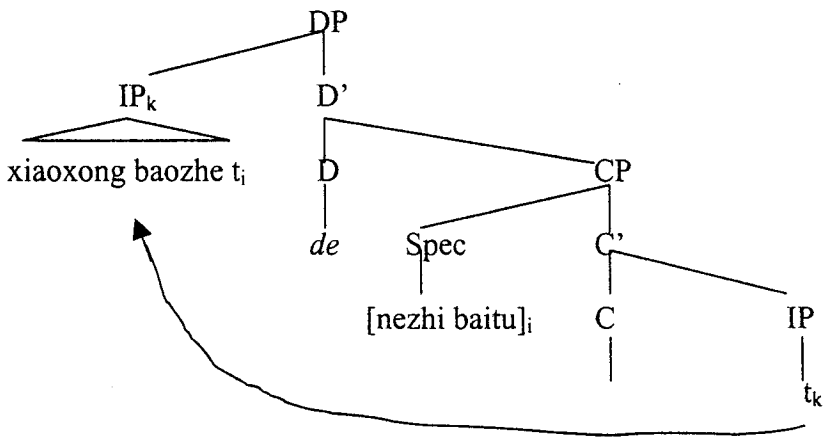
By assuming the particle *de* as D^0, the generation of Chinese relative clauses is taken to consist of two steps (Wu, 1998). The first step is the raising of the NP which Kayne suggests takes place in relativization for all languages, as already illustrated in (33). Thus, Chinese relatives start out as a head-initial structure, as illustrated in (34) below:

34.



The second step might be called IP-raising, moving the whole gapped IP into the Specifier of the DP, as illustrated in (35), and resulting in the observed head-final word order of relatives in Chinese:

35



The analysis of *de* as DP head has the advantage of resolving the apparent anomaly that the relative precedes the head in Chinese, which is otherwise typologically a right-branching language.

Chapter Three

Backgrounds & Goals II: Empirical Justification

This chapter is intended as a synthesis of the past acquisition research on null arguments and relative clauses in Mandarin Chinese, with a view to providing some empirical background for my experimental tasks. The empirical data from the acquisitional studies available to me, albeit quantitatively limited, qualitatively converges toward one point. That is, null arguments, in both subject and object positions, emerge at a very early age for Chinese-speaking children. This empirical finding underpins the research presented here that presupposes null arguments are part of child's competence. The chapter is organized in two sections. Section 3.1 deals with null arguments in the early Chinese grammar, subsuming two pieces of acquisition research, one naturalistic and the other experimental. Section 3.2 moves on to some experimental studies of how Chinese-speaking children treat relative clauses in their language.

3.1 Null Arguments in the Early Grammar

3.1.1 Naturalistic study: Wu 2000 It has been noticed that children universally tend to drop subjects in their speech regardless of whether the language they are learning permits this or not. This observation has given rise to one of the ongoing debates in current acquisition studies: is it because of a competence or performance deficit that children omit subjects where the adult grammar does not permit this? For the competence deficit approach, the omission of subjects is simply a reflex of the immature

grammar, in which either children universally start with an initial parameter setting that allows null subjects (e.g. the pro hypothesis, see Hyams, 1986), or child's phrase structure is truncated at the VP node without the IP node (e.g. Guifoyle, 1984; Radford, 1990) and thus there is no genuine sentential subject at all in child grammar. By contrast, the performance deficit approach argues that children do have knowledge of whether their language permits null subjects or not. It is because of some processing constraints that children fail to use null or lexical subjects properly in their language. The two approaches make different predictions about the distribution of null object as well as null subject. It is for this reason that the issue of null subjects has been extended to that of null objects. Hence the term null arguments in the literature, a practice followed in the title of this section.

It was in light of the above-mentioned debate that Wu (2000) conducted an investigation into the use of null arguments in Chinese child spontaneous speech. Her work was based on Tardif's naturalistic corpus, which was recorded in Beijing, China, between August 1991 and January 1992. The data is available on CHILDES (MacWhinney, 1993). Out of Tardif's data, Wu culled five children's speech covering two early recording sessions, namely the first and fifth visits. The average ages of these children were respectively 1;9 old at visit 1, and 2;1 old at visit 5. These children were chosen for the reason that their MLU (Mean Length of Utterance) matched up with that of the Portuguese children in Valian et al (1995), an earlier study of spontaneous speech addressing the issue of null arguments in child speech from the performance deficit perspective.

In the literature, two predictions under the performance-deficit theorizing have been made as to child's use of null arguments. First, more null subjects should be used for a child who is learning a pro-drop language than for the one who is learning a non pro-drop language, since it is assumed that at the very beginning the child already knows whether lexical subjects are required or are just a syntactic option in his language. Second, the use of lexical subjects will increase with age and MLU regardless of whether the target language is a null subject or a non-null subject language. The maturational increase of lexical subjects for a null subject language learner is attributed to a trade-off effect between null subjects and pronominal subjects. That is, null subjects decrease as a result of being replaced by full pronouns with development.

Valian et al's study of Portuguese children confirms these two performance-based predictions, and Wu's study replicates that of Valian et al's in these two respects. In particular, both Portuguese and Chinese children use more null subjects than do American children. This indicates that Chinese children at an early age know their language is a null subject language. Second, as development proceeds, Chinese-learning children increase their use of lexical subjects, which mainly take the pronominal form, as is the case with Portuguese-speaking children. The trade-off effect between pronominal subjects and null subjects indicates that the increase in the use of subjects is not because children are changing from a null subject language to a non-null subject language, since both Portuguese and Chinese are null subject languages.

Furthermore, Wu's analysis suggests that the distribution of null arguments is asymmetrical between subject and object positions. For the five children, the mean percentage of the use of total lexical subjects increased from 26% to 45% over the two

visits whereas that of total lexical object increased from 58% to 71%. The Wilcoxon signed ranks test indicates that while there is a significant drop in the child's use of null subjects over the two visits, the use of null object does not significantly decrease. This finding suggests that Chinese children distinguish between null subjects and null objects at a very early age. I take this finding as one source of empirical justification for the present research program, in which the experimental tasks presuppose the availability of null objects as well as null subjects to young Chinese-speaking children.

3.1.2 Experimental study: Wang, Lillo-Martin, Best & Levitt 1992. Wu's naturalistic finding on asymmetrical distribution of null subjects and null objects in early grammar of Chinese is supported also by an experimental study by Wang et al. In summary, in the latter study, Chinese children's use of null subjects declines from 55% to 38% with age while the use of null objects increases slightly from 20% to 26%, a clear indication that the use null subjects changes over time while the use of null objects is comparatively stable, roughly in line with Wu's observation above. As far as the goals of my review here are concerned, the two pieces of study lend support to my research program on the same empirical grounds: not only are null arguments part of the early grammar of Chinese, but the grammatical status of null objects is distinct from that of null subjects. On the other hand, as far as the theoretical debate on the issue of universality of null subjects in child language, Wang et al situate the asymmetrical issue of null arguments in Chinese in the competence-based framework, as opposed to Wu's performance-based analysis. In what follows, I report Wang et al's findings in some detail.

Wang et al was an elicited production experiment on 9 Chinese-speaking children ranging in age from 2;0 to 4;6, and 9 American children ranging in age from 2;5 to 4;5. There were two storybooks used for the experiment. Production data were elicited by asking the subjects to tell the stories to the experimenter.

The mean percentage of subjectless sentences from each speaker's productions was calculated as the proportion of the sentences with null subjects to the total number of sentences produced in telling the two stories. The mean percentage of sentences with null objects was calculated using a similar method. The proportion was the total number of sentences with an underlying structure of SVO to the total number of sentences produced with a null object. These proportions were then averaged over the total number of subjects in each language group. In particular, the mean percentages of sentences with null subjects were 46.54% for the Chinese children, and 33.11% for the American children. The mean percentages of sentences with null objects were 22.53% and 3.75% respectively for the Chinese and American children.

Given the difference in the mean percentages of subjectless sentences in the two language groups, it is clear that the Chinese children drop their subjects at a higher rate than the American children. This is suggestive of a performance-based account: from the very beginning children already have full knowledge of whether their language is [-pro-drop] or [+pro-drop]. However, Wang et al argue that the finding is not necessarily interpreted in this manner. Instead, they take the position that a parameter-setting account would better accommodate the fact, which is essentially of a competence-based approach.

First of all, Wang et al believe that early grammar is hard-wired by UG with an initial positive setting of the pro-drop parameter. This in effect argues for an early stage

of genuine [+ pro-drop] for English-speaking children. Indeed, there is a significant difference in the overall use of null subjects in the two language groups, but when those overall mean percentages are broken down by age and MLU, a different picture emerges: at the earlier MLU stage the use of null subjects for the two language groups does not differ significantly. In particular, for the earlier MLU level of 3.5 (2-year-olds), the American children produced subjectless sentences 25.89% of the time, and 8.9 of the time for the later MLU level of 4.5 (3- and 4- year-olds). For the two corresponding MLU levels, the Chinese children produced subjectless sentences respectively 55.7% and 45.6% of the time. The difference between the Chinese and American in the earlier MLU groups is not statistically significant. It is only at the later MLU level that the difference between the two groups is significant. In both languages, the proportion of subjectless sentences decreases over time, a maturational process that is particularly clear for the American group. Drastic decline in subjectless sentences in the American children suggests that the children are in the process of resetting their initial [+pro-drop] to [-pro-drop].

While maintaining that the initial grammar involves a positive setting of the pro-drop parameter for all language learners, Wang et al however contend that this does not necessarily mean that the American children use the same mechanism in identifying and licensing the null subjects as do the Chinese children, as assumed by the pro-hypothesis (Hyams, 1991). According to the latter, English-speaking children begin speaking a Chinese-like language, that is, a language in which null subjects can be identified by null topics. Based on their findings, Wang et al argue this is not the case. On the contrary,

they contend that English-speaking children begin with an Italian-like language, where null subjects are licensed by certain Case-assigning maximal categories.

Wang et al's contention above rests on the following assumption: UG provides more than one single parameter for controlling the use of null arguments. For example, the parameter constraining null arguments in Italian-type languages can be argued to be different from that in Chinese-type languages. For the latter type parameter, Wang et al dub it the Discourse-Oriented Parameter, following Huang (1982, 1984). This parameter permits languages with discourse-oriented properties to have null arguments in both subject and object positions. These null arguments can be either a variable which is identified by a discourse topic, or a *pro* which is identified by a c-commanding NP. As I have explained in Chapter II, whereas the null argument in the subject position can be either a variable or *pro,* the null object is necessarily a variable since it is invariably A'-bound. With this reasoning in mind, it then follows naturally that Chinese-speaking children are predicted not only to use both null subjects and objects, but also to treat them differently. This is exactly what Wang et al's experiment on the Chinese-speaking children has obtained: although both null subjects and null objects were concurrently used their distributional patterns were different from each other. Furthermore, while the mean percentage of sentences with null subjects decreases with age from 55% to 38%, the mean percentage of sentences with null objects slightly increases from 20% to 26%. All this suggests that the grammars of null subjects and null objects are not entirely the same.

The other parameter, which Wang et al call the Null Pronoun Parameter, constrains null arguments in Italian type language. These null arguments are considered

members of the empty category *pro* [+pronominal, -anaphoric] because they are identified by the person, number, and/or gender features of the licensing category Agr. Although subject-verb agreement is insufficient to license or identify in adult English, Wang et al take it that English-speaking children who use null subjects are doing so because of this parameter, not because of the Discourse-Orientated Parameter. The evidence provided by Wang et al for the operation of the Null Pronoun Parameter in the acquisition of English is the asymmetrical use of null subjects vs. null objects in the American children. Compared to the Chinese children who used null objects systematically and productively, the American children did not. Although they do have a few sentences with null objects, the mean percentage of their sentences with null objects is only 3.75, which was in fact ungrammatical and thus counted as errors, that is, outside the children's grammar. The unavailability of null objects for English-speaking children falls neatly in line with a cross-linguistic observation, that is, object agreement for most languages studied so far is usually not rich enough to identify the *pro*. Reasoning along this line, Wang et al contend that English-speaking children initially posit an Infl category with the potential of being a licenser for empty subjects but not for empty objects. As a result, the young American children are found to use null subjects, but not null objects. Changing the setting of Null Pronoun Parameter to disallow null subjects follows from a reanalysis of morphological agreement trigged by evidence from the linguistic environment. This occurs during the third year when the use of null subject in the American children's utterances decreases drastically as evidenced by Wang et al's findings.

The theoretical goals of Wang et al are to provide cross-linguistic evidence that it is the null subject, but not the null object, that has special status for language development, an observation that is argued to be better accommodated in light of parameter resetting, rather than in that of performance limitations. However, what is most pertinent to my study is Wang et al's exploration of the use of null objects in a discourse-oriented language such as Chinese. There are two points I would like to bring to the foreground of this review. First, the use of null objects by Chinese-speaking children is not only grammatical and productive, but maturationally remained fairly constant. This observation points to the fact that the null object is indeed a well-established phenomenon in the early grammar of Chinese, a critical point for the feasibility of my experimental tasks, as has been noted earlier. The theoretical goals of my study are distinct from Wang et al's. I go one step further and subject the grammatical status of null object, as oppose to that of null subject, to an acquisitional test in the form of children's comprehension of double-gapped relatives.

Second, Wang et al's work indicates that the role of pragmatic factors in language development should be distinct from that of grammatical setting. They found that whereas the Chinese adults produced sentences with a null argument interpreted by a discourse topic several sentences earlier, the youngest children did not exhibit this kind of long-distance use of null arguments. This amounts to saying that the "factors that control the pragmatically acceptable use of null arguments, opposed to their general grammaticality, will need to be learned by Chinese-speaking children."(p. 450). I will return to this observation from a language-processing point of view in the discussion of my experimental results in chapter 6.

3.2 Acquisition of Relative Clauses in Chinese

The acquisitional studies on relative clauses in Chinese available for a review here are Chang (1984), Lee (1992), and Chiu (1998). The former two are comprehension studies, and the latter is a production study. My impression is that these three studies epitomize the past mainstream thoughts of acquisitional studies on Chinese relatives. In fact, Chiu is the only piece of production research in the generative tradition so far available to me. The comprehension studies reflect one sustained theme in the acquisitional study of Chinese relatives: describing and explaining the effects of sentence type and age on the comprehension of relatives.

3.2.1 Production Study: Chiu 1998. This is a cross-sectional study of relative clauses in Chinese-speaking children, in which a total of 65 subjects underwent an elicited production experiment. The subjects ranged from 3;2 to 6;1 in age, averaged 4;5. The experiment was conducted by two experimenters with the following procedure: one of the experimenters first covers her eyes while the other introduces a prop girl named *Maomao* to the participant. The second experimenter then enacts a scenario using two identical props. For example, there are two identical pigs and a strawberry on the table. The experimenter acts out a scenario in which one of the pigs is eating the strawberry and tells the subject that *Maomao* likes the strawberry-eating pig. The first experimenter takes off her blindfold and asks the subject which of the pigs *Maomao* likes. The subject is expected to answer with a relative clause, such as

1. [$_{CP}$Maomao xihuan chi caomei de] neizhi xiaozhu

Maomao like eat strawberry De that pig

'Maomao likes the pig that is eating the strawberry'

With enactment of various scenarios, a full range of relative types, as illustrated in (26) in Section 2.2 of Chapter II, was tested. Every scenario was enacted twice for each subject on each type of relatives.

Summarily, out of the 1105 utterances elicited in the study, 882 contain relative clauses; thus overall relative clause production rate was as high as 75%. The child subjects in Chiu's study were organized in three age groups, namely the young, the middle, and the old groups with their mean age respectively being 3;5, 4;7 and 5;6. Table 1 gives numbers of utterances and relatives elicited broken down by age group.

Table 1
Numbers of utterances and relatives elicited by age group

Subject group	No. of utterances	No. of relatives	Percentage
Small	408	274	67
Middle	488	367	75
Old	209	181	87
Mean	1105	822	75

A noticeable maturation process was observed in the production of relative clauses, as can be seen from the table above. As the age increases the percentage of relative clauses elicited increases. Most importantly, the subjects in the old group were

able to produce relative clauses almost on the first trial of each type of relatives. I have taken this finding, in conjunction with the relevant observations from Lee 1992 (see Section *3.2.3* below for detail), into consideration when deciding on the children population in terms of age structure in this research.

Apart from the above observations that are immediately relevant to the present study, Chiu's work is also theoretically interesting with respect to the types of relatives elicited in her study. Summarily, three type relatives were produced: gapped, RP (resumptive pronoun), and RNP (resumptive noun) relatives. As noted in the previous chapter, both gapping and RP linkage are available in the adult relative grammar of Chinese. However, the subjects in Chiu were found to use RNP linkage to form relatives as well. This option is not available in adult Chinese. Example in (2) illustrates this non-adult form of relative produced by children in Chiu's study (her (25)):

2. [$_{CP}$ luotuo chi caomei de] caomei
   camel eat strawberry DE strawberry
   'the strawberry which the camel ate'

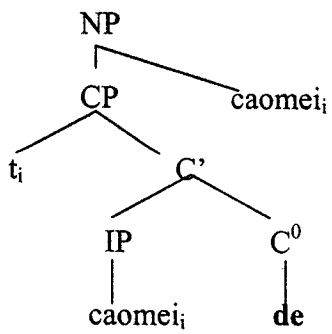
Furthermore, like the well-formed gapped and RP relatives that can be headed or headless, the illicit RNP relative in child Chinese can also take both headed and headless forms. The example in (2) above is a headed RNP relative, whereas that in (3) below is a headless RNP relative:

3. [CPganggang neige daxiang tiao de] ____
just now that elephant jump DE e
'the elephant that just jumped'

It is clear from (3) that the type of RNP relatives without head gives rise to a structure similar to that of head internal relatives. According to Chiu, headless type RNP relatives make the majority of the RNP relatives elicited in the study: out of the 93 RNP relatives, 77 were headless.

To account for the RNP, both headed and headless, relatives in the early Chinese grammar, Chiu follows Guasti & Shlonsky (1992) in assuming that the relative operator is maturationally unavailable to young children, and thus contends that young Chinese children form relative clauses by raising the head noun directly from within the CP of the subordinate clause in a manner similar to that I have explained in section 2.2 of the previous chapter. By adopting Chomsky's copy theory of movement (1995), Chiu further assumes that RNP is the full NP copy of the moved element spell out at PF. Thus, the RNP relative in (2) is assigned the following partial structure, which indicates the head noun moves out of the relative clause via SpecCP:

4.



With the structure of (4) in mind, Chiu then conjectures that the illicit headed RNP relative arises simply because children fail to delete the lower copy of the trace at PF.

Chiu's analysis above is coincident with what Goodluck & Stojanovic (1996: 308-309 note 18) call "a copying-without-deletion analysis", which was proposed as an alternative to Guasti & Shlonsky's analysis of RNP relatives as the NP in the relativization site in situ plus a base-generated pleonastic NP in head position. The basic idea behind this copying-without-deletion analysis is to take the production of non-adult-like resumptive relatives as a derivational stage that precedes PF. Chiu is not explicit on this point, but it appears that she assumes that not only is the deletion before PF an optional process, but also that children can randomly delete either of the two copies of the move constituent. Thus, when deletion does apply and it is to the higher copy of the trace, then a headless RNP relative as illustrated in (3) results, which is an illicit form much as is the headed RNP relative. If deletion does apply but this time it is to the lower copy of the trace, then a 'normal' gapped (subject or object) relative is produced, which is an adult form of relatives, as illustrated in (5) (her (35)):

5. [$_{CP}$___ chi caomai de] zhu
   e eat strawberry DE pig
   'the pig that ate a strawberry'

Again, if deletion does apply but it is now unselectively to both copies, then a headless gap relative obtains, which is also well-formed in the adult grammar, as illustrated in (6) (her (36)):

6. [CP_____ tiao tiao de] _____

e jump DE e

'one who is jumping'

To sum up, in Chiu's analysis the grammar of child relative clauses in Chinese is distinct from that of adult relative clauses. In the former, relatives are formed by moving the head noun directly out of the CP relative to its adjoining position. For the latter, relatives are formed by the movement of the relative operator that links the antecedent and a variable in a proposition. However, Chiu is silent as to the time and path for the connection between the two grammars.

3.2.2. Comprehension Studies I: Chang 1984 In this study, 48 Mandarin-speaking children aged between 6 and 12 acted out different types of relative clauses using toy animals. The main purpose of the research was to examine the effects of sentence type on children's comprehension of relative clauses across different age groups. Thus, there were two independent variables in the study, each of which was measured at four levels. For the age variable, the 48 subjects were divided into four equal groups. From the oldest to the youngest, they were 6th, 4th, 2nd, and 1st graders respectively.

Four types of relative constructions were examined, defined in terms of the grammatical role of the head noun in the matrix sentence with respect to its role in the relative clause. In particular, they were subject-subject (SS), subject-object (SO), object-subject (OS), and object-object (OO). In these four labels, the first letter indicates the grammatical function of the head noun in the matrix clause while the second letter

indicates the grammatical function of the head in the relative clause. Thus, SS is a relative construction, in which the head noun functions as subject in both matrix and relative clauses. In SO type relatives, the head noun serves as subject in the matrix but as object in the relative. Table 2 lays out the linear orders of the four types of relative constructions each with a Chinese example and its translation in English beside it.

Table 2

Linear order of the four type relative clauses tested

SS	[_ V NP] de NP V NP	[__chi laoshu] de mao yao gou e eat rat DE cat bit dog 'The cat that bit the dog ate the rat
SO	[NP V _] de NP V NP	[gou yao __] de mao zhui laoshu dog bit e DE cat chase rat 'The cat that the dog bit chased the rat'
OS	NP V [_ V NP] de NP	mao yao [__ zhui laoshu] de gou cat bit e chase rat DE dog 'The cat bit the dog that chased the rat'
OO	NP V [NP V _] de NP	mao yao [laoshu zhui __] de gou cat bit rat chase e DE dog 'The cat bit the dog that the rat chased'

The taxonomy of relatives as listed in table 2 originates from Sheldon (1974) in English, who found SS sentences were the easiest to comprehend for her children between 3;8 and 5;5 years, followed by OO, OS and SO with increasing difficulty. It appears that neither the role of the head noun in the main clause nor its function in the relative alone can account for this result. Sheldon postulated a parallel function analysis:

SS and OO sentences were easier to comprehend due to the identical role (either subject or object) that the head noun plays in both main and relative clauses; the relative difficulty in comprehension of OS and SO was accordingly due to the fact that the head noun assumes a different role in the main clause than that in the relative.

Another school of research on comprehension of relative clauses with respect to the four sentence types reported a different order of difficulty: it was OS, SS, OO and SO in descending order. It had been proposed that the results were best accounted for by Bever's N-V-N strategy (1970), a default heuristic processing method for young children to parse a complex sentence with a NVN sequence as agent-action-object. Thus, an OS construction in English (e.g. The car hit the bus that ran over the man) would be easiest for children, whereas the SO constructions (e.g. The car that the bus hit ran over the man) would be most difficult in English.

Tavakolian (1981) represents yet another school of thought on the issue, which is known as Conjoined Clause analysis. In this analysis, children would process a relative-embedded sentence as if the first NP were the subject of the main as well as relative verbs. Accordingly, children are predicted to perform well on SS sentences in English, but poorly on OS sentences. As far as OO and SO sentences are concerned, this strategy would be hard to apply because the verbs in these sentences are not in the normal English word order of SVO. Consequently, children's performance on OO and SO would be inconsistent.

When we consider these three analyses in the context of Chinese sentences with relative clause, the following may be predicted: (1) if the parallel function hypothesis is correct, then the order of difficulty would be SS / OO < SO /OS (where < is interpreted as

easier to comprehend); (2) if a NVN strategy is employed, the order of difficulty would be SO < OO / SS < OS; and (3) if a Conjoined Clause Analysis is applied, there would not exist any predictable order of difficulty, since none of the Chinese sentence types listed in Table 2 can be successfully analyzed by this strategy.

However, Chang's data indicates that there is a clear order of difficulty, which also disconfirms the other two predictions. In particular, SS and SO types of sentences in Chinese were significantly easier to comprehend than OS and OO types. The author attributes this to the disruptive effect of interruption of linguistic units on comprehension, a point that has been raised in Slobin (1973). It is clear from table 2 that OS and OO type sentences involve center-embedding, or interruption of the main clause by the relatives, whereas SS and SO types do not. It is this disrupted linear order, the author argues, that gives rise to the comprehension difficulty, which can be rated as SS = SO < OS = OO. What is implied in this schematic order of comprehension difficulty is that differences between SS vs. SO, on the one hand, and between OS vs. OO, on the other, are all statistically insignificant. Specifically, Tukey's test (HSD=0.6 at a =.5 and V =1320 showed there was no significant difference between SS and SO, nor between OO and OS, across the four age groups. But differences between SS, OO; SS, OS; SO, OO; and SO, OS were all significant. From the point of view of the present experimental design (see section 5.1.1 *Sentence Types Tested*), Chang's finding on the relative order of comprehension difficulty can be interpreted as follows: a relative clause with its head functioning as matrix subject is always easy to comprehend irrespective of whether the extraction site is the subject or the object position.

With respect to the age of acquisition, the author noted " even the oldest age group (approximately 12years old) had a less than perfect score (mean =4.21, where max.=6) for OS and OO type constructions" (p. 64).

3.2.3. Comprehension Studies II: Lee 1992. Lee refines Chang's work substantially, providing me not only with a much sharper picture of the relative order of comprehension difficulty across different types of relative clauses in Chinese, but also with a clear understanding that Chinese-speaking children do grasp syntactic bindings of relatives in their language as young as four years.

Lee's work consists of two experiments. In the first experiment, the types of sentences containing relatives tested included SS, SO, OS, OO, SIO and OIO. The first four types have been described in the last subsection. The last two types, namely SIO and OIO, involve relativization of the indirect object, as indicated by the second two letters (i.e. IO) in their labels. When such a relative modifies the matrix subject, a SIO sentence results; when the relative modifies the matrix object, it is then an OIO sentence. As explained in the previous chapter, a resumptive pronoun is obligatory for relativization out of the indirect position. Thus, SIO and OIO were collectively intended as a relative type that involves pronominal linkage, as opposed to the first four type sentences that involve gap binding. (7) and (8) are reproductions of SIO and OIS sentences from Lee (his (9) and (10)):

7. [$_{CP}$ xiaogou ti ta shuaya de] neige baitu gen zhe xiaoxing SIO

puppy for him brush-tooth DE that rabbit follow teddy bear

'The rabbit for whom the puppy is brushing his teeth follows the bear'

8. xiaoxiong gen zhe [$_{CP}$ xiaogou ti ta shuaya de]neige baitu OIO

teddy-bear follow puppy for him brush-tooth DE that rabbit

'The bear follows the rabbit for whom the puppy is brushing his teeth'

Four tokens of each type of the six relatives listed above were presented. 61 Mandarin-speaking children, split into five age groups ranging from 4- through 8-year-olds, participated in the experiment.

The central theme of Lee's study is that comprehension difficulty across the six types of relative constructions for Chinese children should be accounted for by a syntactic-based approach rather than a heuristic-based one. This argumentation is borne out by his data. In summary, the attested order of difficulty across the 5 age groups in the first experiment is SS < SIO < OS < SO < OO <OIO, a comprehension pattern that none of the heuristic-based processing approaches as reviewed by Lee can accommodate. Given the purposes of this writing, I will not go into details of the inadequacies of various heuristic-based analyses in explaining the empirical findings in Lee's study. What is important is that Lee's syntactic-driven analysis of his data provides me with a clear understanding that Chinese-speaking children as young as four have developed adult-like knowledge of the syntactic bindings of relatives in their language: gap binding which is acquired by four, and pronominal binding which is acquired by five.

Returning to the details of the results of Lee's first experiment, the first thing I noticed is that the SS type sentence is acquired by age 6, and SO, OS, and SIO are acquired by age 8. This acquisitional assessment is based on 75% correct responses for 75% subjects out of each age group. None of the subjects in any age group could reach that accuracy level on OO and OIO type sentences.

Furthermore, the data indicate that children perform significantly better on relatives which modify the matrix subject (i.e. SS and SO relatives) than those that modify the matrix object (i.e. OS and OO). This finding holds true for all the age groups studied, confirming what Chang described as a disruptive effect of center embedding on comprehension of OS and OO type sentences. This observation in Lee is extended to SIO and OIO type sentences as well.

On the other hand, Lee departed from Chang in finding that relativization site does matter in comprehension. In particular, his data indicate that, with other things held equal, sentences involving object relativization (i.e. SO, OO, SIO and OIO) are significantly harder than sentences containing subject relativization (i.e. SS and OS). (9) schematically summarizes the types of sentences tested in Lee and the percentage correct averaged across 4-8 age range.

9.	a.	[_ V NP] de NP V NP	SS – 72% correct
	b.	[NP V _] de NP V NP	SO – 37% correct
	c.	NP V [_ V NP] de NP	OS – 43% correct
	d.	NP V [NP V _] de NP	OO – 17% correct
	e.	[NP V Pro. NP] de NP V NP	SIO – 44% correct
	f.	NP V [NP V Pro NP] de NP	OIO – 6% correct

In his second experiment, Lee found that the difficulty children experience with relativization of the object position was considerably lessened when the main clause was intransitive and when the relative is held constant by limiting its head noun invariably as the matrix subject. (10) gives schematic representations of these three sentence types tested, and the mean percentage correct for 4-5 year old children

10.	a.	[_ V NP] de NP V	SS – 82% correct
	b.	[NP V _] de NP V	SO – 84% correct
	c.	[NP V Pro. NP] de NP V	SIO –86% correct

It is clear from (10) that not only is children's performance on these intransitive sentences considerably better than on their transitive counterparts in (9a), (9b) and (9e), but also the effect of subject vs. object relativization on comprehension observed among the set of (9) does not exist any more in (10).

In sum, Lee's work provides us with clear evidence that, despite various difficulties experienced in comprehension of relative clauses in transitive sentences, children do very well on those relative clauses that modify the subject of an intransitive sentence, regardless of whether relativization is in the subject or the object position. This finding is important in the sense that it provides me with a working prototype for the design of the one-gap relative sentences, which take the form of (10a)/(10b) for simple argument relatives and that of (10c) for oblique relatives. I will return to this point in Section 5.1.1 Sentence Types Tested in Chapter 5.

3.3 Summary: Empirical Studies

This chapter provided a background review of empirical studies on the acquisition of null arguments in general and of relative clauses in particular. From the studies, it has been seen that both null subjects and null objects emerge as part of competence grammar as early as two years. Importantly, one consistent finding is that Chinese-speaking preschoolers treat null subjects and null objects differently, a crucial point that is also examined in this experimental work.

The acquisition studies reviewed here reveal one fact that, despite their seemingly late full knowledge of relative clauses, Chinese-speaking children are able to produce relative constructions as young as 3;3 of age, and the production rate for 4;7 year olds is as high as 75% (see table 1). With respect to comprehension studies, argument (subject and object) relativization is acquired by age of four, and indirect object relativization with the resumptive by age of five. These data were useful in determining the appropriate ages to test children on relative clauses in the present research.

With respect to sentence types on comprehension, there is a fairly clear picture: comprehension is facilitated when the relative modifies the matrix subject and when the matrix clause is intransitive. Again, these two features were critical in designing test sentences in this work. This point will be taken up again in Chapter 5.

With the theoretical and empirical backgrounds and goals of this research set out respectively in Chapter 2 and 3, I am now ready to move on to the hypothesis and predictions, the topic of Chapter 4.

Chapter Four

Hypotheses & Predictions

4.1 Subject-object Asymmetry: a Recapitulation

This chapter is an immediate continuation of Section 2.1.5 of Chapter 2, where I ended up with a postulation of subject-object asymmetry. The central point is this: while an embedded null subject can be either A-bound or A'-bound, interpreted respectively as the matrix subject or the discourse topic, a null object must be A'-bound, referring to an entity whose identity has been established in the discourse. While recognizing that the object-EC-as-variable hypothesis has been challenged in the literature, I note that the hypothesis of subject-object asymmetry can be translated into a principled analysis of double-gapped relatives in Chinese. This was demonstrated in the examples of (24) and (25) in Section 2.1.5 of Chapter 2, reproduced as (1) and (2) here for ease of reference:

1. Li Xiaojie hai zhao-bu-dao [$_{NP}$[$_{CP}$ **e** xinzhong xihuan **e**$_i$ de] nanren$_i$]
   Miss Li still can't find in heart like DE man
   'Miss Li still cannot find a man she loves in her heart'

2. *Li Xiaojie$_i$ hai zhao-bu-dao [$_{NP}$[$_{CP}$ **e**$_i$ xinzhong xihuan **e** de] nanren]
   Miss Li still can't find in heart like DE man
   '*Miss Li still cannot find a man who loves her in his heart'

With this mode of interpretation of the null relative object in mind, it is now ready to articulate my research hypotheses, which are concerned with how children will process double-gapped relative clauses in Chinese.

4.2 Covert- vs. Overt-binder RCs: a Characterization

For purposes of this experimental design, I distinguish between two types of double-gapped relatives. One type may be designated as Covert-binder RC and the other as Overt-binder RC. By Covert-binder RC I mean those 2-gap relative clauses whose non-head EC binder is covert, as illustrated in (3) below:

3. [$_{NP}$[$_{CP}$ **e** xinzhong xihuan **e** *de*] nanren]]

in heart like DE man

By Overt-binder RC I mean the type of 2-gap relative clause whose non-head EC binder is overtly present. Since the non-head EC binder can be in an A-position or A'-position, it is appropriate to further distinguish between two subtypes of Overt-binder RCs: one is Subject-binder RC where the non-head EC is bound by the matrix subject as illustrated in (1); the other is Topic-binder RC where the non-head EC is bound by the discourse Topic. For ease of reference, a new sample pair of these two subtypes of Overt-binder RCs is provided in (4) and (5) below:

4. Subject-binder RC

Ma xihuan [$_{NP}$ [$_{CP}$ e wen e de] niu]

Horse likes e kiss e DE cow

a) 'The horse$_i$ likes the cow who he$_i$ kisses'

b) *'The horse$_i$ likes the cow who kisses him$_i$'

5. Topic-binder RC

Ma, [$_{NP}$ [$_{CP}$ e ti e de] niu] hen shengqi

Horse, e kick e DE cow very angry

a) 'The cow who the horse kicks is mad.'

b) 'The cow who kicks the horse is mad.'

As already demonstrated in (1)/(2) and (4), a Subject-binder RC is linguistically not ambiguous under the null-object-as-variable analysis. In contrast, this is not the case with the example in (5), however. As a Topic-binder RC, it has an overt NP in the matrix topic position, which is capable of binding into either the embedded subject or object position. This gives rise to true ambiguity, as demonstrated in the English translations of (5a) and (5b). The (5a) reading obtains when the topic NP 'horse' is construed as the relative subject, as opposed to the (5b) reading in which the same topic is interpreted instead as the relative object. In other words, the relative head functions as the relative object in (5a) but as the relative subject in (5b).

4.3 Covert- vs. Overt-binder RCs: Two Assumptions

Following the above characterization of two types of double-gapped relatives, one should be able to establish two assumptions about potential linguistic contrasts embedded in the doubled-gapped relative in Chinese. One assumption is about what I have called Overt-binder RCs, where the linguistic contrast is simple and straightforward enough as illustrated in (4) and (5). That is, for a double-gapped relative with its non-head EC A-bound (i.e. example (4)), a logically possible interpretation of the head as the relative subject should be linguistically blocked, but not for a relative with its non-head EC A'-bound (i.e. example (5)). This contrastive interpretation of Overt-binder relative clauses is taken to be part of the competence grammar of Chinese-speaking children, following the acquisition literature reviewed in Chapter 3, which has indicated that Chinese children do possess the full knowledge of empty categories in their language.

The second assumption is about what I have called Covert-binder RC, namely the type of double-gapped relative with its non-head EC binder phonetically missing in the sentence. Here my reasoning is along the following lines: since the embedded object EC in a double-gapped relative can be A'-bound by a discourse topic, it amounts to saying that, within the conceptual frame adopted here, this is an alternative way to the "normal" binding under the complementizer phrase of the relative clause. The most critical assumption here is this: the relative head can then be released to function as the binder of the subject EC. Again, all the subtleties of this knowledge about Covert-binder RCs are taken to be a built-in feature of the early grammar of Chinese for the same reason that the contrastive interpretation of two subtypes of Overt-binder RCs has been assumed to be part of children's grammar.

4.4 Predictions

The above two assumptions enable me to make two sets of experimental predictions about double-gapped relative clauses in Chinese. One set concerns Covert-binder relatives, and the other Overt-binder relatives. In keeping with the experimental sequence, let me proceed from the Covert-binder to the Overt-binder clauses.

It is clear enough that, under the object-as-variable hypothesis, there is a requirement for the head of a double EC relative to be construed as the object. This suggests that the provision of a topic might produce a swing towards the head being construed as the relative subject. That is, an established discourse topic would provide an alternative way for the object EC to be A' bound, thereby freeing up the head to serve as the binder of the subject EC.

This argumentation inspired me to design a pair of Covert-binder relative clauses that contrasted in terms of a specific discourse topic. Specifically, the paired sentences were lexically identical, but one was introduced under a pragmatically neutral condition while the other was introduced by a topic-focusing condition. I attempted to achieve this contextual contrast by use of a simple introductory sentence that was either pragmatically bleached or enriched. A sample pair of Covert-binder RCs, each with a lead sentence, is shown in (6) and (7) below.

6. Covert-RC in bleached condition

Introductory sentence:	Dongwu xihuan wan youxi.
(pragmatically bleached)	Animal like play game
	'Animals like to play games.'
Test relative:	[$_{NP}$[$_{CP}$ e pai e de] nei pi ma] paokai le.
	pat De that horse run away
	a) 'The horse that x pats runs away.'
	b) 'The horse that pats x runs away.'

7. Covert-RC in enriched condition

Introductory sentence:	Gou hen gaoxing.
(pragmatically enriched)	Dog very happy
	'The dog is happy.'
Test relative:	[$_{NP}$[$_{CP}$ e wen e de] nei tou niu] luantiao.
	kiss De that cow jump
	a) 'The cow that x kisses jumps around.'
	b) 'The cow that kisses x jumps around.'

As noted above, where the context sentence is neutral, only the head of the relative presents itself as the binder for the object position of the relative. Thus it was predicted that the type of sentences in (6) should be interpreted analogously to (4), with the head construed as the relative object EC only. That is, the head noun 'horse' in (6)

receives, but not gives, the patting, as glossed in (6a), exactly as the head noun 'cow' in (4) must be interpreted as receiving, but not giving, the kiss, as glossed in (4a).

In contrast, the focusing lead sentence in (7) establishes a discourse topic by introducing a specific entity, namely 'the dog' in this particular case. This experimental manipulation creates in effect a Topic-binder RC like (5), with the consequence of pitting the discourse topic against the head as the binder of the null object. In other words, the discourse topic can potentially free up the head from functioning as the binder of the relative object EC. The end result is that the head can then be construed as the relative subject EC, as glossed in (7b).

Given the above reasoning, it was predicted there would be a higher proportion of interpretation of the head as the subject EC of the relative for (7) than for (6). Such an experimental result would be compatible with Huang's thesis that the null object in Chinese, whether in the independent or embedded clause, is inexorably an A'-bound variable.

My predictions about the Overt-binder relative are embedded in the assumption that has already been made clear in section 4.3. That is, since the interpretation of the head as relative subject should be linguistically blocked in the case of Subject-binder relatives, but not in that of Topic-binder relatives, it was predicted that responses to former type sentences should strongly or completely favor an object interpretation of the relative head, whereas responses to latter type sentences would permit the head to be construed as either subject or object of the relative.

Chapter Five

Experiments: Design & Results

In the foregoing chapter, two types of double-gapped relative clauses were identified, namely Covert-binder RCs and Overt-binder RCs. Embedded in each of these two types of RCs is a contrast. That is, a pragmatic contrast for the former, and a linguistic one for the latter. The pragmatic contrast was tested with a prediction that a higher proportion of construals of the relative head as the subject EC should be found in a pragmatically enriched condition than in a neutral, or bleached, condition. This test was designated as Experiment One. Experiment Two was intended as a follow-up, testing the linguistic contrast between Subject-binder and Topic-binder RCs, with a prediction that Topic binder would be linguistically ambiguous whereas the Subject-binder was not. This follow-up study was motivated under the hypothesis that children might be in a better position to discriminate A'-binder from A-binder when provided with an explicit topic than when tipped off indirectly with a simple introductory sentence for what I have called the covert condition. In what follows, I will first spell out the details of design and procedure of these two experiments in Section 5.1, and then report the results in Section 5.2.

5.1 Design and Procedure

5.1.1 Sentence types tested. Summarily, both double gap and single gap relative constructions were tested in this study. As set out earlier, double-gapped

relatives include two types of contrast, namely bleached vs. enriched and subject vs. topic contrasts. Sample tests in the two types of contrast have been given respectively in (6) and (7) and in (4) and (5) in the last chapter, which are reproduced here as (1a) and (1b), and (2a) and (2b) below:

1. Covert-binder RCs: Pragmatically bleached vs. enriched

a) the lead: Dongwu xihuan wan youxi.

Animal like play game

'Animals like to play games.'

the test: [$_{NP}$[$_{CP}$ e pai e de] nei pi ma] paokai le.

pat De that horse run away

i) 'The horse that x pats runs away.'

ii) 'The horse that pats x runs away.'

b) the lead: Gou hen gaoxing.

Dog very happy

'The dog is happy.'

the test: [$_{NP}$[$_{CP}$ e wen e de] nei tou niu] luantiao.

kiss De that cow jump

i) 'The cow that x kisses jumps around.'

ii) 'The cow that kisses x jumps around.'

2. Overt-binder RCs: Subject- vs. Topic-binder

a) Ma xihuan [$_{NP}$ [e wen e] de niu]

Horse likes [$_{NP}$ [e kiss e] DE cow]

i) 'The horse$_i$ likes the cow who he$_i$ kisses'

ii) *'The horse$_i$ likes the cow who kisses him$_i$'

b) Ma, [$_{NP}$ [e ti e] de niu] hen shengqi

Horse, [$_{NP}$ [e kick e] DE cow] very angry

i) 'The cow who the horse kicks is mad.'

ii) 'The cow who kicks the horse is mad.'

The above two types of double-gapped relatives were presented as two separate experiments. The Covert-binder clause was presented in Experiment One, whereas the Overt-binder clause in Experiment Two (see section 5.1.3 for more detail).

One-gap relative clauses were also tested. They were presented in two different versions. The first version of one-gap relatives followed the template of (3) below:

3. [$_{NP}$ [RC]**de** NP] VP_{intr}

NP: Relative head NP is matrix subject

VP_{intr}: intransitive verb of the matrix clause

Specifically, the one-gapped relatives in form (3) were invariably embedded in the subject NP of the matrix sentence, in which the verb must be intransitive. The only possible variation among the one-gapped stimuli was the positions of relativization, which can roughly be in two categories, namely simple argument vs. oblique relativization. Samples of simple argument relativization are in (4), and those of oblique relativization in (5). In the latter case, a resumptive pronoun is required for comitative and goal relatives.

4. One gap argument relatives in form (3)

a) Subject gap

[$_{NP}$[$_{CP}$ **e** yongbao gou de] neitou niu] zuoxia.

hug dog DE that cow sit down

'The cow that hugs the dog sits down.'

b) Object gap

[$_{NP}$ [$_{CP}$ ma ti **e** de] neitou niu] zuoxia.

horse kick DE that cow sit down

'The cow that the horse kicks sits down.'

5. One-gap oblique relatives in form (3)

a). Comitative

[$_{NP}$ [$_{CP}$ gou gen ta wan de] neitou niu] jiao

dog with him play DE that cow moo

'The cow that the dog plays with moos.'

b). Goal

[NP [CP ma gei ta shu de] neitou niu] tiaowu

horse give him book DE that cow dance

'The cow that the horse gives a book to dances.

c). Locative

[NP [CP gou zai shangmian e zhuo de] neizhang chang] huai le

dog on above sit DE that bed break Asp

'The bed the dog sits on breaks.

To sum up, the one-gapped relative tests in this particular version took the form of either (6a), which is simple argument relativization, or (6b) which is oblique relativization, where the first letter indicates the head in the matrix sentence and the following three letters after the hyphen indicate the site of relativization.

6. a) S-Sub/Obj (argument relativization)

b) S-Obl (oblique relativization)

Sub = Subject b; Obj = Object; Obl = Oblique

The choice of the structure (6) has been motivated by some empirical findings from previous acquisition studies, specifically, Chang 1984, and Lee 1992, both of which have been reviewed in sections 3.2.2 and 3.2.3 of Chapter 3. To recap here for ease of reference, Chang's findings concern the linear sequence of grammatical function of the head in the matrix sentence with respect to the relativised position in the embedded

clause. His data indicate that SS and SO type relatives were less difficult for children than OS and OO type sentences, suggesting that a relative clause with its head functioning as the matrix subject is easier for children to handle, regardless of whether the relativised site is the subject or the object position.

Lee (1992) departs from Chang in finding that relativization site does matter in comprehension. Specifically, his data indicate that object relativization was harder for the children to handle than subject relativization. In his second experiment, however, he found that the difficulty the children experienced with object relativization was lessened considerably when the verb of the main clause was intransitive.

It was these two findings, respectively from Lee and Chang, that led me to construct my experimental sentences consistently in the form of (3), with the relative invariably modifying the subject of matrix sentence, in which the verb must be intransitive. This was a unifying feature of the sentences tested in questionnaire II (see section 5.1.2 below for more detail).

The inclusion of one gapped argument relatives in the experiment was to provide a baseline performance of children's knowledge, against which their performance on double-gapped relatives could be evaluated. The inclusion of oblique relatives was out of interest. In general, relativization out of oblique position has been argued to be less frequent than relativization out of argument position in a language that permits oblique relatives (Keenan & Comrie, 1977). Furthermore, oblique relatives in Chinese do have some special features. For example, a resumptive pronoun is obligatory for relativization out of a commitative or goal position, but optional for relativization out of the object position (Chao, 1968).

The second test version of the one-gap relative is represented in the form of (7) below:

7. X see [$_{NP}$ [RC]de NP]

This type of one-gap relatives was always in sentence final position, modifying the object of the main clause verb "see", the meaning of which was not required to be acted out. These sentences were constructed in a form identical to those in (4a-b) and (5a-c), and thus were labeled correspondingly as (4'a-b) and (5'a-c) for ease of reference:

4' One gap argument relatives in form (7)

a) Subject gap

X sees [$_{NP}$[$_{CP}$ **e** yongbao gou de] neitou niu].

hug dog that cow

'X sees the cow that hugs the dog'

b) Object gap

X sees [$_{NP}$ [$_{CP}$ ma ti **e** de] neitou niu].

horse kick that cow

'X sees the cow that the horse kicks.'

5' One-gap oblique relatives in form (7)

a). Goal

X sees [$_{NP}$ [$_{CP}$ ma gei ta shu de] neitou niu]

horse give him book DE that cow

'X sees the cow that the horse gives (him) a book to.'

b). Locative

X sees [$_{NP}$ [$_{CP}$ gou zai shangmian e zhuo de] neizhang chang]

dog on above sit DE that bed

'X sees the bed that the dog sits on.'

c). Comitative

X sees [$_{NP}$ [$_{CP}$ gou gen ta wan de] neitou niu]

dog with him play DE that cow

'X sees the cow that the dog plays with.'

The purposes of this version of one-gap relatives were twofold. First, it was a preparatory test intended to direct the children towards the desired interpretation of DE as a relativization particle, rather than as a resultative one, in principle avoiding the problem that the DE clause admits of resultative as well as restrictive interpretation in Chinese[1].

Second, one-gapped tests in form (7) served as a screening program, by which a cut-off line was established for inclusion in the further test on double-gapped relatives (see section 5.1.3. for detail).

Table 1 summarizes the sentence types used in the two experiments:

Table 1

sentence types tested

2-gap RCs	Covert-binder RC (Experiment One)	Under bleached condition
		Under enriched condition
	Overt-binder RC (Experiment Two)	Subject-binder RC
		Topic-binder RC
1-gap RCs	In the form of (3) (Experiment One)	$[_{NP}$ [RC **de**] NP] $VP_{intr.}$
	In the form of (7) (Screening test for both Experiments One and Two)	X see $[_{NP}$ [RC **de**] NP]

5.1.2 Organization of questionnaires The test sentences as listed in table 1 above were organized into three separate questionnaires. Specifically, one-gapped relatives in the form of (7) (i.e. in the object position of the verb 'see') were presented as Questionnaire I, which consisted of 15 sentences with 3 tokens each for 5 types of the one-gap relatives as illustrated in (4') and (5').

Questionnaire II was composed of Covert-binder relatives, and one-gapped relatives in the form of (3). The Covert-binder RCs were contrasted in the bleached vs. enriched conditions as illustrated in (2a) and (2b). One-gapped relatives were a mixture of argument relatives in (4a) and (4b), and oblique relatives in (5a) through (5c). Thus, Questionnaire II included 7 test categories altogether: two types of Covert-binder RCs (i.e. bleached and enriched), two types of one-gapped argument RCs (i.e. subject and

[1] This point was brought to my attention by Lee Thomson through Helen Goodluck.

object relativization), and three types of one-gapped oblique RCs (i.e. goal, locative, and commitative relativization). Each test category was represented by 3 tokens. This amounted to 6 Covert-binder RCs, 6 simple argument, and 9 simple oblique relatives, making a total of 21 test sentences in Questionnaire II. Table 2 lays out the compositional details of Questionnaire II.

Table 2

7 categories of 21 test sentences in Questionnaire II

Type	Token
Covert-binder RCs:	
Bleached	3
Enriched	3
One-gap argument RC:	
Subject	3
Object	3
One-gap oblique RCs:	
Goal	3
Commitative	3
Locative	3

With the 6 Covert-binder RCs interspersed among the 15 one-gapped relatives, Questionnaire II was executed in two variants, labeled respectively as QIIA and QIIB, which were identical in terms of stimulus content, but differed in the relative sequence of the 6 Covert-binder RC tests. In particular, the enriched Covert-binder RC sentence in QIIA was replaced by a bleached one in QIIB. Conversely, the bleached test clause in QIIB became its enriched counterpart in QIIA.

Questionnaire III consisted simply of two subtypes of Overt-binder RCs, known as Subject-binder and Topic-binder as illustrated in (2a) and (2b). There were 3 tokens for each of the two subtypes of overt-binder RCs, making up a total of 6 test sentences.

Table 3 summarizes the contents of Questionnaires I through III. A complete set of sentences in the three questionnaires can be found in the Appendix.

Table 3

The Contents of Questionnaires I through III

Questionnaire	**Content**
Questionnaire I	15 test sentences representing 5 types of one-gap relatives in the form of (3)
Questionnaire II	21 test sentences representing 2 types of covert-binder RCs and 5 types of one-gap relatives in the form of (7)
Questionnaire III	6 test sentences representing 2 types of overt-binder RCs

5.13. Procedure As indicated earlier, there were two separate experiments in this study. Procedurally, each of the two experiments began with Questionnaire I, which served as a screening as well as a warming test. By screening it was meant that Questionnaire I would provide a baseline measure, upon which a cut-off line was established for inclusion in further tests on Questionnaire II (for Experiment One) or on Questionnaire III (for Experiment Two). In particular, the cut-off point was

set at one-third of incorrect or/and unscorable responses out of the total 15 stimuli in the Questionnaire. In other words, those children who scored less than 10 responses (i.e. two-thirds out of the total 15 tests) for Questionnaire I would be excluded from a further test on Questionnaires II or III. For sake of clarity, table 4 makes a list of the component tests for each of the two experiments.

Table 4

Component Tests: Experiment One vs. Experiment Two

Expriment One:
----Questionnaire I
----Questionnaire II
Expriment Two:
---Questionnaire I
----Questionnaire III

The experiments used an act-out task with toy animals, which were a cow, a horse and a dog. A chair, a bed, a ball and a flower were also used as props. A large-size panda was used as an extra toy for Questionnaire I (see below for detail).

Every session began with the experimenters and the child playing with the toy animals and props a number of times. This activity was intended to establish a rapport between the experimenters and the child, as well as making sure that the subject was able

to name the test toys without difficulty and properly. All interactions with the children were conducted in standard Mandarin.

The testing was administered by two experimenters who are native speakers of standard Mandarin. One was to read out test sentences and the other kept a record of the act-out by hand. The entire session was tape-recorded. The details that were to be hand-recorded are as follows:

a. Noting the number of readings. Each test sentence was allowed to be repeated up to 2 times (i.e. 3 readings in total), if the child did not respond at first.
b. Marking the verb which was acted out first by a circle. Except for questionnaire I where only the relative clauses had to be acted out, both the main and relative clauses had to be acted out. If the child acted out only one clause, the other experimenter would prompt with a question on the other clause (e.g. " what about the singing?").
c. Recording the interpretation of ECs by placing the initial letter of the animal that did the action of a verb under an empty subject position of that verb, and the initial letter of the animal that was made object of the verb under an object position.
d. Recording incorrect actions by noting the wrong verb for act-out and the wrong animal for subject or object underneath the corresponding slot in the test sentence.

Examples:

[dog kiss __ de] cow (sings)

c

= *The cow sings and then the dog kisses the cow*

[__ kiss __ de] cow (sings)

h c x 2

= *The cow sings and then the horse kisses the cow. The sentence had been read twice before the child responded.*

[__ ~~kiss~~ dog de] ~~cow~~ (sings)

cow kick dog

= *The dog sings and then the cow kicks the dog.*

As pointed out earlier, the experiment began with Questionnaire I as a warm-up session. In this test, children were required to act out the relative verb only:

X sees [dog kiss __ de] cow

c

= *X sees (no requirement to act out) the dog kisses the cow.*

A toy Panda was used to represent the 'X' in the test stimulus above. The Panda was much larger in size than the toy animals that were paired up for acting out the embedded relative clause. This was to discourage children from attempting to use the Panda in acting out. The paired toy animals were about the same size, to facilitate act-out, and care

was taken that there was no stereotypical association (e.g. a cat would be stereotypically associated with active pursuit of a mouse) present within the pairs. Every test sentence in the questionnaire was introduced as follows: "Here is Panda, he is going to watch what the animals do. You show him what the animals do."

Experiment One was conducted in Wenzhou No. 1 Kindergarten affiliated to Wenzhou Teachers' College, PRC.

Experiment Two was conducted in Wenshi Shiyuang Fuxiao, a primary school affiliated to Wenzhou Teachers' College, and on a different body of children from that for Experiment One.

5.1.4. Subjects For Questionnaire I in Experiment One, 40 Chinese-speaking children, ranging from 4;1 to 6;1, participated in the experiment. Their mean age was 4;9. Of them, 22 were female. With 6 subjects excluded from this preliminary test by the cut-off criterion described in the above section, 34 children remained for further test on Questionnaire II, with a mean age of 5;1. They were split randomly into two groups, with 17 of them each for QIIA and QIIB tests. All the children were born to a family where some variety of Mandarin is spoken, and were being educated exclusively in standard Mandarin in school, though a great portion of the ambient language outside of their home is non-Mandarin Chinese.

For Experiment Two, 12 children participated in the experiment, with a mean age of 5;7, ranging from 5;3 to 6;0. Of them, 6 were female. The subjects were from the same linguistic population as those participating in Experiment One. The subjects also underwent a screening test by Questionnaire I. All subjects had achieved a performance

score well over two-thirds of correct enactment out of a total of 15 screening sentences, and thus were included in the test on Questionnaire III.

Table 5 gives a profile of child subjects in the two experiments. The age structure of the subjects reflects that of the previous acquisitional studies. Specifically, the subjects in Chiu (1998) ranged in age from 3;25 to 6;10, averaged 4;50, and the subjects in Lee's second experiment were 4- and 5- years old.

Table 5

Profile of Child Subjects

Experiment	**Number**	**Mean age**	**Age range**
Experiment One			
---Q I	40	4;9	4;1-6;1
---QII	34	5;1	4;4-6;1
Experiment Two			
---Q I	12	5;7	5;3-6;0
---Q III	12	5;7	5;3-6.0

There were 10 adult controls for Experiment One and five for Experiment Two. They are all native Wenzhounese with successful secondary education. The adults were tested either in their working place or home.

5.2 Results

5.2.1 Screening Test: Questionnaire I Table 6 reports the results of Questionnaire I as a screening test in the two separate administrations. The relevant experimental parameter here is percent passing of the screening test across two experimental groups

Table 6

Percent passing of Questionnaire I *

	Number of participants	Mean age of participants	Percentage Passing
For Experiment One	40	4;9	85% (34/40)
For Experiment Two	12	5;7	100% (12/12)

* passing score was two-third correct responses and more out of 15 stimuli

The data in table 5 shows a trend, in which children' comprehension seems to mature with age. However, this observation is made across two groups which are not matched in the number of participants, and thus cannot be employed as statistical evidence for age effect on comprehension.

5.2.2. Experiment One: Questionnaire II The results for Questionnaire II are reported in Table 7, which presents the data on the one-gap relatives, Table 8, which is a preliminary summary of data on the Covert-binder relatives, and Table 9, which is adjustment of Table 8 with the unscorable responses eliminated from the data thereof. For the data in Table 7, the children are split into two groups: A younger group aged 5;2 and below (n=18) and an older group aged 5;3 and above (n=16).

Table 7.

The correct percents for the children on one-gap relative

	Young Group	Older Group
Subject	83	98
Object	78	100
Goal	85	96
Locative	58	92
Comitative	68	92

The data in Table 7 show that the older children were near perfect on their comprehension of all simple relative types. The younger children did well with the simple subject, object and goal relatives, but performed less well on locative and comitative relatives. There is a significant main effect of relative types for the children ($F(4,128)=8.787$; $p < .001$, and of group ($F(1,32=10.491$, $p = .003$, and a significant group x relative type interaction ($F(4,128)=3.443$, $p = .010$).

Table 8 below gives the unadjusted data on Covert-binder RC tests for an overview. Questionnaire II was originally tested on a total of 34 children. Of these, 4 children were statistically invisible to the collection of the data as presented in Table 8, since none of them had any scorable response on the Covert-binder RC tests, and were thus excluded out of calculation. Thus, the actual number of the children on Covert-binder RC tests was 30 instead of 34. For percent calculation, the numerator in Table 8 is the total sum of construals of the head as either subject or object, and the denominator is the multiplication of 3 (i.e. the number of tokens for Covert-binder RC presented for each

condition) by the total number of the subjects in the group concerned, which is 30 for the children and 10 for the adults.

Table 8

Mean percentages (unadjusted) of Subject vs. Object Construals of the Head NP of Covert-binder RCs in Two Contrastive Conditions

	Children[a]	Adults[b]
Bleached context		
Head as relative subject	38% (34/90)	33% (10/30)
Head as relative object	51% (46/90)	67% (20/30)
Enriched context		
Head as relative subject	32% (29/90)	47% (14/30)
Head as relative object	52% (47/90)	53% (16/30)

[a] n =30; [b] n =10

As can be seen from the table above, the percent totals for children for each condition fall short of 100%. This is because not all responses could be scored for subject vs. object construal of the head (for example, there were cases of failures to respond and incorrect act-outs of the relative clause predicate). In total, there were 10 unscorable responses under the bleached condition, and 14 unscorable responses under the enriched condition.

Table 9 gives the adjusted mean percentages of scorable responses, and also breaks down the child data into the age groups 5;2 and younger and 5;3 and older. As can be seen from Table 9, both children and adults favor an object construal of the head for double gapped relative clauses, in both the bleached and enriched conditions. However, the amount of subject responses given is substantial: never less than 30%. The number of subjects who had more object than subject responses for each condition was evaluated by the binominal test, under the null hypothesis that the number of subjects

who preferred an object interpretation would not differ from the number of subjects who preferred a subject interpretation. This hypothesis could be rejected for the adults in the bleached condition (p = .021, two tail), the younger children in the bleached condition (p = .036, two tail) and the older children in the enriched condition (p = .036, 2 tail). While adults appear to show some sensitivity to the bleached vs. enriched conditions, giving more subject construals in the enriched condition, as predicted, caution must be taken in interpreting this as sensitivity on the part of the adults to context, since the older children, but not the younger children, show a reverse trend. An analysis of variance comparing the proportion of object as head responses for the bleached vs. enriched conditions revealed no main effect of condition ($F(1,37)=7.85$, $p = .381$) and no main effect of group (younger children, older children and adults) ($F(2,37)=p.019$, $p = .981$). The condition x group interaction approached significance ($p = .085$), but this is difficult to interpret as a meaningful trend, since, as noted above, the younger children and adults pattern in the predicted direction, but the older children do not.

Table 9

Mean percentages (adjusted) of subject vs. object
Construals of the head NP in Covert-binder RCs

	Children		Adults
	Young group (n = 15)	Older group (n = 15)	
Bleached condition			
Head as RC subject	37	48	33
Head as RC object	63	52	67
Enriched condition			
Head as RC subject	41	35	47
Head as RC object	59	65	53

5.2.3. Experiment Two: Questionnaire III The mean percentages of subject vs. object construals of the relative head are reported in Table 10 below. There were three unscorable responses for children and adults, respectively, which were excluded for adjustment.

Table 10

Mean percentages of subject vs. object construals of the head NP of Subject- vs.Topic-binder RCs

	Children[a]	Adults[b]
Subject binder		
Head as relative subject	35	38
Head as relative object	65	62
Topic binder		
Head as relative subject	37	43
Head as relative object	63	57

[a] n = 12; [b] n =5

Both the children and the adults show a preference for an object construal of the relative head regardless of whether the non-head EC is overtly subject- or topic-bound. For the child data, the number of participants who had more object than subject responses for each condition was evaluated by the binomial test, under the null hypothesis that the number of participants who preferred an object interpretation would not differ from that of those who preferred a subject interpretation. The null hypothesis is rejected for both the subject binder condition ($p = .006$, two tail) and the topic binder condition ($p = .033$, two tail). In this sense, overt binder conditions do not, contrary to my prediction, make

children better able to discriminate A and A'-binders. The number of adult subjects is too small for statistical evaluation, but they do show a trend, as predicted, towards more subject construal of the head in the topic-binder condition.

To sum up, the experimental results indicate that there is a general preference for object response to the head of a double-gapped relative, regardless of whether it is presented under overt or covert binding conditions. On top of this, there is an effect of context on subject vs. object interpretation of the relative head for the adults and the young children, though not for the older children. In particular, the younger children give more subject construals of the head under the pragmatically-loaded condition.

Chapter Six

Discussion: Grammar & Processing

As noted in the last chapter, the object construal of the head is found to be an across-the-board interpretive preference for Chinese double-gapped relatives, both Covert- and Overt-binders. Apart from this main finding, a context effect is seen on the object vs. subject interpretation of the head for the adults and the young children, though not for the older children. These two findings can be brought to bear on the current research on grammar and processing, and acquisition and processing. The chapter is organized around these two theoretical issues. Section 6.1 is concerned with the issue of grammar and processing, beginning with a brief review of the theoretical debate on the null object in the light of the current data, followed by a proposal for a processing explanation of the attested general preference for object construal of the relative head. The conclusion is that the restrictions on interpretation of double-gapped relatives in Chinese as observed in the theoretical literature can be seen as a reflex of processing, rather than of competence. Section 6.2 brings up the issue of acquisition and processing, motivated by the finding that it is the younger children, but not the older children, that show some sensitivity to context, giving more subject construals under the pragmatically-loaded condition. This situation calls for an explanation in the light of processing and acquisition.

6.1 Preference for Object Construal: Competence & Processing

The fact that the object construal of the head is a general interpretive preference for double-gapped relatives in Chinese indicates that it is the object, but not the subject, position that is more accessible by the head. Under the conceptual framework adopted here, this finding is apparently compatible with Huang's claim that the object EC in Chinese is not a pronominal in Chomsky 1982's system. However, this cannot be taken to mean hard support for the object-as-variable hypothesis as formulated in Huang (1984, 1989). Instead, the tendency appears to reflect a strong processing bias, which is not powerful enough to categorically block the interpretation of the head as referring to the subject EC. This is evidenced by the data from Experiment Two, which contradicts my predictions. In particular, as argued earlier, since a logically possible interpretation of the head as either subject or object EC should be linguistically available for a Topic-binder relative construction only, but not for a Subject-binder one, it was predicted that the processing patterns for two types of relatives would contrast in the following manner: for Topic-binder tests the subjects would be divided between a subject and an object interpretation of the head, whereas for Subject-binder tests they would converge towards an object response. The test results disconfirm this prediction: what the experiment has ended up with instead is a similar processing pattern for the two types of relatives. In particular, the percentages of object response on Topic-binder tests were 57% and 63% respectively for the adults and the children. This statistics was paralleled by those of Subject-binder tests, in which percentage object responses were 62% and 65 % for the adults and the children, respectively. This parallel in object response between two types

of Overt-binder relatives casts doubt, at least at a descriptive level, on Huang's null-object-as-A'-bound variable hypothesis that restricts the relative head to the object interpretation for the Subject-binder condition but not for the Topic-binder condition.

This point brings me back to the theoretical debate, raised by Xu (1986), on the linguistic identity of the null object in Chinese. Xu notes that there are double-gapped relative sentences of the type in example (1), for which, under pragmatically neutral context, only the object-as-variable interpretation is available:

1. Li Xiaojie hai zhao-bu-dao [$_{NP}$[$_{CP}$ **e** xinzhong xihuan e_i de] nanren$_i$]

   Miss Li still can't find in heart like DE man

   'Miss Li still cannot find a man she loves in her heart'

   '*Miss Li still cannot find a man who loves her in his heart'

But at the same time he calls object-as-variable analysis into question by bringing up a contrasting pair in (2) and (3) below:

2. *Li Xiaojie zhao bu zhao [e_i keyi qu e de] nanren$_i$

   Li Miss find not Asp can take-as-wife DE man

   'Miss Li can't find any man who can take her as his wife'

3. Li xiaojie zhao bu zhao [e_i ken qu e de] nanren$_i$

   Li Miss find not Asp will take-as-wife DE man

   'Miss Li can't find any man who will take her as his wife'

Both (2) and (3) have the same structure in the relevant respects as (1). They differ only in the modal: *keyi* (can) in (2) and *ken* (willing) in (3). The ungrammaticality of (2) might as well be argued to follow from the supposed block on a pronominal interpretation of the null object. But in (3) the head of the relative is interpreted as the subject of the relative, with the object position referring to the subject of the main clause, a counterexample of the object-as-variable analysis.

Based on the above observations, Xu argues that it is not the case that the subject-object asymmetry argued for by Huang exists only in pragmatically neutral contexts: " Replacement of one modal by another does not make the context any less neutral" (p. 97). On his analysis, Chinese syntax uses a type of empty category, or Free Empty Category (FEC), which is not equivalent to any of the empty categories in the typology of Chomsky (1982).[1]

Without committing myself to the theoretical debate between Huang and Xu, unexplained under the Free-Empty-Category account is, I feel, why in pragmatically neutral case such as (1) the head of the relative cannot be construed as referring to the subject empty category in the relative clause. Thus, it appears that the Free-Empty-Category postulation is no more viable of my data as is the object-as-variable one: if it is hard for the latter model to weather my data on Overt-binder relatives in Experiment Two, the former one looks equally shaky, providing no explanation of the across-the-board interpretive preference for object construal of the relative head.

---

[1] Nor is it in any way related to what Rizz (1994) calls the null constant. The latter is, among other things, intrinsically definable as [-a, -p, -v]. Xu's FEC is, however, indefinable by any feature specifications. It is featureless and functionally, it is a non-syntactic category, which is determined entirely by pragmatics. I feel deeply indebted to Juana Munoz-Liceras for bring this point to my attention.

Leaving the theoretical debate on the grammatical status of the null object in something of a limbo, let me turn to human language processing theories for an explanation of the interpretive preference in double-gapped relatives. From the psycholinguistic perspective, the fundamental issue here concerns coreference assignment in on-line sentence comprehension, a process that establishes a relationship between referentially dependent elements and their antecedents. Conventionally, the term referentially dependent element covers both overt and covert anaphoric forms. In the present study, both the referentially dependent elements in a double-gapped relative are of the covert form. Thus, the coreference relationship in a double-gapped relative can be conveniently conceived of as an issue of filler-gap dependency, though the latter term has generally been limited to the interpretive relation between the moved (or deleted) elements and their traces, which is not entirely true of Chinese double-gapped relatives.

A working thesis for gap resolution in the psycholinguistic literature can be spelled out in a manner like (4) below:

4. Gaps are always identified and filled online as soon as possible in coreference assignment.

The thesis above for gap identification and filling has been around for a while, figuring in different guises such as Recent Filler Strategy (Frazier, Clifton & Randall, 1983), Active Filler Strategy (Frazier & Flore d'Arcais, 1989), Minimal Chain Principle (de Vincenizi, 1991), and more recently, the Syntactic Prediction Locality Theory (Gibson, 1998). Admittedly, all these models do not entirely share the same theoretical grounds.

However, they do have been inspired with the same assumption. That is, the language parser must have been conceived of as a least-effort device, the very bottom line behind the assumption in (4).

The insight of immediate identification and filling of empty category on line has been supported by several lines of experimental studies. For instance, in Crain & Fodor (1985)'s study, processing was compared for paired sentences such as the following:

5. Who could the little girl have forced *us* to sing those stupid French songs for at Christmas?
6. The little girl could have forced *us* to sing those stupid French songs for Cheryl at Christmas.

Using a self-paced reading task,[2] the authors found the general pattern of comprehension times was the same for the Wh-question (5) and its declarative counterpart (6), but the reading time at position 'us' in (5) was significantly longer than that for the corresponding object position in (6). This increased reaction time is known as "filled gap effect" in the literature. The effect is attributed to the perceiver expecting a grammatical gap in the object position of the verb *forced*, only to find it has been filled by a lexical noun phrase. As a result of this surprise effect, the sentence has to be reanalyzed and the processing time increases accordingly. This processing effect is not observed at the object position of the main verb in (6), since the expectation of a gap at this point is correct and thus no reanalysis results. In light of the thesis on the identification of empty categories in

[2] For this task subjects read sentences word by word, or phrase by phrase, initiating the appearance of new words by a pressing a button.

coreference assignment in (4), the filled gap effect can be interpreted in the following manner: the parser's attempt at immediate identification of an empty category on line is successfully met in (6), but is frustrated in (5).

Stowe (1986) replicates and extends the filled gap effect by looking into the issue of availability of gap in island constructions. She found that this effect illustrated in (5) disappears when the potential gap was inside an island. In particular, she organizes her experimental sentences in a two-way contrast, as illustrated by (7a) vs. (7b), and by (8a) vs. (8b):

7. a The teacher asked what the team laughed about Greg's older brother fumbling.

   b The teacher asked if the team laughed about Greg's older brother fumbling the ball.

8. a The teacher asked what the silly story about Greg's older brother was supposed to mean.

   b The teacher asked if the silly story about Greg's older brother was supposed to mean anything.

While a contrast in reaction times was observed at the position following the preposition *about* in (7a-b), Stowe did not find a similar contrast for (8a-b) where the preposition is part of the subject noun island. Stowe interprets this result as suspension of gap identification within an island structure. [3]

[3] Subsequent studies, Saah & Goodluck 1995 for example, challenge this interpretation.

The relevant point here from Stowe's finding is that immediate gap identification is essentially a syntactic process. This assumption is maintained by Nicol and Swinney (1989). All the studies reviewed therein point to the fact that the reactivation and assignment of antecedents to anaphoric elements, overt and non-overt, is an immediate perceptual process that is syntactically determined. One particularly relevant study under this review is Nicol and Osterhout (1988), a cross-modal priming experiment [4] that examined the reactivation patterns of antecedents at the gaps of the relative in sentences such as

9. That's the actress that the dentist from the new medical center in town had invited__ to go to the party.
10. That's the actress that the dentist from the new medical center in town had planned__ to go to the party with.

In both types of sentences, there was priming for *'actress'* immediately following the relative verb, suggesting that a gap is identified and filled following verbs such as *invite* which is transitive, as well as after verbs such as *plan* which only optionally take an NP complement. The activation of *actress* following the transitive verb is understandable since an object position must be postulated there. However, the finding of immediate reactivation of the antecedent *actress* after the so-called quasi-intransitive verb *plan* (as opposed to true intransitive verbs such as *hesitate*) is surprising since it usually takes

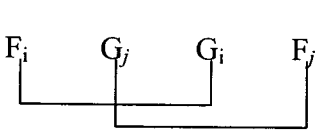
[4] The technique of cross-modal priming engages subjects in listening to sentences, usually over headphones, while simultaneously they are required to perform a lexical decision task presented on a computer screen.

inanimate NPs (as in "plan a trip"), but not animate ones; despite the fact that one cannot "plan the actress", this referent is reactivated immediately after the verb. This strongly suggests that gaps are always identified and filled on line, a purely syntactic process that is accomplished without consulting semantic and pragmatic factors. [5]

Returning to my study here, relative clauses in Chinese are invariably of head-final format, in contrast to the overall backdrop of SVO word order of the language. With this in mind, the gaps in a double-gapped relative are theoretically capable of the following two arrangements with respect to their candidate fillers in (11):

11. a) F_i G_i G_j F_j

b) F_i G_j G_i F_j



F: filler; G: gap

The two possible configurations of filler-gap dependency in (11) are captured by indexing as originally described by Fodor (1978:448): (11a) is termed disjoint filler-gap dependency, and (11b) intersecting dependency. In Fodor's original formulation of what she called the Nested Dependency Constraint, the disjoint dependency is treated as one instance of nested dependency. I follow Fodor here terminologically in using the word 'nested' as a default term for 'disjoint' in the following theoretical exposition.

In the psycholinguistic literature, there has been a debate as to which dependency should be easier to process. According to one school of thought, it all depends on the

[5] There is literature that argues that readers do take thematic fit, i.e. the verb-filler combination, into account in gap assignment (see Tanenhaus & Trueswell 1995 for a review).

structure of language concerned. For example, the intersecting dependency is considered unmarked for the objects of stacked verbs. Bach, Brown, & Marslen-Wilson (1986) contrasted Dutch and German in this regard:

12. Dutch: De mannen_i hebben Hans_j de paarden leren t_i voeren t_j (crossed)

German: Die Manner_i haben Hans_j das Pferde-futtern t_j lehren t_i (nested)

The men have Hans the horse feed teach

'The men taught Hans to feed the horse'

As shown above, Dutch and German differ in their clause-final verb cluster: the former with the verb stacked displays a crossed dependency between the verb and its arguments, whereas the latter a nested dependency. Using comprehensibility ratings and a test of successful comprehension, the authors find that cross-dependency is easier for double gap filling in Dutch, but is harder for German, where nested-dependency is preferred for gap filling.

On the other hand, the nested dependency is unmarked for the arguments of a single verb, which is the case with English, where the dependencies are nested (Fodor, 1978; Steedman, 1983):

13. a Which violin_j is this sonata_i easy to play t_i on t_j? (nested)

b * Which sonata_i is this violin_j easy to play t_i on t_j? (crossed)

(13b) is unprocessible for the native speakers of English simply because of its intersected indexing between the gaps and the fillers. But the sentence would become processible, as pointed out by Fodor, if it were analyzed with a nested indexing even if it would result in the pragmatically bizarre interpretation that the violin is played on the sonata.

It is obvious enough that the two relative gaps in Chinese are the arguments of one single verb. Reasoning along the markedness postulation as presented in the foregoing paragraphs, I assume that the nested dependency, or more precisely the disjoint dependency in the case under study, is unmarked for double-gap relatives. Thus, for a double-gapped relative, the configuration of (11a) should be considered easier to process than the one of (11b). I take this supposition as a starting point to provide a processing-based answer to the question of why the object position is always more accessible to the head in double-gapped relatives in Chinese.

To flesh out the representation of (11), I replace it with (14), in which the first letter F in (11) is collectively spelled out as T(opic) and S(ubject), and the second F is now the head NP.

14. T/S … [$_{NP}$[$_{CP}$ **e** xihuan **e** de] nanren$_i$]

like man

a) T/S … [$_{NP}$[$_{CP}$ **e** $_{SUB}$ V **e** $_{OBJ}$ de] NP]

b) T/S … [$_{NP}$[$_{CP}$ e $_{SUB}$ V e $_{OBJ}$ de] NP]

T: topic; S: subject

With an assumption that the sentence processor works serially from left to right and that the processor seeks to bind a gap at the earliest opportunity, it is clear to link the subject gap to a discourse topic or the matrix subject, as showed in (14a), is the preferred interpretation. In other words, the subject construal of the head entails a delay and thus an effort in the assignment of reference to the subject position of the relative, whereas the object construal of the head permits the subject gap to be discharged immediately, an exemplary run of the working thesis for gap resolution in (4). This accounts for why it has been found that a subject construal loses out to an object construal even for Topic-binder relatives, in contradiction to my predictions made along the reasoning of the object-as-variable analysis,

Thus, a processing-based interpretation appears to be in a better position to accommodate the attested general preference for object construal of the head in Chinese relative clauses, and I am led to conclude that the previously proposed restriction on the null object in relatives should be reformulated as a reflex of processing, rather than of competence.

At this point, a general comment on the relation of competence grammar and processing principles is in order. This has been a central theme in theoretical psycholinguistics studies since the 1960s when a theory known as the Derivational Theory of Complexity (DTC) simply took processing complexity of a sentence as a function of the complexity of its derivation under the then rule-based transformational grammar (see Fodor et al, 1974 for a detailed account). With the demise of the DTC, there has been a growing consensus that processing cannot be reduced to a theory of grammar as the DTC did. Behind this broad agreement is a recognition that there are

some principles of processing, which, having no place in competence grammar notwithstanding, must operate independently in on-line sentence parsing. To establish a correlation between the principles of grammar and of processing, however, the question has been asked in two different directions. The mainstream direction is from competence to performance. In particular, the majority of psycholinguistic theorists have concerned themselves with the issue of how much grammar is required for an explicit model of processing, and of when and how grammar exercises its effect on processing. As a result, most of the work in psycholinguistics describes processing in terms of a special computational device that makes direct use of grammatical information for syntactic analysis.

However, the question of the correlation of competence and processing can also be asked in the opposite direction: from performance to competence. One version of the question is this: to what extent is processing dissociated from competence?[6] This is what has been asked in Saah and Goodluck (1995), and some evidence was brought forward therein. In this particular study, the authors find that the speakers of Akan, a Kwa language spoken in Ghana, process potentially ambiguous questions in a manner similar to English speakers, despite the fact that the former is a language that does not use successive cyclic movement in question formation whereas English does. As a result, syntactic islands (in particular, temporal clause islands) are mimicked on line in a language that does not respect island constraints. This mismatch between parsing islands and competence islands argues strongly for the independence of processing principles. Thus, it is reasonable to conclude that "the theory of processing must contain a

[6] An extreme version of this question in the literature is: to what extent are the grammatical rules/principles shaped by performance (Hawkins 1994, 1999)?

component of procedures that are not directly derivable from the competence grammar" (Saah & Goodluck, 1995:406).

Returning to the debate revolving around the sentences in (1) through (3), it is tempting to argue that, comparable to the processing island effect that denies Akan speakers access to positions inside embedded temporal adverbials, the principle of immediate gap assignment in (4) can be a strong processing force that creates the illusion of a competence rule of the kind we have seen in Huang's theorizing on the subject-object asymmetry. Seen in this light, the unavailability of subject construal of the relative head in Huang's example in (1) should be reinterpreted as being ruled out by the processing principle in (4), but not by a competence constraint as postulated by Huang. This processing account appears to fare better than Xu's Free-Empty-Category analysis, since the latter offers no explanation for why a subject construal of the head in a pragmatically neutral sentence such as (1) is not available, in which the relative verb *xihuan* (like) is a semantically and pragmatically neutral word, as opposed to the relative verbal complex in (3) *ken qu* (willing to take-as-wife), which is clearly a highly loaded phrase, both semantically and pragmatically.

If my argumentation above holds, the contrast between (2) and (3) then receives a different explanation. That is, ruling out sentence (2) can in principle be seen as the operation of the on-line processing principle for immediate gap completion. On the other hand, independent as it is, a processing principle can however be overridden by a range of other factors involved in sentence comprehension, including semantics and pragmatics. This point can be brought to bear on the subject interpretation of the relative head in the example of (3). In particular, the lexical semantics of the verbal phrase *ken qu* (take-as-

wife) requires a female object. As a result, the sentence is ruled in against the force of a processing principle that calls for immediate gap completion.

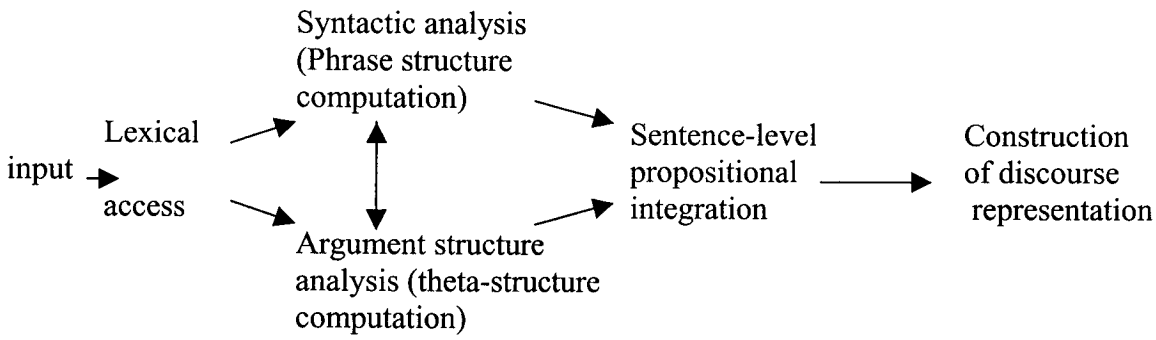
This last point on the relative independence of processing principles with respect to other grammatical factors in language comprehension reminds me of a more recent proposal on the relation between principles of competence and of processing in Gibson (1998), who takes the position that there is no such independent processing principles as have been discussed here in this context. What is really operative in on-line language processing is just an interaction of memory load with rule execution, whether it is a syntactic, semantic, or pragmatic rule. The points raised in Gibson remain to be fully evaluated by empirical data and thus I would like to leave them for future study.

6.2 Pragmatic Effect: Acquisition & Processing

As noted earlier, it is the young children, but not the older children, that parallel the adults in showing some sensitivity to context effect by giving more subject construals under the pragmatically loaded condition. Why is there a match, on the one hand, between the younger children and adults in processing while on the other, a mismatch between the older children and adults? This question brings me to one of the key notions in the studies of the sentence processing mechanism, namely the concept of modularity. The basic issue revolving around the concept, at a macro level, as pointed out by Goodluck & Rochemont (1992: 15), is whether online sentence comprehension involves a detailed interplay between syntactic constraints and pragmatic and discourse-based factors.

A strong modular position on the issue is represented by Forster (1979), who proposes a serial model of the language processor, where the operations of processing are sequentially staged such that initial lexical access and the construction of syntactic configuration are carried out without reference to other knowledge sources. The figure in (15) is a reproduction of Goodluck & Rochemont (1992: 23), where an ordered sequence of processing operations is proposed:

15.



Modularity in processing is a controversial issue (see Tanenhaus & Trueswell, 1995 for a review) but modular approaches of the type exemplified by (15) have been defended in the recent literature (see for example Frazier, 1999).

As argued in Goodluck 1990, efficiency in performing operations at a given level may be dependent on the point at which the particular operations are scheduled. Since the construction of discourse representation is the last in the chain of processing operations, as indicated in (15), it is only natural for an immature parser to feel burdened at this stage, and consequently experience some difficult integrating this type of knowledge into their comprehension. It is under this staged processing model that some of empirical findings in the acquisition literature have been explained. For example, Chien and Wexler

(1991) report that English-speaking children experience difficulty interpreting definite pronouns, and argue that this results from a total lack of pragmatic principles in children's grammar that govern apparent exceptions to Principle B, in spite of their full knowledge of pronominal binding. Avrutin (2000) attributes children's difficulty in interpreting definite pronouns to their inability to integrate discourse-based knowledge. A similar observation that pragmatic knowledge should be set apart from syntactic knowledge was also made in Wang el al (1992: 250), who found that factors involving a pragmatically-based interpretation of null arguments in Chinese need to be learned later in development.

With the above modularity view in mind, the Chinese-speaking children in this experiment, as a whole, should have been expected to show little sensitivity to the bleached vs. enriched conditions. At the very least, it would have been the older children, but not the younger children, that show some sensitivity to context, contrary to the fact. One way out of this difficult situation is that the older children in this study be simply treated as an anomaly, and the significant trend in the reverse of the predicted direction is an accident. However, recall that on simple (one gap) oblique relatives the older children out-performed the younger children, suggesting that they were not as a group less able than the younger children. Notice also that the magnitude of differences between the bleached and enriched conditions for all three groups (adults, younger and older children) is not great, raising the possibility that, given the mixed pattern of results for the three groups, none of the differences is in fact real.

Clearly, the topic of Chinese children's sensitivity to discourse factors in processing is a topic for much future work. Children learning Chinese might be

expected to be more sensitive to context than children learning English-type languages, given the prevalence of empty categories and in this sense the performance of the younger children in the enriched condition is perhaps to be expected. One possibility to speculate on is that the older children's performance does reflect a true developmental pattern, in which children learning Chinese temporarily 'switch off' from discourse in processing, analogously to the loss for a period of sensitivity to some non-native sound contrasts in phonological development (Werker 1995) (this however, would not account for the reverse trend). These issues must be left for future research.

Chapter Seven

Conclusion: Summary

This thesis is an experimental study of the first language acquisition of relative clauses in Mandarin Chinese. The focus is on relative clauses with two null positions, such as those represented by (1):

1. Li Xiaojie hai zhao-bu-dao [$_{NP}$[$_{CP}$ **e** xinzhong xihuan **e**$_i$ de] nanren$_i$]

   Miss Li still can't find in heart like DE man

   'Miss Li still cannot find a man she loves in her heart'

   *'Miss Li still cannot find a man who loves her in his heart'

As indicated in the English translation, the interpretation of the head as the subject gap in the relative is not permitted. The subject-object asymmetry as found in a double-gapped relative like that in (1) has given rise to a debate on the grammatical identity of the null object in the language. Huang (1984) develops an object-as-variable hypothesis under the classic GB model and explains away the subject-object asymmetry as a competence restriction on the null position. By contrast, Xu (1986) gives counterexamples and argues that null object positions are not restricted grammatically in the way proposed by Huang, but both of their interpretations are subject to lexical and pragmatic factors.

Motivated by this theoretical debate, two sets of double-gapped relatives were designed as an act-out task to test child and adult comprehension of relative clauses. One set of tests is called the Covert-binder relative, a double-gapped relative with the binder of its non-head position phonetically missing, such as that in (2)

2. [NP [CP e wen e de] nei tou niu] luantiao
   kiss that cow jump

The relative in (2) has two logically possible interpretations: the head of the relative clause (the cow) could refer to the object position in the relative (3a) or the subject position in the relative (3b):

3. a. The cow that x kisses jumps around
   b. The cow that kisses x jumps around

With this logically possible dual interpretation in mind, the Covert-binder relatives were presented in both a pragmatically enriched and a pragmatically neutral context. The pragmatically enriched context used a lead sentence to focus attention on an animal other than the head of the relative clause, with the prediction that this focused animal could attract the object position of the relative clause.

The other set of tests was those relatives with two gaps in which there was either an overt topic NP or a subject NP in the sentence as well as the head NP. Thus, hence the label Overt-binder relative as illustrated in (4).

4. a. Subject-overt

Ma xihuan [$_{NP}$ [e wen e] de niu]

Horse likes [$_{NP}$ [e kiss e] DE cow]

'The horse$_i$ likes the cow who he$_i$ kisses'

*'The horse likes the cow who kisses him'

b. Topic-overt

Ma, [$_{NP}$ [e ti e] de niu] hen shengqi

Horse, [$_{NP}$ [e kick e] DE cow] very angry

'The cow who the horse kicks is mad' or

'The cow who kicks the horse is mad'

On the theory of Huang, a topic NP, but not a subject NP, can be used to fill the object position of the relative. As a result, the experimental prediction was that it would be (4b), but not (4a), that was capable of dual interpretations.

The questionnaires in this study were composed of three subtests, namely covert-binder relative test; overt-binder relative test; and simple one-gap relative test. The simple relative test served as a screening program for both the covert-binder and the overt-binder tests. For the covert-binder test, 40 4-6 year old children participated the

experiment. Six children failed to reach criterion of 70% or more correct on simple one-gap relative for inclusion in the sample. Of these, a further four children were dropped because they had no scorable responses on the covert-binder relatives. For the overt-binder test, 12 5-6 year old children participated the experiment. 10 adults were used as control for the covert-binder test, and 5 for the overt-binder test. The main results are as follows:

- For the covert-binder test, both adults and children show a preference for interpreting the head of relatives with two gaps as referring to the object position in the relative. However, this is a preference only, with 25% or more responses showing the alternative reading.
- There is a suggestion that adults and the younger children, though not the older children, are sensitive to context, showing a swing to the (3b) reading when an animal other than the head is focused by the enriched context.
- When there is more than one animal mentioned in the test sentence (i.e. in overt-binding condition), there continues to be a preference for the reading in which the head refers to the object position of the relative.

The main conclusion of this research program is that Huang's account, under which the null object position of the relative is grammatically restricted in reference, is not supported by the data. In spite of this, there is however a strong preference for construing the head as referring to the object position of a double-gapped relative. This

preference can be explained in terms of an independently attested principle of sentence processing (e.g. Nicol and Swinney 1989): Interpret null positions as soon as possible. In a sentence such as (2), this processing principle allows the first null position (i.e. the subject position of the relative) to be immediately interpreted as an entity outside the sentence, leaving only the second null position (i.e. the object) available to be linked to the head NP. Young children's sensitivity to context calls for further work in the future.

Starting with Huang (1984), the grammatical status of the object EC in Chinese has been one of the major concerns in the linguistic studies of the language. Much of the controversy over this issue has confined itself to syntactic speculations. Without committing myself to the theoretical debate, I have instead attempted to disentangle grammar from processing by looking into the acquisition aspect of Chinese double-gapped relatives. The results from this dissertation work are not inclusive, but I hope that my data provide some new food for reflection on the relation of grammar and processing, an issue that will eventually lead to a better understanding of the linguistic status of the null object in Chinese.

REFERENCES

Avutrin, S. (1999). *Development of the syntax-discourse interface.* Dordrecht: Kluwer Academic Publishers.

Bach, E., Brown, C. & Marslen-Wilson, W. (1986). Crossed and nested dependencies in German and Dutch: A psycholinguistic study. *Language and Cognitive Processes.* 1 (4), 249-262

Chang, H. W. (1984). The comprehension of complex Chinese sentences by children: Relative clauses. *Chinese Journal of Psychology.* 26, 57-66.

Chien, Y-C., & Wexler, K. (1991). Children's knowledge of locality conditions in binding as evidence for the modularity of syntax and pragmatics. *Language Acquisition.* 1, 225-295

Chao, R. (1968). *A grammar of spoken Chinese.* Berkeley: University of California Press.

Chiu, B. (1998). *Relative clauses in child Chinese.* Ms. National Taiwan Normal University, Taiwan.

Chomsky, N. (1977). On Wh-movement. In Culicover, P. & et al. (eds). *Formal Syntax.* Orlando: Academic Press.

Chomsky, N. (1981). *Lectures on Government and Binding.* Dordrecht: Foris

Chomsky, N. (1982). *Some concepts and consequences of the theory of Government and Binding.* Cambridge, MA.: MIT Press.

Chomsky, N. (1995). *The Minimalist Program.* Cambridge, MA: MIT Press.

Crain, S. & Fodor (1985). How can grammars help parsers? In Dowty, D., Kartuunen, L., & Zwicky, A. (Eds.) *Natural Language Parsing: Psychological, Computational and Theoretical Perspectives.* Cambridge, MA: Cambridge University Press.

de Vincenzi, M. (1991). *Syntactic parsing strategies in Italian.* Dordrecht: Kluwer Academic Publisher

Frazier, L. (1999). *On sentence interpretation.* Dordrecht: Kluwer Academic Publisher

Frazier, L. & Clifton, C. (1989). Successive cyclicity in the grammar and the parser. *Language and Cognitive Processes.* 4, 93-126.

Frazier, L., Clifton, C. & Randall, J. (1983). Filling gaps: Decision principles and structure in sentence comprehension. *Cognition* 13, 187-222.

Frazier, L & Flores d' Arcais, G. (1989). Filler-driven parsing: A study of gap-filling in Dutch. *Journal of Memory and Language.* 28, 331-344.

Fodor, J. A., Bever, T. G. & Garrett, M. F. (1974). The *Psychology of Language.* New York: McGraw-Hill.

Fodor, J. D. (1998). Parsing strategies and constraints on transformation. *Linguistic Inquiry.* 9, 427-473.

Gibson, E. (1998). Linguistic complexity: Locality of syntactic dependencies. *Cognition* 68: 1-76.

Goodluck, H. (1990). Knowledge integration in processing and acquisition: Comments on Grimshaw and Rosen. In *Frazier, L. , & de Villiers, J. (eds.). Language Processing and Language Acquisition.* Dordrecht: Kluwer Academic Publisher.

Goodluck, H. & Rochemont, M. (1992). Island constraints: an introduction. In Goodluck, H. & Rochemont, M. (Eds.). *Island Constraints: Theory, acquisition and processing.* Dordrecht: Kluwer Academic.

Goodluck, H. & Stojanovic, D. (1996). The structure and acquisition of relative clauses in Serbo-Croatian. *Language Acquisition.* 5(4), 284-351.

Hawkins, J. A. (1994). *A performance theory of order and constituency.* New York: Cambridge University Press.

Hawkins, J. A. (1999). Processing complexity and filler-gap dependencies across grammars. *Language.* 75, 244-280.

Huang C. T. (1989). Pro-drop in Chinese: A generalized control theory. In Jaeggli, O., & Safir, K. (Eds.). *The Null Subject Parameter.* Dordrecht: Kluwer Academic

Huang C.T. (1984) On the distribution and reference of empty pronoun. *Linguistic Inquiry* 15, 531-574.

Huang C.T. (1982). *Logical relations in Chinese and theory of grammar.* Unpublished Doctoral Dissertation, MIT

Huang, C-T. J. & Liu, L. (2001). Logophoricity, attitudes and Ziji at the interface. In

Cole, P., Hermon, G., & Huang, C-T. J. *Long-distance Reflexives.* San Diego, CA: Academic Press.

Huang, Y. (2000). *Anaphora.* New York: Oxford University Press.

Hyams, N. (1986). *Language acquisition and the theory of parameters.* Dordrecht: Reidel.

Kayne, R. (1994). *The antisymmetry of syntax.* Cambridge, MA.: MIT Press.

Keenan & Comrie, (1977). Noun phrase accessibility and universal grammar. *Linguistic Inquiry.*1, 63-100.

Lee. T. (1992). The inadequacy of processing heuristics: Evidence from relative clause acquisition in Mandarin Chinese. In Lee. T. (Ed.). *Research on Chinese Linguistics in Hong Kong.* Linguistic Society of Hong Kong.

Nicol, J., & Swinney, D. (1989). The role of structure in co-reference assignment during sentence comprehension. *Journal of Psycholinguistic Research* 18, 5-20.

Ning, CY (1993). The overt syntax of relativisation and topicalization in Chinese. Ph.D. Dissertation, University of California, Irvine.

Pollard, C. & Xue, P. (2001). Syntactic and non-syntactic constraints on long-distance reflexives. In Cole, P., Hermon, G., & Huang, C-T. J. *Long-distance Reflexives.* San Diego, CA: Academic Press.

Radford, A. (1990). *Syntactic theory and the acquisition of English syntax: the Nature of early child grammars of English.* Oxford: Blackwell.

Reinhart, T. & Reuland, E. (1991). Anaphors and logophors: An argument structure perspective. In Koster, J. & Reuland, E. (Eds.) *Long-Distance Anaphora.* Cambridge: Cambridge University Press.

Reinhart, T. & Reuland, E. (1993). Reflexivity. *Linguistic Inquiry.* 24, 657-720.

Rizzi, L. (1994). Residual verb second and the WH-criterion, in Belletti, A., & Rizzi, L (Eds.) *Parameters and functional heads: Essays in comparative syntax.* New York: Oxford University Press.

Saah, K., & Goodluck, H. (1995). Island effects in parsing and grammar: Evidence from Akan. *The Linguistic Review.* 12, 381-409

Sheldon, A. ((1974). The role of parallel function in the acquisition of relative clauses in English. *Journal of Verbal Learning and Verbal Behavior. 13, 272-281.*

Steedman, M.J. (1985). Dependency and coordination in the grammar of Dutch and

English. *Language.* 61, 523-568.

Stow, L. A. (1986). Parsing Wh-constructions: Evidence for on-line gap location.

Tanenhaus, M., & Tueswell, J.C. (1995). Sentence comprehension. In Miller, J. L. & Eimas, P. D. (Eds.). San Diego: Academic Press.

Tavakolian, S. (1981). The conjoined clause analysis of relative clauses. In Tavakolian, S. (ed.). *Language Acquisition and Linguistic Theory.* Cambridge, MA: MIT Press.

Wang, Q. , Lillo-Martin, D., Best, C. T., & Levitt, A. (1992). Null subject versus null object: Some evidence from the acquisition of Chinese and English. *Language Acquisition.* 2(3), 221-254.

Simpson, A. (1997). *On the status of 'modifying' DE and the structure of the Chinese DP.* Ms. SOAS, London.

Werker, J. (1995). Exploring developmental changes in cross-linguistic speech perception. In Gleitman, L & Liberman, M. (Eds). *An Invitation to Cognitive Science, Volume 1: Language.* Cambridge, MA: MIT Press.

Wu, B. (2000). *Null Subject and Null Object in Child Chinese.* Unpublished MA thesis, Department of Linguistics, the University of Ottawa, Canada

Wu, X-Z. Z. (1998). *On the structure of relative clause in Chinese.* Ms. SOAS, London.

Xu, L. (1986). Free Empty Category. *Linguistic Inquiry.* 17, 75-93.

Appendix: Sentences Tested

- Questionnaire I
- Questionnaire IIA
- Questionnaire IIB
- Questionnaire III

Questionnaire I

S'-1 cow/dog
Da Xiongmao kanjian e bao zhe xiaogou de nei tou niu
big panda see hug Asp puppy that Cl cow
'The panda sees the cow that is hugging the puppy.'

C'-1 dog/horse
Da Xiongmao kanjian ma gen ta zai dajia de nei tou xiaogou
big panda see horse with it Asp fight that Cl puppy
'The panda sees the dog that the horse is fighting with'

G'-1 dog/cow
Da Xiongmao kanjian niu gei ta qiu de nei tou xiaogou
big panda see cow give him ball that Cl puppy
'The panda sees the dog that the cow gives a ball'

O'-1 cow/horse
Da Xiongmao kanjian ma ti e de nei tou niu
Big panda see horse kick that Cl cow
'The panda sees the cow that the horse kicks.'

L'-1 bed/cow
Da Xiongmao kanjian niu zaishangmian e suijao de nei zhang chuang
Big panda see cow on sleep that Cl bed
'The panda sees the bed that the cow is sleeping on.'

O'-2 horse/dog
Da Xiongmao kanjian xiaogou wen e de nei pi ma
big panda see puppy kiss that Cl horse
'The panda sees the horse that the dog kisses.'

G'-2 horse/dog
Da Xiongmao kanjian xiaogou gei ta hua de nei pi ma
big panda see puppy give he flower that Cl horse
'The panda sees the horse that the dog gives flower.'

S'-2 cow/horse
Da Xiongmao kanjian e pai niu de nei pi ma
big panda see pat cow that Cl horse
'The panda sees the horse that pats the cow.'

C'-2 cow/dog
Da Xiongmao kanjian xiaogou gen ta wan de nei tou niu
big panda see puppy with he play that Cl cow
'The panda sees the cow that the dog is playing with.'

L'-2 chair/horse
Da Xiongmao kanjian ma zaishangmian e zhanzhe de nei zhang yizi
big panda see horse on stand that Cl chair
'The panda sees the chair that the horse is standing on.'

S'-3 horse/dog
Da Xiongmao kanjian e da ma de nei tou xiaogou
big panda see hit horse that Cl puppy
'The panda sees the dog that hits the horse jumps around.'

L'-2 dog/bed
Da Xiongmao kanjian xiaogou zaishangmian e zhou zhe de nei zhang chuang
big panda see puppy on sit Asp that Cl bed
'The panda sees the bed that the dog sits on.'

O'-3 cow/dog
Da Xiongmao kanjian niu tui e de nei tiao xiaogou
big panda see cow push that Cl puppy
'The panda sees the dog that the cow pushes.'

C'-3 horse/cow
Da Xiongmao kanjian niu gen ta sanbu de nei pi ma
big panda see cow with he walk that Cl horse
'The panda sees the horse that the cow is walking with.'

G'-3 cow/horse
Da Xiongmao kanjian ma gei ta shu de nei tou niu
big panda see horse give he book that Cl cow
'The panda sees the cow that the horse gives the book.'

Notes of Coding:
Cl: classifier Phrase
C': commitative RC
G': goal RC
L': locative RC
O': object RC
S': subject RC

Questionnaire II A

S-1 cow/dog
e bao zhe xiaogou de nei tou niu zuxia lai
hug Asp puppy that Cl cow sit down Asp
'The cow that is hugging the puppy sits down.'

C-1 dog/horse
ma gen ta zai dajia de nei tou xiaogou jiao qilai
horse with it Asp fight that Cl puppy bark Asp
'The dog that the horse is fighting with barks.'

DG-1 No lead: horse/dog
Dongwu xihuan wan youxi
Animal like play games
'The animals like to play games'

e pai e de nei pi ma paokai le
pat De that Cl horse run away Asp
a) 'The horse that the dog pats runs away.'
b) 'The horse that pats the dog runs away.'

G-1 dog/cow
niu gei ta qiu de nei tou xiaogou luantiao*
cow give him ball that Cl puppy jump around
'The dog that the cow gives a ball jumps around'

O-1 cow/horse
ma ti e de nei tou niu jiao qilai
horse kick that Cl cow moo Asp
'The cow that the horse kicks moos.'

DG-2 Lead: cow/dog
Gou hen gaoxing
Dog very happy
'The dog is happy'

e wen e de nei tou niu luantiao qilai
kiss that Cl cow jump Asp
a) 'The cow that the dog kisses jumps around.'
b) 'The cow that kisses the dog jumps around.'

L-1 bed/cow
niu zaishangmian e suijao de nei zhang chuang yaodong qilai
cow on sleep that Cl bed shake Asp
'The bed that the cow is sleeping on shakes.'

O-2 horse/dog
xiaogou wen e de nei pi ma daoxia lai le
puppy kiss that Cl horse fall over Asp
'The horse that the dog kisses falls over.'

G-2 horse/dog
xiaogou gei ta hua de nei pi ma changqige lai
puppy give he flower that Cl horse sing Asp
'The horse that the dog gives flower sings.'

DG-3 No lead: cow/dog
Dongwu hen xingfen
Animal very excited
'The animals are very excited'

e ti e de nei tou xiaogou jiao qilai
kick that Cl puppy bark Asp
a) 'The dog that kicks the cow barks.'
b) 'The dog that the cow kicks barks.'

S-2 cow/horse
e pai niu de nei pi ma tiaowu la
pat cow that Cl horse dance Asp
'The horse that pats the cow dances.'

C-2 cow/dog
xiaogou gen ta wan de nei tou niu jiao qilai
puppy with he play that Cl cow moo Asp
'The cow that the dog is playing with moos.'

DG-4 lead: cow/horse
niu you zongse bandian
cow has brown spot
'The cow has brown spots'

e da e nei pi ma jiao qilai
hit that Cl horse neigh Asp
a) 'The horse that hits the cow neighs.'
b) 'The horse that the cow hits neighs.'

L-2 chair/horse
ma zaishangmian e zhanzhe de nei zhang yizi fandao le
horse on stand that Cl chair fall over Asp
'The chair that the horse is standing on falls over.'

S-3 horse/dog
e da ma de nei tou xiaogou luantiao
hit horse that Cl puppy jump around
'The dog that hits the horse jumps around.'

DG-5 No lead: cow/horse
tianqi zhen hao
it really fine
'It's fine today'

e yongbao e de nei tou niu zhe changge la
hug that Cl cow Asp sing Asp
a) 'The cow that hugs the horse is singing.'
b) 'The cow that the horse hugs is singing.'

L-2 dog/bed
xiaogou zaishangmian e zhou zhe de nei zhang chuang yaodong qilai
puppy on sit Asp that Cl bed shake Asp
'The bed that the dog sits on shakes.'

O-3 cow/dog
niu tui e de nei tiao xiaogou paokai le
cow push that Cl puppy run away Asp
'The dog that the cow pushes runs away.'

C-3 horse/cow
niu zaigen ta sanbu de nei pi ma jiao qilai
cow with he walk that Cl horse neigh Asp
'The horse that the cow is walking with neighs.'

DG-6 Lead: horse/dog
ma hen keai
horse very lovely
'The horse is very lovely.'

e wen e de nei tiao xiaogou tiaoqiwu lai
kiss that Cl puppy dance around Asp
a) 'The dog that kisses the horse dances around.'
b) 'The dog that the horse kisses dances around.'

G-3 cow/horse
ma gei ta shu de nei tou niu tiaoqiwu lai
horse give he book that Cl cow dance around Asp
'The cow that the horse gives the book dances around.'

Notes of Coding:

Cl: classifier Phrase
Asp: aspect marker
DG: double-gapped RC (covert-binder)
C: commitative RC
G: goal RC
L: locative RC
O: object RC
S: subject RC

Questionnaire II B

S-1 cow/dog
e bao zhe xiaogou de nei tou niu zuxia lai
hug Asp puppy that Cl cow sit down Asp
'The cow that is hugging the puppy sits down.'

C-1 dog/horse
ma gen ta zai dajia de nei tou xiaogou jiao qilai
horse with it Asp fight that Cl puppy bark Asp
'The dog that the horse is fighting with barks.'

DG-2 Lead: cow/dog
Gou hen gaoxing
Dog very happy
'The dog is happy'

e wen e de nei tou niu luantiao qilai
kiss that Cl cow jump Asp
a) 'The cow that the dog kisses jumps around.'
'The cow that kisses the dog jumps around.'

G-1 dog/cow
niu gei ta qiu de nei tou xiaogou luantiao*
cow give him ball that Cl puppy jump around
'The dog that the cow gives a ball jumps around'

O-1 cow/horse
ma ti e de nei tou niu jiao qilai
horse kick that Cl cow moo Asp
'The cow that the horse kicks moos.'

DG-1 No lead: horse/dog
Dongwu xihuan wan youxi
Animal like play games
'The animals like to play games'

e pai e de nei pi ma paokai le
pat De that Cl horse run away Asp
a) 'The horse that the dog pats runs away.'
b) 'The horse that pats the dog runs away.'

L-1 bed/cow
niu zaishangmian e suijao de nei zhang chuang yaodong qilai
cow on sleep that Cl bed shake Asp
'The bed that the cow is sleeping on shakes.'

O-2 horse/dog
xiaogou wen e de nei pi ma daoxia lai le
puppy kiss that Cl horse fall over Asp
'The horse that the dog kisses falls over.'

G-2 horse/dog
xiaogou gei ta hua de nei pi ma changqige lai
puppy give he flower that Cl horse sing Asp
'The horse that the dog gives flower sings.'

DG-4 lead: cow/horse
niu you zongse bandian
cow has brown spot
'The cow has brown spots'

e da e nei pi ma jiao qilai
hit that Cl horse neigh Asp
a) 'The horse that hits the cow neighs.'
b) 'The horse that the cow hits neighs.'

S-2 cow/horse
e pai niu de nei pi ma tiaowu la
pat cow that Cl horse dance Asp
'The horse that pats the cow dances.'

C-2 cow/dog
xiaogou gen ta wan de nei tou niu jiao qilai
puppy with he play that Cl cow moo Asp
'The cow that the dog is playing with moos.'

DG-3 No lead: cow/dog
Dongwu hen xingfen
Animal very excited
'The animals are very excited'

e ti e de nei tou xiaogou jiao qilai
kick that Cl puppy bark Asp
a) 'The dog that kicks the cow barks.'
b) 'The dog that the cow kicks barks.'

L-2 chair/horse
ma zaishangmian e zhanzhe de nei zhang yizi fandao le
horse on stand that Cl chair fall over Asp
'The chair that the horse is standing on falls over.'

S-3 horse/dog
e da ma de nei tou xiaogou luantiao
hit horse that Cl puppy jump around
'The dog that hits the horse jumps around.'

DG-6 Lead: horse/dog
ma hen keai
horse very lovely
'The horse is very lovely.'

e wen e de nei tiao xiaogou tiaoqiwu lai
kiss that Cl puppy dance around Asp
a) 'The dog that kisses the horse dances around.'
b) 'The dog that the horse kisses dances around.'

L-2 dog/bed
xiaogou zaishangmian e zhou zhe de nei zhang chuang yaodong qilai
puppy on sit Asp that Cl bed shake Asp
'The bed that the dog sits on shakes.'

O-3 cow/dog
niu tui e de nei tiao xiaogou paokai le
cow push that Cl puppy run away Asp
'The dog that the cow pushes runs away.'

C-3 horse/cow
niu zaigen ta sanbu de nei pi ma jiao qilai
cow with he walk that Cl horse neigh Asp
'The horse that the cow is walking with neighs.'

DG-5 No lead: cow/horse
tianqi zhen hao
it really fine
'It's fine today'

e yongbao e de nei tou niu zhe changge la
hug that Cl cow Asp sing Asp
a) 'The cow that hugs the horse is singing.'
b) 'The cow that the horse hugs is singing.'

G-3 cow/horse
ma gei ta shu de nei tou niu tiaoqiwu lai
horse give he book that Cl cow dance around Asp
'The cow that the horse gives the book dances around.'

Notes of Coding:

Cl: classifier Phrase
Asp: aspect marker
DG: double-gapped RC (covert-binder)
C: commitative RC
G: goal RC
L: locative RC
O: object RC
S: subject RC

Questionnaire III

Sub-1 ma xihuan e pai e de niu
horse like pat cow
'The horse likes the cow it pats s'

Top-1 ma ne, e ti e de niu hen shengqi.
horse, TP kick e cow very angry
a. 'The cow the horse kicks is very angry'
b. 'The cow that kicks the horse is very angry'

Sub-2 niu bu xihuan e ti e de gou
cow not like kick dog
'The cow does not like the dog he kicks

Top-2 niu ne, e xihuan e de dongwu hen duo
cow TP like animal very many
a. 'Animals the cow likes are great in number'
b. 'Animals that like the cow are great in number.'

Sub-3 houzi xihuan e yongbao e de gou
monkey like hug dog
'The monkey likes the dog he hugs.'

Top-3 houzi ne, e yongbao e de niu hen gaoxing
monkey TP hug cow very happy
a. 'The cow the monkey hugs is very happy.'
b. 'The cow that hugs the monkey is very happy.'

TP: topicalization particle
Sub: subject-binder RC
Top: topic-binder RC