

INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

The quality of this reproduction is dependent upon the quality of the copy submitted. Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps. Each original is also photographed in one exposure and is included in reduced form at the back of the book.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

UMI

A Bell & Howell Information Company
300 North Zeeb Road, Ann Arbor MI 48106-1346 USA
313/761-4700 800/521-0600

A

PROCESSING NP-TRACE AND REFLEXIVES IN CHINESE

by

JIAYE XIE

A dissertation submitted to the Graduate Faculty in Linguistics
in partial fulfillment of the requirement for the degree of Doctor
of Philosophy, The City University of New York

1997

UMI Number: 9720153

**Copyright 1997 by
Xie, Jiaye**

All rights reserved.

**UMI Microform 9720153
Copyright 1997, by UMI Company. All rights reserved.**

**This microform edition is protected against unauthorized
copying under Title 17, United States Code.**

UMI
300 North Zeeb Road
Ann Arbor, MI 48103

©1997

JIAYE XIE

All Rights Reserved

This manuscript has been read and accepted for the Graduate Faculty in Linguistics in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

January 28 1997
Date

Janet Dean Fodor
Janet Dean Fodor
Chair of Examining Committee

1.28.97
Date

CE Cairns
Charles E. Cairns
Executive Officer

Dianne Bradley

Martin Chodorow

Weijia Ni

Supervisory Committee

THE CITY UNIVERSITY OF NEW YORK

PROCESSING NP-TRACE AND REFLEXIVES IN CHINESE

by

Jiaye Xie**Advisor: Professor Janet Dean Fodor**

This dissertation reports a research project on the on-line processing of five constructions in Chinese: “bei” passive, “shi” passive, copular construction, topicalization, long distance reflexives. The goal was to investigate the processing of binding relationships between dependent elements such as NP-trace, WH-trace and overt anaphors such as “ziji”, and their antecedents. The primary purpose was to explore the psychological reality of NP-trace.

The existence of phonologically empty categories, such as NP-trace and WH-trace, in natural language has been a matter of debate in linguistic studies. Government-Binding theory postulates four types of empty categories, while nontransformational grammars such as Head Driven Phrase Structure Grammar, which takes maximum advantage of lexical structures, rejects empty categories. This is a controversy which is difficult to resolve by theoretical studies. Therefore, experimental data on sentence processing can be helpful. Taking the transparency hypothesis as a working assumption, psycholinguists have recently made efforts to address this issue.

In previous experiments on English, stronger evidence was found for WH-trace than for NP-trace. Nicol (1989) attributed the lack of strong on-line effects for NP-

trace to the temporary structural ambiguity in English passives, which obscures the binding relationship. Because the passive verb is ambiguous and the antecedent NP is in an A(rgument) position (surface subject), the parser cannot tell that it was moved to that position, so it cannot predict the upcoming trace, as it can in the case of WH-trace.

Chinese offers an unambiguous passive structure on which this hypothesis can be tested. In the “bei” passives, the passive preposition “bei” (by) precedes the agentive NP, the verb and the following trace, and unambiguously cues the parser that there will be a trace after the verb. Two cross-modal experiments, one using a naming task and the other a lexical decision task, were conducted on the processing of “bei” passives and the other four Chinese structures listed above.

Neither experiment showed any evidence for NP-trace. In Experiment I, all results were as predicted except for the “bei” passives. The data exhibited a significant antecedent-activation effect for “ziji”, but no effect for the copular sentence, which contains no trace, or the “shi” passive, which is ambiguous. Experiment II found, as predicted, no effect of the WH-trace in topicalization, which is also an ambiguous structure in Chinese. The data showed no priming in the “bei” passive, but a reverse effect for the overt anaphor “ziji”. Some possible explanations for the latter finding are proposed. Though the overall pattern of results is not fully decisive, the consistent absence of priming in the “bei” passives challenges the existence of NP-trace.

ACKNOWLEDGMENT

First and foremost, I would like to sincerely thank my adviser, Professor Janet Fodor, who has given me academic guidance and financial support on this research project. Her outstanding linguistic expertise and endless patience has helped throughout my studies, researches and writing of the dissertation at the Graduate School of the City University of New York. Without her encouragement and support, I could not have completed this project.

I would also like to sincerely thank Professor Martin Chodorow, Professor Dianne Bradley from the Linguistics Department at the Graduate Center of the City University of New York, and Dr. Weijia Ni from Haskins Laboratory in New Haven, Connecticut. They have spent a lot of their precious time with me in working on the design of the experiments and the analysis of the data.

I would also like to extend my sincere thanks to Professor David Swinney, who provided me with many ideas in our discussion about the design of the first experiment in this project when he was at the Graduate School of CUNY.

Finally, thanks to all the Chinese students at the Graduate School of CUNY, who have participated in the experiment.

TABLE OF CONTENTS

ACKNOWLEDGMENT.....	vi
1. INTRODUCTION.....	1
2. EMPTY CATEGORIES AND LINGUISTIC THEORIES...11	
2.1. Empty Categories as Grammatical Constituents.....	11
2.2. Empty Categories in GB theory.....	13
2.3. Empty Categories in HPSG.....	27
2.4. Empty Categories in LFG.....	31
2.5. Summary: Empty Categories in the Theory of Language.....	34
3. PSYCHOLINGUISTIC EXPERIMENTS ON PROCESSING EMPTY CATEGORIES.....	37
3.1. Experiments on Processing WH-trace.....	39
3.2. Experiments on Processing Reflexives.....	49
3.3. Experiments on Processing NP-trace.....	54
3.4. Explaining the Variable Results for NP-trace.....	57
4. EXPERIMENT I: PROCESSING NP-TRACE AND REFLEXIVES IN CHINESE.....	65
4.1. Purpose.....	65
4.2. Method.....	74
4.2.1. Materials and Design.....	74
4.2.2. The analysis of Materials.....	79
4.2.3. Experimental Sentences.....	94
4.2.4. Target Words.....	98
4.3. Subjects.....	101
4.4. Procedure.....	101
4.5. Results.....	103
4.6. Discussion.....	104

5. EXPERIMENT II: PROCESSING NP-TRACE, WH-TRACE, AND REFLEXIVES IN CHINESE.....	108
5.1. Purpose.....	108
5.2. Method.....	111
5.2.1. Materials and Design.....	111
5.2.2. The Analysis of Topicalization Construction.....	113
5.2.3. Experimental Sentences.....	120
5.2.4. Target Words.....	126
5.3. Subjects.....	128
5.4. Procedure.....	128
5.5. Results.....	130
5.6. Discussion.....	131
 APPENDICES:	
Appendix A. Materials for Experiment I.....	144
Appendix B. Materials for Experiment II.....	176
 BIBLIOGRAPHY.....	201

LIST OF TABLES

1. Table 1: Summary of WH-trace and NP-trace Features.....	23
2. Table 2: Experiment I: Mean Naming Onset Times (msec) to Visual Targets.....	103
3. Table 3: Experiment II: Mean Response Times (msec) to Visual Targets in Three Types of Sentences.....	131

CHAPTER 1

INTRODUCTION

This thesis is a presentation of a sentence processing research project which attempts to investigate the processing of binding relationships involving three types of dependent elements in Chinese: NP-trace and WH-trace, which are phonetically empty categories, and reflexive, an overt anaphor. The project includes two experiments focusing on processing Chinese sentences such as: passive sentences constructed with a "bei" phrase, which have been claimed to contain NP-trace, as in (1);¹ topicalization sentences claimed to contain WH-trace, as in (2); and sentences containing long distance (LD) reflexives, as in (3).

(1) Zhangsan bei Lisi kajan le.

Zhangsan Pass. Lisi see Asp.

'Zhangsan was seen by Lisi.'

(2) Zhangsan Lisi kanjian le.

Zhangsan Lisi see Asp.

'Zhangsan Lisi has seen.'

¹ In Chinese, there are passive sentences constructed with elements other than "bei", e.g. "jiao", "rang" etc. (see chapter 4). However, the passive sentence with "bei" is the most typical and commonly used.

(3) Zhangsan yiwei Lisi meiyou kanjian ziji

Zhangsan think Lisi not see self

‘Zhangsan thought Lisi didn’t see him.’

The purpose of the project is to provide some experimental data concerning processing of sentences that have been claimed to contain traces of movement, from Chinese, a non-Indo-European language, as a contribution to the debate in linguistic theory about the existence of NP-trace and other types of empty category in the syntactic representations of sentences. Chinese has some characteristics that permit testing of important hypotheses which cannot be investigated using English sentences. The results of the experiments conducted have not provided positive psycholinguistic evidence from Chinese for the linguistic hypothesis that empty categories such as NP-trace are grammatical constituents holding structural positions in syntactic representations. However, the results also indicate that it is still too early, at this stage of sentence processing studies of Chinese, to draw from the lack of favorable evidence the conclusion that NP-trace has no psychological reality in the syntactic structure of Chinese.

A brief overview of the contents of subsequent chapters follows.

In linguistic analysis, on standard assumptions of Government-Binding theory (Chomsky, 1981, 1982; 1986a; 1986b), phonologically null elements such as NP-

trace and WH-trace were postulated in syntactic representations as empty categories in sentences such as (1) and (2) above, as illustrated in the structural representation (1a) and (2a). (For detailed linguistic analysis of Chinese within GB theory, see Huang, 1982; 1983.)

(1a) [IP Zhangsan_i [bei Lisi kanjian le t_i le]]

(2a) [CP Zhangsan_i [Lisi [kanjian t_i]]]

However, other contemporary grammatical theories, for example, Generalized Phrase Structure Grammar (GPSG) (Gazdar, Klein, Pullum, and Sag, 1985), or its latest version, HPSG (Head-Driven Phrase Structure Grammar) (Pollard and Sag, 1994) and Lexical-Functional Grammar (LFG) (Bresnan, 1982) differ from GB theory in that they do not postulate a transformational mechanism for sentence generation, and over the years they have also eliminated empty categories from syntactic representations. Sentences such as (1) and (2) generated within these non-transformational frameworks will not contain empty categories like those in (1a) and (2a). Chapter 2 of this thesis presents a general review of the perspectives of three major current theories of universal grammar (UG), and discusses why and how these grammar differ on the status of ECs in syntactic representations. The evidence for NP-trace and WH-trace in linguistic analysis is reviewed, and it is pointed out that the evidence for NP-trace is not as substantial

as that for WH-trace (Fodor, 1993). There are no signs that the controversy about the need to postulate empty categories is likely to be resolved by theoretical studies in the near future, so experimental evidence bearing on this issue would be particularly welcome.

Note: In what follows I will simplify the exposition by referring to NP-trace and other types of empty category without noting in every case that their existence is a matter of debate. This is a convention for convenience only. It is to be understood that reference to NP-trace, for example, is not inconsistent with the conclusion that NP-trace does not exist. The development of new research techniques has given experimental psycholinguistics observational access to the on-line parsing of binding relationships involving putative empty categories. Taking the transparency hypothesis (Bresnan 1982; Fodor 1991)² as a working hypothesis, psycholinguists have made efforts to address these linguistic phenomena from the point of view of language comprehension. Many sentence processing experiments have been conducted recently to investigate such topics as: Are anaphoric relations between overt pronouns and/or reflexives and their antecedents computed on line in sentence processing? Is sentence processing

² The hypothesis assumes that sentence processing computations make use of the mental (competence) grammar. Detailed discussion will be given in Chapter 3.

similar for overt anaphors and for the ECs postulated by GB theory? Do different types of theoretically posited ECs behave differently in sentence processing? Do the observed processing phenomena constitute evidence for the reality of any or all of the postulated ECs? The majority of these experiments were conducted on the processing of English sentences (Corbett and Chang, 1983; Crain and Fodor, 1985; MacDonald, 1989; Bever and McElree, 1988; Frazier and Clifton, 1989; Tanenhaus, 1989; Carlson and Seidenberg, 1985; Swinney and Bresnan, 1988; Swinney and Nicol, 1989; Nicol and Swinney 1989; Fodor, 1991; Osterhout, 1993; among others). Chapter 3 is a general review and discussion of these sentence processing experiments and their results. In addition to the differences between the linguistic evidence for NP-trace and WH-trace presented in Chapter 2, Chapter 3 discusses the differences between the experimental evidence for NP-trace and WH-trace. Also discussed in Chapter 3 is Nicol's (1988) hypothesis concerning processing differences between NP-trace and WH-trace in English, which is the primary motivation for this project. According to the hypothesis, English passives are not ideal experimental structures for studying NP-trace in sentence processing, because of such disadvantages as the temporary structural ambiguity in passive sentences caused by the multiple function of the English verb "be", the ambiguity

of “by”, and the common ambiguity between passive verbs and adjectives. For example:

(4) The runner was worn out by the strenuous training.

(5) The runner was worn out by the tenth mile.

In an English WH-construction, the processor can generally anticipate the existence of a subsequent WH-trace as soon as the antecedent phrase is processed. But when processing English passive sentences such as (4), the processor cannot immediately recognize the subject NP as the antecedent of a trace, since it cannot know for certain that the sentence is passive until later. Indeed, it cannot determine even at the position of the NP-trace that a trace is present, because the verb phrase could be a deverbal adjective as in (5) with a non-agentive by-phrase. This temporary structural ambiguity in English passive sentences can be expected to hamper processes by which NP-trace is recognized and associated with its antecedent.

Unlike its English counterpart, in the Chinese passive sentence with “bei”, the passive marker “bei” will unambiguously cue the processor that this is a passive structure as soon as it is processed, before the passive verb and the NP-trace position. An agent phrase of any length can appear between “bei” and the verb. (It is reasonable to assume that NP-trace immediately follows the verb in Chinese

since this is the canonical position of direct object.) Thus the processor can be given ample time to compute that a trace will follow the verb. Chapter 4 discusses this unique feature of Chinese passive sentences with “bei” in comparison with its English counterpart, and concludes that the Chinese “bei” passive construction is indeed a suitable structure for sentence processing experiments on NP-trace, because it eliminates any ambiguity which might cause extraneous difficulties for the human processor. Therefore, sentence processing data on Chinese passives with “bei” can be expected to shed a clearer light on the question of the psychological reality of NP-trace and hence its linguistic status.

Chapter 4 also discusses the materials to be tested in Experiment I of the project (employing a cross-modal paradigm naming task). Four types of sentences were experimented on: passive sentences with “bei”, as in (6); passive sentences with “shi”, as in (8); “shi” copular sentences, as in (9); and sentences containing long-distance “ziji”, as in (7).

- (6) zhefu huai bei ganggang zhanzhai zheli he nimen shuohua de nage nuren
 this picture Pass just now stand here with you talk that woman
 nadao ti ta penyou jiali qu le.
 take her friend home to Asp.

‘This picture has been taken by the woman who was standing here talking to you just now to her friend's home.’

- (7) huajiai yiwei zhanzhai zheli he nimen shuohua de nage nuren meiyou
 painter think stand here with you talk that woman not
 kangjian ziji zhenzhai zhunbei huahua
 see self Tense prepare paint

‘The painter thought the woman who was standing here talking to you just now didn't see him preparing to paint.’

- (8) zhefu huai shi ganggang zhanzhai zheli he nimen shuohua de nage nuren
 this picture is just now stand here with you talk that woman
 nadao ti ta pengyou jiali qu de .
 take her friend home to

‘This picture has been taken by the woman who was standing here talking to you just now to her friend's home.’

- (9) zhefu hua shi ganggang zhanzhai zheli he nimen shuohua de nage nuren de
 this picture is just now stand here with you talk that woman 's
 jiali weiyi de yifu hua.
 home only one picture

‘This picture is the only picture in the home of the woman who was standing here talking to you just now.’

The formal analysis of the syntactic structures of experimental sentences such as (6), (7), (8), and (9) is presented in Chapter 4. The results of Experiment I are discussed. In considering possible interpretations of the data, some shortcomings in the design of the experiment are discussed.

Experiment II was designed to improve the materials and to allow for a more robust effect of NP-trace. Chapter 5 discusses the materials tested in Experiment II (which employed a cross-modal lexical decision task). Three types of sentences were tested, namely, passive sentences with "bei", as in (11); topicalization sentences which are analyzed in GB theory as containing a WH-trace, as in (10); and sentences containing long-distance reflexive anaphors, as in (12). The formal analysis of topicalization, a new type of structure introduced into the experiment, is presented Chapter 5.

(10) **nage zhumin de huajiai zhege chongmin piaoliang de nuhai he ta de pengyou**
that well-known painter this clever pretty girl and her friend
qingle ti shanchi dao nasuo shili xuexiao qu jiangke.
invite three times to that private school lecture

‘That well-known painter this clever and pretty girl and her friend has invited
three times to lecture at that private school.’

(11) nage zhumin de huajiai bei zhege chongmin piaoliang de nuhai he ta de

that well-known painter Pass this clever pretty girl and her

pengyou qingle ti shanchi dao nasuo shili xuexiao qu jiangke

friend invite three times to that private school lecture

‘That well-known painter has been invited three times by this clever and
pretty girl and her friend to lecture at that private school.’

(12) nage zhumin de huajiai yiwei zhege chongmin piaoliang de nuhai he ta de

that well-known painter think this clever pretty girl and her

pengyou meiyou kangjian zijii zhenzhai zhuenbei huahua

friend not see self Asp. prepare paint

‘That well-known painter thought this clever and pretty girl and her didn’t
see him preparing to paint.’

The methodology and results of this experiments are then discussed, and their
bearing on psycholinguistic and linguistic issues is considered. Details of the
design of the two experiments are also discussed and suggestions are made for the
further development of Chinese sentence processing research in the future.

CHAPTER 2

EMPTY CATEGORIES AND LINGUISTIC THEORIES

2.1. Empty Categories as Grammatical Constituents

Empty categories (ECs), as the name suggests, differ from traditional overt grammatical constituents in that they have no physical realization. In other words, they are not audible or visible in the phonetic representation or standard orthographic representation. ECs were hypothesized by Government-Binding (GB) theory (Chomsky, 1981, 1982, 1986a, 1986b) as important grammatical constituents and have since become one of the corner stones of the theory. Chomsky argues that ECs hold structural positions in sentences just as overt constituents do and play an important role in accounting for the wellformedness or illformedness of syntactic structures. The assumption that EC's exist allows GB principles to be simpler and more general than on the assumption that ECs do not exist. For example, traces are one kind of such null elements. Traces are generated in the course of applying movement transformations. A trace appears in the position from which a constituent was moved. Its antecedent is the moved phrase, with which it is coindexed. This is illustrated in example (13) for Wh-movement,

and in (14) for NP-movement. (Both operations are instances of the general transformation *Move- α*)

(13) Who_i did John say that Mary invited *t_i* to her birthday party ?

(14) John_i was invited *t_i* by Mary to her birthday party.

Chomsky (1981) stated that "...the study of such elements, with the related investigation of anaphors and pronouns, has proven to be an excellent probe for determining properties of syntactic and semantic representations, and rules that form them."

However, controversies about whether there are such null syntactic constituents in natural language constructions have arisen since the time that ECs were first postulated. Other competing contemporary theories of grammar, such as HPSG and LFG, disagree partly or wholly with the GB claim that ECs are indispensable constituents in syntactic representations. These linguistic theories differ from each other in a number of respects but are similar in that they adopt a non-transformational generative process which takes maximum advantage of lexically derived structures, and does not insist on similar underlying structures for sentences with similar meaning. Semantic rules map syntactic structures onto the semantic level, and can assign the same semantic content to sentences with different syntactic structures. To a considerable extent the postulation of

movement operations and the postulation of ECs are independent. For instance, GPSG assumed WH trace without assuming WH-movement. But as it happens, LFG and HPSG do not now recognize either movement or traces. ECs have been found not to make any useful contribution to the statement of grammatical principles or the representation of sentence structures, in these theories.

Let us review in more detail why and how ECs were postulated or not postulated in contemporary theories of grammar.

2.2. Empty Categories in GB Theory

The GB typology of ECs includes two major classifications, i.e., trace (NP-trace and WH-trace) and pronominal (PRO and pro) (Chomsky, 1981, 1982, 1986a)³. The two major types are differentiated by their origins. A trace is created by transformation, while the pronominals are base generated by the phrase structure rules. A PRO is always the subject of a non-finite verb, for reasons having to do with government and its relation to the binding theory. The discussion in this thesis, however, will focus only on traces, since that is the topic of the psycholinguistic experiments reported here.

³ I am unable in this dissertation to discuss recent developments of the transformational model within the minimalism framework of Chomsky (1992, 1994).

A trace is a syntactic category, e.g. noun phrase (NP), that has been voided of physical content by the transformational rule *Move- α* , during the course of mapping certain D-structure onto their S-structures. Examples that contain a trace include questions, relative clause constructions, topicalizations and passive sentences:

(15) D-structure

- a. John will eat what for breakfast
- b. John likes the food Mary cooks which
- c. John really likes that apple pie.
- d. e was invited John by Mary to her birthday party

(16) S-structure

- a. What_i will John eat t_i for breakfast.
- b. John likes the food which_i Mary cooks t_i .
- c. That apple pie_i John really likes t_i .
- d. John_i was invited t_i by Mary to her birthday party.

The trace (represented by t) retains only an index that is identical to the index of the category that was moved out of the trace position. Although this coindexation is created in overt syntax by the movement operation, it is subject to wellformedness conditions on Logical Form (LF), which is an abstract

representation of what was traditionally called the “structural meaning” of the sentence. LF is derived from S-structure by the successive application of the rules of interpretation, e.g., binding rules, quantification rules, etc., in an orderly sequence. Violation of these LF rules will produce an illformed LF representation and consequently an unacceptable sentence. The Empty Category Principle (ECP) applies to all types of ECs at LF.

(17) ECP: An empty category must be properly governed.

The ECP is a species of locality principle. The definition of proper government has been much debated and need not be given here. It suffices to note that the ECP has a number of empirical consequences, such as differences in the extractability of subject and object NPs. A trace is thus a coindexed null syntactic constituent subject to the ECP in LF. Through this coindexation, or chain, a trace and its antecedent share some abstract properties such as case and theta-role.

Although transformational rules were integral to the original development of generative-transformational grammar (Chomsky 1957), empty categories were later discoveries (Chomsky 1981,1982). The motivation for positing a trace posttransformationally is that it preserves pretransformational structural properties generated by the phrase structure rules. This is encapsulated in the Projection Principle (Chomsky 1981):

(18) Projection Principle:

Representations at each syntactic level (i.e. LF, and D- and S-structure) are projected from the lexicon, in that they observe the subcategorization properties of lexical items.

This principle stipulates that a sentence structure at any level of representation must respect the subcategorization of the lexical items it contains. For example, (d) in (15) contains the verb "invite", which is subcategorized for a subject and a direct object (as well as an optional PP or infinitival complement). Thus both the D-structure and S-structure must satisfy this subcategorization frame of "invite". The presence of "e" (which is a base generated null constituent in contrast to "t", which is created by movement) in (15d) makes the D-structure of the sentence meet the requirement of (18); the presence of "t" in (16d) makes the S-structure of the sentence satisfy the Projection Principle. Chomsky (1986) commented "A consequence of the Projection Principle is, to put it informally, that if some element is "understood" in a particular position, then it is there in syntactic representation, either as an overt category that is phonetically realized or as an empty category assigned no phonetic form." Another principle, the Theta-Criterion, limits the ways in which subcategorization requirements can be satisfied.

(19) Theta-Criterion

Each argument bears one and only one θ -role, and each role is assigned to one and only one argument.

The Projection principle requires that this holds at D-structure, S-structure and LF.

“John” in (15d) has the object (or theme) θ -role. By virtue of (19), “John” in (15d) cannot be both the subject argument and the object argument of “invite”. And the passive verb preceding it is unable to assign a case to it. So “John” in (15d) does not have a case, a violation of the Case Filter.

(20) Case Filter

*NP, where NP has no case

Therefore the D-structure object “John” has to be transformed by *Move- α* into the subject position in (16 d). The moved NP leaves a trace in its original position. Since the moved NP “John” is coindexed with the trace, it shares a θ -role and case with the trace, satisfying (19) and (20).

In addition to preserving the validity of the Projection Principle, positing a trace was also motivated by an observed parallelism between structures involving movement and those involving antecedent-anaphor relations. Anaphors are NPs, either reflexives or reciprocals, which require an antecedent. For example:

(21) John thought he_i hit himself_i.

(22) John thought they_i hit each other_i.

It was discovered (Fiengo, 1974) that there is a parallelism between NP-trace and anaphors.

(23) (i) John_i was hit t_i.

(ii) John_i hit himself_i.

(iii) John_i was expected t_i to win.

(iv) John_i expected himself_i to win.

(24) (i)*John_i was expected Bill to hit t_i.

(ii)*John_i expected Bill to hit himself_i.

(iii)*John_i was expected t_i would win.

(iv)*John_i expected himself_i would win.

It appears that both NP-trace and overt anaphors are subject to a c-command condition and a locality constraint on their relations to their antecedents.

(25) c-command:

A c-commands B if and only if the first branching node dominating A also dominates B and A does not itself dominate B.

According to GB theory, movement must be always be to a c-commanding position and it is governed by locality constraints such as the ECP (17) and Subjacency (see below). This is illustrated in examples (i) and (iii) of (23) and

(24). Examples (ii) and (iv) of (23) and (24) show that an anaphor is subject to similar constraints. This parallelism between movement and an overt anaphor would follow from the assumption that movement leaves a trace which is an anaphor (a null anaphor). The behavior of both would then fall under the Proper Binding condition (van Riemsdijk and Williams, 1986)

(26) Proper Binding: An anaphor (including trace) must be properly bound (i.e. coindexed and c-commanded) by its antecedent (including moved phrases).

The examples in (23) and (24) also show that NP-trace and overt anaphors are subject to the same binding constraints. In GB theory (Chomsky, 1981, 1982), coindexation assignment is subject to the Binding conditions which specify whether two NPs are coreferent or disjoint in reference.

(27) Binding Conditions:

- A. An anaphor must be bound in its governing category.
- B. A pronoun must be free in its governing category.
- C. A lexical NP must be free.

The sentences in (24) are ungrammatical because they violate principle A, which imposes a very strict locality constraint on anaphor binding. As example (24i) and (24iii) show, this constraint applies equally to passivization. This would be explained if passivization (NP-movement) leaves a trace that is an anaphor.

Besides NP-trace in passive structures, NP-traces in other structures such as raising structures, e.g. “Johni seems *ti* to be happy”, are also subject to these principles.

Wh-trace and NP-trace are both created by movement. But they possess different features in terms of Case theory and the Theta-Criterion and they are regulated by different Binding conditions in GB theory. An important difference between WH-trace and NP-trace is that their coindexed lexical antecedent is situated in different syntactic positions. According to the Projection Principle and the Theta-Criterion, the positions where WH-trace and NP-trace are originally created by *Move- α* are assigned a θ -role by the verb (or other predicates), so WH-trace and NP-trace retain the θ -role which they acquired from the position before it was voided of phonetic content by the transformational movement. Their coreferential lexical antecedents only inherit the θ -role through the θ -chain that links them with their traces. But the θ -chain involving WH-trace is different from that involving NP-trace because of the different positions that their lexical antecedents occupy. The antecedent of WH-trace only appears in [spec CP], a position outside of the domain of IP (sentence) which is a barrier to the assignment of theta-role as well as case. So [spec CP] is a non-argument ($\bar{A}$) position. This $\bar{A}$

chain relationship between the lexical antecedent and WH-trace is subject to Subjacency.

(28) Subjacency Condition

No rule can relate X,Y in the structure

$$...X...[\alpha...[\beta...Y...(or:...Y...) \beta...] \alpha...X...]$$

where α, β are bounding nodes.

On the other hand, the lexical antecedent of NP-trace is in a subject position where a subject theta-role may be assigned. It is in an argument position, i.e. A-position. However, in a passive sentence, this A position does not receive a θ -role. This is because the subcategorization (or argument structure) of a passive verb prevents the assignment of a θ -role to the subject position (or case to the object position). Because the object position lacks case, the D-structure overt object must move to a case position, such as the subject position. Because the subject position is not assigned a θ -role, the NP can move to it without violating the Theta-Criterion.

This position difference between the lexical antecedents of WH-trace and NP-trace is of considerable interest from a psycholinguistic point of view, because it suggests different on-line processing routines for sentences containing the two kinds of traces. In processing a sentence containing Wh-trace, the processor is not

able to integrate the fronted WH-NP in $\bar{A}$ position into the sentence structure because it has no case or θ -role in its surface position. So the processor will look for a 'gap' in the sentence structure where it can construct a trace for this lexical antecedent to associate with in a chain, via which it can receive case and a theta role; see the Active Filler Strategy of Frazier and Clifton (1989). But in processing a sentence containing NP-trace, the processor may first integrate the lexical antecedent in the subject position as an agent NP, because the position the antecedent occupies is an argument (A-position) where subject case and the theta-role "agent" are assigned by default. Then at the time when the processor recognizes the passive verb in the sentence, it would have to look back to reassign the appropriate theta-role and rebuild the semantic representation. Processing routines for NP-trace and WH-trace constructions will be fully discussed later in chapters 4 and 5.

The linguistic differences between WH-trace and NP-trace can be summarized as follows:

(29) Table 1. Summary of features of WH-trace and NP-trace.

Properties	Type of trace	
	Wh-trace	NP-trace
anaphoric	-	+
θ -role	+	+
case	+	-
$A/\bar{A}$ -bound	$\bar{A}$	A
Binding Principle	C	A
ECP	+	+
Visible at PF	+	-

WH-trace is a variable, which is neither anaphoric nor pronominal. It is therefore subject to Binding Principle C in GB theory, which requires that a variable be free. The antecedent of WH-trace is in an $\bar{A}$ position where it receives no case or θ -role. So Wh-trace must always occur in a position where a theta-role and case are assigned to it. This contrasts with NP-trace, which as noted above is an anaphor subject to Binding Principle A, and which has no case because a passive verb undergoes case absorption so it has no case to assign to its object position.

The arguments for positing WH-trace in GB theory are clearly stronger than the arguments for positing NP-trace. van Riemsdijk and Williams (1981) were able to argue that the properties of NPs undergoing NP-movement in GB theory are comparable to the properties of un-moved NPs. This is clearly not so for NPs that have undergone WH-movement, since these occupy non-argument positions exclusively, and their overt case marking reflects their underlying position as subject or object, rather than reflecting their surface position, as the overt case of an NP-moved phrase does. van Riemsdijk and Williams proposed to capture these differences by having all NP-movement precede all WH-movement, with case assignment applying at a level of “NP-structure” between the two. Their arguments are equally compatible with handling all “NP-movement” phenomena in the lexicon rather than in the syntactic derivation. It is generally assumed that lexical operations do not leave traces. Thus these considerations, raised by van Riemsdijk and Williams within a general GB framework, are compatible with the approach of LFG and HPSG which treats all local phenomena such as passive, raising, control, etc. as due to lexical operations, and which does not posit NP-trace.

Dispensing with WH-trace in GB theory would be much more damaging to its general principles. WH-movement clearly cannot be lexical (because it is not

local and its output is not a lexical subcategorization property), and GB theory has no mechanisms other than movement (such as the slash feature of HPSG or the function composition of LFG) to describe the long-distance A-bar displacements observed in WH-constructions. Once WH-movement is accepted, the constraints which limit it are subject to considerations of generality as outlined above, which favor treating the pre-movement position as containing a syntactic entity comparable (in all except its lack of phonology) to an overt syntactic constituent.

In addition to those theory internal considerations which provide stronger theoretical motivation for WH-trace than NP-trace in the GB framework, it has been held that there is phonological evidence for WH-trace which is lacking for NP-trace. The phenomenon of “wanna” contraction is shown in (30i). The blocking of this contraction is shown in (30ii).

(30) “wanna” Contraction

- (i) a. Which wine do you wanna drink?
- b. Which wine do you want to drink?
- (ii) a. * Who do you wanna get wine?
- b. Who do you want to get wine?

It has argued in support of GB theory that (30 (ii) a) is unacceptable because the WH-trace intervening between “want” and “to” in (30 (ii) b) is visible at the level

of Phonological Form (PF) even though it itself has no phonological content. The intervening trace violates the adjacency condition on the contraction at PF⁴. By contrast, there is no comparable evidence that NP-trace blocks contraction processes. In fact, in so far as a clear test can be found, it appears that NP-trace does not block contractions. For example, (31) is a raising construction, and on a GB analysis there would be an NP-trace between the “have” and “to” of (31b), coindexed with the subject NP.

(31) a. Your great-grandparents hafta be dead.

b. Your great-grandparents have to be dead.

Thus it seems necessary to conclude that NP-trace is not visible at PF. Like the other properties pointed out by van Riemsdijk and Williams, this is compatible with the non-existence of NP-trace. To summarize: though there is certainly no clear proof that NP-trace does not exist, it is also the case that there is little or no proof that it does exist (i.e., that it essential to adequate description and explanation of the linguistic facts) even given other GB assumptions.

Thus in psycholinguistic studies it is worth considering three hypotheses:

(i) WH-trace and NP-trace both exist.

⁴ This argument about the physical evidence for WH-trace has been discounted recently; see the debate by Fodor (1993), Barss (1993), and Sag and Fodor (1993), and the many references cited there. For details of extraction without trace, see Sag and Fodor (1994).

(ii) WH-trace exists but NP-trace does not.

(iii) No traces exist.

2.3. Empty Categories in HPSG

HPSG (Pollard and Sag, 1987, 1994) is a non-transformational lexical based theory of grammar that has evolved from its predecessor GPSG (Generalized Phrase Structure Grammar, Gazdar, Klein, Pullum and Sag, 1985). The review here, as the one on GB theory, will be limited to those arguments and rules relevant to ECs and the syntactic structure of sentences that contain ECs.

HPSG is also a generative grammar model, but it does not assume a transformational derivation as GB theory does. It is a mono-stratal theory which rejects the model of multiple levels of sentence representation. Where GB theory takes formalizing syntactic structure as its prime task, HPSG regards the specification of relations between expressions of a language and their meaning as the central goal of linguistic research. All syntactic constituents are represented as collections of feature values, which conform to general UG principles as well as language specific rules and constraints. Structural configuration is controlled separately from word order: the syntax is in ID/LP format. (ID stands for immediate dominance rule and LP stands for linear precedence statement). The

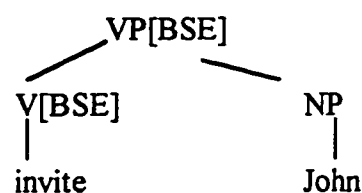
syntactic representation is a single level representation, with semantic representation as a parallel level. The sentence structure is generated directly without any mapping from D-structure to S-structure, and is interpreted by semantics. For example, a passive sentence which is generated by movement in GB theory is directly generated by using a passive lexical argument structure for the verb, that is derived in the lexicon. So a sentence such as “John was invited by Mary to her birthday party” (cf. example (16d) above), would be generated using the lexical entry (32)(i b).

(32)(i) a. { invite, V[BSE, SUBCAT {NP, NP}]} }

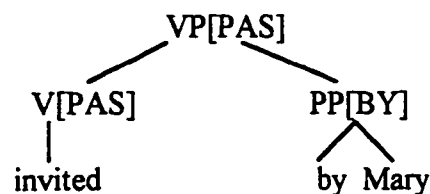
b. { invite, V[PAS, SUBCAT{PP[BY], NP}]} }

The active lexical specification for “invite” in (32)(i a) would permit generation of the verb phrase in (32)(ii a), and the passive specification (32)(i b) would permit generation of the verb phrase in (32)(ii b).

(32)(ii) a.

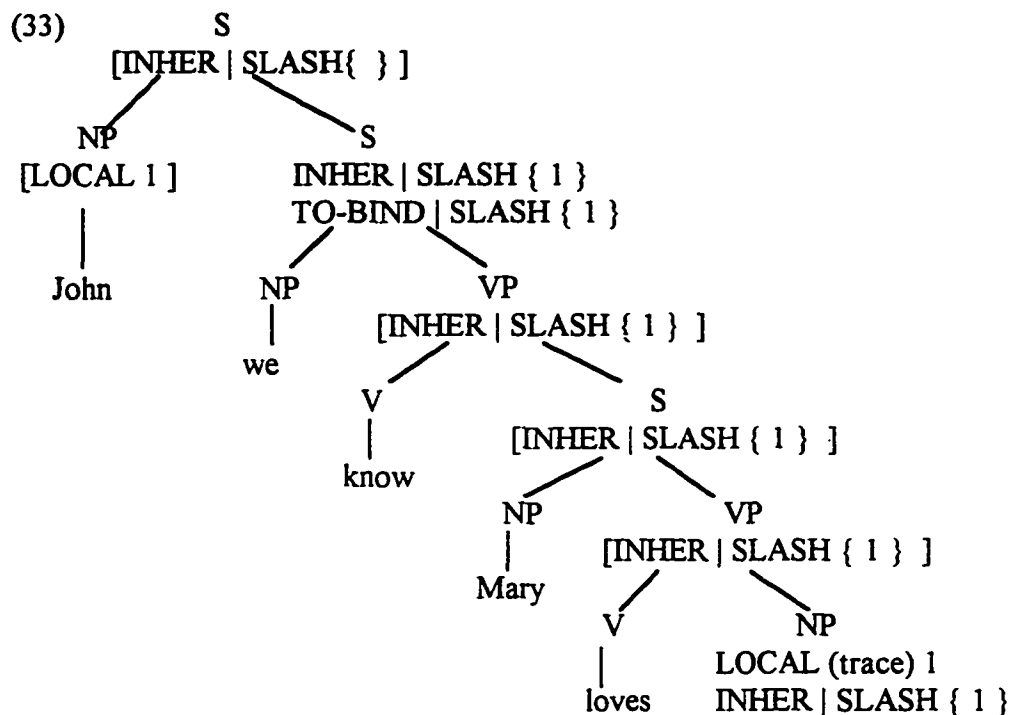


b.



Thus there is no structural movement in passive sentences or in raising and other local constructions which in GB theory would contain NP-trace. And there is nothing to be gained in terms of descriptive coverage or theoretical economy in this framework by assuming that passive or raising constructions contain an empty category coindexed to the overt subject.

HPSG also does not posit other kinds of ECs such as PRO and pro. However, until very recently (Pollard and Sag, 1994 chapter 9), HPSG did adopt an EC analysis for the unbounded dependency constructions which include topicalization, relative clause, wh-questions, etc. Through most of the development of GPSG (Gazdar et al 1985) and HPSG (Pollard and Sag, 1987, 1994), a null element comparable to GB theory's WH-trace was assumed in these constructions. For example:



But there is no movement involved in generating the dependency between the trace and its antecedent by means of slash features such as (33). The “filler” and the “gap” are both generated in their surface positions. The grammar establishes the long distance coreferential relationship by features which are generated by the phrase structure schemata, and through which the antecedent can inherit, in the semantics, the thematic role appropriate to the position of the trace. A slash feature is a non-local synsem (i.e. syntax/semantics) feature, which is inherited by each mother node from its daughter, until the grammar permits it to be bound to a

filler phrase (antecedent). While this is the HPSG analysis that will be assumed in this thesis, it has to be pointed out the theory is still being developed rapidly. A model without even WH-trace has already been proposed by Pollard and Sag (1994, chapter 9). It is argued by Sag and Fodor (1994) that there is no reliable “external” evidence for WH-trace (not even “wanna”-contraction), but only theory-internal considerations limited to GB theory. While the syntactic dependency between a WH-phrase and its theta-assigner must be represented and constrained, the SLASH features suffice to do this in HPSG and nothing is gained by assuming that there is a phonologically empty constituent at the bottom of the SLASH feature path.

2.4. Empty Categories in LFG

Another contemporary non-transformational model is Lexical Functional Grammar (LFG) (Bresnan, 1982). In its classic form, it also posited WH-trace but no other kinds of ECs. More recently (Kaplan and Zaenen 1989), the WH-trace element has been eliminated from the theory. LFG maintains that a richer theory of lexical rules and representations can replace the syntactic transformations and Projection Principle that are postulated by GB theory. In LFG, the lexical entries represent subcategorization properties of the verb independent of phrase

structure, and lexical rules capture the relationship between lexical entries, such as the active and passive lexical argument structures for a verb. A single predicate argument structure may have several alternative lexical assignments of grammatical functions. For example:

(34) (i) see: see [(subj) (obj)]

agent patient

(ii) see: be seen [(obli(que)AG(ent) (subj)]

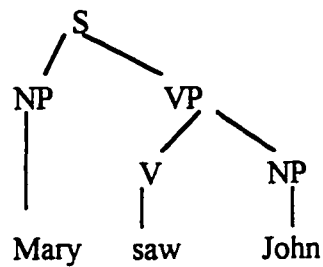
agent patient

(34 (i)) is the active lexical entry of the verb “see” and (34 (ii)) is the passive entry of “see”.

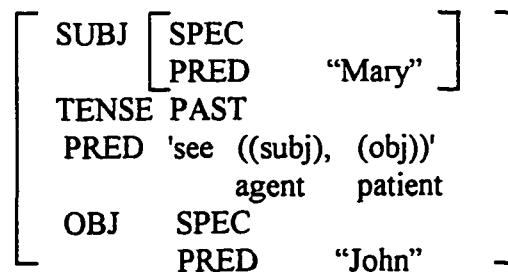
In LFG, without a transformational derivation, the surface form of syntactic structure is represented by a single level of phrase structure, which is called the constituent structure (c-structure). There is a mapping which correlates the grammatical functions that are assigned to lexical predicate argument structures (such as (34)) with the grammatical functions that are associated with c-structure forms. This correlation is formally represented by a functional structure (f-structure). Thus, the rules of grammar defined in LFG provide each sentence of a language with a dual representation consisting of a c-structure and a f-structure. The c-structure is the surface form of the sentence which is phonologically

interpreted and the f-structure is the representation of its meaningful grammatical relations which is semantically interpreted. For example, the representations of the sentences " Mary saw John" and "John was seen by Mary" are as follows.

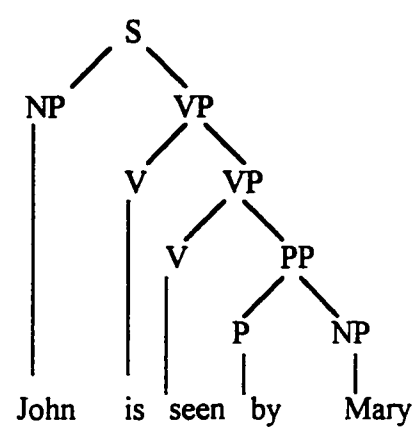
(35) c-structure



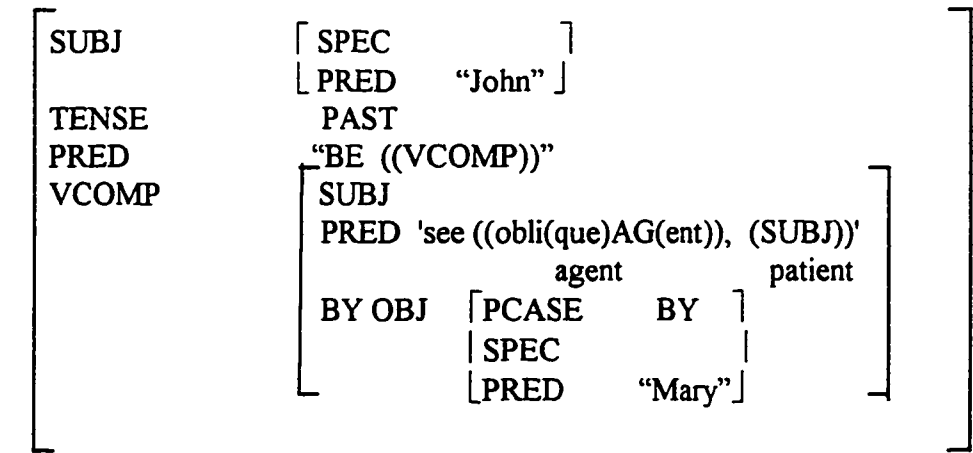
f-structure



(36) c-structure



f-structure



2.5. Summary: Empty Categories in the Theory of Language

GB theory accepts the evidence for NP-trace, because NP-trace is compatible with the movement mechanism and multi-level syntactic representations, which are

key components of the theory. It is argued that without NP-trace, the descriptive coverage, and/or the theoretical elegance of the theory would be diminished.

Other theories of grammar have assessed the evidence for NP-trace and decided it is insufficient. Theory-neutral empirical proof of its existence is lacking. And these theoretical frameworks have other mechanisms, particularly lexical specifications and semantic rules, which can capture the facts that GB theory captures by NP-movement. Because it is possible, at the present state of research, for different linguistic theories to take very different stands on the issue of NP-trace, it is of particular interest to see whether there is psychological evidence for the involvement of NP-trace in sentence processing.

A final note: In recent years, non-transformational theories have also abandoned WH-trace (Sag and Fodor, 1994). To understand this shift, it is necessary to distinguish between syntactic dependencies (or chains) and syntactic constituents. HPSG and LFG have found that their sentence descriptions and grammatical principles can be formulated just as well without any phonologically empty syntactic constituents. But they must still capture the long-distance dependencies observed in WH-constructions, topicalization, and so forth. With regard to these dependencies, the long-distance ones cannot be denied, but the putative local dependencies in passive etc. may simply not exist at all in the syntax.

As noted above they may be merely a mistaken way of trying to capture meaning similarities across sentence types. Certainly, the two types of construction call for very different formal descriptive mechanisms (see Sag and Fodor, 1993); and for the local constructions those mechanisms more closely resemble those for simple phrase structure configurations with no dependencies. In this sense, then, these theories do continue to distinguish the local and long-distance phenomena. They capture an antecedence relation in WH-constructions but deny the existence of any antecedency relation in the local constructions. Thus they might provide an account of processing differences between the two types of construction even though they do not postulate an empty category in either of them. In the discussion of experimental work in the following chapters, the simplifying assumption will be made that all linguistic theories agree that WH-trace exists, in order to serve as a background for the issue of major interest, which is whether NP-trace exists. However, as outlined above, there are really three theoretical positions that have some plausibility: that WH-trace and NP-trace are both genuine syntactic constituents; that only WH-trace is; and that neither is. All three possibilities need to be borne in mind in future experimental studies.

CHAPTER 3

PSYCHOLINGUISTIC EXPERIMENTS ON PROCESSING EMPTY CATEGORIES

As noted in the last chapter, current linguistic theories disagree about the existence of ECs such as NP-trace. Different theories describe and explain the relevant facts, (e.g. passive sentences) in different ways. This fact has made the postulation of ECs in syntactic representation a controversial issue in the theoretical exploration of UG in recent years. Particularly disputed is the status of NP-trace. Yet it is an important issue, because if it could be settled, many other theoretical issues would be settled with it. For example, what is the proper division of responsibility between syntax and the lexicon? Are there abstract levels of syntactic representation that are not directly perceptible? Is semantics transparently reflected in syntactic structure?

One kind of research that has been pursuing the answers to these questions in recent years is the experimental psycholinguistic study of ECs. The flourishing of experimental studies of ECs is not accidental. It has been nourished by three conditions. First, there has been a commitment to a methodological hypothesis which relates linguistic and psycholinguistic concerns, i.e. the Transparency Hypothesis (Bresnan, 1982; Fodor, 1991). The Transparency Hypothesis assumes

a transparent relation between linguistic competence (mentally represented knowledge of language) and the human language production and comprehension routines. That is to say that the performance mechanisms draw their information about the language from the mental grammar. As is pointed out by Fodor (1991): “although it is possible that the relation between the processing computations and the grammar is not fully transparent because of, for example, on-line parsing errors, many psycholinguists have accepted the transparency principle as a working hypothesis, to be assumed except where there is some specific reason to suppose that it is inappropriate to do so.” This means that psychological evidence for some construct in sentence processing is *prima facie* evidence for its linguistic existence; and psychological evidence for its non-involvement in sentence production and perception is at least a reason for doubting its validity as a theoretical construct. Secondly, the development of experimental techniques for the on-line study of sentence processing (Crain and Fodor, 1985; Frazier and Clifton, 1989; Swinney et al, 1988; Bever and McElree, 1988), have made ECs observable in sentence processing so that they can be subject to systematic study. Thirdly, as was illustrated in Chapter 2, pure theoretical studies of ECs alone have persistently failed to arrive at a generally accepted conclusion. Though they may

in the future, this is an opportune time for insights contributed by a different methodology.

By studying ECs together with overt anaphors in sentence processing with psycholinguistic methods, psycholinguists and linguists hope that the results of these experimental researches can shed some light on the controversial issue about the existence of ECs in syntactic representations. Many experiments have been conducted on processing various kind of ECs in English sentences (for review, see Fodor, 1991). In the following sections, a general review will be given of those experiments. Since the present project focuses on investigating NP-trace, in comparison with WH-trace and overt reflexives, the review will concentrate on the previous experiments on these elements, and on hypotheses related to the interpretation of their results.

3.1. Experiments on Processing WH-trace

Constructions containing WH-trace in English include questions, relative clauses, and topicalized sentences. In the observation of the processing of these types of sentences, researchers are interested mainly in two issues. First, how does the processor parse the “filler” constituent (the antecedent in $\bar{A}$ position) in these types of sentences? Second, how is this constituent associated with a “gap” (WH-

trace) later in the on-line computation? The dependency between the “filler’ and “gap” is a potentially long distance relation that has to be established though the processor can only process sentence structure locally, constituent by constituent sequentially.

Generally speaking, there have been two stages in the development of research on processing WH-trace. At the earlier stage, the design of experiments focused on the processing of the antecedent, i.e., the overt member of the chain (Crain and Fodor, 1985). At issue, for example, was whether the processor makes use of the antecedent information in its on-line computations in order to anticipate a WH-trace in positions in the word string where it could occur, (e.g. following a verb later in the sentence). Also of interest was whether the processor is eager to get the antecedent associated with a trace position as soon as possible, even at the cost of more computational effort in establishing one. This can be determined by experiments on sentences with “decoy gaps” (really non-gaps but ambiguous), and “filled gaps” (a lexical NP in what might have been a gap position). Results suggest that the processor opts for the earliest possible gap (Fodor, 1978; Stowe, 1986; Frazier and Clifton, 1989). Some of these experiments are summarized below.

More recent studies have focused on the processing of WH-trace, i.e., the null partner of the chain. It has been asked whether, when the trace is constructed by the processor, it is immediately associated with its antecedent by the processor. This can be established by showing that the meaning of the antecedent is activated at the trace position (Swinney and Nicol, 1989). The results of these experiments have been used as evidence for the psychological reality of the trace and consequently of linguistic theories that posit trace as discussed in Chapter 2. Research on processing WH-constructions has been too extensive to be reported in full here. Presented here are some significant studies that illustrate these issues and experimental methods.

Crain and Fodor (1985) and Stowe (1986) conducted some pioneer experiments that demonstrated that once the processor has encountered an antecedent phrase, it seeks out possible trace positions in the sentence. In Crain and Fodor's experiment, sentences containing WH-trace such as the following were tested in a self-paced word by word reading task.

(40) Who_i could the little child have forced t_i to sing those stupid French songs
for Cheryl last Christmas?

(41) Who_i the little child could have forced us to sing those stupid French song for
t_i last Christmas?

(42) The little child could have forced us to sing those stupid French songs last Christmas.

After the verb "force" in (40) and (41), (40) has a trace while (41) has a lexical NP, and a trace later in the structure. It was found that reading time increased in sentences like (41) at the NP position after the verb, indicating an increase in processing difficulty at that position. This can be explained if it is assumed that, computing from left to right, the parser is predicting a possible WH-trace at the object position immediately following the main verb and does not expect to find the position taken by a lexical NP instead of a gap. This kind of processing difficulty has been called the "filled gap" effect. In (42), where there is no filler and no trace at all, no such processing difficulty at the post verbal NP is observed. This experiment thus provides support for the claim that in sentences like (40), there is a WH-trace after the main verb which is associated with its antecedent by the processor during on-line computation. It appears that the $\bar{A}$ chain theoretically postulated by GB theory or the path of "slash" features in HPSG may be involved in language perception as well.

Frazier and Clifton (1989) conducted another self-paced reading task experiment on sentences containing a fronted WH-phrase, such as (43) and (44).

.

(43) What_i did the cautious old man whisper _{ti} to his fiancée during the movie last night?

(44) What_i did the cautious old man whisper to his fiancée about _{ti} during the movie last night?

In (43), WH-trace occurs after the verb “whisper”, but in (44), the trace appears in a prepositional phrase, as complement of the preposition “about”. If the processor, having encountered the fronted WH-word, guesses that there is a trace immediately following the main verb (as in Crain & Fodor’s experiment), the structure after the verb “whisper” in sentence (43) should be easier to process than the same words in sentence (44). The potential gap after “whisper” is a decoy in (44); the parser may be distracted by it, though it is not the correct gap position for (44). If the processor does not guess a trace immediately following the verb after it processes the antecedent, the structure after the verb “whisper” in sentence (44) should be easier to process than that of sentence (43). If the processor does not make any guess but just waits for more information to be provided by the sentence, then the two sentences should exhibit a similar degree of processing difficulty.

The results of the experiment showed that subjects were faster at reading “to his fiancée during the movie” in sentence (43) than “to his fiancée about during the movie” in sentence (44). Even after the reading times were adjusted for the length

difference between these word strings, the effect still persisted. Like Crain and Fodor's experiment, this "decoy gap effect" suggests that the processor keeps the antecedent in mind during its on-line computation and guesses a trace at the earliest legitimate position. Frazier and Clifton (1989) named this guessing strategy the "Active Filler Strategy".

More recent sentence processing experiments have adopted other types of techniques and designs. For example, Swinney et al (1988) and Swinney and Nicol (1989), using a cross-modal paradigm, conducted a series of experiments on WH-constructions. In the cross-modal paradigm, subjects were asked to focus on listening to the sentences, which were pre-recorded on tape and presented to them auditorily through earphones. At the same time, they were asked to watch the CRT screen before them, on which a string of letters (a word or non-word) would appear at some time during the spoken sentence. Whenever an item (the target) appeared on the screen, subjects were to make a lexical decision (i.e. decide whether it is a word or non-word) or, in another task, to name (say aloud) the target word as quickly as possible. There were two kinds of target word, i.e., the associated and non-associated target. The two types were matched in length and frequency, but the former was associated in meaning with the antecedent and the other was not. The target word was timed to coincide with a trace position, or

occur at some other position in the sentence. Since the subjects were concentrating on listening to the sentences through the earphones, the responses they made to the target word in both the lexical decision and naming task were supposed not to be the result of conscious reflection, but to truly reflect the operation of the processor in language comprehension. The purpose of the experiment was to observe whether in processing the trace, the parser associates it with its antecedent, with the result that the meaning of the antecedent is reactivated at the WH-trace position. It has been well established that lexical decision on a word is faster if there is a strong associative relation between the word and another word that is presented immediately before it as a priming stimulus (Meyer and Schvaneveldt, 1971). That is, the response to the target word is facilitated by the semantically associated word just processed. The antecedent reactivation paradigm extends this phenomenon to priming words that are mentally activated, rather than physically perceived, at the relevant time. This technique has now been used extensively in experiments to examine lexical processing within sentences (Swinney, 1979; Tanenhaus, Leiman, and Seidenberg, 1979; Boland, 1993; Nicol, 1993, among others).

Using a cross-modal lexical decision paradigm, Swinney, Ford, & Bresnan (1988) investigated the processing of sentences such as the following:

(45) The policeman saw the boy that the crowd at the party# accused of# the#
crime. 1 2 3

In this sentence, there is binding relationship between “the boy”, which functions as the head that is modified by the relative clause, and the WH-trace after the verb “accused” in the relative clause. Because of this, the sentence means that the boy was accused. Target words were presented to subjects at certain points (marked #) in the sentence. The target word was either an associate of the antecedent “the boy” or a control word which is not related in meaning with the antecedent. A similar test was made for a non-antecedent NP in the same sentence, to determine whether the processor is precise in achieving just the grammatically correct antecedent. In this case the non-antecedent noun tested for priming was “crowd”. The results obtained in this experiment were as follows.

(46) Priming scores (lexical decision RTs in msec to nonassociated targets minus RTs to associated targets for each referent) at each probe point.

Referent	Probe Point		
	1	2	3
boy	12	27*	27*
crowd	44*	19	8

*p<.05

The target presented at position 1, before the trace, is intended to make sure that any priming effect observed at the trace position is not merely a residue of the

original activation of the antecedent when it is processed. This can be assumed to be so, if there is no priming of the associate target at a point between the antecedent and its trace. As the results show, the associate target for “boy” at position 1 did not exhibit significant priming. The significant priming of “crowd” at position 1 presumably is not due to reactivation of “crowd” but merely reflects the fact that its initial activation has not yet decayed. At position 2, the WH-trace position, significant priming was obtained only for the target associated with “ boy ”. This indicates that the subjects’ responses to the associate probe are facilitated by the reactivating of the antecedent noun at the trace position. It can be assumed that the antecedent is reactivated when it is co-indexed by the processor with the trace that it has constructed at that position. Swinney et al. concluded from the results of this experiment that a WH-trace immediately reactivates its antecedent in sentence processing, and that the processor makes use of accurate grammatical information in identifying the correct antecedent. The fact that the associate target for “boy” at position #3, which is 500 msec after the trace position, also showed significant priming may simply reflect the fact that the activation at the trace position has not yet declined to resting level, or it may reflect on-going semantic level processing of the antecedent-trace relation.

Experimental findings such as this have been interpreted as revealing the psychological reality of theoretically posited WH-traces in the syntactic representation of sentences. This conclusion rests on two points. First, the data do clearly indicate that a semantic link is established, during processing, between the antecedent phrase and the position of the putative trace. Second, this relationship can be regarded as paralleling the relation between an overt anaphor and its antecedent, for which antecedent activation in sentence processing has also been experimentally demonstrated. This is discussed below. It should be noted, though, that the experimental results for WH-trace would be equally well explained by any linguistic analysis which assigns a WH sentence the correct meaning, in which the WH-trace bears the theta-role appropriate to the putative trace position. To the extent that this relationship can be accurately captured by a linguistic theory which posits no trace at that position, the results do not constitute evidence for WH-trace per se, but only for the rapid computation of the WH-dependency. To assume that they do is to reason circularly. This point will not be pressed here, however, because the primary focus of this thesis is the comparison of WH-trace with NP-trace phenomena. It will be taken here as established that a syntactically-sensitive semantic relation is computed on-line in WH-constructions, whether or not it actually involves a trace (a phonetically null syntactic

constituent). In what follows, WH-trace will be referred to for convenience, but this caveat should be borne in mind. At issue will be whether or not a similar relationship is computed in constructions in which NP-trace has been theoretically posited.

3.2. Experiments on Processing Reflexives.

Using the cross-modal paradigm lexical decision task, Nicol (1988) investigated the processing of a coreferential relationship involving two overt partners, i.e. an anaphor and its antecedent in such sentences as follows.

(47) The boxer told the skier that the doctor for the team would blame himself #
for the recent injury.

The probe was timed to occur at the offset of the reflexive “himself” (marked by #). All the potential antecedents in the sentence (“doctor”, “skier”, and “boxer”) were probed, using associated and non-associated targets as described above. The results showed that only the grammatically correct antecedent “doctor” exhibited significant priming of its associate target (see data in (49) below). However, because “doctor” is the nearest NP to the reflexive, it is possible that the priming effect obtained in the experiment just reflected the residual activation of “doctor”, or some non-grammatical “minimal distance” strategy. In order to rule out these

alternative explanations, the experiment also tested sentences containing a pronoun in place of the anaphor, such as follows.

(48) The boxer told the skier that the doctor for the team would blame him# for the recent injury.

As for (47), all three potential referents were tested for (48). Note here that “boxer” and “skier” are grammatically acceptable antecedents for the pronoun, but “doctor” is ruled out by Principle B of the binding theory: a pronoun must not be bound in its governing category. Following is the table of results for each potential referent within both sentence types.

(49) Priming scores (lexical decision RTs in msec to nonassociated targets minus RTs to associate targets for each referent) at each probe point.

Referent	Anaphor	Pronoun
boxer	-1	43*
skier	11	58*
doctor	104*	-21

*p<.05

For the pronoun, there is no significant priming for the grammatically illicit “doctor”, but there is significant priming for both legitimate antecedents, “boxer” and “skier”. The priming pattern obtained for both types of sentence suggests that processing the overt anaphor and the pronoun involves reactivation of their

antecedents, presumably in order to coindex them. Furthermore, there is a good reason to believe that this processing reflects a close knowledge of the grammar, because the observed reactivation pattern is compatible with syntactic constraints (Binding conditions A and B in GB theory, see previous chapter).

The results of experiments using the cross-modal paradigm on WH-trace, overt anaphor and pronouns constructions are compatible with the claim that in language comprehension, there is a parallelism between the processing of coreferential relationships involving empty NPs and those involving overt NPs. The parallelism is instantiated, first of all, in the fact that both empty NP and overt NP involved in a coreferential relationship trigger the reactivation of their antecedent during on-line computation; and secondly, in the fact that both types of reactivation are subject to the relevant syntactic constraints. These results also give confidence in the reliability of the cross-modal paradigm as an experimental technique to investigate coreferential relationships in sentence processing.

The finding that WH-trace triggers the reactivation of its antecedent has been replicated in a number of experiments. For example Nicol (1988) tested the reactivation pattern in sentences such as follows:

(50) That's the actress that the dentist from the new medical center in town had
planned/invited # to go to the party.

In both types of sentence, there was significant priming by “actress” at a position immediately following the embedded verb, indicating that a WH-trace was postulated after the verb. In the sentence containing “plan”, a verb which optionally takes a NP complement, the reactivation occurred despite the fact that “plan the actress” is not semantically coherent. This result is of interest because this reactivation pattern indicates that the processor was guessing a gap immediately following the verb in on-line processing, as the “Active Filler Hypothesis” predicts, regardless of semantic considerations.

Further support for the finding that WH-trace triggers the reactivation of its antecedent was provided by Garnsey, Tanenhaus, and Chapman’s research (1988). They measured evoked brain potentials during the controlled serial visual presentation of sentences containing relative clauses. Taking advantage of the fact that the implausibility of a word in context results in a particular electroencephalography (EEG) pattern, referred to as “N400”, they designed sentence pairs containing an item that was either contextually plausible or implausible as the antecedent of WH-trace. An example is the following sentence pair.

- (51) a. The mother found out which book_i the child read t_i in school.
 b. The mother found out which food_i the child read t_i in school.

They also created pairs of control sentences that did not contain a trace. For example:

- (52) a. The mother found out whether the child read the book in school.
 b. The mother found out whether the child read the food in school.

The researchers predicted that the appearance of the contextually implausible object, “food”, should give rise to N400, whereas the plausible object, “book”, should not. So N400 should only occur in the (b) sentence in (52), and also in the (b) sentence in (51) if the antecedent of the WH-trace is reactivated immediately after the verb. The EEG data showed that N400 occurred immediately following the verb “read” in (51b), and after “food” in (52b), but not at the comparable positions in the sentences containing plausible objects, (51a) and (52a). Thus, this study provides additional evidence, using a different methodology, that Wh-trace does reactivate its antecedent.

As noted above, even clear experimental findings such as these cannot provide decisive evidence for WH-trace as a syntactic entity, but they do show convincingly that the processor computes a syntactic/semantic dependency between the antecedent phrase and the position where GB theory posits a trace, i.e. the position of the “gap” (a “missing” constituent), which must be present in the sentence and which determines the theta role of the antecedent. Thus, WH-

dependencies are psychologically real. However, the significance of this finding is limited in its linguistic import, because WH-dependencies are assumed by both GB theory and nontransformational theories such as HPSG, though the former accounts for WH-dependencies with a movement mechanism and latter does not (see previous chapter). Therefore, further experiments were designed to extend investigation to other kinds of putative ECs, such as NP-trace and PRO, which GB theory posits but HPSG does not. These experiments were intended to evaluate linguistic theories by finding out whether there is evidence, in the form of antecedent reactivation, for the existence of NP-trace and PRO.

3.3. Experiments on Processing NP-trace

McElree and Bever (1989) conducted an experiment using a probe recognition task. (See also MacDonald's (1989) sentence processing experiment on NP-trace.) Subjects were asked to read sentences presented visually in "chunks" of a few words at a time on a CRT display. At the end of each sentence, a probe word appeared on the screen and the subject made a decision as to whether that word had been in the sentence. Sentences such as follows were investigated.

(53) (i) The shrewd lawyer_i who argued for the defense was suspected _{ti} by the judge.

(ii) The shrewd lawyer who argued for the defense had spoken to the judge.

(53i) is a passive sentence containing a NP-trace and (53ii) is the control sentence containing no empty category.⁵ At the end of each of these sentences, the word "shrewd " was probed. The subjects were asked to tell whether the word was in the sentence and their response time was measured. The experimenters' assumption is that if a referentially dependent element causes reactivation of the antecedent phrase in the course of processing the sentence, the end-of-sentence recognition of the antecedent phrase (or a word drawn from it) would be facilitated so that the reaction time will be speeded. The result they obtained was as predicted on the assumption that NP-trace activates its antecedent: response time to the probe following sentences like (53i) was significantly faster than that to the probe following constructions like (53ii).

In another experiment (Bever and McElree, 1988), sentences such as the following pair were tested.

⁵ In their experiment, other structures containing NP-trace, such as a raising structure, were also tested. Only the passive structure is discussed here because (a) the the passive structure is the focus of the experiments to be reported here; (b) it is the most representative of the structures containing NP-trace, which has been tested most often in the experiments on processing NP-trace.

(54) (i) The astute lawyer_i who faced the female judge was suspected _{ti} constantly.

(ii) The astute lawyer who faced the female judge was suspicious constantly.

Here a passive construction is compared with a closely similar adjectival construction with no trace. The probe word, as before, was an adjective that appeared in the antecedent NP, in this case “astute”. The results showed that probe recognition was faster following the passive sentence than following the adjectival sentence. The experimenters concluded that NP-trace in a passive structure reactivates its antecedent just as WH-trace does and an overt anaphor does. The experimenters presented this result as evidence in favor of the existence of NP-trace as postulated by GB theory.

However, Nicol (1988) provided evidence that in the cross-modal paradigm the pattern of reactivation of the antecedent by NP-trace is different from what has been found for WH-trace. She cited an experiment by Osterhout (subsequently published as Osterhout, 1993) using a cross-modal lexical decision paradigm, which tested passive sentences using an associate of the head noun of the antecedent NP as the associate target. For example, the target was an associate of “dentist” in the following experimental sentence.

(55) The dentist from the new medical center in town was invited t# by the
act#ress to# go to the party.

The target was presented at one of three points: just after the verb "invited", which is the NP-trace position, and at two other positions 500 msec. and 1000 msec. downstream from that point. Priming for the antecedent at the NP-trace position or the following position did not reach significance; significant priming was obtained for the associate target only at the probe position 1000 msec after the trace position. This contrasts with the immediate antecedent reactivation observed in the cross modal priming paradigm for WH-trace and overt reflexives. This discrepancy between the results for NP-trace and the results for WH-trace and overt anaphors, in cross modal priming experiments raises the question of whether a coreference relationship is or is not established on-line in processing the sentences containing NP-trace.

3.4. Explaining the Variable Results for NP-trace

As the above review has shown, in previous sentence processing experiments on English there have been inconsistent reports on the processing of NP-trace, compared to quite consistent reports on WH-trace. To understand why, we need to determine what factors affect the NP-trace results. Though there have been too

few experiments so far for this to be more than speculation, we may point to differences in the experimental methods (see Fodor, 1991). In post-sentence probe recognition experiments, quite strong effects for NP-trace have been reported, whereas in the cross-modal priming experiment of Osterhout (1993), only a delayed effect for NP-trace was obtained. Within the cross-modal paradigm, results for WH-trace are stronger than for NP-trace. For the visual probe recognition paradigm no comparison between empty categories can be made since WH-trace has not been tested.

Let us consider first the within-paradigm difference between NP-trace and WH-trace with cross-modal priming. If a provisional assumption were made that NP-trace does exist and does reactivate its antecedent as WH-trace does, how is the difference in the time course of reactivation to be accounted for? Nicol (1988) suggested that the lag in priming in processing NP-trace constructions may be attributed to temporary structural ambiguities in the English passive sentences. As noted in Chapter 1, in English, the word string that constitutes a passive construction is often confusable with that of an adjectival construction followed by a temporal or locative prepositional phrase. For example,

(56) (i) The runner_i was worn out t_i by the strenuous training.

(ii) The runner was worn out by the tenth mile.

Nicol pointed out that the word string in an example like (56 (i)) does not unambiguously cue the processor that it is processing a passive sentence, and hence that a trace should be created immediately following the verb. The processor has no way to determine on-line whether “the runner” has been moved from a different underlying position. It also cannot tell whether “worn out” is a verb or a deverbal adjective, yet this grammatical category information is important to the processor in deciding whether the sentence contains a trace. Even when processing the prepositional phrase following the trace position, the processor cannot confidently establish the agentive reading of “by” until it rules out the temporal or locative reading of the “by” phrase on semantic grounds.⁶ Nicol concluded that this double ambiguity in the passive verb and in the agentive preposition, may make it unclear on-line that a sentence is actually passive, and that the subject is involved in a coreferential relationship with NP-trace.

In some instances of the passive construction, disambiguation can take place at the verb position, for example:

(57) (i) The door was opened by John.

⁶ This could happen as late as at the end of the sentence. For example, in (56) the processor could not disambiguate even at the position of “tenth”, because it could be “the tenth coach”. (In fact, (61ii) is fully ambiguous between adjective and verbal passive. It can mean that the runner had become worn out at the time of running the tenth mile, or that the tenth mile was particularly grueling (e.g. uphill) and wore out the runner.)

(ii) The door was open by 10 o'clock.

In (57), the processor will be cued by the morphological difference between the passive verb and the adjective. Other unambiguous examples include those whose verb has no deverbal adjective counterpart, e.g. "hit". However, even in these cases, the English passive sentence still has some disadvantages for processing. Recall that in constructions containing WH-trace, the antecedent in non-argument position has been shown to trigger the Active Filler Strategy in the processor, which will predict the presence of a trace at the earliest possible position in the sentence and so will be ready to process the trace as soon as it occurs. In a passive construction containing NP-trace, the antecedent is in an argument position and will not be recognizable as a filler, so it will not activate the Active Filler Strategy. According to the Minimal Chain Principle (de Vincenzi, 1993), the parser will first analyze the subject NP as a non-moved element. Thus no trace will be anticipated. At the point at which disambiguation takes place, the processor will need to revise this analysis. This creates extra processing load. Also, because the trace in a passive sentence is immediately following the verb, the processor has no time to predict it in advance, and so would need some time to create it and co-index it once its existence has been established. For these reasons, the co-indexing of an NP-trace with its antecedent could be delayed. Thus the

experimental data showing weaker effects for NP-trace than for WH-trace could be accounted for without challenging the linguistic status of NP-trace.

Fodor (1991), on the other hand, put forward a different hypothesis to explain the conflicting different results for NP-trace between the cross-modal priming experiments and the sentence-final probe recognition task. It is proposed that the two tasks are sensitive to different linguistic levels: the probe recognition task reflects semantic (or LF) processing, while cross-modal priming effects reflect primarily syntactic structure processing. This suggestion is supported by the following considerations. The probe task elicits the processor's response only after sentence processing has been completed, when the sentence is stored in short term memory and represented primarily in terms of its semantic content, while the cross-modal task coincides with the processor's construction of a syntactic representation for the sentence. Fodor proposed therefore that the probe recognition results do not reflect the presence of NP-trace in syntactic structure, but only the fact that the passive sentence has been accurately comprehended by the processing system. This is compatible with any linguistic analysis of the passive construction, with or without an empty category in the syntax. By contrast, the consistent rapid effects of WH-trace in the on-line cross-modal task suggests that WH-dependencies do exist in syntactic structure.

Based on this hypothesis, it is possible to make the following summary of the previous experiments on WH-trace and NP-trace in English. First, some sentence processing studies (e.g. Swinney et al, 1988; Nicol et al , 1989; however, see also McKoon, Racliff and Ward 1994) have found what appears to be evidence for the psychological reality of WH-trace during the course of a processing routine in which the syntactic representation of a sentence is being constructed, but the comparable effect for NP-trace is apparently delayed. Secondly, some sentence processing studies (e.g. Bever and McElree, 1989) have found what appears to be evidence for the psychological reality of NP-trace but only in the course of a processing routine in which the whole sentence, stored in short term memory, is being mentally searched. It seems reasonable to suggest that the latter results are not evidence of NP-trace in syntax but are really effects at the semantic level only. Even the apparent evidence for NP-trace in Osterhout's cross-modal priming experiment (1993) is more compatible with this suggestion, because no significant priming for NP-trace was obtained until approximately 1 second after the trace position. According to Fodor's hypothesis, the relevant part of the sentence could be undergoing semantic level processing at that time. Secondly, there has been experimental evidence (Boland, 1993) that the cross-modal lexical decision task, as used by Osterhout, is sensitive to semantic as well as syntactic processing.

Boland (1993) conducted several experiments to compare the cross-modal lexical decision task with the cross-modal naming task. She found that the lexical decision task was sensitive to both syntactic and semantic incongruity, while the naming task was sensitive only to syntactic incongruity. Based on these results, Boland concluded that the syntactic representation of a sentence is most influential in the naming task, while syntactic and semantic representations both influence lexical decision performance.

In summary, two facts are clear: (a) At this stage of psycholinguistic studies, there is no clear evidence to prove that NP-trace is created as a constituent in the syntactic representation assigned by the processor to a passive sentence, although there is evidence that passive sentences are appropriately interpreted on-line. (b) Because of the properties of the English passive construction, which create a garden path in processing that may mask any priming effects, it will be very difficult if not impossible to answer the question whether NP-trace appears in the sentence structures computed by the human sentence processor, by conducting sentence processing experiments on English sentences. It is clearly important to evaluate the two proposed explanations of the weak results for NP-trace, since they have such different implications for the linguistic status of NP-trace. Nicol's temporary ambiguity explanation implies that NP-trace does exist in syntactic

structures (but fails to reveal itself on-line). Fodor's linguistic level explanation implies that NP-trace does not exist in syntactic structures (though the thematic roles of NPs in passive sentences are computed correctly once they are disambiguated. The research project on Chinese passive sentence with "bei", which is presented in detail in the following chapters, is designed to distinguish these two hypotheses.

CHAPTER 4

EXPERIMENT I: PROCESSING NP-TRACE AND REFLEXIVES IN CHINESE

4.1. Purpose

The linguistic concern that informs this sentence processing project is whether or not NP-trace exists in mental representations of syntactic structures. It is proposed that experimental observation of the processing of unambiguous “bei” passive sentences in Chinese could provide some clear evidence for or against the psychological reality of NP-trace. To illustrate in detail the non-ambiguity of Chinese “bei” passive sentences, as contrasted to the ambiguity of English passive sentences (cf. 56), let us first take a look at the GB analysis of Chinese passive sentences with a “bei” phrase. For example:

(58) Zhangsan bei Lisi da le

Zhangsan Pass. Lisi hit Asp.

‘Zhangsan was hit by Lisi.’

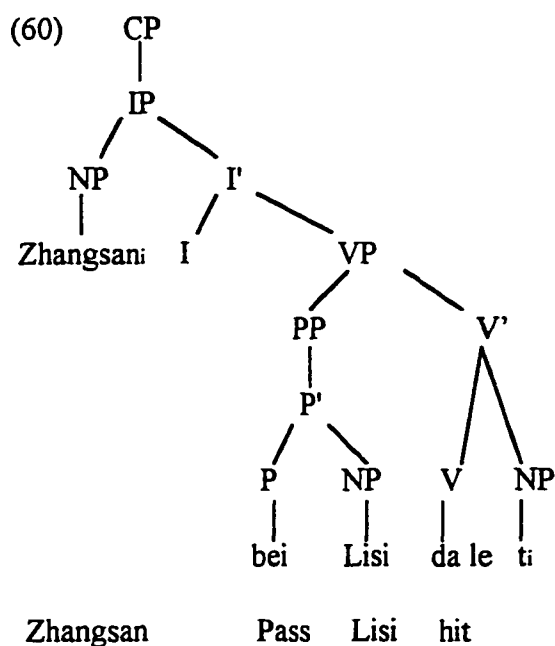
For convenience and uniformity, GB theory terminology will be employed throughout the thesis in discussing the syntactic analysis of Chinese, just as

previously in the discussion of English and Chinese facts.⁷

According to Huang (1982, 1987), (58) is generated just like its English counterpart. At D-structure, (58) is generated as (59):

(59) e bei Lisi da le Zhangsan

Then (59) maps onto (60) through the transformational rule *Move- α* .



⁷ However, we take no position here as to whether this is the optimal grammatical analysis of the language facts under discussion. If the experimental results indicate that NP-trace does not exist, either GB theory is incorrect or there is no transparent relation between the competence grammar and performance processes.

The transformational rule *Move- α* moves the post-verbal NP into subject position, leaving a phonologically empty trace "t" at the former site, which is coindexed with the moved overt NP in LF. The "short passive" in Chinese must contain the preposition "bei"⁸, even though there is no overt agent NP. For example:

(61) a. Zhangsan bei da le.

Zhangsan Pass hit Asp.

'Zhangsan has been hit.'

b. *Zhangsan da le.

Zhangsan hit

'Zhangsan hit.'

For purposes of investigating NP-trace in language comprehension, Chinese passive sentences as exemplified in (60) have several structural advantages as compared to their English counterparts. One is that the passive preposition "bei", whether it occurs alone (61) or with a following agent NP (58), has only one reading, i.e., an agentive reading. Moreover, the passive verb is not ambiguous between a verb and a deverbal adjective as it is in English. So in Chinese sentence processing, once the passive preposition "bei" is processed, the processor is able to

⁸ There is no agreement on what part of speech the word "bei" should be. Different labels have been used for it, e.g., "preposition", "coverb", and "passive particle" etc.. For consistency, this thesis adopts the "preposition" analysis in accordance with Huang (1982).

anticipate a passive structure. Finally, the agent NP, if present, precedes the verb, and the following NP-trace, so between the passive preposition “bei” and the trace, any number of words can be added, as a modifier phrase in the agent NP, or as adverbial phrase modifying the verb. For example:

(62) Zhangsan_i bei shenchai gaodaqiangzhuang de Lisi zai xuexiaoli

Zhangsan Pass body tall and strong Poss. Lisi in school

da le ti.

hit Asp

‘Zhangsan was hit by Lisi who is tall and strong in school.’

These structural features of Chinese passive sentences with “bei” are very important to the testing of hypotheses about sentence processing. As has been discussed in the last chapter, some possible psychological evidence has been found for the existence of NP-trace, but only with a task or a time delay which suggests that syntactic processing is over, and the processor is engaged in semantic interpretation. (cf. Fodor’s explanation of the results reported by Bever and McElree, 1988, and Osterhout, 1993). Because of the temporary structural ambiguities in the processing of English passive sentences (listed in section 3.4.) the processor cannot predict an upcoming NP-trace as it can in the case of processing of WH-trace.

However, these disadvantages do not exist in the structure of Chinese passive sentences with “bei”. While processing Chinese “bei” passive sentences, the processor can identify the passive structure immediately upon processing the passive preposition “bei”. Prior to this, it may have assumed that the subject NP has its canonical role, i.e. agent. But on processing “bei”, the processor will be able to reassign the θ -role immediately. And because the agentive “bei” phrase precedes the verb and has no ambiguity, the reassignment of the θ -role should take place prior to processing the verb, so it can take place earlier than in English passive sentences. If NP-trace exists and the processor is equipped with the relevant information about it, it then will be able to identify the passive subject NP as the antecedent of an NP-trace immediately following the verb. So the parser can actively look out for the NP-trace, as in the case of WH-trace. The processor can even build in advance the structure of the passive VP with the trace in object position. Moreover, since constituents of any length can be inserted between “bei” and the verb and trace, the processor can be given ample time to build this structure before it receives the verb. So in on-line syntactic processing of Chinese “bei” passives containing a long agent NP, the parser should have enough time to predict an upcoming NP-trace and so to process the trace without undue effort.

Nicol's concern about the difficulty of NP-trace processing in English therefore does not apply to these Chinese constructions.

Based on the above analysis and relevant hypotheses, it can be concluded that NP-trace, if there is any, will speedily reactivate its antecedent in syntactic level processing of Chinese "bei" passives so that this reactivation should be observable using an on-line experimental technique, e.g., cross-modal naming or lexical decision. The reactivation pattern obtained from either of these two tasks should be compatible with those that have been obtained in previous experiments on the processing of WH-trace and reflexives in English. It is for this reason that Chinese "bei" passives were used as the primary experimental sentences in the project described here.

One previous processing experiment on the time course of sentence comprehension in Chinese should be mentioned here. It is not an experiment on ECs in Chinese, but it has a direct bearing on this experiment. Li (1994) conducted a sentence processing experiment using a sentence gating task to investigate the time course of sentence comprehension in Chinese. He experimented with three types of sentence: simple sentences, "ba" sentences⁹.

⁹ In Chinese, the preposition "ba" appears in the same position as "bei" does. The difference between "ba" and "bei" is that a "ba" sentence is always an active one. The NP following "ba" is always the object.

"bei" sentences, and The results suggested that listeners are able to identify the meaning of a sentence before they hear the complete acoustic-phonetic information. Adapting the gating method that was initially used for word-level processing research, the experiment presented subjects with spoken sentences gated into smaller fragments. Subjects heard increasingly longer fragments until the whole sentence was presented. For example, if the sentence were "Xiaogou chidiao xiaoya" (little dog eats duckling), subjects would hear the following segments in sequence "xiaogou" (little dog), "xiaogou chidiao" (little dog eats) and finally "xiaogou chidiao xiaoya" (little dog eats duckling). Each time subjects were required to point out the agent of the sentence by making a decision on two pictures (showing, in this case, a small dog and a duckling respectively) presented on the computer screen simultaneously with the audio input. The experiment also systematically manipulated word order as an independent variable in addition to the three types of experimental sentence, i.e., (simple, "ba", and "bei"). The three types of experimental sentence were each presented in three different word orders, i.e., NNV, NVN, and VNN. But for sentences with "bei" or "ba", the preposition "bei" or "ba" was randomly generated by the computer at any position prior to an NP in the three word orders, giving more variations for the "bei" and "ba" sentences than for the simple sentence. For example, the sentence "xiaoya bei

xiaogou chidiao" (The duckling was eaten by the little dog) was presented in different word orders such as follows.

(63) (i) NP bei NP V

(ii) bei NP NP V

(iii) V NP bei NP

Following are some examples of the experimental sentences.

(64) (i) Simple sentence

NVN: xiaogou chidiao xiaoya.

little dog eat duckling

'The little dog eats the duckling.'

NNV: xiaogou xiaoya chidiao.

little dog duckling eat

'The little dog, the duckling eats.'

(ii) "ba" sentence

NbaNV: xiaogou ba xiaoya chidiao.

little dog Act. duckling eat

'The little dog eats the duckling.'

?* baNNV: ba xiaogou xiaoya chidiao.¹⁰

little dog duckling eat

‘The duckling eats the little dog.’

(iii) “bei” sentence

NbeiNV: xiaogou bei xiaoya chidiao.

little dog Pass. duckling eat

‘The little dog is eaten by the duckling.’

?*beiNNV: bei xiaogou xiaoya chidiao.

Pass little dog duckling eat

‘The duckling is eaten by the little dog.’

The results of the experiment showed that subjects' comprehension of the sentences was facilitated by structural cues such as word order and markers like "ba" (active marker) and "bei" (passive marker). One of Li's conclusions based on the results of the experiment is particularly related to this project. That is, he found that "bei" sentences elicited the fastest response from the subjects. This is

¹⁰ The mark ?* is added by the present writer, because, as the real sentences illustrate, these are not well-formed Chinese sentences. The design of the experiment was to determine how the structural cues facilitate the comprehension of the sentence. (The subjects were asked to identify the agent of the action rather than the meaning of the whole sentence.) Grammatical word order was treated as one of the possible cues, and was contrasted with ungrammatical word order.

compatible with the outcome of another Chinese sentence processing experiment (Li, Bates, and MacWhinney, 1993), which employed the same technique to experiment on Chinese “bei” and “ba” sentences. The earlier the passive marker was given, e.g. at the beginning of the sentence, the quicker the response. Li concluded that this is because “bei” has a uniform function of passivizing the sentences, so that it uniformly facilitates the comprehension process. In fact, the sentences with early “bei” have the earliest disambiguation of the agent role, which is what subjects had to identify in their response. Li's conclusion about “bei” sentences confirms the assumption needed to motivate the present experiment, i.e. as soon as the processor has parsed “bei”, it immediately makes a decision about the sentence structure and the role of the NPs.

4.2. Method

4.2.1. Materials and Design

As has been shown in the above section, Chinese passive sentences with “bei” are more suitable than their English counterparts for the experimental observation of antecedent activation of NP-trace in syntactic processing. So this sentence type is included as the primary experimental sentence. It is expected that

this sentence type will provide clear evidence, either positive or negative, concerning the psychological reality of NP-trace.

Besides the “bei” passives, Experiment I also included three other types of experimental sentences. They are passive sentences with “shi”, sentences with copular “shi”, and sentences with overt long-distance anaphors. The purpose of including another passive sentence type, i.e., “shi” passives was to make a within language comparison of an unambiguous passive structure, i.e., “bei” passives, with an ambiguous one, i.e., “shi” passive. In Chinese, “shi” passives are structurally similar to “bei” passives. For example,

(65) Zhangsan shi Lisi dade.

Zhangsan Pass. Lisi hit

‘It is by Lisi Zhangsan was hit.’

However, they are temporarily ambiguous on-line, because, “shi” is a homonym of the copula “shi”.

(66) Zhangsan shi Lisi de pengyou.

Zhangsan is Lisi Poss. friend

‘Zhangsan is Lisi’s friend.’

This can be expected to make a difference to the processor when it is processing a “shi” passive, as compared to a “bei” passive. In processing a “bei” passive the

processor can identify the passive structure at the point when “bei” is processed, whereas in processing a “shi” passive, the processor is not able to identify the passive structure at the point when “shi” is processed, because the word string might instead be a sentence with “shi” as a copula, as in (66). So this “shi” passive in Chinese exhibits an ambiguity very similar to that of English passive sentences. The disambiguation as a passive does not occur until the main verb is processed, which is the point at which the NP-trace needs to be postulated. It seems likely that the copula analysis will be favored by the processor because it is more common, and because it does not require construction of a syntactic chain (the Minimal Chain Principle; see Chapter 3). So the passive construction will require revision of the initial parse. In short, the “shi” passive construction is expected to exhibit a “garden path” effect, because the processor may first assign it a non-passive analysis, i.e., assigning an agent role to the surface subject, and later when the verb is processed, it has to revise that syntactical representation, and co-index the surface subject with NP-trace in object position. Therefore, “shi” passives are expected to present parsing problems comparable to those of English passives. If Nicol’s explanation for the lack of robust antecedent reactivation effects in on-line tasks on English passive is correct, then only weak effects should be observed in the “shi” passives also, in contrast to the unambiguous “bei” passives.

Specifically, the following predictions are made. If NP-trace does exist at the level of syntactic processing, and does reactivate its antecedent on-line, then this reactivation should be observable in the “bei” sentences in this experiment. This would suggest that the processing difficulty account of why on-line NP-trace effects are weak relative to WH-trace effects in English is correct. This conclusion would be further supported if “shi” passives (65) showed a significantly less robust cross-modal priming reactivation effect than “bei” passives (58). By contrast, the hypothesis that NP-trace does not exist would be supported if neither “bei” nor “shi” passives shows a strong antecedent reactivation effect. The “shi” passives might well be more difficult to process than “bei” passives, due to the on-line thematic ambiguity, but the design of the experiment permits reactivation to be distinguished from processing load (see page 80-89).

In addition to the “shi” passive sentence, the “shi” copular sentence, as in (73) is also included in Experiment I. The purpose of doing so is to use it as the baseline for both passive structures. Since it is not a sentence containing any empty categories involved in a binding relationship, there should be no difference in response time between the associated and non-associated target word, for there should not be any reactivation of an antecedent in either case so that the subjects’ response would not be facilitated. If any response time difference is in fact

observed, it must be due to some artifact of the experimental situation. Including the “shi” copula sentence is thus a safeguard to ensure that results for the other sentence types can be securely interpreted as due to antecedent reaction.

An experiment testing just these sentences (“bei” passive, “shi” passive, and “shi” copular construction) would suffer from the problem that a null result might be obtained. The “shi” passive and “shi” copula sentences were not expected to show an antecedent activation effect. Whether or not the “bei” passive will do so is an open question, with predictions differing for different linguistic theories. If the result failed to show any significant priming for all three types of sentence, the possibility would arise that the failure was due to experimental insensitivity. The reliability of the cross-modal priming paradigm has been challenged (Mckoon, Ratcliff, and Ward, 1994), though also defended (Nicol, Fodor and Swinney, 1994). But a null result is always a possibility (because of mere insensitivity of cross-modal priming to all antecedent reactivation in Chinese for whatever reason) and must be guarded against. It is because of this concern that sentences containing the overt “long-distance” anaphor “ziji”, were included. This should presumably show antecedent reactivation just as overt anaphors and pronouns do in English (see Chapter 3). A full structural analysis of these 4 types of experimental sentences will be presented in the next section.

4.2.2. The Analysis of Materials

Chinese is a less studied language, compared to most of the Indo-European languages. The formal analysis of Chinese is full of controversies. There is no settled opinion on the analysis of many structures including the “bei” passive, e.g. what is the part of speech of “bei”? Therefore before presenting the real experimental materials, a discussion of the syntactic analysis of these sentence types is in order.

(1) “bei” passives

The analysis of “bei” passives has been presented in detail in the section above. What is worthy of remark here is another important feature of Chinese passive sentences: that is, in Chinese, passives can be constructed by the use of elements other than “bei” and “shi”, though the former is the most commonly used for passivization in Mandarin, the standard variety of Chinese. For example, there are also passives formed with “rang” and “jiao”. The use of these elements may affect the shade of meaning of the passivization. Although these constructions are rarely mentioned in formal studies of Chinese syntax (in the United States), they are listed in traditional pedagogical Chinese grammar books and have been studied

in China (Chu, 1982, Ren, 1981, Chang, 1981 among others).¹¹ Among them, the forms with “rang” and “jiao” can be used interchangeably with “bei” forms in conversation and writing.

(67) (i) Zhangsan rang Lisi da le.

Zhangsan Pass. Lisi hit Asp.

‘Zhangsan was hit by Lisi.’

(ii) Zhangsan jiao Lisi da le.

Zhangsan Pass. Lisi hit Asp.

‘Zhangsan was hit by Lisi.’

(67) (i) and (ii) have exactly the same meaning and structure as (58), except that the use of “rang” in (67) (i) and “jiao” in (67) (ii) has a dialectal color. But passive sentences with “shi” show more difference from the “bei” passives, as we will see below.

(2) “shi” passives

The “shi” passive structure is no less commonly used than the “bei” one in both speech and writing. Although the former looks similar to the latter, it shows minor differences from the latter both in meaning and structure. Structurally, “shi”

¹¹ There are still more passive expressions in Chinese. But there is insufficient space for an exhaustive exploration of the topic.

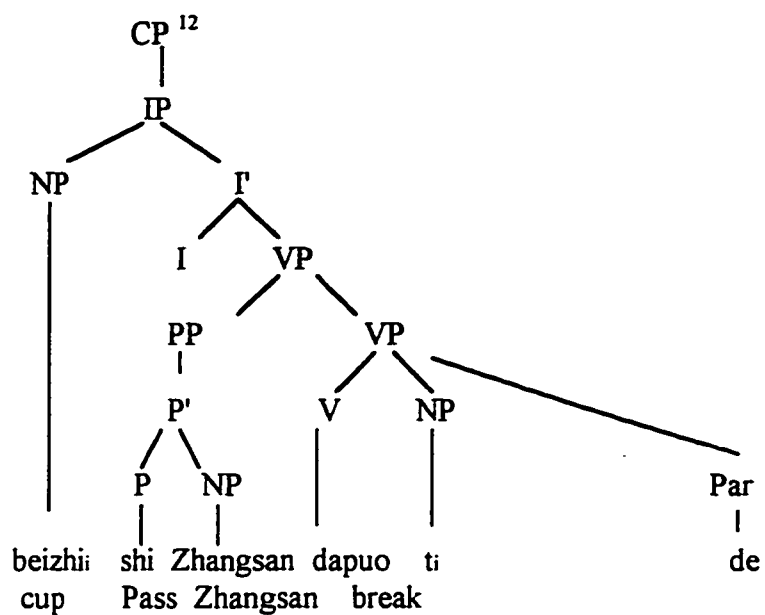
passives use a particle “de” at the sentence final position instead of “le”, a tense/aspect marker, which the “bei” passives end with. Semantically, it is slightly different in the shade of meaning. Comparing the following examples allows us see the difference between the two.

(68) beizhi shi Zhangsan dapuo de
 cup Pass. Zhangsan break Modal
 ‘It was by Zhangsan that the cup was broken.’

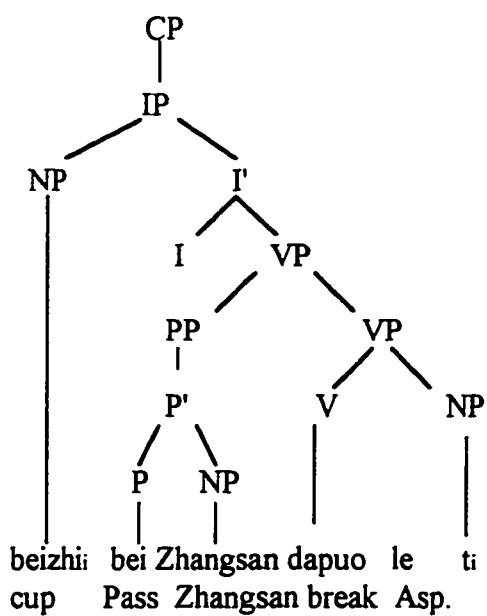
(69) beizhi bei Zhangsan dapuo le.
 cup Pass Zhangsan break Asp
 ‘The cup has been broken by Zhangsan.’

The difference in the shade of meaning between the (68) and (69) is that the “bei” construction (69) is a plain statement telling a fact, while the “shi” construction (68) emphasizes the agent of the action. The English translation of (68) given here is an attempt to reflect this fact. “beizhi” is not the subject in either (68) or (69). The structural difference between the two is that “shi” passives always end with “de”, and “bei” passives always end with “le” (cf. 60). The following analysis will illustrate this difference in detail.

(70)



(71)



¹² Putting "shi" under P is just to indicate that it should be treated like "bei" as a preposition. This will be further discussed later.

Unlike the “bei” passive structure, the “shi” passive has hardly been mentioned in the formal studies of Chinese. So controversies may arise in the analysis of “shi” passives as in that of other Chinese structures. Questions may be raised about the analysis in (70), such as: why is “shi”, which is also a copula, in the same category as “bei” ? what is “de” and why does it appears in sentence final position? etc. In order to explain why (70) is the right analysis of (68), some additional syntactic argument is needed here.

Let us start with “de”. “de” is a particle of multiple uses. Generally it is a possessive or adjective marker used with pronouns and adjectives. For example:

(72) (i) wo de beizhi

my cup

(ii) yuan de beizhi

round cup

But “de” can also serve as a sentence final particle, as is illustrated in (73) and (74)

(73) Zhangsan ziji lai de.

Zhangsan self come Par

‘Zhangsan came by himself.’

(74) ni bu pen, hua buhui diao xialai de.

you not touch picture won’t fall downward Par.

‘If you don’t touch it, the picture won’t fall.’

This sentence final particle “de” can be used together with “shi”, which emphasizes the part that follows it. For example, in (75) there is emphasis on the verb phrase “wanted to go to school”.

(75) Zhangsan benlai shi yao dao xuexiao qu de.

Zhangsan originally want go school to Par.

‘Originally Zhangsan wanted to go to school.’

Because this collocation of "shi" and "de" is commonly used, it is listed as a fixed "shi...de" structure in Chinese grammar. However, at the same time, “shi” is also a copula. For example:

(76) Zhangsan benlai shi xuexiao de jiaoshi.

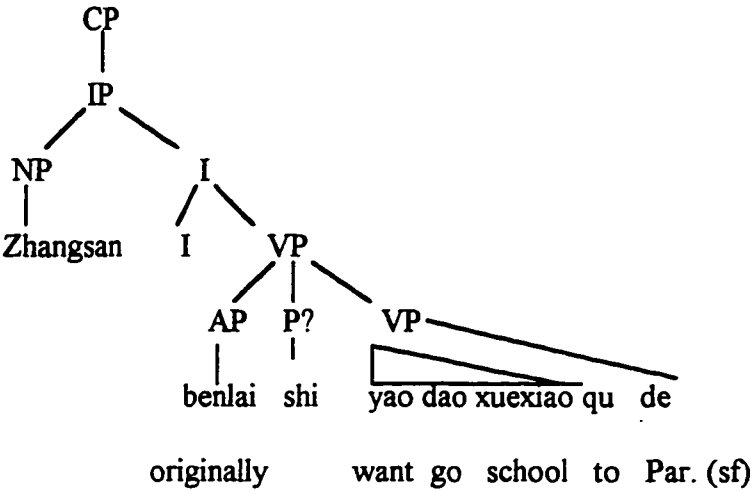
Zhangsan originally was school Poss. teacher

‘Originally Zhangsan was a teacher in the school.’

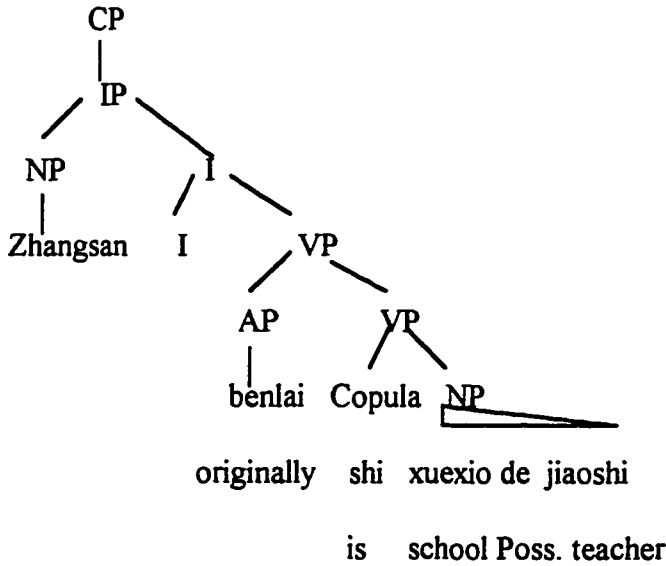
The fact that in Chinese "shi" is also a copula gives rise to the following question:

Is "shi" in (75) the same word as in (76)? The answer is negative. They are homophones but are different words. While “shi” in (76) is a copula, “shi” in (75) is only a preposition/adverb like element, which has the function of emphasizing. Further analysis of (75) and (76) can show this difference.

(77)



(78)



If “shi” in (77) is a copula, the analysis is both semantically implausible and structurally problematic. It is semantically implausible, because (77) does not have

the meaning of an ordinary copulative sentence; it is neither equative, nor does it indicate class inclusion, as ordinary copulative sentences usually do. It is structurally problematic, because the verb phrase cannot be headed both by a copula and a verb. “P?” in (77) indicates that the syntactic category of “shi” is still an open question. Huang (1982) discussed this use of “shi” in a similar sentence:

(79) wo shi mingtian yao mai neiben shu.

I tomorrow want buy that book

“It is tomorrow that I want to buy that book.”

Huang maintains that when “shi” occurs as an emphasizer, it is just a phonetic spellout of the diacritic feature (+focus). He suggested treating it as a focus operator having the status of an adverb on a par with negation and modals.

What we have discussed about “shi” and “de” so far has indicated that “shi” is not necessarily a copula and “de” is not necessarily a possessive marker. Now let us go back to the analysis of “shi” passives as shown in (70). Some linguists might argue that “shi” in (70) is a copula introducing a headless predicate nominal, meaning in effect: “The cup was the one broken by Zhangsan.” If this is true, it has important implications for experiment I, since there would be no NP-trace following the main verb (“dapuo”) in (70). (in fact, there would presumably be a WH-trace in the putative subordinate clause. But there is evidence that this is not

a correct analysis. For example, idiom analysis will discredit the copula analysis easily. In Chinese there is an idiom: “chu fengtou”, which is the counterpart of “show off” or “to get the limelight” in English, but its literal translation is “send out wind”. The following examples are commonly used sentences with the idiom.

(80) shiqin shi wo zhuo de, fengtou shi Lisi chu de.

things I do wind Lisi send out

‘It was by me things were done, but it was by Lisi the limelight was got.’

(81) shiqin shi wo zhuo de, fengtou bei Lisi chu le.

things I do wind Lisi send out

‘It was by me things were done, but the limelight was got by Lisi.’

If “shi” in (80) is a copula, the sentence would mean in effect: “things are things I did, wind is wind Lisi sent out”, which does not make any sense. The clauses of (80) parallel the structure of (70) above, so it is reasonable to conclude that “shi” in (70) is also not a copula.

There are many other such examples. For instance, the idiom “tong mafengwuo” which is the counterpart of “making trouble”, has the literal translation “poke a wasp hive”. The following sentences made with this idiom are commonly used sentences.

(82) baogao shi Lisi xie de, mafengwuo shi Lisi tong de.

report Lisi write wasp hive Lisi poke

‘It was by Lisi the report was written and it was by Lisi the trouble was made.’

(83) baogao shi Lisi xie de, mafengwuo bei Lisi tong le.

report Lisi write wasp hive Lisi poke

‘It was by Lisi the report was written and the trouble has been made by Lisi.’

Again if “shi” in (82) is a copula, the sentence would mean in effect: the report is what was written by Lisi, the wasp hives were the ones that Lisi poked, which is not what the sentence means, the implied contrast are incorrect. Moreover the fact that “shi” passives and “bei” passives can be used in Chinese interchangeably, as (80-83) show, also supports the analysis of treating a “shi” phrase on a par with a “bei” phrase.

If “shi” in the “shi” passive is not a copula, what is it? Is it a preposition like “bei”? Or is it a focus operator as Huang suggests? Or is it something else?

While it is still difficult to answer the question at this stage, the terminology is not of central importance here, because it will not affect the experiment. We have argued that “shi” in “shi” passives is not a copula. It is reasonable to assume that it has the same linguistic status as that of “bei” in a “bei” passive; at least, they are

both regarded as functional elements in contrast to such elements as noun and verb. In that case, we can conclude with some confidence that “shi” passives are true passives, comparable to “bei” passives structurally, but with an interesting ambiguity with copular sentences as discussed above. It is based on this analysis that the “shi” passive is included in Experiment I for the purpose of observing whether there is any difference in the processing of the two types of passive structure.

(3) “shi” Copula

There is little controversy in the analysis of this structure and the analysis has been presented above; see (78).

(4) Long Distance Reflexives in Chinese

Reflexives in Chinese do not behave exactly like those in English. To illustrate the difference between the reflexives of the two languages, the linguistic properties of Chinese reflexives must be outlined here. In contrast to reflexives in English, reflexives in Chinese do not respect Binding condition A which requires an anaphor to be locally bound. On the contrary, the Chinese reflexive “ziji” exhibits long distance binding that goes beyond the local domain. For example:

(84) Zhangsan_i yiwei Lisi_j meiyou kanjiang ziji_i.

Zhangsan think Lisi not see self

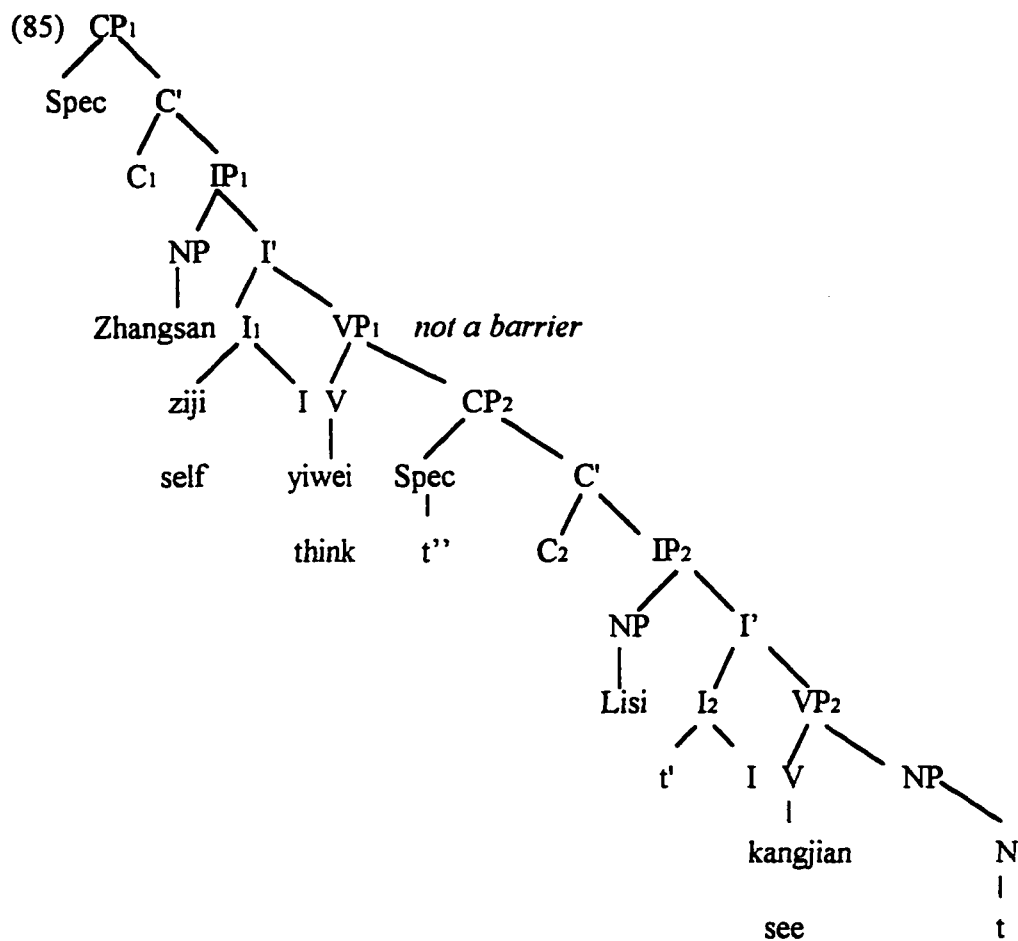
‘*Zhangsan_i thought that Lisi_j didn't see himself._i’

According to Binding Principle A, the antecedent of "ziji" ((him)self) in (76) should be “Lisi”, the subject of its clause. “Zhangsan” and “ziji” should be disjoint in reference. On the contrary, "ziji" in (76) can only refer to Zhangsan, not to Lisi.

Many studies have been done on the long-distance reflexives in Chinese (Huang et al, 1989; Cole et al, 1990, 1994, 1996; Kang, 1988, among others). Although linguists still differ in explaining why and how this long distance binding of reflexives is allowed in Chinese, they are all agreed that “ziji” in Chinese is a long-distance anaphor. The theoretical differences about the structure will not affect the use of the sentence type in the experiment, because the theoretical analysis does not change the fact of the coindexation between the antecedent and anaphor in the structure.

In order to present the structure clearly, only one analysis, i.e., Cole’s (1994) analysis within GB theory, will be given here. Cole assumes that all anaphors must be locally bound at LF, and that so called long distance anaphors have the property of being able to move up at LF to be adjacent to the antecedent. This movement is not possible in all languages, because of intervening barriers. Cole suggested that in Chinese, Infl is lexical, it L-marks VP which then will not be a barrier, allowing

the reflexive to move across VP at LF. The proposed LF movement is illustrated in (85).



In (85) "ziji" moves into Infl in the local clause first. This is legitimate because the trace left in the object position is lexically governed by the verb "kangjian" (see).

Movement from Infl₂ to COMP₂ is also legitimate because no barrier intervenes

between Infl and COMP. Thus the trace in Comp antecedent-governs the trace adjoined to Infl. "ziji" finally ends up adjoining to Infl₁ which governs it. Infl₁ is adjacent to a c-commanding element, the subject, with which "ziji" is coindexed.

However, it has to be pointed out that the Chinese empirical data show that the obligatory long-distance binding of “ziji” discussed above only occurs when (a) there are two or more clauses in a sentence and (b) all the heads of the clauses are third person. If these two conditions are not met, long-distance binding of “ziji” is not possible, and local binding is acceptable. For example:

(86) Zhangsan zhebei zijii.

Zhangsan blame self

‘Zhangsan blame himself.’

(87) Zhangsan suo ni zhebei zijii.

Zhangsan say you blame self

‘Zhangsan said that you blame yourself.’

Sentences such as (86) and (87) were not used in the experiment. All the experimental sentences that contain “ziji” have a obligatory long-distance binding relationship between the antecedent and “ziji”.

To summarize what we have discussed in this section, the following set of Chinese sentences illustrates the sentence constructions tested in Experiment I, though the actual sentences were more complex, for reasons discussed below.

(88) (i) "bei" passive sentence

Zhangsan bei wo dasang le.

Zhangsan bei I hurt Asp.

'Zhangsan was hurt by me.'

(ii) "shi" passive sentence

Zhangsan shi ta dasang de.

Zhangsan shi he hurt Par.

'Zhangsan was hurt by him.'

(iii) "shi" copular sentence

Zhangsan shi Lisi de penyou.

Zhangsan is Lisi Poss friend

"Zhangsan is Lisi's friend."

(iv) Long distance reflexive

Zhangsani yiwei Lisi maiyou kanjian zijii.

Zhangsan think Lisi not see self

"Zhangsan thought that Lisi did not see himself."

4.2.3. Experimental Sentences

The actual experimental sentences tested in Experiment I had to meet a number of design constraints and other conditions. The experimental materials are illustrated by the following set of sentences. The symbol # indicates the point at which the target word was presented (see details in the next section).

(89) (i) “bei” passive

zhefu huai bei ganggang zhanzhai zheli he nimen

this picture Pass. just stand here with you

shuohua de nage nuren nadao ti # ta penyou jiali qu le

talk that women take her friend home Asp.

‘This picture has been taken by the woman who was standing here talking to you yesterday to her friend's home.’

(ii) “shi” Passive

zhefu huai shi ganggang zhangzhai zheli he nimen

this picture Pass just now stand here with you

shuohua de nage nuren nadao ti # ta penyou jiali qu de

talk that woman take her friend home Par.

‘This picture has been taken to her friend's home by the woman who was standing here talking to you just now.’

(iii) Copular sentence

zhèfú huà shì gānggāng zhānzhāi zhèlǐ hē nǐmen

this picture is just now stand here with you

shuō huà de nàge nǚrén de jiā # lǐ wéiyí de yí fú huà.

talk that woman's home only one picture

'This picture is the only picture in the home of the woman who was

standing here talking to you.'

Target word for (i), (ii), and (iii): *tú huà* (picture).

(iv) Long distance reflexive “zìjǐ”

huàjiā yíwèi zhānzhāi zhèlǐ hē nǐ shuō huà de nàge nǚrén

painter think stand here with you talk that woman

meiyou kàngjiàn zìjǐ # zhēnzhāi zhūnbèi huà huà.

not see self Tense prepare paint

'The painter thought the woman who was standing here talking to you

did not see him preparing to paint.'

Target word: *huàjiā* (painter).

The experimental materials were constructed in sets of 4 matched sentences as illustrated in (89). All four sentences were composed of the same number of syllables. In (89)(i) and (ii), the assumed trace occurs right after the main verb, so the probe has been set at the onset of the syllable immediately following the verb. A relative clause has been included in the NP complement of the passive particle "bei" and "shi", in order to increase the distance between these particles and the verb.

This increase of the distance between the antecedent and the assumed trace has a twofold purpose. First it allows the processor enough time to predict an upcoming trace when it identifies the passive structure (in (89) (i) at "bei"). Processing at the trace position should therefore be easy, so antecedent reactivation, if it occurs, should be rapid. At the same time, this extra distance/time between the antecedent and the test position allows the original activation of the antecedent to die down, so that it will not obscure evidence of reactivation of the antecedent by the trace. If NP-trace does exist in the mental representation of Chinese passive sentences, as GB theory assumes, it is expected that significant priming will be obtained for the associate target in (89) (i) (relative to the non-associate target). In contrast, little or no priming is predicted in (89) (ii) and (iii). In the copulative sentence (89) (iii), the possessive marker "de" and

the following noun are arranged to align with the position where the verb occurs in (89) (i) and (ii). It is only at this point that the processor can tell the difference between "shi" passive (89) (ii) and "shì" copulative sentence (89) (iii). The possessive "de" in (89) (iii) is a one-syllable word and the verbs in (89) (i) and (ii) are composed of two syllables, so the target position in (89) (iii) is set at the onset of the second syllable counting from "de", to match the target position in (89) (i) and (ii). Because of the structural as well as semantic ambiguity of "shi...de" in (89) (ii) and (iii), it is expected that the processor will have difficulty in differentiating the presence of the putative NP-trace in (89) (ii).

An overt long distance anaphor is contained in (89) (iv), in which the reflexive "ziji" is bound by the antecedent in the subject position in the matrix clause. The sentence structure is necessarily somewhat different from that of the other sentence types. However, the content is approximately matched. And (89) (iv) has exactly the same length (in the sense of the same number of syllables) as the other three sentences. The target position is set at the offset of the last syllable of "ziji", the reflexive, since this is the first point at which the reflexive "ziji" can be processed and assigned its antecedent.

4.2.4. Target Words

Experiment I employed a cross-modal naming task. The naming task is generally similar to the cross-modal lexical decision task design described in Chapter 3, in that there are two conditions, one in which the target word is an associate of the antecedent, and one in which the target is a control word that has no semantic relationship with the antecedent. Note that this can be achieved either by keeping the antecedent constant and employing two different target words, or by varying the antecedent nouns and keeping the target word constant. The present experiment used the latter design. Furthermore, in the “related” condition, the target was not an associate of the antecedent noun, but was the noun itself. That is, in an identity naming task, which is the present design, the antecedent itself is used as the target word. For (89) (i), (ii) and (iii), the target word is “tuhua” (picture); and for (89) (iv) the target word is “huajia” (painter). Note that in (i), (ii) and (iii) the antecedent is “hua”, though the target is “tuhua”, so they are not exactly identical. This point will be discussed below.

The Chinese writing system, unlike that for English, is not an alphabetic system. During the experiment, the subjects heard the antecedent as part of the sentence which is presented to them auditorily, but what they saw on the screen was a pictographic character, the written form of the same word. The problem

arises that there could be various degrees of difficulty in visually recognizing target words, which might affect the accuracy of the results. It was in order to avoid this problem that this experiment varied the identity relation between the antecedent and target word by varying the antecedent phrase in the spoken sentence, and keeping the visually presented word constant. Each of the 4 sentence types thus came in two versions, differing only in the lexical content of the antecedent phrase. Corresponding to the example sentences in (89) in which there was a (partial) identity relation between the antecedents and the targets, there were the sentences in (90) in which the antecedents were not identical (or even related) to the targets.

(90) (i) zheba qiang bei ganggang zhanzhai zheli he nimen

this gun Pass. just now stand here with you

shuohua de nage nuren nadao ta pengyou jiali qu le

talk that woman take her friend home Asp.

‘This gun has been taken to her friend's home by the woman who was standing here talking to you just now.’

(ii) zheba qiang shi ganggang zhanzhai zheli he nimen

this gun Pass. just now stand here with you

shuohua de nage nuren nadao ta pengyou jiali qu de.

talk that woman take her friend home Asp.

‘This gun has been taken to her friend's home by the woman who was standing here talking to you just now.’

(iii) zheba qiang shi ganggang zhanzhai zheli he nimen

this gun is just now stand here with you

shuohua de nage nuren jiali weiyi de yi ba qiang.

talk that woman's home only one gun

‘This gun is the only gun in the home of the woman who was standing here talking to you just now.’

Target word for (i), (ii), and (iii): tuhua (picture)

(iv) xiaotou yiwei zhanzhai zheli he ni shuohua de nage nuren

thief think stand here with you talk that woman

meiyou kangjian ziji zhenzhai zhunbei huahua.

not see self Tense prepare paint

‘The thief thought that the woman who was standing here talking to you did not see him preparing to paint.’

Target word: huajia (painter)

This design is preferable to the use of different target words in the identity and control conditions, because different words vary in their composition in characters in ways that are difficult to control.

The prediction is as follows. Since the control antecedent "qiang" (gun) in (90) (i), (ii), and (iii) and "xiaotou" (thief) in (90) (iv) have no relationship with the visual target word "hua" (picture) and "huajia" (painter) respectively, the responses to the latter are not expected to be facilitated. But for (89)(i), (ii), (iii), and (iv), if there is antecedent reactivation, then the processor's response to the identity visual target should be facilitated. Thus, responses to "huajia" should be faster for (89) (iv) than for (90) (iv); and response to "tuhua" may be faster for (89) (i) than for (90) (i), depending on whether there is antecedent reactivation by NP-trace.

4.3. Subjects

A total of 64 subjects participated in the experiment. All of them are Chinese native speakers from mainland China. They were all graduate students studying for either a Ph.D or a masters degree in various departments at the Graduate School of the City University of New York.

4.4. Procedure

The design is a 2x4 within subject cross-modal priming identity naming task. The subjects were well informed in Chinese about their task before the experiment began. They were instructed to concentrate on listening to the sentences presented

to them through the earphones and to read aloud the Chinese characters that appeared on the CRT screen in front of them as quickly as possible whenever they saw them. They were given a practice session with 4 test sentences before proceeding to start the real experiment.

24 sets of experimental sentences (identity condition) were tested in the experiment, plus an equal number of matched sentences in the control (non-identity) condition, so there was altogether a total of 192 (24 sets of 8) sentences. Each set contained 4 sentence versions (“bei” passive, “shi” passive, “shi” copular, and reflexive) and each version had two different antecedent nouns (e.g. “hua” (picture) and “qiang”(rifle). The sentences were recorded on 8 tapes, each of which had one of the 8 variants of each of the 24 experimental sentences, appropriately balanced. In this way no subject heard two sentences from the same set of 8 matched items. No subject was tested on more than one tape. Each tape began (after the practice items) with 7 warm-up sentences, and 48 filler sentences were interspersed among the experimental sentences such that no experimental sentences occurred consecutively. Thus, a total of 83 sentences including the practice sentences were recorded on each tape ($=4+7+24+48$). For each tape, 8 subjects were tested. The experiment lasted about 15 minutes after the practice session. There was no comprehension task. A Target stayed on the screen until

the subject responded to it, up to a maximum of one second. No feedback was given to the subjects.

4.5. Results

Table 1 presents the mean naming onset times to visual targets, identity or non-identity, in the four types of experimental sentences. An analysis of variance revealed a main effect for the long distance reflexive that was significant for analyses employing both subject and materials as random factors, $F(1,63)=8.912$, $p=.0041$; $F(1,23)=5.136$, $p=.0242$. But the main effects for all the other three types of sentence failed to reach significance: for “bei” passive, $F(1,63)=.215$, $p=.6446$; $F(1,23)=.001$; $p=.9806$; for “shi” passive, $F(1,63)=.215$, $p=.6448$; $F(1,23)=.206$; for “shi” copular, $F(1,63)=.305$; $p=.5829$; $F(1,23)=.079$, $p=.7787$.

(91) Table 2. Experiment I: Mean Naming Onset Times (msec) to Visual Targets.

Target Type	Sentence Type			
	“bei” passive	“shi” passive	“shi” copular	Reflexive
Identity Target	544	532	546	540
Non-identity target	542	540	552	577
Magnitude of Priming	-2	8	6	*37

* $P<.005$

4.6. Discussion

The experimental sentence type containing an overt anaphor (long distance reflexive) exhibited significant priming, indicating that the Chinese reflexive “ziji” activates its antecedent rapidly in on-line processing. This result is compatible with what was obtained in an earlier experiment on English anaphor/pronoun constructions (Nicol, 1989; cf. Chapter 2). This result indicates that there were no serious hitches in adapting the cross modal paradigm to Chinese materials. The significant positive result for the overt anaphor serves as a point of comparison for the other sentence types. In contrast to the overt anaphor, the two passive sentence types showed no priming attributable to NP-trace. The main effects for these two sentences did not differ significantly from that for the “shi” copula sentence which contains no anaphor either explicit or phonologically null. By the logic set out above this fact implies that there is no antecedent reactivation by the NP-trace in either the “bei” passive or the “shi” passive. This would seem to cast doubt on the existence of such an EC in Chinese passive structures. In the case of the “shi” passive, the temporary structural ambiguity could be the cause for no significant priming, following Nicol’s (1989) hypothesis. But in the case of the “bei” passive, there is no reason for failing to reach significant priming as

compared to the long distance reflexive. A reasonable conclusion from this experiment, therefore, is that on-line evidence for NP-trace antecedent activation is lacking not because of processing difficulties, but because NP-trace is not present in syntactic structures. Unlike WH-trace, this element that has posited by linguists is not confirmed by psychological data.

However, it must be considered whether there could be alternative explanations of these findings. One alternative explanation of the data might be that priming does not occur when responses are already very fast. In other words this experiment may have obtained a “floor effect”, which means that the subjects are unable to react to the visual target significantly faster than they do in the baseline non-identity condition. Note that naming time for the non-identity target is higher in the reflexive condition than for the other three sentence types and this is the only case in which significant facilitation of the identity target is observed.¹³ The existence of this discrepancy in the non-identity condition is quite probably explained by the fact that the visual targets for the reflexive sentences were animate nouns, while the targets for the other three sentence types were mostly inanimate nouns. One possible explanation is that inanimate nouns have a higher

¹³ It is conceivable that the significant difference was due to inhibition of the non-identity target. However, in light of other factors discussed below, this distinction is not important to current concerns.

frequency than animate ones. For example, “tuhua” (picture) is probably used more often than “huajia” (painter).

There is, however, another possible explanation of why only the reflexive sentences showed significant priming. This is that the identity targets were fully identical to the antecedent nouns only for the reflexive sentences. For example, the identity target for (89)(iv) was “huajia”, which is fully identical to the head noun of the noun phrase antecedent of the reflexive anaphor. But for (89)(i) -(iii), the “identity” target word was “tuhua”, which shares only one morpheme with the head noun of the antecedent NP, which was “hua”. The word “tuhua” is composed of two characters; “tu” and “hua”, both meaning picture, but the former by itself is used more often to mean “map” or “drawing”. Together, they mean “painting”.

A target word totally identical to the antecedent would be expected to be primed more strongly than a target word only partially identical to the antecedent. It is possible, therefore, that there was activation of the subject NP in all four sentence types, but that the priming phenomenon by which this activation is detected in this experimental paradigm was too weak to be measurable in the partial identity conditions. For this reason, it is not possible to conclude, after all, that there is no processing reflex of NP-trace in Chinese passive sentences.

The only evidence in favor of this conclusion is that the “bei” passive construction did not show even a tendency toward greater priming of the related target than the “shi” constructions did, despite the fact that the partial morphological identity (and semantic similarity) between target word and antecedent noun might have been expected to offer an opportunity for priming if there were any antecedent reactivation. However, this is a slender point on which to hang such a weighty inference about linguistic structure. Therefore Experiment I should be regarded as inconclusive with respect to the status of NP-trace. A second experiment was therefore conducted.

CHAPTER 5

EXPERIMENT II: PROCESSING NP-TRACE, WH-TRACE, AND REFLEXIVES IN CHINESE

5.1. Purpose

The main purpose of Experiment II was the same as that of Experiment I, that is, to investigate whether there is antecedent reactivation by NP-trace and overt anaphors in on-line Chinese sentence processing, in order to assess the linguistic status of NP-trace. Therefore, the experiment was still focused on the “bei” passives that were the primary experimental materials in Experiment I, and on the long-distance reflexive sentences that provide the important safeguard against uninterpretable null results. An additional goal of Experiment II was to see whether there is evidence in sentence processing of an EC at the thematic position in Chinese sentences that are analyzed as containing WH-trace. For this purpose, Experiment II included the Chinese topicalization construction, which has been argued to be the only structure in Chinese that contains WH-trace in S-structure. Since we are interested in whether NP-trace has the same sort of psychological reality as WH-trace, testing NP-trace and WH-trace constructions in the same experiment is ideal.

As has been discussed in Chapter 2 and 3, WH-trace has shown immediate on-line antecedent reactivation in English sentence processing (e.g. Swinney et al 1989, cf. Chapter 3), but NP-trace has not. As is discussed in Chapter 3, the processor may not be able to predict a NP-trace in processing English passive sentences because the fact that they are passive is not evident until right before the trace position. But it is not difficult for the processor to predict a trace in processing English sentences containing WH-trace. This is mainly because the antecedent of WH-trace is in a non-argument position, the [spec CP] position, where theta assignment and case assignment by Agr are blocked. The WH-marking and the word order make it generally very easy in English to recognize when an NP is in [spec, CP], and needs to be associated with a WH-trace to receive a theta role and case. Fodor (1991) hypothesized that this can make a difference in sentence processing. When an $\bar{A}$ -chain is processed, its head is immediately recognized as such. Since it can receive neither case nor a theta role, it cannot be properly incorporated into the LF representation as the sentence structure is processed. It has to be carried along in the on-line computation by the processor until it receives a case and theta role from its trace. This pressure on the processing routines may facilitate the reactivation of the antecedent as soon as a position is reached, eliciting a quicker response from the processor. Though the

WH-trace position cannot be precisely predicted, because of temporary ambiguity, the processor knows that there must be a trace. And Frazier's observation that the processor obeys an Active Filler Strategy indicates that the processor is prepared to use its resources to find the trace site as soon as possible.

Processing NP-trace is inevitably rather different. The head of the A-chain is in an argument position, where it can receive a case assigned by Agr. Its theta role is in fact inherited from the trace position, but the processor, not knowing this, would naturally assign it the default role (agent) for a subject NP. Therefore the head of an A-chain can quickly take a position in the LF representation. There is no great pressure, therefore, for the processor to find a trace. Moreover, the processor may not identify a passive structure until very late in processing the English passive sentence (Nicol, 1989, discussed in Chapter 3 above). Even if it can identify a passive structure at the verb position, the trace then occurs immediately so that it has no time to anticipate it and prepare for its processing ahead of time.

In Chinese, the situation is just the opposite. That is, in a "bei" passive sentence which contains a putative NP-trace, there is no ambiguity and the processor should be able to anticipate the trace, as has been discussed in Chapter 4. Indeed, the processor knows not only that there will be an NP-trace, but

exactly where it will be (i.e. immediately following the verb). On the other hand, in a Chinese topicalization construction containing a WH-trace, there is temporary structural ambiguity, which is illustrated in the following section. Therefore if ease of parsing empty categories is what determines results in investigations of antecedent reactivation, WH-trace should show only a weak or delayed effect in Chinese topicalizations, while NP-trace should show a robust effect in Chinese “bei” passives. Thus experiment II offers a double test of the processing difficulty explanation of the English empty category findings.

5.2. Method

5.2.1. Materials and Design

Methodologically, there were changes in several aspects in Experiment II. In the last Chapter it was pointed out that there were some defects in the design of the first experiment. For example, in the constructions containing long-distance reflexives the antecedents and target words were all two-syllable animate nouns, and were fully identical, but in the other constructions, most of the targets were inanimate nouns, and there was only a partial match between them and the antecedents in the “associated” condition. (Also, the antecedents were one-syllable words in these constructions.) Experiment II corrected these

shortcomings by using all two syllable animate nouns as both antecedents and probe words, for all types of experimental sentences.

Another major change in the experimental method was that Experiment II used a cross-modal lexical decision task rather than naming. Fodor (1991) argued that experiments on English have only provided evidence of activation of the subject of a passive sentence at a semantic level processing, while NP-trace if genuine must be present in syntax. According to Boland (1993; cf. Chapter 3), the cross-modal naming task is sensitive to syntactic level processing only while the cross-modal lexical decision task is sensitive to both syntactic and semantic level processing. The purpose of employing the lexical decision task in experiment II was to provide the greatest possible opportunity for NP-trace to reveal its existence. Then, if negative findings persist, it could be concluded with some confidence that NP-trace does not exist. Since lexical decision has a broad-spectrum sensitivity, including semantic sensitivity, it could show a strong subject facilitation effect regardless of the syntactic status of NP-trace. This would confirm that the Chinese materials and the experimental procedure are indeed capable of exhibiting subject activation in Chinese passive sentences. Having established this, the next step would be to repeat the experiment with the same materials but with the purely syntax-sensitive naming task. For GB theory the

prediction would be that the reactivation phenomenon would persist, while the hypothesis that there is no trace in passives would predict that naming shows no reactivation effect in contrast to lexical decision. As will be seen, however, the results of the lexical decision were not as anticipated, so this larger program could not be carried through.

The experimental materials in Experiment II include (1) “bei” passives; (2) long distance reflexive constructions; (3) topicalization constructions. The two “shi” constructions were dropped, in order to keep the experiment to a manageable size while making room to test the topicalization construction containing a WH-trace. The analysis of the “bei” passive and long-distance reflexives has been presented in Chapter 4. The analysis of the topicalization construction is presented here.

5.2.2 The Analysis of the Topicalization Construction

Generally speaking, WH-words in Chinese are not fronted by *Move-α* during the mapping of D-structure to S-structure. For example:

(92) *[CP shuii [IP Zhangsan [VP kanjianle ti ?]]]

who Zhangsan see Asp

‘Who did Zhangsan see?’

However, Huang (1982, 1987) has argued that there is a type of EC in the Chinese topicalization construction that meets the criteria for WH-trace in GB theory. The topicalization structure in English involves, in accordance with GB theory, fronting of an XP (an NP in (93)) which leaves a trace at the premovement site. For example:

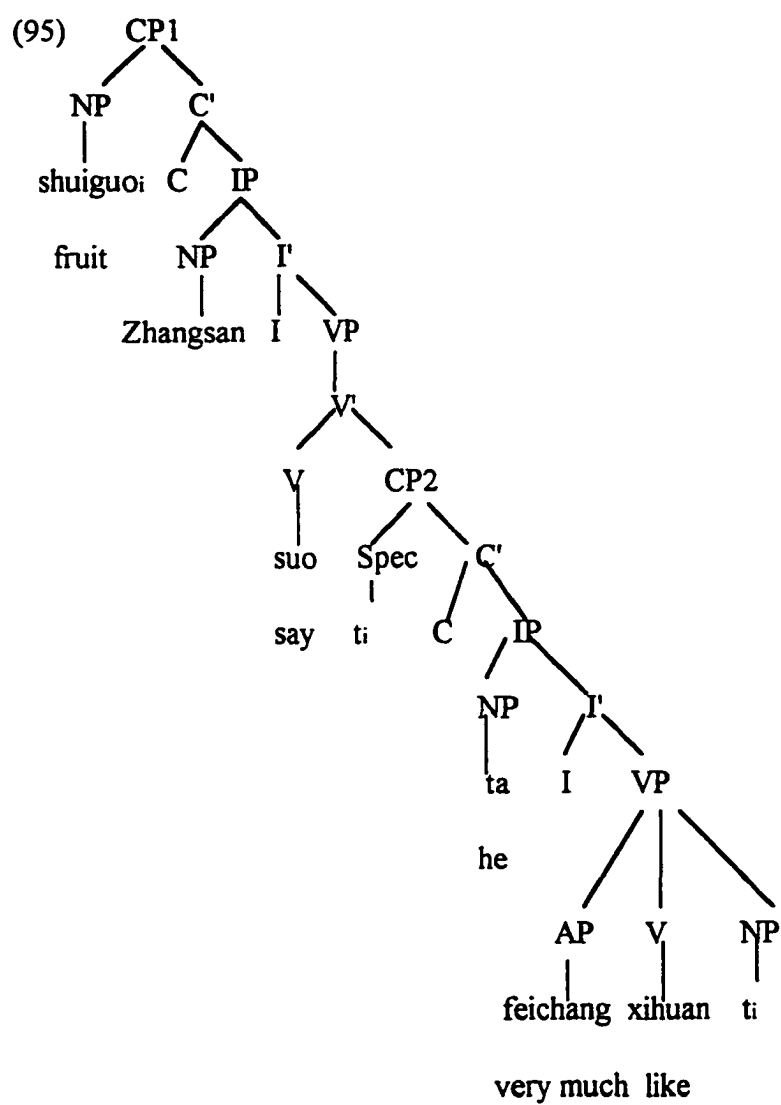
(93) [CP Fruit_i [IP John says [CP [IP he likes _{*t_i*} very much]]]]]

Huang claimed that the Chinese counterpart of this, as in (94), should be assigned a similar analysis, as shown in (95).

(94) shuiguo Zhangsan shuo ta feichang xihuan.

fruit Zhangsan say he very much like

‘Fruit, Zhangsan says he likes very much.’



The trace in (95) is an $\bar{A}$ -bound trace in contrast to the A-bound NP-trace in Chinese passive sentences.

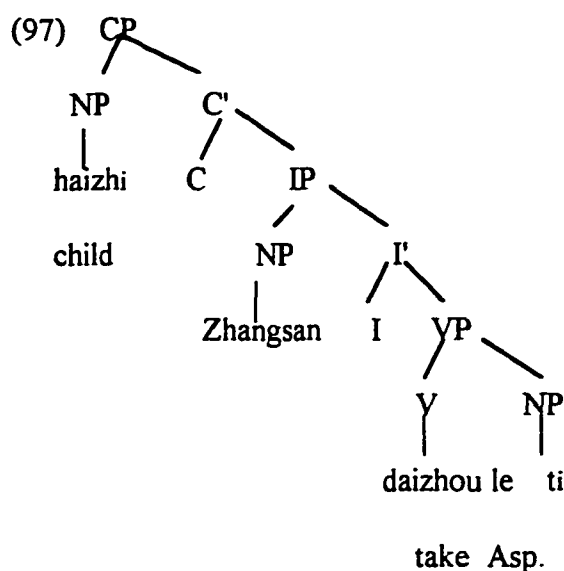
It should be pointed out here that Huang's analysis has not been accepted by all. Whether there is movement, and consequently traces, in Chinese topicalization constructions is still a largely controversial issue. The existence of WH-trace in Chinese topicalization has been questioned (e.g. Xu and Langendon, 1985; Xu, 1986). However, as mentioned in the previous chapter, the analysis in this thesis is based on GB theory. Within GB theory, Huang's analysis is widely accepted and it will be adopted here.

Experiment II was designed to compare the processing of constructions containing an antecedent in non-argument position with those containing an antecedent in argument position. For this purpose, the topicalization structure illustrated in (95) is the only possible candidate in Chinese. However, sentence (94) has an inanimate noun as the topicalized NP. In order to be comparable to the animate nouns used in the other experimental sentences in Experiment II, an animate topic is required, as in (96) and (97):

(96) haizhi Zhangsan daizhou le

child Zhangsan take Asp

'The child Zhangsan has taken with him.'



However, once the topicalization sentences use animate topic nouns, they present a temporary structural ambiguity for the processor. The processor may fail to recognize the NP at the beginning of the sentence as a fronted topic, but may misanalyze the string of two NPs as coordinated NPs in subject position. In this case, the processor may fail to assign (96) the structure (97) until it processes the verb and finds no overt object NP following it. The tendency to adopt the conjunction analysis will naturally be greater if the topicalized NP is an animate

noun like the subject NP. Note that a conjunction word is optional in Chinese.

For example:

(98) (i) haizhi he Zhangsan yichi laile.

child and Zhangsan together come Asp.

‘The child and Zhangsan have come together.’

(ii) haizhi Zhangsan yichi laile.

child Zhangsan together come Asp.

‘The child and Zhangsan have come together.’

In (98 (ii)), “Zhangsan” and “haizhi” together constitute a coordinated NP in the subject position, but, unlike (97), the verb in (98(ii)) is an intransitive verb. This shows that the verb is a critical cue for the processor to decide which structure it should assign to the sentence. If there is no object following a transitive verb, it has to reanalyze the first NP as a topic. However, if the processor initially constructs this coordinate NP analysis, it will have no reason to predict a trace later in the sentence. Thus, despite the Active Filler Strategy, the parser will have a heavy processing load when it eventually encounters the trace. When it identifies the topicalization structure on the basis of the missing object following the verb, it has to go back and rebuild the structure of the beginning of the sentence. This would be expected to increase the processor’s response time to the probe word

presented at the trace position in the experiment. However, this would occur in both the experimental and the control condition (which differ only in the relatedness of the target word and the antecedent noun). More importantly, the inability to anticipate the trace and the different processing involved in establishing it could diminish the speed or extent to which it reactivates its antecedent. Thus there might be no measurable difference between the two conditions even if WH-trace does exist in the topicalization condition. Therefore, the situation for Chinese topicalization is similar to that for English passive sentences (cf. Chapter 3): temporary ambiguity causes processing difficulty which could delay or diminish any facilitation due to antecedent reactivation. Thus, if the sentence processing explanation of weak NP-trace results in English is correct, we should expect to observe little or no priming of the associated target word in Chinese topicalization constructions, in contrast to the “bei” passive construction. The predictions for the WH-trace and NP-trace constructions are therefore exactly the opposite of those for English, which provides a very strong test of the processing difficulty explanation proposed by Nicol.

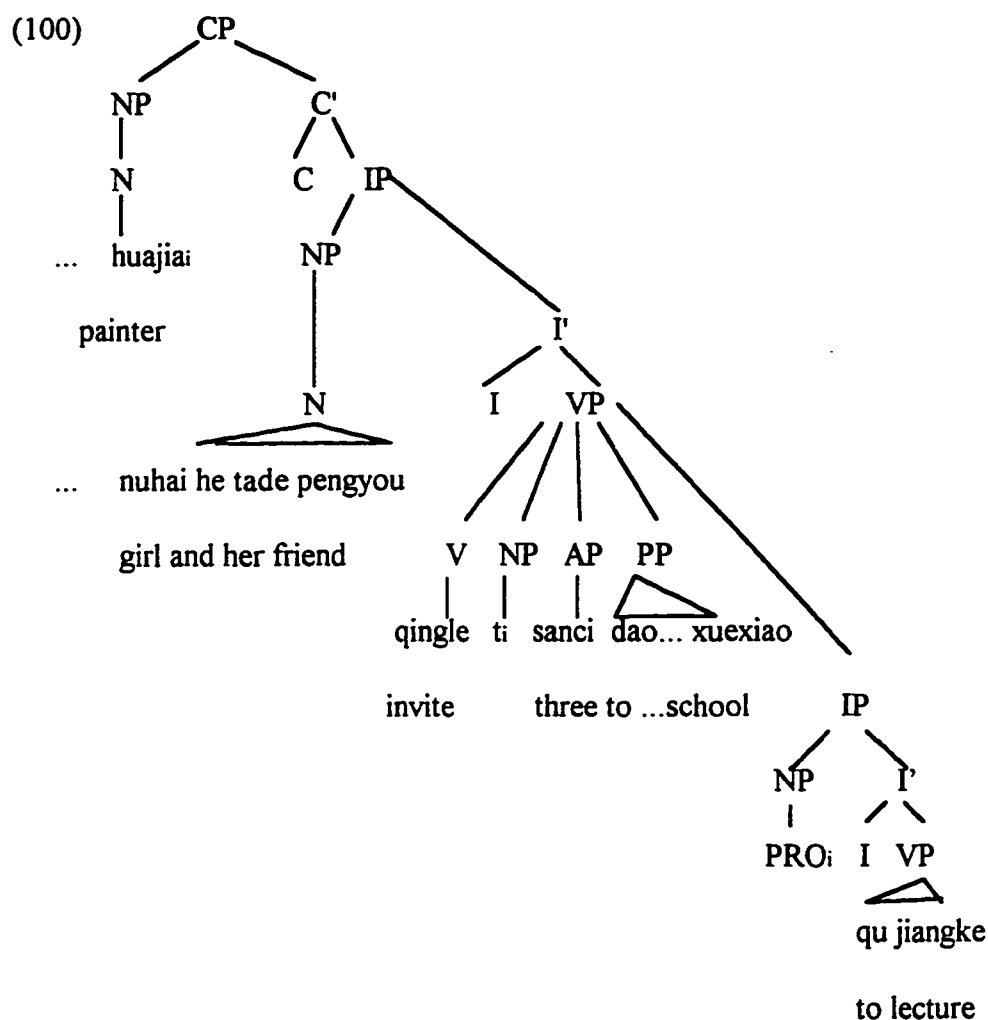
5.2.3. Experimental Sentences

All three types of experimental sentences, i.e., topicalization, "bei" passive and long-distance reflexive, were designed to meet certain length criteria, and they were matched as far as possible in meaning. They are illustrated respectively by the following examples.

(99) Topicalization:

nage zhumin de huajia: zhege chongmin piaoliang de nuhai he ta de pengyou
 that well-known painter this clever pretty girl and her friend
 qingle ti # shanchi dao nashuo shili xuexiao qu jiangke.
 invite three times to that private school to lecture
 'That well-known painter this clever and pretty girl and her friend has invited
 three times to lecture at that private school.'

The syntactic analysis of (99) is as follows. The modifiers of the NPs are omitted to save space, and same braching structure in VP has been suppressed. In some examples, such as this one, a lower chance contained an EC subject of an infinitive, known as PRO in GB theory, coindexed with the trace and its antecedent. However this was always several words later than the trace and so would not be expected to influence processing at the trace position.



The noun "painter" in [spec CP] in (100) is the antecedent or topic. It is moved from its original position into [spec CP], leaving a trace "t" which is coindexed with it at the preextraction site. Since [spec CP] is a non-argument position, the

antecedent "painter" receives neither case nor a theta-role there, but it inherits case and a theta role from its trace through the chain. However, because of the temporary structural ambiguity as noted, the processing of this construction may be masked by a severe garden path. Note that the subject NP was purposely made long to allow initial activation of the antecedent noun to decline prior to the trace position, so that it would be possible to detect reactivation. However, this incidentally has the effect of extending the conjunction misanalysis, thus possibly increasing the magnitude of the garden path effect.¹⁴

(101) "bei" Passive Construction:

nage zhumin de huajia bei zhe chongminpiaoliang de nuhai
 that well-known painter Pass. this clever pretty girl
 he ta de pengyou qingle ti # sanci dao nashuo shili xuexiao qu jiangke
 and her friend invite three times to that private school to lecture
 'That well-known painter has been invited three times by this clever and pretty
 girl and her friend to lecture at that private school.'

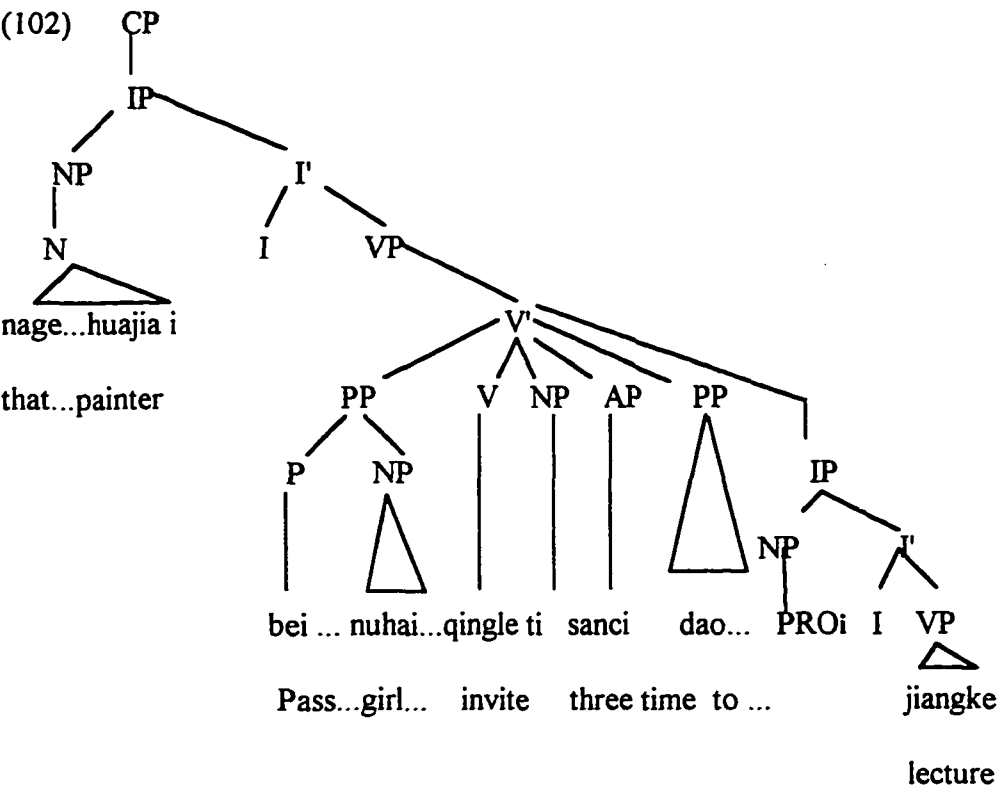
¹⁴ (Another way to lengthen the subject NP is adding a relative clause to it, as in (i):

(i) [nage zhumin de huajia] [zuoyian laidao zheli he nimen tiaowu de nuhai]...
 that well-known painter yeasterday come here with you dance girl

That well-known painter the girl who came here yesterday to dance with you...

But the magnitude of the garden path effect remains the same. There appears to be no way of blocking the conjunction analysis.

The analysis of this example is shown in (102). As in (100) some details are suppressed here for simplicity.



The "bei" passive construction in Experiment II is similar to that in Experiment I discussed in Chapter 4, except that in Experiment II all the antecedent NPs are headed by animate nouns. The passive marker "bei" appears immediately after the subject NP "the painter", unambiguously telling the processor that it is a passive construction. Thus, (101) does not have the conjoined-NP ambiguity in (99).

(103) long-distance Reflexive

nage zhumin de huajia: yiwei zhege chongmin piaoliang de nuhai

that well-known painter think this clever pretty girl

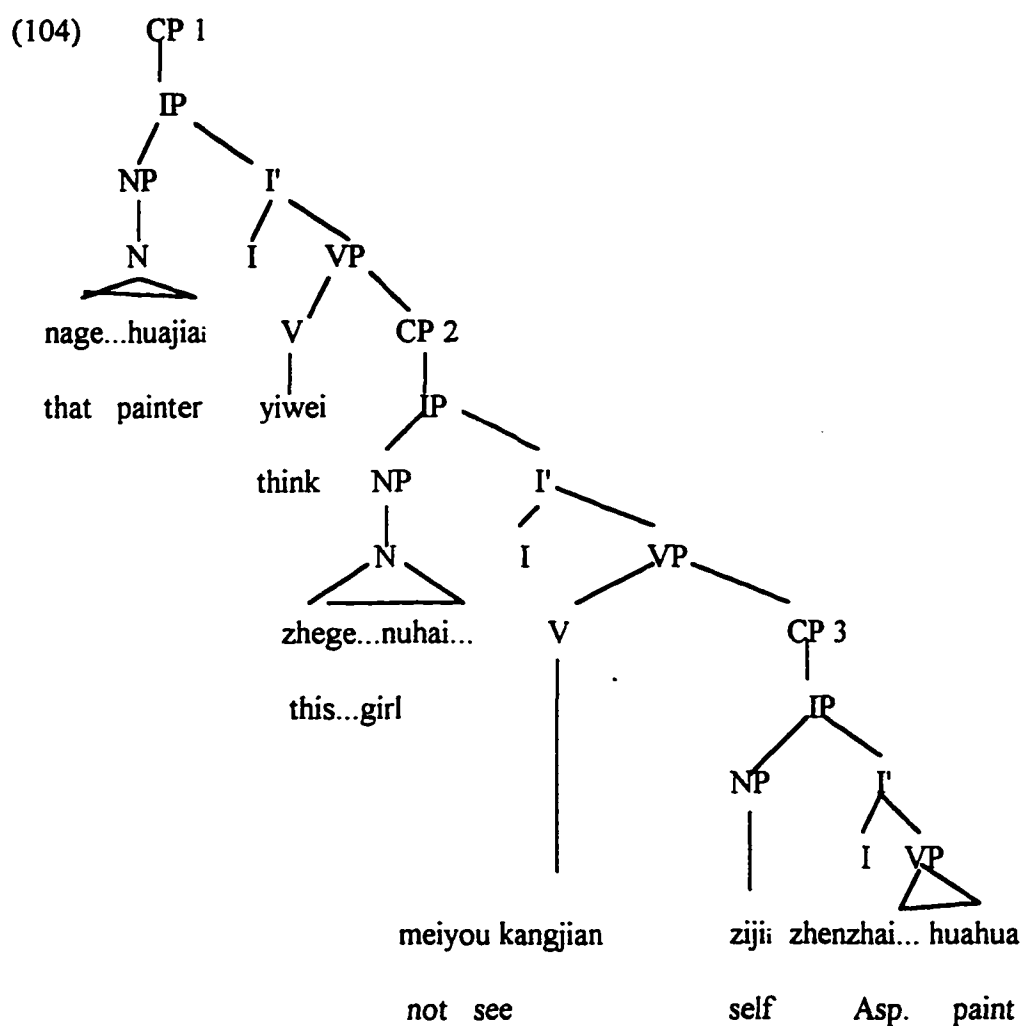
he ta de pengyou meiyou kangjian ziji # zhenzhai zhuenbei huahua.

and her friend not see self Asp. prepare paint

'That well-known painter thought this clever and pretty girl and her friend

didn't see he was preparing to paint.'

The analysis of this example is shown in (104).



The long-distance reflexive construction tested in the present experiment is similar the one tested in Experiment I. Although “zijì” in this construction is the subject of the clause beneath the verb, it is in the local domain of the subject of “see”, because the lower clause is non-finite. Therefore the subject of “see” cannot be its

antecedent. The only possible antecedent is the subject of the highest clause. Thus the long distance binding is unambiguous (cf. Chapter 4). The antecedent in this construction is also headed by an animate noun like the antecedent in the other two constructions tested in this experiment.

The three experimental sentences (99), (101), and (103) all have the same length of 35 syllables (or 35 characters). In (99) and (101), there are exactly the same number of syllables (23 syllables) before the trace. The visual target position in both is set at the onset of the syllable following the verb. In (103), the visual target is set at the coda of the last syllable of "ziji" (self). This is not aligned with the trace position in (99) and (101) because of differing grammatical constraints on the construction. In general, "ziji" appeared later in the sentence (in terms of number of syllables/characters) than the traces did.

5.2.4. Target Words

For each of the experimental sentences, there were two target conditions. In one, the target was an "associated" target which has a close semantic relationship with the antecedent, e.g. "shechai" (color) for "huajia" (painter) in (99), (101) and (103). In the other condition, the target was a "non-associated" one which has no semantic relationship at all with the antecedent, e.g. "shoukao" (handcuff) for

"huajia" (painter) in (99), (101) and (103). The latter served as a control target. Neither target was wholly or partly identical to the antecedent. Note that unlike Experiment I, the antecedent noun was held constant across experimental and control conditions, and the target word was varied. However, the target words were paired, such that the associated target for sentence 1 was the non-associated target for sentence 2; the associated target for sentence 2 was the non-associated target for sentence 1. Associated and non-associated targets were likewise exchanged between sentences 3 and 4, and so on. Thus the same words were tested in both target conditions (associated and non-associated) so that irrelevant properties of them such as length and familiarity could not be the source of any significant response differences. This "switched targets" design was first used in the cross-modal experiments run by McKoon, Ratcliff and Ward (1994). The design was also endorsed by Nicol, Fodor and Swinney (1994) as having improved the control over experimental stimuli, though not flawless. Target words, associated or non-associated, were all real Chinese words composed of two Chinese characters. Since experiment II employed a lexical decision task, half of the words presented with the 48 filler sentences were real Chinese words, the others were not. The Chinese non-words were also composed of two Chinese characters, but the combination did not make any sense. For example: "qingling"

(green else). All the visual targets, words and non-words, were made of common Chinese characters of similar frequency.¹⁵

5.3. Subjects

A total of 48 subjects participated in Experiment II, 8 for each list. Each of them was paid \$5 for participating in the experiment. The background of the subjects participating in Experiment II is the same as that of those who participated in Experiment I.

5.4. Procedure

There were 24 sets of experimental sentences. Each set contained three sentence versions: one topicalization, one “bei” passive, and one overt reflexive as in (99), (101), and (103). Thus there were three sentence versions and two target conditions for each sentence. This is a 2x3 within subject design. Altogether there were six lists, each containing 24 experimental sentences interspersed among 49 filler sentences of different length and a variety of syntactic constructions. 10 of the filler sentences were structurally similar to those of the experimental sentences

¹⁵ Word Frequency data were obtained from the Chinese Word Frequency Dictionary (1991) compiled by The Language Research Institute of the Chinese Academy of Social Science, published by Beijing Printing House.

in order not to let subjects detect a pattern; the others were different from the experimental sentences and from each other. The last sentence on each list was always a filler sentence. The experimental sentences and filler sentences were preceded by 4 practice sentences and 6 warm up sentences on each tape. So each subject heard a total of 83 sentences.

This experiment employed a cross-modal paradigm with lexical decision as the primary task. DMaster software was used for stimulus presentation and data collection. Both the audio and visual stimuli files were recorded in an IBM compatible personal computer. The visual file was made by a Chinese word processor software "Xia Li Ba Ren". The characters shown on the monitor were in the standard printing style with a size of 1" x 0.5".

Auditory presentation and procedure were the same as in Experiment I. But the naming task is substituted by a lexical decision task. At a point during each sentence a Chinese word would appear on the computer screen in the form of Chinese characters. A box with two buttons, one labeled "yes" and the other labeled "no" (both in Chinese), was placed before subjects. Subjects were instructed to make a lexical decision (whether it is a word or a non-word) as quickly as possible by pressing the "yes" or "no" button when they saw the Chinese word appear on the screen. A paraphrase task requiring sentence comprehension

was employed to keep the subject concentrating on listening to the auditory input, while also responding to the visual stimulus. The words “please paraphrase” was prerecorded on the audio tape at the end of 11 of the total 83 sentences. 2 of these 11 sentences carrying the comprehension task were experimental sentences. The 11 paraphrase tasks were scattered pseudorandomly, either every several sentences (varying from 6 to 10) or two in a row, so that the subject could not predict when they would be required to respond. The subjects were instructed to paraphrase (not repeat word by word) the sentence they heard into a microphone in front of them. The microphone was actually a decoy which did not record what the subjects said.

5.5. Results

Prior to data analysis, missing data points, erroneous responses, and response times slower than 2000 msec or faster than 250 msec were treated as errors and discarded. Table 2 presents the mean lexical decision response time to visual targets. An analysis of variance revealed that main effects of associated vs. non-associated targets for the topicalization and “bei” passive conditions, failed to reach significance for analyses employing both subjects (F1) and materials (F2) as random factors. For topicalization: $F(1,42)=0.18$, $p>.05$; $F(1,18)=0.08$, $p>.05$;

for "bei" passive: $F_1(1,42)=0.53$, $p>.05$; $F_2(1,18)=0.06$, $p>.05$; the main effects for reflexive reached significance but in an unexpected direction: $F_1(1,42)=4.83$, $p<.05$; $F_2(1,18)=7.99$, $p<.025$.

(104) Table 3. Experiment II: Mean Lexical Decision Response Times (msec) to Visual Targets in Three Types of Sentences; Mean Percentage of Errors in Parentheses.

Target type	Sentence Type					
	Topicalization		"bei" Passive		Reflexive	
Associated	819	(4.7)	823	(7.3)	842	(3.7)
Non-associated	824	(3.1)	817	(3.1)	794	(6.8)
Magnitude of priming	6	-1.6	-6	-4.2	*-48	2.9

* $P<.05$

5.6. Discussion

All three types of sentences in Experiment II failed to exhibit an expected priming effect. We will discuss them separately first.

The fact that topicalization failed to exhibit a priming effect may indicate that the temporary structural ambiguity involved in this type of Chinese sentence, which has been discussed earlier in the chapter, does cause problems for the processor, which mask any antecedent reactivation effect. This is compatible with Nicol's (1988) hypothesis (see Chapter 3), but as a null result it cannot provide positive

support for it in the absence of a significant and interpretable priming effect for some other sentence type in the experiment. All that can be said is that this result is greatly different from those obtained in previous experiments on English sentences containing antecedents in non-argument positions, and it may be supportive of Nicol's hypothesis.

The fact that there was no significant main effect for the "bei" passive would also be of interest if this null finding were securely interpretable. Together with the lack of facilitation for the "bei" passives in Experiment I, it could constitute evidence against the existence of NP-trace. The lack of an effect is somewhat surprising, in view of the fact that activation effects have been found in passives with the visual probe task, and the fact that Boland's research indicates that the cross-modal lexical decision task is sensitive to semantic level processing. With cross-modal lexical decision, Osterhout obtained a significant (though delayed) activation effect for English passives, and Chinese passives should be at least as likely to show an effect of semantic interpretation as English passives to semantic level processing. Why, then, is there no sign of antecedent activation at any level of representation, in the case of the Chinese "bei" passive? There are several possible explanations to be considered:

(i) Absence of activation might be due to insensitivity or artifacts of some kind in this experiment. This cannot be ruled out. Though it is not clear what the problem would be, there are other results of the experiment which suggest that it differed from experiments on English reported in the literature. See discussion below.

(ii) The lack of an effect might be due to the fact that, despite Boland's conclusions, the cross-modal lexical decision task is not sensitive to semantic processing but only to syntactic processing. Note that this would account for the data for "bei" passives only on the assumption that passives do not contain NP-trace in their syntactic structure. In other words, Experiment II would have just the same implications as a cross-modal naming experiment: if no priming occurs, that would strongly suggest that NP-trace is not real. (The only fact this would leave unaccounted for is Osterhout's observation of delayed but significant priming with lexical decision for English passives.)

No other research has systematically explored the syntax/semantics difference between naming and lexical decision proposed by Boland. D. Swinney (personal communication) notes that the literature contains no reported contrasts between outcomes from the two tasks in EC experiments on English. He reports that a study by Swinney et al (1988) reported by Nicol and Swinney (1989) found essentially identical results for the two tasks on the same sentence materials (which

contained WH-trace and lexical pronouns). Swinney observes “ The only overall difference when the two studies were compared was an overall main effect for lexical decision and naming; that is, naming was faster overall than lexical decision.” However, the Swinney et al study addressed elements (WH-trace and overt pronouns) which could be expected to show antecedent reactivation even in a task sensitive only to syntactic structure. So the sensitivity of cross-modal naming to semantic processing of materials such as these still remains to be confirmed. We have seen, however, that it would make little difference to the present argument, since the absence of priming in “bei” passives challenges the existence of NP-trace as long as the lexical decision task taps into syntactic structure regardless of what other linguistic levels it may be sensitive to as well.

(iii) The lexical decision task may have occurred too early in the sentence to reveal priming. This seems fairly unlikely. It is true that the decision task immediately followed the trace position in Experiment II, while Osterhout observed signs of priming only at 500 ms after the trace position, and significant priming only 1000 ms after it. So some later test points in the Chinese passives would have been welcome. However, the motivation for Experiment II was that there is no reason in Chinese for any delay in the priming effect, if there is one. Results should be as rapid as for WH-trace in English, yet clearly they were not.

(iv) The lexical decision task may have occurred too late in the sentence to reveal priming. This is an intriguing possibility. If it could be established it would undermine arguments for NP-trace as a syntactic constituent, since it would support a quite different account of previous processing results for passives in English. If the absence of priming in the “bei” passives is genuine, then it cannot be attributed to processing delay as Nicol proposed for English. There is no support, then, for the processing account of the English data. There is no support, then, for the processing account of the English data. Turning to Fodor’s alternative explanation, we may consider the possibility that the priming observed in English by Osterhout was a reflection of late semantic processing, and in particular that it was due to the reassignment of thematic roles once the sentence was discovered, belatedly, to be passive. The parser must then assign the theme role (or other role appropriate to the underlying object) to the NP in surface subject position. However, in the “bei” passive, the word “bei” unambiguously shows that the surface subject is the underlying object. Therefore thematic reassignment would either not occur (if there was sufficient look-ahead to avoid misassignment on the first pass) or else would occur early, at the position of “bei”, which was well before the verb in the experimental materials. Thus, while there might possibly be priming at a preverbal point, it would be predicted that there

would be no priming at the post-verbal position in the Chinese examples, even in a task sensitive to semantic representations or semantic (thematic) processing. This account is not incompatible with the existence of NP-trace, but NP-trace plays no essential role in the explanation. Thematic reassignment would occur late in English passives, and early (or not at all) in Chinese passives, regardless of whether passives are derived by *Move- α* in the syntax, or by a lexical rule which does not create a trace.

The fact that the main effect for long distance reflexives reached significance but in the wrong direction is most puzzling of all, because the results of Experiment I seemed to show that the anaphoric reflexive in Chinese does reactivate its antecedent, just as English (locally bound) reflexives do. However, a closer look at the experimental reflexive sentences used in Experiments I and II respectively suggests a possible explanation.

In the reflexive sentences used in Experiment I, there were only two NPs before the reflexive, and hence only two potential referents for the processor to choose between. For example:

(105) Long-distance anaphora in Experiment I.

nage huajiai yiwei ganggang zhanzhai zheli he nimen suohua de nuren
 that painter think just now stand here with you talk woman
 meiyou kangjian ziji zhenzhai zhuengbei huahua
 not see self Asp. prepare paint
 ‘That painter thought that the woman who was standing here talking with
 you didn’t see him (self) preparing to paint.’

But in Experiment II, in order to match the other two sentences in length, the reflexive sentence was constructed with a coordinate NP as subject of the embedded clause. Counting the two coordinated NPs, there were therefore three NPs before the reflexive. For example:

(106) Long-distance anaphora in Experiment II.

nage huajiai yiwei zhege chongming piaoliangde nuhai he tade pengyou
 that painter think this clever pretty girl and her friend
 meiyou kangjian ziji zhenzhai zhuengbei huahua.
 not see self Asp. prepare paint
 ‘The painter thought that this clever and pretty girl and her friend didn’t see
 him (self) preparing to paint.’

Recall the analysis of the reflexive in Chinese (cf. Chapter 3). The reflexive “ziji” can be locally bound in a single clause sentence. But “ziji” must not be locally bound if there is a third person NP in the subject position of a higher clause and no intervening 1st or 2nd person subject. In the latter case, “ziji” can be coindexed with any third person referent outside its local domain. For example:

(107) Possible bindings in Chinese long-distance reflexive:

nage huajia yiwei zhege nuhai suo tade pengyou

that painter think this girl say his/her friend

meiyou kangjian ziji zhenzhai huahua.

not see self Tense paint

‘That painter thought that this girl said that her friend didn’t see him/her preparing to paint.’

Note that in (107), in place of the conjunction in (106) there is an additional embedded clause. The anaphor “ziji” in (107) can be bound by either “nuhai” (girl) or “huajia” (painter), since both referents are outside the local domain of “ziji”. Because of this fact, and the structural similarity between the experimental sentence (106) and a sentence like (107), subjects in Experiment II may possibly have been confused at the “ziji” about which NP was its antecedent. They may have misheard “he” (and) as a verb, or they may just have fallen behind in

computing the structure of the sentence which is quite complex. In either case, the first of the two conjoined NPs in the lower subject position could have seemed (incorrectly) to be a legitimate antecedent for the anaphor. And it might be preferred over the true antecedent, because it is closer. Then the visual target word in the associated target condition may have suggested the more distant noun, setting up a competition that would slow down responses in the associated target condition. As a consequence of this competition, the reaction time to the associated target would become slower rather than faster. Alternatively, some subjects may have detected a pattern in the materials. In approximately half of the cases the reflexive sentences ended with a verb associated partially (in meaning as well as in form) with the antecedent as “huahua” (to paint) is associated with “huajia” (painter). Subjects who noticed this may have developed a strategy of waiting to be cued by the verb at the end of the sentence before attempting to interpret the anaphor. Such a strategy would be encouraged by the complexity of these sentences, which could overload the parser. The error rate in the reflexive sentence may provide some evidence for this hypothesis. An analysis of the error rate for the reflexive revealed a trend in the analysis employing materials as random factors towards fewer errors in the associated target-condition. $F_1(1,42)=2.00, p>.10$; $F_2(1,18)=3.60, .10>p>.05$. If it can be assumed that there

was a speed and accuracy trade off here, then the analysis indicates that those who sacrificed speed for accuracy found that the associated target was easier to make a decision on. This suggests that there was some facilitation of the associated target by the reactivated antecedent.

Another possibility is that subjects, in their attempt to simplify aspects of the sentence comprehension task, would try to use the target word as a cue for the interpretation of the anaphor, since they had noticed that it was sometimes associated with the referent of “ziji”. In that case they might postpone response to the target word while they interpreted “ziji”, if the target provided a useful clue (in the associated condition). But when the target was unhelpful (in the non-associated condition) they would set aside interpretation of “ziji” while responding to the target word. D. Swinney (personal communication) reports that slower responses to associated than to non-associated targets have been observed in other experiments, also. He suggests that this was most likely to happen “when presentation of the sentence material was quite slow (so that, while it was fluent, it felt labored to the listener). Our unproved assumption has been that slow speech allowed for extra-sentential ‘thinking time’, which led to specific expectations for related words that did not occur. The related word is rarely the most likely associate, so if subjects were expecting the most likely one they would often be

surprised by the actual probe word. It may also be suggested that this would be more likely to occur for overt anaphors, like “ziji”, which subjects are aware of and whose interpretation they may think about, rather than for ECs which may be processed only unconsciously. The sentences in Experiment II were not judged to be spoken particularly slowly, but it is possible nevertheless that subjects were trying too hard to make a link between the sentence and the visually presented word, and that their efforts at prediction succeeded only in slowing them down, as Swinney suggests.

These speculations do not decide the matter but offer some possible reasons for the unexpected reversal of the predicted effect for the overt anaphor in Experiment II, despite the positive finding in Experiment I. Taking the experimental results as a whole, however, none of the main effects reached significance in the anticipated direction, and so the interpretation for any one sentence type remains questionable. In particular, the absence of priming for the “ziji” construction means that there is no clear positive instance of priming against which to contrast the absence of priming for the “bei” passive construction. Therefore, in order to evaluate the status of NP-trace, additional experiments need to be conducted.

Chinese is a language spoken by a quarter of the total population on the earth. But it is much less studied, compared to English and other Indo-European languages, in terms of both syntactic studies and sentence processing studies. There is a very limited literature on Chinese syntax. Most research has been done within transformational grammar and has focused on just a few structures, e.g. long-distance anaphors. Research on Chinese sentence processing is even less plentiful. None has been conducted to investigate the processing of empty categories. The project presented in this dissertation has taken a step in this direction. Some useful experimental techniques have been explored, for example, varying the antecedent NP phrase to be the non-associated target rather than presenting non-associated targets visually. This technique can control irrelevant properties of Chinese characters, such as their complexity in strokes, so that they are not the source of any significant response differences.

Although the interpretation of the results of the two experiments is not conclusive because of some unknown facts, the experiments have at least shown that Chinese sentence processing experiments are feasible and can address issues of general theoretical interest. In particular, the linguistic status of empty categories, especially NP-trace, in Chinese is well worth exploring in psycholinguistic research. Future experiments should still focus on the comparison of the three

structures included in Experiment II with some changes to simplify the construction containing the overt long-distance anaphor “ziji”. In other words, the experimental materials in Experiment II can be revised and the experiment should be repeated. This research project is a first step in a worthwhile direction. It is my belief that carefully designed future experiments on NP-trace and reflexives in Chinese will be more successful in finding clearer evidence either for or against the linguistic hypothesis addressed in this thesis.

APPENDIX I.

EXPERIMENT I: EXPERIMENTAL SENTENCES

1 A. Passive with "bei"

那幅画被刚刚站在这里和你们说话的那个女人拿到她朋友家里去了。

nafuhua bei ganggang zhanzai zeli he nimen shuohua de

that picture Pass. just now standing here with you talk

nage nuren nadao ta pengyou jiali qu le.

that woman take her friend home to Asp.

That picture has been taken by the woman who was standing here talking to you just now to her friend's home.

1 B. Passive with "shi"

那幅画是刚刚站在这里和你们说话的那个女人拿到她朋友家里去的。

nafuhua shi ganggang zhanzai zeli he nimen shuohua de

that picture Pass. just now standing here with you talk

nage nuren nadao ta pengyou jiali qu de.

that woman take her friend home to Par.

It was by the woman who was standing here talking to you just now that picture has been taken to her friend's home.

1 C. "shi" copula

那幅画是刚刚站在这里和你们说话的那个女人的家里唯一的一幅画。

nafuhua shi ganggang zhanzai zeli he nimen shuohua de

that picture is just now standing here with you talk

nage nuren de jiali weiyi de yifu hua.

that woman Poss. home only one picture

That picture is the only picture in the home of the woman who was standing here talking to you just now.

Non-associated antecedent: 那把枪 nabaqiang (that gun)

Visual target: 图画 tuhua (picture)

1D. long-distance reflexive

画家以为站在这里和你说话的那个女人没有看见自己正在准备画画。

huajia yiwei zhanzai zeli he ni shuohua de nage
 painter think standing here with you talk that
 nuren meiyong kangjian ziji zhengzai zhunbei huahua.
 woman not see self Tense prepare paint
 The painter thought that the woman who was standing here
 talking to you did not see him preparing to paint.

Non-associated antecedent: 士兵 shibing (soldier)

Visual target: 画家 huajia (painter)

2A. 那支笔被上午坐在这里和你们写字的那个学生放到他同学包里去了。

nazhibi bei shangwu zuozai zeli he nimen xiezhi de
 that pen Pass. morning sitting here with you write
 nage xuesheng fangdao ta tongxue baoli qu le.
 that pupil put his classmate bag to Asp.
 That pen has been put by the pupil who was sitting here
 writing with you in the morning in his classmate's bag.

2B. 那支笔是上午坐在这里和你们写字的那个学生放到他同学包里去的。

nazhibi shi shangwu zuozai zeli he nimen xiezhi de
 that pen Pass.morning sitting here with you write
 nage xuesheng fangdao ta tongxue baoli qu de.
 that pupil put his classmate bag to Par.
 It was by the pupil who was sitting here writing with you
 in the morning that pen has been put in his classmate's bag.

2C. 那支笔是上午坐在这里和你们写字的那个学生的包里唯一的一支笔。

nazhibi shi shangwu zuozai zeli he nimen xiezhi de
 that pen is morning sitting here with you write
 nage xuesheng de baoli weiyi de yizhi bi.
 that pupil Poss bag only one pen to Asp.
 That pen is the only pen in the bag of the pupil
 who was sitting here writing with you in the morning.

Non-associated antecedent 那块糖 nakuaitang (that candy)

Visual target 铅笔 qianbi (pencil)

2D. 教师以为站在这里和你写字的那个学生没有看见自己正在准备上课。

jiaoshi yiwei zuozai zeli he ni xiezi de nage
 teacher think sitting here with you write that
 xuesheng meiyou kangjian ziji zhengzai zhunbei shangke.
 pupil not see self Tense prepare lecture
 The teacher thought that the pupil who was sitting here
 writing with you did not see him preparing to lecture.

Non-associated antecedent 店员 dianyuán (shop assistant)

Visual target 教师 jiaoshi (teacher)

3A. 那瓶酒被天天坐在这里和你们喝酒的那个醉汉倒到桌下的桶里去了。

napingjiu bei tiantian zuozai zeli he nimen hejiu de
 that pen Pass. every day sitting here with you drink
 nage zuihan daodao zhuoxia de tongli qu le.
 that drunk pour table under bucket to Asp.
 That bottle of wine has been poured by the drunk who is sitting
 here drinking with you every day into the bucket under the table.

3B. 那瓶酒是天天坐在这里和你们喝酒的那个醉汉倒到桌下的桶里去的。

napingjiu shi tiantian zuozai zeli he nimen hejiu de
 that pen Pass. every day sitting here with you drink
 nage zuihan daodao zhuoxia de tongli qu de.
 that drunk pour table under bucket to Par. (sf.)
 It was by the drunk who is sitting here drinking with you every
 day that bottle of wine has been poured into the bucket under
 the table.

3C. 那瓶酒是天天坐在这里和你们喝酒的那个醉汉的一整天唯一的饮料。

napingjiu shi tiantian zuozai zeli he nimen hejiu de
that pen is every day sitting here with you drink
nage zuihan de yizhengtian weiyi de yingliao.

that drunk Poss. whole day only drink

That bottle of wine is the only drink of the drunk who is
sitting here drinking with you every day for the whole day.

Non-associated antecedent 那块布 nakuaibu (that cloth)

Visual target 啤酒 pijiu (beer)

3D. 酒保以为坐在这里和你喝酒的那个醉汉没有看见自己正在准备倒酒。

jiubao yiwei zuozai zeli he ni hejiu de nage
bartender think sitting here with you drink that
zuihan meiyou kangjian ziji zhengzai zhunbei daojiu.

drunk not see self Tense prepare pour wine

The bartender thought that the drunk who was sitting here
drinking with you did not see him preparing to pour wine.

Non-associated antecedent 议员 yiyuan (congressman)

Visual target 酒保 jiubao (bartender)

4A. 那匹马被早上留在赛场帮你们训马的那个骑师牵到那个马棚里去了。

napima bei zaoshang liuzai saichang bang nimen xunma de
that horse Pass.morning stay race track help you train
nage qishi qiandao meige mapengli qu le.

that rider pour that stable to Asp.

That horse has been taken by the rider who stayed in the
race track this morning helping you train to that stable.

4B. 那匹马是早上留在赛场帮你们训马的那个骑师牵到那个马棚里去的。

napima shi zaoshang liuzai saichang bang nimen xunma de
that horse Pass. morning stay race track help you train
nage qishi qiandao meige mapengli qu le.
that rider pour that stable to Par.

It was by the rider who stayed in the race track this morning
helping you train that horse has been taken to that stable.

4C. 那匹马是早上留在赛场帮你们训马的那个骑师的马棚里最好的赛马。

napima shi zaoshang liuzai saichang bang nimen xunma de
that horse is morning stay race track help you train
nage qishi de mapengli zuihao de saima.
that rider Poss stable best racing horse

That horse is the best racing horse in the stable of the rider
who stayed in the race track this morning helping you train.

Non-associated antecedent: 那根草 nagencao (that grass)

Visual target: 骏马 junma (horse)

4D. 公主以为留在赛场帮你训马的那个骑师没有看见自己正在准备骑马。

gongzhu yiwei liuzai saichang bang ni xunma de
princess think stay race track help you train
nage qishi meiyou kangjian ziji zhengzai zhunbei qima.
that rider not see self Tense prepare ride horse

The coach thought that the rider who stayed in the race track
helping you train did not see him preparing to ride.

Non-associated antecedent: 和尚 heshang (monk)

Visual target: 公主 gongzhu (princess)

- 5A. 那条鱼被刚刚躺在桌下看你们吃饭的那只花猫拖到我儿子床上去了。

natiaoyu bei ganggang tangzai zhuoxia kang nimen chifan de
 that fish Pass. just now lie table under see you eat
 nazhi huamao tuodao wo erzi de chuangshang qu le.
 that cat take my son bed on to Asp.
 That fish has been taken by the cat which was lying under the
 table watching you eat just now on to my son's bed.

- 5B. 那条鱼是刚刚躺在桌下看你们吃饭的那只花猫拖到我儿子床上去的。

natiaoyu shi ganggang tangzai zhuoxia kang nimen chifan de
 that fish Pass. just now lie table under see you eat
 nazhi huamao tuodao wo erzi de chuangshang qu de.
 that cat take my son bed on to Par. (sf.)
 It was by the cat which was lying under the table watching you
 eat just now that fish has been taken on to my son's bed.

- 5C. 那条鱼是刚刚躺在桌下看你们吃饭的那只花猫的一星期唯一的食物。

natiaoyu shi ganggang tangzai zhuoxia kang nimen chifan de
 that fish is just now lie table under see you eat
 nazhi huamao de yixingqi weiyi de shiwu.
 that cat Poss. one week only food
 That fish is the only food of the cat which was lying under the
 table watching you eat just now for the whole week.

Non-associated antecedent: 那张纸 nazhangzhi (that paper)

Visual target: 金鱼 jīnyú (gold fish)

5D. 主人以为躺在桌下看你吃饭的那只花猫没有看见自己正在准备杀鱼。

zhuren yiwei tangzai zhuoxia kang ni chifan de
 host think lie table under see you eat
 nazhi huamao meiyou kangjian ziji zhengzai zhunbei shayu.
 that cat not see self Tense prepare clean fish
 The host thought that the cat which was lying under the table
 watching you eat did not see him preparing to clean the fish.

Non-associated antecedent: 黄牛 huangnu (cow)

Visual target: 主人 zhuren (host)

6A. 那棵树被常常来到农场帮你们种地的那个农民弄到那间房子里去了。

nakeshu bei changchang laidao nongchang bang nimen zhongdi
 that tree Pass.often come farm help you till land
 de nage nongmin nongdao neijian fangzhili qu le.
 that farmer take that house to Asp.
 That tree has been taken by the farmer who often comes to the
 farm to help you till land to that house.

6B. 那棵树是常常来到农场帮你们种地的那个农民弄到那间房子里去的。

nakeshu shi changchang laidao nongchang bang nimen zhongdi
 that tree Pass.often come farm help you till land
 de nage nongmin nongdao neijian fangzhili qu de.
 that farmer take that house to Par.
 It was by the farmer who often comes to the farm to help you
 till land that tree has been taken to that house.

6C. 那棵树是常常来到农场帮你们种地的那个农民的农场里最后的木材。

nakeshu shi changchang laidao nongchang bang nimen zhongdi
that tree is often come farm help you till land
de nage nongmin de nongchanli zuihou de muchai.
that farmer Poss. farm last wood
That tree is the last wood in the farm of the farmer who
often comes to the farm to help you till land.

Non-associated antecedent: 那杯水 nabeishui (that water)

Visual target: 树木 shumu (tree)

6D. 小孩以为来到农场帮你种地的那个农民没有看见自己正在帮助推车。

xiaohai yiwei laidao nongchang bang ni zhongdi de nage
child think come farm help you till land that
nongmin meiyou kanjian ziji zhengzai bangzhu tuiche.
farmer not see self Tense help push cart
The child thought that the farmer who comes to the farm to
help you till land did not see him helping pushing cart.

Non-associated antecedent: 电工 diangong (electrician)

Visual target: 小孩 xiaohai (child)

7A. 那张报被刚刚站在这里和你们看书的那个作家藏到那黑色包里去了。

nazhangbao bei ganggang zhanzai zeli he nimen kanshu de
that newspaper Pass.just now standing here with you read
nage zuojia changdao naheishe baoli qu le.
that writer hide black bag to Asp.
That newspaper has been hided by the writer who was standing here
reading with you just now in that black bag.

7B. 那张报是刚刚站在这里和你们看书的那个作家藏到那黑色包里去的。

nazhangbao shi ganggang zhanzai zeli he nimen kanshu
that newspaper Pass. just now standing here with you read
de nage zuojia changdao naheishe baoli qu de.

that writer hide black bag to Par.

It was by the writer who was standing here reading with you
just now that newspaper has been hided in that black bag.

7C. 那张报是刚刚站在这里和你们看书的那个作家的黑包里唯一的東西。

nazhangbao shi ganggang zhanzai zeli he nimen kanshu de
that newspaper is just now standing here with you read
nage zuojia de heibaoli weiyi de dongxi.

that writer Poss. black bag only thing

That newspaper is the only thing in the black bag of the
writer who was standing here reading with you just now.

Non-associated antecedent 那根针 nagenzhen (that needle)

Visual target 报纸 baozhi (newspaper)

7D. 读者以为站在这里和你看书的那个作家没有看见自己正在要他签名。

duzhe yiwei zhanzai zeli he ni kanshu de
reader think standing here with you read

nage zuojia meiyou kanjian ziji zhengzai yao ta qianming.

that writer not see self Tense want him autograph

The reader thought that the writer who was standing here
reading with you did not see him asking for his autograph.

Non-associated antecedent 小鸟 xiaoniao (little bird)

Visual target 读者 duzhe (reader)

- 8A. 那块肉被每天跑来这里和孩子玩耍的那只小狗拖到那饭桌下面去了。

nakuairou bei meitian paolai zeli he haizhi wanshua de
 that meat Pass. every day come here with child play
 nazhi xiaogou tuodao nafanzhuo xiamian qu le.
 that dog hide dinner table under to Asp.
 That meat has been taken by the little dog which comes here
 everyday to play with the child to under the dinner table.

- 8B. 那块肉是每天跑来这里和孩子玩耍的那只小狗拖到那饭桌下面去的。

nakuairou shi meitian paolai zeli he haizhi wanshua de
 that meat Pass. every day come here with child play
 nazhi xiaogou tuodao nafanzhuo xiamian qu de.
 that dog hide dinner table under to Par.
 It was by the little dog which comes here everyday to play
 with the child to that meat has been taken under the dinner
 table.

- 8C. 那块肉是每天跑来这里和孩子玩耍的那只小狗的一整天最大的享受。

nakuairou shi meitian paolai zeli he haizhi wanshua de
 that meat is every day come here with child play
 nazhi xiaogou tuodao nafanzhuo xiamian qu de.
 that dog hide dinner table under to Par.
 That meat has been taken by the little dog which comes here
 everyday to play with the child to under the dinner table.

Non-associated antecedent 那块铁 nakwaitie (that iron)

Visual target 牛肉 niurou (beef)

8D. 门房以为跑来这和孩子玩耍的那只小狗没有看见自己正在赶它走开.

menfang yiwei paolai zei he haizhi wanshua de nazhi
 doorman think come here with child play that
 xiaogou meiyou kanjian ziji zhengzai gan ta zhoukai.
 dog not see self Tense drive it away
 The doorman thought that the little dog which comes here
 to play with the child did not see him driving it away.

Non-associated antecedent: 律师 lushi (lawyer)

Visual target: 门房 menfang (doorman)

9A. 那把刀被晚上跑来这里和你们跳舞的那个医生丢到窗外河里面去了.

nabadao bei wangshang paolai zeli he nimen tiaowu de
 that knife Pass.evening come here with you dance
 nage yisheng diudao chuanguwai helimian qu le.
 that doctor throw window out river in to Asp.
 That knife has been thrown by the doctor who came here in the
 evening to dance with you into the river outside of the window.

9B. 那把刀是晚上跑来这里和你们跳舞的那个医生丢到窗外河里面去的.

nabadao shi wangshang paolai zeli he nimen tiaowu de
 that knife Pass.evening come here with you dance
 nage yisheng diudao chuanguwai helimian qu de.
 that doctor throw window out river in to Par.
 It was by the doctor who came here in the evening to dance with
 you that knife has been thrown into the river outside of the
 window.

9C. 那把刀是晚上跑来这里和你们跳舞的那个医生的皮包里的医疗器具。

nabadao shi wangshang paolai zeli he nimen tiaowu de
that knife is evening come here with you dance
nage yisheng de pibaoli de yiliao qiju
that doctor Poss bag medical equipment.
That knife is the medical equipment in the bag of the doctor
who came here in the evening to dance with you.

Non-associated antecedent: 那根线 neigengxian (that thread)

Visual target: 小刀 xiaodao (knife)

9D. 病人以为跑来这里和你跳舞的那个医生没有看见自己正在溜出病房。

bingren yiwei paolai zeli he ni tiaowu de nage
patient think come here with you dance that
yisheng meiyou kanjian ziji zhengzai liuchu bingfang.
doctor not see self Tense sneak out ward
The patient thought that the doctor did not see him sneaking
out of the ward.

Non-associated-target: 翻译 fanyi (interpreter)

Visual target: 病人 bingren (patient)

10A. 那些钱被明天将来厂里和你们工作的那个会计退回到那家公司去了。

naxieqiang bei mingtian jianglai changli he nimen gongzuo
that money Pass. tomorrow come factory with you work
de nage kuaiji tuihuidao neijia gongsi qu le.
that accountant send back that company to Asp.
That money has been sent back by the accountant who will come
to work with you in the factory tomorrow to that company.

10B. 那些钱是明天将来厂里和你们工作的那个会计退回到那家公司去的。

naxieqiang shi mingtian jianglai changli he nimen gongzuo
that money Pass. tomorrow come factory with you work
de nage kuaiji tuihuidao neijia gongsi qu de.
that accountant send back that company to Par.
It was by the accountant who will come to work with you in
the factory tomorrow that money has been sent back to that
company.

10C. 那些钱是明天将来厂里和你们工作的那个会计的帐户里所有的存款。

naxieqiang shi mingtian jianglai changli he nimen gongzuo
that money is tomorrow come factory with you work
de nage kuaiji de zhanghuli suoyou de chunkuan.
that accountant Poss. account all savings
That money is all the savings in the account of the accountant
who will come to work with you in the factory tomorrow.

Non-associated antecedent: 那些米 naxiemi (that rice)

Visual target: 金钱 jinqian (money)

10D. 厂长以为将来厂里和你工作的那个会计没有看见自己正在问他要钱。

changzhang yiwei jianglai changli he ni gongzuo de
director of factory think come factory with you work
nage kuaiji meiyou kanjian ziji zhengzai wen ta yaoqiang.
that accountant not see self tense ask him money.
The manager thought that the accountant who will come to work
with you in the factory did not see him asking for money.

Non-associated antecedent: 将军 jiangjun (general)

Visual target: 厂长 changzhang (director of factory)

11 A. 那辆车被后天将来公司和你们实习的那个司机开到那个车库里去了。

nalianche bei houtian jianglai gongsi he nimen shixi
that car Pass.after tomorrow come company with you practice
de nage siji kaidao neige chekuli qu le.
that driver drive that garage to Asp.

That car has been driven by the driver who will come to practice
with you in the company the day after tomorrow to that garage.

11 B. 那辆车是后天将来公司和你们实习的那个司机开到那个车库里去的。

nalianche shi houtian jianglai gongsi he nimen shixi
that car Pass.after tomorrow come company with you practice
de nage siji kaidao neige chekuli qu de.
that driver drive that garage to Par.

It was by the driver who will come to practice with you in the
company the day after tomorrow that car has been driven to that
garage.

11 C. 那辆车是后天将来公司和你们实习的那个司机的车库唯一的一辆车。

nalianche shi houtian jianglai gongsi he nimen shixi
that car is after tomorrow come company with you practice
de nage siji de cheku wei de yiliangche.
that driver Poss. garage only one car

That car is the only car in the garage of the driver who will
come to practice with you in the company the day after tomorrow.

Non-associated antecedent: 那盒钉 naheding (that box of nails)

Visual target: 汽车 qiche (car)

11D. 警察以为将来公司和你实习的那个司机没有看见自己正在要他停车.

jīngchá yīwei jiānglái gōngsī he nǐ shíxí de nage
policeman think come company with you practice that
sījī méiyǒu kànjiàn zìjǐ zhèngzài yào tā tīngchē.
driver not see self Tense ask him stop car
The policeman thought that the driver who will come to practice
with you in the company did not see him asking him to stop the
car.

Non-associated antecedent: 小贩 xiǎofan (paddler)

Visual target: 警察 jīngchá (jingcha)

12A. 那块糕被下午来到这里和你们唱歌的那个儿童放到他弟弟嘴里去了.

nàkuàigāo bei xiàwǔ láidào zhèlǐ he nǐmen chànggē
that cake Pass. afternoon come here with you sing
de nage ertóng fàngdao tā dìdì zuìlǐ qù le.
that child put his brother mouth to Asp.
That cake has been put by the child who came to sing with you
in the afternoon into his brother's mouth.

12B. 那块糕是下午来到这里和你们唱歌的那个儿童放到他弟弟嘴里去的.

nàkuàigāo shì xiàwǔ láidào zhèlǐ he nǐmen chànggē
that cake Pass. afternoon come here with you sing
de nage ertóng fàngdao tā dìdì zuìlǐ qù de.
that child put his brother mouth to Par.
It was by the child who came to sing with you in the afternoon
that cake has been put into his brother's mouth.

12C. 那块糕是下午来到这里和你们唱歌的那个儿童的心里最想要的东西。

nakuaigao shi xiawu laidao zheli he nimen changge
that cake is afternoon come here with you sing
de nage ertong de xinli zuixiang yaode dongxi.
that child Poss. mind most want thing
That cake is the most wanted thing in the mind of the child
who came to sing with you in the afternoon.

Non-associated antecedent: 那封信 nafengxin (that letter)

Visual target: 糕饼 gaobing (cake)

12D. 校长以为来到这里和你唱歌的那个儿童没有看见自己正在叫他过去。

xiaozhang yiwei laidao zheli he ni changge de
pricipal think come here with you sing
nage ertong meiyou kangjian ziji zhengzai jiao ta guoqu.
that child not see self Tense call him go over
The principal thought that the child who came to sing with
you in the afternoon did not see him calling him go over.

Non-associated antecedent: 流氓 liumang (hooligan)

Visual target: 校长 xiaozhang (principal)

13A. 那只包被常常坐在屋里和你们打牌的那个警察放到那辆警车里去了。

nazhibao bei changchang zuozai wuli he nimen dapai
that bag Pass. often sit room you play card
de nage jingcha fangdao neilian jingcheli qu le.
that policeman put that police car to Asp.
That bag has been put by the policeman who often sits in the
room to play cards with you in that police car.

13B. 那只包是常常坐在屋里和你们打牌的那个警察放到那辆警车里去的。

nazhibao shi changchang zuozai wuli he nimen dapai
that bag Pass. often sit room you play card
de nage jingcha fangdao neilian jingcheli qu de.
that policeman put that police car to Par.
It was by the policeman who often sits in the room to play
cards with you that bag has been put in that police car.

13C. 那只包是常常坐在屋里和你们打牌的那个警察的警车里的必需用品。

nazhibao shi changchang zuozai wuli he nimen dapai
that bag is often sit room you play card
de nage jingcha de jingcheli de bixu yongpin.
that policeman Poss. police car necessary tool
That bag is a necessary tool in the police car of the
policeman who often sits in the room to play cards with you.

Non-associated antecedent: 那碗汤 nawantang (that soup)

Visual target: 皮包 pibao (bag)

13D. 小偷以为坐在屋里和你打牌的那个警察没有看见正在准备逃跑。

xiaotou yiwei zuozai wuli he ni dapai de nage
thief think sit room with you play card that
jingcha meiyou kanjian ziji zhengzai zhunbei taopao.
policeman not see self Tense prepare escape
The thief thought that the policeman who often sits in the
room to play cards with you did not see him preparing to escape.

Non-associated antecedent: 翻译 fanyi (translator)

Visual target: 小偷 xiaotou (thief)

14A. 那把尺被昨天来到这里帮你们装修的那个工人收到那工具箱里去了。

nabaci bei zuotian laidao zheli bang nimen zhuangxiudi
that ruler Pass. yesterday come here help you repair
de nage gongren shoudao nei gongjuxiangli qu le.
that worker take that tool box to Asp.
That ruler has been taken by the worker who came here to
help you with the repairing yesterday to that tool box.

14B. 那把尺是昨天来到这里帮你们装修的那个工人收到那工具箱里去的。

nabaci shi zuotian laidao zheli bang nimen zhuangxiudi
that ruler Pass.yesterday come here help you repair
de nage gongren shoudao nei gongjuxiangli qu de.
that worker take that tool box to Par.
It was by the worker who came here to help you with the
repairing yesterday that ruler was taken to that tool box.

14C. 那把尺是昨天来到这里帮你们装修的那个工人的工具箱里的好工具。

nabaci shi zuotian laidao zheli bang nimen zhuangxiudi
that ruler is yesterday come here help you repair
de nage gongren de gongjuxiangli de hao gongju.
that worker Poss. tool box good tool
That ruler is a good tool in the tool box of the worker
who came here to help you with the repairing yesterday.

Non-associate antecedent: 那口钟 nakouzhou (that clock)

Visual target: 木尺 pichi (ruler)

14D. 老板以为来到这里帮你装修的那个工人没有看见自己正在叫他收工。

laoban yiwei laidao zheli bang ni zhuangxiudi de nage
 boss think come here help you repair that
 gongren meiyou kanjian ziji zhengzai jiao ta shougong.
 worker not see self Tense call him stop work
 The boss thought that the worker who came here to help you
 with the repairing did not see him calling him to stop
 working.

Non-associated antecedent: 兽医 shouyi (vet)

Visual target: 老板 laoban (boss)

15A. 那杯茶被刚刚坐在这里和你们写作的那个记者碰到他椅子下面去了。

nabeicha bei ganggang zuozai zeli he nimen xiezu
 that cup of tea Pass. just now sit here with you write
 de nage jizhe pengdao ta yizhi xiamian qu le.
 that correspondant knock his chair under to Asp.
 That cup of tea has been knocked by the correspondant who
 was sitting here writing with you just now down under his chair.

15B. 那杯茶是刚刚坐在这里和你们写作的那个记者碰到他椅子下面去的。

nabeicha shi ganggang zuozai zeli he nimen xiezu de
 that cup of tea Pass. just now sit here with you write
 nage jizhe pengdao ta yizhi xiamian qu de.
 that correspondant knock his chair under to Par. (sf.)
 It was by the correspondant who was sitting here writing with
 you just now that cup of tea was knocked down under his chair.

15C.那杯茶是刚刚坐在这里和你们写作的那个记者的一整天最大的享受.

nabeicha shi ganggang zuozai zeli he nimen xiezu de
that cup of tea is just now sit here with you write
nage jizhe de yizhengtian zuida de xiangshou.
that correspondant Poss. whole day biggest pleasure
That cup of tea is the biggest pleasure for that
correspondant who was sitting here writing with you today.

Non-associated antecedent: 那只灯 nazhiteng (that light)

Visual target: 绿茶 lücha (tea)

15D.编辑以为坐在这里和你写作的那个记者没有看见自己正在准备排版.

bianji yiwei zuozai zeli he nin xiezu de nage jizhe
editor think sit here with you write that correspondant
meiyou kanjian ziji zhengzai zhunbei paiban.
not see self Tense prepare compose
The editor thought that the correspondant who was sitting
here writing with you did not see him preparing to compose.

Non-associated antecedent: 房客 fangke (tenant)

Visual target: 编辑 bianji (editor)

16A.那只球被昨天来到海边和你们游泳的那个球员踢进那个球门里去了.

nazhiqiu bei zuotian laidao haibian he nimen youyong
that ball Pass.yesterday come beach with you swim
de nage qiuyuan tijin neige qiumenli qu le.
that player kick that goal to Asp.
That ball has been kicked by the player who came to the beach
to swim with you yesterday into that goal.

16B. 那只球是昨天来到海边和你们游泳的那个球员踢进那个球门里去的。

nazhiqiu shi zuotian laidao haibian he nimen youyong
that ball Pass. yesterday come beach with you swim
de nage qiuyuan tiji neige qiumenli qu de.

that player kick that goal to Par. (sf.)
It was by the player who came to the beach to swim with you
yesterday that ball has been kicked into that goal.

16C. 那只球是昨天来到海边和你们游泳的那个球员的一生最精彩的进球。

nazhiqiu shi zuotian laidao haibian he nimen youyong
that ball is yesterday come beach with you swim
de nage qiuyuan de yisheng zuijingcai de jingqiu.

that player Poss. whole life most wonderful goal
That goal is the most wonderful one in the entire life of
the player who came to the beach to swim with you yesterday.

Non-associated antecedent: 那只碗 nazhiwan (that bowl)

Visual target: 足球 zuqiu (soccer)

16D. 裁判以为来到海边和你游泳的那个球员没有看见自己正在准备捡球。

caipan yiwei laidao haibian he nimen youyong de nage
referee think come beach with you swim that
qiuyuan meiyou kanjian ziji zhengzai zhunbei jianqiu.

player not see self Tense prepare pick ball up
The referee thought that the player who came to the beach to
swim with you did not see him preparing to pick up the ball.

Non-associated antecedent: 罪犯 zuifan (criminal)

Visual target: 裁判 caipan (referee)

17A. 那只狗被天天来到球场看你们打球的那个男孩赶到山上树林里去了。

nazhigou bei tiantian laidao qiuchang kan nimen daqiu de
that dog Pass. everyday come stadium see you play ball
nage nanhai gandao shanshang de shulinli qu le.
that boy drive mountain woods to Asp.
That dog has been driven by the boy who comes to the
stadium everyday to watch you playing ball into the woods on
the hill.

17B. 那只狗是天天来到球场看你们打球的那个男孩赶到山上树林里去的。

nazhigou shi tiantian laidao qiuchang kan nimen daqiu de
that dog Pass. everyday come stadium see you play ball
nage nanhai gandao shanshang de shulinli qu de.
that boy drive mountain woods to Par.
It was by the boy who comes to the stadium everyday to watch
you playing ball that little dog was driven into the woods
on the hill.

17C. 那只狗是天天来到球场看你们打球的那个男孩的家里唯一的一只狗。

nazhigou shi tiantian laidao qiuchang kan nimen daqiu de
that dog is everyday come stadium see you play ball
nage nanhai de jiali weiyi de yizhigou.
that boy Poss. home only one dog
That dog is the only one in the house of the boy who comes
to the stadium everyday to watch you playing ball.

Non-associated antecedent 那棵菜 nakecai (that vegetable)

Visual target 小狗 xiaogou (little dog)

17D. 教练以为来到球场看你打球的那个男孩没有看见自己正在准备练习。

jiaolian yiwei laidao qiuchang kan ni daqiu de
coachg think come stadium see you play ball
nage nanghai meiyou kanjian ziji zhengzai zhunbei lianxi.
that boy not see self Tense prepare practice
The coach thought that the boy who comes to the stadium to
watch you playing ball did not see him preparing to practice.

Non-associated antecedent: 顾客 guke (customer)

Visual target: 教练 jiaolian (coach)

18A. 那只鸡被昨晚来到饭店和你们做饭的那个厨师煮进昨天晚餐里去了。

nazhiji bei zuowan laidao fandan he nimen zuofan
that chicken Pass.last night come restrand with you cook
de nage chushi zhujin zuotian wancanli qu le.
that chef cook yesterday dinner to Asp.
That chicken has been cooked by the chef who came to the
restrand yesterday to cook with you into yesterday's dinner.

18B. 那只鸡是昨晚来到饭店和你们做饭的那个厨师煮进昨天晚餐里去的。

nazhiji shi zuowan laidao fandan he nimen zuofan
that chicken Pass.last night come restrand with you cook
de nage chushi zhujin zuotian wancanli qu de.
that chef cook yesterday dinner to Par.
It was by the chef who came to the restrand yesterday to cook
with you that chicken has been cooked into yesterday's dinner.

18C. 那只鸡是昨晚来到饭店和你们做饭的那个厨师的拿手菜中最好的菜。

nazhiji shi zuowan laidao fandian he nimen zuofan
that chicken is last night come restrant with you cook
de nage chushi de nashoucai zhong zuihao de cai.
that chef Poss. special dish among best dish
That chicken is the best of the special dishes of the chef
who came to the restrant yesterday to cook with you.

Non-associated antecedent: 那块泥 nakwaini (that mud)

Visual target: 母鸡 muji (chicken)

18D. 经理以为来到饭店和你做饭的那个厨师没有看见自己正在叫他作菜。

jinli yiwei laidao fandian he ni zuofan de nage
manager think come restrant with you cook that
chushi meiyou kanjian ziji zhengzai jiao ta zuocai.
chef not see self Tense call him cook dish
The manager thought that the chef who came to the restrant
to cook with you did not see him calling him to cook dishes.

Non-associated antecedent: 教师 jiaoshi (that teacher)

Visual target: 经理 jinli (manager)

19A. 那张纸被每天坐在那里为你们打字的那个秘书丢到那垃圾筒里去了。

nazhangzhi bei meitian zuozai nali wei nimen dazhi de
that paper Pass. every day sit there for you type
nage mishu dudao na lajitongli qu le.
that secretary that gabbage can to Asp.
That piece of paper has been thrown by the secretary who sit
there everyday to type for you into the gabbage can.

19B. 那张纸是每天坐在那里为你们打字的那个秘书丢到那垃圾筒里去的。

nazhangzhi shi meitian zuozai nali wei nimen dazhi de
that paper Pass. every day sit there for you type
nage mishu dudao nei lajitongli qu de.
that secretary throw that gabbage can to Par.

It was by the secretary who sits there everyday to type for
you that piece of paper has been thrown into the gabbage can.

19C. 那张纸是每天坐在那里为你们打字的那个秘书的工作计划的第一页。

nazhangzhi shi meitian zuozai nali wei nimen dazhi de
that paper is every day sit there for you type
nage mishu de gongzuo jihua de diyiye.
that secretary Poss. work plan first page
That piece of paper is the first page of the working plan
of the secretary who sits there everyday typing for you.

Non-associated antecedent: 那块板 nakwaiban (that board)

Visual target: 纸张 zhizhang (paper)

19D. 主任以为坐在那里为你打字的那个秘书没有看见自己正在准备工作。

zhuren yiwei zuozai nali wei ni dazhi de nage
director think sit there for you type that
mishu meiyou kanjian ziji zhengzai zhunbei gongzuo.
secretary not see self Tense prepare work
The director thought that the secretary who sits there
everyday typing for you did not see him preparing to work.

Non-associated antecedent: 水手 shuishou (seaman)

Visual target: 主任 zhuren (director)

20A. 那只鸟被每天来到公园和你们聊天的那个老人关进那只鸟笼里去了。

nazhiniao bei meitian laidao gongyuan he nimen liaotian
that bird Pass. everyday come park with you chat
de nage laoren guanjin neizhi niaolongli qu le.

that old man put that bird cage to Asp.
That bird has been put by the old man who comes to the park
everyday to chat with you into that bird cage.

20B. 那只鸟是每天来到公园和你们聊天的那个老人关进那只鸟笼里去的。

nazhiniao shi meitian laidao gongyuan he nimen liaotian
that bird Pass. everyday come park with you chat
de nage laoren guanjin neizhi niaolongli qu de.

that old man put that bird cage to Par.
It was by the old man who comes to the park everyday to chat
with you that bird has been put into that bird cage.

20C. 那只鸟是每天来到公园和你们聊天的那个老人的鸟笼里唯一的小鸟。

nazhiniao shi meitian laidao gongyuan he nimen liaotian
that bird is everyday come park with you chat
de nage laoren de niaolongli weiyi de xiaoniao.

that old man Poss. bird cage only bird
That bird is the only little bird in the bird cage of the
old man who comes to the park everyday to chat with you.

Non-associated antecedent: 那根绳 nagensheng (that rope)

Visual target: 小鸟 xiaoniao (bird)

20D. 园工以为来到公园和你聊天的那个老人没有看见自己正在准备割草。

yuangong yiwei laidao gongyuan he ni liaotian
 gardener think come park with you chat
 de nage laoren meiyou kanjian ziji zhengzai zhunbei gecao.
 that old man not see self Tense prepare mow
 The gardener thought that the old man who comes to the park
 everyday to chat with you did not see him preparing to mow.

Non-associated antecedent 助手 zhushou (assistant)

Visual target 园工 yuangong (gardener)

21 A. 那把锁被昨晚来到家里帮你们开门的那个锁匠装到那扇门上面去了。

nabasuo bei zuowan laidao jiali bang nimen kaimen
 that lock Pass.last night come house for you unlock
 de nage suojiang zhuangdao neishan menshang qu le.
 that locksmith fit that door to Asp.
 That lock has been fit on the door by the locksmith who
 came to the house yesterday to unlock the door for you.

21 B. 那把锁是昨晚来到家里帮你们开门的那个锁匠装到那扇门上面去的。

nabasuo shi zuowan laidao jiali bang nimen kaimen
 that lock Pass.last night come house for you unlock
 de nage suojiang zhuangdao neishan menshang qu de.
 that locksmith fit that door Par.
 It was by the locksmith who came to the house yesterday
 to unlock the door for you that lock has been fit on the
 door.

21 C. 那把锁是昨晚来到家里帮你们开门的那个锁匠的手上唯一的一把锁.

nabasuo shi zuowan laidao jiali bang nimen kaimen
that lock is last night come house for you unlock
de nage suojiang de shoushang weiyi de yibasuo.

that locksmith Poss. hand only lock
That lock is the only lock in the hand of the locksmith who
came to the house yesterday to unlock the door for you.

Non-associated antecedent: 那把叉 nabacha (that fork)

Visual target: 门锁 mensuo (lock)

21 D. 强盗以为来到家里帮你开门的那个锁匠没有看见自己正在准备抢劫.

qiangdao yiwei laidao jiali bang ni kaimen de nage
robber think come house for you unlock that
suojiang meiyou kanjian ziji zhengzai zhunbei qiangjie.

locksmith not see self Tense prepare mug
The robber thought that the locksmith who came to the house
to unlock the door for you did not see him preparing to mug.

Non-associated antecedent: 诗人 shiren (poet)

Visual target: 强盗 qiangdao (robber)

22 A. 那块布被刚刚坐在这里和你们研究的那个博士挂到对面的墙上去了.

nakuaibu bei ganggang zuozai zeli he nimen yanjiu de
that cloth Pass. just now sit here with you study
nage boshi guadao duimian de qiangshang qu le.
that Ph.D hang opposite wall to Asp.
That cloth has been hung by the Ph.D who was
sitting here studying with you just now on the opposite wall.

22B. 那块布是刚刚坐在这里和你们研究的那个博士挂到对面的墙上去的。

nakuaibu shi ganggang zuozai zeli he nimen yanjiu de
that cloth Pass. just now sit ere with you study
nage boshi guadao duimian de qiangshang qu de.
that Ph.D hang opposite wall Par.
It was by the Ph.D who was sitting here studying with you
just now that cloth has been hung on the opposite wall.

22C. 那块布是刚刚坐在这里和你们研究的那个博士的去年的唯一的成果。

nakuaibu shi ganggang zuozai zeli he nimen yanjiu de
that cloth is just now sit here with you study
nage boshi de qunie de weiyi de chengguo.
that Ph.D Poss.last year only product
That cloth is the only product of the Ph.D who was sitting
here studying with you just now last year.

Non-associated antecedent 那只表 neizhibiao (that watch)

Visual target 布料 buliao (cloth)

22D. 教授以为坐在这里和你研究的那个博士没有看见自己正在准备讲解。

jiaoshou yiwei zuozai zeli he ni yanjiu de nage
professor think sit here with you study that
boshi meiyou kanjian ziji zhengzai zhunbei jiangjie.
Ph.D not see self Tense prepare explain
The professor thought that the Ph.D who was sitting here
studying with you did not see him preparing to explain.

Non-associated antecedent 歌手 geshou (singer)

Visual target 教授 jiaoshou (professor)

23A. 那扇窗被清晨来到剧场和你们排练的那个演员拆到后台道具房去了。

nashanchuang bei qingcheng laidao juchang he nimen pailian
that window Pass. morning come theatre with you rehearse
de nage yanyuan chaidao houtai daojufang qu le.
that actor remove back stage property room to Asp.
That window has been removed by the actor who came to the
theatre in the morning to rehearse with you into the back
stage property room.

23B. 那扇窗是清晨来到剧场和你们排练的那个演员拆到后台道具房去的。

nashanchuang shi qingcheng laidao juchang he nimen pailian
that window Pass.morning come theatre with you rehearse
de nage yanyuan chaidao houtai daojufang qu de.
that actor remove back stage property room to Par. (sf.)
It was by the actor who came to the theatre in the morning
to rehearse with you that window has been removed into the
back stage property room.

23C. 那扇窗是清晨来到剧场和你们排练的那个演员的道具房里唯一的窗。

nashanchuang shi qingcheng laidao juchang he nimen pailian
that window is morning come theatre with you rehearse
de nage yanyuan de daojufangli weiyi de chuang.
that actor Poss. stage property room only window
That window is the only window in the stage property room of
the actor who came to the theatre in the morning to rehearse
with you.

Non-associated antecedent: 那本书 nabenshu (that book)

Visual target: 窗户 chunaghu (window)

23D. 指挥以为来到剧场和你排练的那个演员没有看见自己正在准备演奏。

zhihui yiwei laidao juchang he ni pailian de nage
 conductor think come theatre with you rehearsal that
 yanyuan meiyou kanjian ziji zhengzai zhunbei yanzhou.
 actor not see self Tense prepare play music
 The conductor thought that the actor who came to the theatre
 to rehearse with you did not see him preparing to play music.
 Non-associated antecedent: 同事 tongshi (tongshi)

Visual target: 指挥 zhihui (conductor)

24A. 那束花被今天刚来医院为你们打针的那个护士搬到后面阳台上去。

nashuhua bei jingtian gangla yiyuan wei nimen dazheng
 that flower Pass. today come hospital for you injection
 de nage hushi bangdao hougian yangtai shang qu le.
 that nurse move back balcony on to Asp.
 That flower has been moved by the nurse who came to the
 hospital to give injection to you today into the balcony
 in the back.

24B. 那束花是今天刚来医院为你们打针的那个护士搬到后面阳台上去的。

nashuhua shi jingtian gangdao yiyuan wei nimen dazheng
 that flower Pass.morning come hospital for you injection
 de nage hushi bangdao hougian yangtai shang qu de.
 that nurse move back balcony on to Par.
 It was by the nurse who came to the hospital today to give
 injection to you that flower has been moved into the balcony
 in the back.

24C.那束花是今天刚来医院为你们打针的那个护士的情人节唯一的礼物.

nashuhua shi jingtian laidao juchang he nimen pailian
 that window is today come theatre with you rehearse
 de nage hushi de qingrenjie weiyi de liwu.
 that nurse Poss.Valentine's day only gift
 That flower is the only Valentine's day gift for that nurse
 who came to the hospital today to give injection to you.

Non-associated antecedent 那只鞋 nazhixie (that shoe)

Visual target 鲜花 xianhua (flower)

24D.医生以为刚来医院为你打针的那个护士没有看见自己正在准备开刀.

yisheng yiwei ganglai yiyuan wei ni dazheng
 doctor think just come hospital for you injection
 de nage hushi meiyou kanjian ziji zhengzai zhunbei kaidao.
 that nurse not see self Tense prepare operate
 The doctor thought that the nurse who just came to the hospital
 to give injection to you did not see him preparing to operate.

Non-associated antecedent 船长 chuanzhang (captain)

Visual target 医生 yisheng (doctor)

APPENDIX II.

EXPERIMENT II: EXPERIMENTAL SENTENCES

1 A. 那个著名的画家这个聪明漂亮的女孩和她的朋友请了三次到那所私立学校去讲课.

nage zhuminde huajia zhege congmingpiaoliangde
 that famous painter this clever pretty
 nuhai he tade pengyou qingle sanci
 girl and her friend invite three times
 dao nasuo shili xuexiao qu jiangke.
 to that private school go lecture

That famous painter this clever and pretty girl and her friend have
 invited three times to go to lecture at that private school.

1 B. 那个著名的画家被这聪明漂亮的女孩和她的朋友请了三次到那所私立学校去讲课.

nage zhumingde huajia] bei zhe congmingpiaoliangde
 that famous painter Pass. this clever pretty
 nuhai he tade pengyou qingle sanci dao
 girl and her friend invite three times to
 nasuo shili xuexiao qu jiangke.
 that private school go lecture

That famous painter has been invited three times by this clever and
 pretty girl and her friend to go to lecture at that private school.

1 C. 那个著名的画家以为这个聪明漂亮的女孩和她的朋友没有看见自己正在准备画画.

nage zhumingde huajia yiwei zhege
 that famous painter think this
 congmingpiaoliangde nuhai he tade pengyou meiyou
 clever and pretty girl and her friend not
 kangjian ziji zhengzhai zhunbei huahua
 see self progressive Asp. prepare paint

That famous painter thought that this clever and pretty girl and her
 friend didn't see him preparing to paint.

- 2A. 那个凶恶的逃犯这个勇敢机智的警察和他的伙伴抓了到那一座遥远的监狱去坐牢。

nage xiongwude taofan zhege yongganjizhide jinchā
that vicious fugitive this brave wise policeman
he tade tongban zhualē dao nāzhuo yaoyuānde
and his partner catch to that far away
jiānyu qu zhuolao.
jail go imprisoned

That vicious fugitive this brave and wise policeman and his partner
have caught and imprisoned in that far away jail.

- 2B. 那个凶恶的逃犯被这勇敢机智的警察和他的伙伴抓了到那一座遥远的监狱去坐牢。

nage xiongwude taofan bei zhege yongganjizhide
that vicious fugitive Pass. this brave wise
jinchā he tade tongban zhualē dao nāzuo
policeman and his partner catch to that
yaoyuan jiānyu qu zuolao.
far away prison go imprisoned

This vicious fugitive has been caught by this brave and wise
policeman and his partner and imprisoned in that far away jail.

- 2C. 那个凶恶的逃犯以为这个勇敢机智的警察和他的伙伴没有看见自己正在准备逃跑。

nage xiongwude taofan yiwei zhege yongganjizhide
that vicious fugitive think this brave wise
jinchā he tade tongban meiyōu kǎnjiàn zìjǐ
policeman and his partner not see self
zhēngzài zhūnbèi tāopao.
prog. Asp. prepare escape

This vicious fugitive thought that this brave and wise policeman
and his partner didn't see him preparing to escape.

- 3A. 那个顽皮的学生这个严格认真的教师和他的助手叫了五次到校长的办公室去谈话。

nage wanpide xusheng zhege yangerenzhende jiaoshi
that naughty pupil this strict serious teacher
he tade zhushou jiaole wuci dao xiaozhangde
and his assistant call ive times to pricipal
bangongshi qu tanhua.
office to talk

That naughty pupil this strict and serious teacher and his assistant
have called five times to the principal's office to talk.

- 3B. 那个顽皮的学生被这严格认真的教师和他的助手叫了五次到校长的办公室去谈话。

nage wanpide xuesheng bei zhege yangerenzhende
that naughty pupil Pass. this strict serious
jiaoshi he tade zhushou jiaole wuci dao
call and his assistant call five times to
xiaozhangde bangongshi qu tanhua.
principal office to talk

That naughty pupil has been called by this strict and serious teacher
and his assistant five times to the principal's office to talk.

- 3C. 那个顽皮的学生以为这个严格认真的教师和他的助手没有看见自己正在准备上课。

nage wanpide xuesheng yiwei zhege yangerenzhengde
that naughty pupil think this strict serious
jiaoshi he tade zhushou meiyou kanjian ziji
teacher and his assistant not see self
zhengzhai zhunbei shangke.

progressive Asp. prepare go to class

That naughty pupil thought that this strict and serious teacher and
his assistant didn't see that he was preparing to go to a class.

4A. 那个年轻的军人这个蛮横无理的司机和他的同伴押了到那个出租汽车公司去付钱

nage nianqingde juren zhege manhenwulide siji
 that young soldier this rude unreasonable driver
 he tade tongban yale dao nage chuzuciche gongsi
 and his friend escort to that taxi Co.
 qu fuqian.

go pay money

That young soldier this rude and unreasonable driver and his friend
 have escorted to go to pay money in that taxi Co.

4B. 那个年轻的军人被这蛮横无理的司机和他的同伴押了到那个出租汽车公司去付钱

nage nianqingde juren bei zhe manhenwulide siji
 that young soldier Pass. this rude unreasonable driver
 he tade tongban yale dao nage chuzuciche gongsi
 and his friend escort to that taxi Co.
 qu fuqian.

go pay money

That young soldier has been escorted by this rude and unreasonable
 driver and his friend to go to pay money in that taxi Co.

4C. 那个年轻的军人以为这个蛮横无理的司机和他的同伴没有看见自己正在准备付钱

nage nianqingde juren yiwei zhege manhenwulide
 that young soldier think this rude unreasonable
 siji he tade tongban meiyou kanjian ziji zhengzai
 driver and his friend not see self prog. Asp.
 zhunbei fuqian.

prepare pay money

That young soldier thought that this rude and unreasonable
 driver and his friend didn't see him preparing to pay money.

- 5A. 那个英俊的演员这个非常优秀的导演和他的摄影找了四次到那家电影公司去拍戏。

nage yingjunde yanyuan zhege feichangyouxiude daoyan
that handsome actor this outstanding director
he tade sheying zhaole sici dao najia
and his photographor ask four times to that
dianying gongshi qu paixi.
film Co. to shoot film

That handsome actor this outstanding director and his photographor
have asked four times to go to shoot film for that film Co..

- 5B. 那个英俊的演员被这个非常优秀的导演和他的摄影找了四次到那家电影公司去拍戏。

nage yingjude yanyuan bei zhege feichangyouxiude
that handsome actor Pass. this outstanding
daoyan he tade sheying zhaole sici qu najia
director and his photographor ask four times to that
dianying gongshi qu paixi.
film Co. to shoot film

That handsome actor has been asked by this outstanding director and
his photographor to shoot film for that film Co. for four times.

- 5C. 那个英俊的演员以为这个非常优秀的导演和他的摄影没有看见自己正在准备拍戏。

nage yingjunde yanyuan yiwei zhege feichangyouxiude
that handsome actor think this outstanding
daoyan he tade sheying meiyou kanjian ziji zhengzai
director and his photography not see self prog. Asp.
zhunbei paixi.
prepare shoot film

That handsome actor thought that this outstanding director and his
photographor didn't see him preparing to shoot the film.

- 6A. 那个新来的教授这个热情的学生和办公室人员带了到学校新建的实验大楼去参观。

nage xinlaide jiaoshou zhege reqingde xuesheng he
that newly come professor this warm student and
bangongsi ren yuan daile dao xuexiao xinjiande
office staff take to school newly built
shiyán dalou qu canguan.
lab building go visit

That newly-come professor these warm students and office staff
have taken to visit the school's newly-built lab building.

- 6B. 那个新来的教授被这热情的学生和办公室人员带了到学校新建的实验大楼去参观。

nage xinlaide jiaoshou bei zhe reqingde xuesheng
that newly come professor Pass. this warm student
he bangongsi ren yuan daile dao xuexiao
and office staff take to school
xinjiande shiyán dalou qu canguan.
newly-built lab building go visit

That newly-come professor these warm students and office staff
have taken to visit the school's newly-built lab building.

- 6C. 那个新来的教授以为这个热情的学生和办公室人员没有看见自己正在准备参观。

nage xinlaide jiaoshou yiwei zhege reqingde xuesheng
that newly come professor think this warm student
he bangongsi ren yuan meiyou kanjian ziji
and office staff not see self
zhengzai zhunbei canguan.
prog. Asp prepare visit

That newly-come professor thought that this warm students and
office staff didn't see him preparing to visit.

7A. 那个高明的医生这个身体不好的富人和他的太太拉了几次到那所豪华别墅去吃饭。

nage gaomingde yisheng zhege shengtibuhaode furen he
 that bright doctor this unhealthy rich man and
 tade taitai lale jici dao nasuo haohua
 his wife pull several times to that luxurious
 bieshu qu chifan.
 villa go eat dinner

This bright doctor this unhealthy rich man and his wife have pulled
 several times to go to eat dinner at that luxurious villa.

7B. 那个高明的医生被这身体不好的富人和他的太太拉了几次到那所豪华别墅去吃饭。

nage gaomingde yisheng bei zhe shengtibuhaode furen
 that bright doctor Pass. this unhealthy rich man
 he tade taitai lale jici dao nasuo haohua
 and his wife pull several times to that luxurious
 bieshu qu chifan.
 villa to eat dinner

That bright doctor has been pulled several times by this unhealthy
 rich man and his wife to go to eat dinner at that luxurious viller.

7C. 那个高明的医生以为这个身体不好的富人和他的太太没有看见自己正在准备吃饭。

nage gaomingde yisheng yiwei nage shengtibuhaode
 that bright doctor think that unhealthy
 furen he tade taitai meiyou kanjian ziji
 rich man and his wife not see self
 zhengzai zhunbei chifan.
 prog. Asp. prepare eat dinner

That bright doctor thought that this rich man and his wife didn't
 see him preparing to eat dinner.

- 8A. 那个愚蠢的国王这个阴险狡猾的大臣和他的同谋骗了到哪一望无际的沙漠去生活.

nage yuchunde guowang zhege yinxianjiaohuade dachen
that foolish king this sinister sly minister
he tade tongmou pianle dao na yiwangwujide
and his conspirator deceive to that stretch to horizon
shamo qu shenghuo.
desert go shenghuo

That foolish king this sinister and sly minister and his conspirator
have deceived into going to live in that desert that stretches to
horizon.

- 8B. 那个愚蠢的国王被这阴险狡猾的大臣和他的同谋骗了到哪一望无际的沙漠去生活.

nage yuchunde guowang bei zhe yinxianjiaohuade dachen
that foolish king Pass. this sinister sly minister
he tade tongmou pianle dao na yiwangwujide
and his conspirator deceive to that stretch to horizon
shamo qu shenghuo.
desert go shenghuo

That foolish king has been deceived by this sinister and sly minister
and his conspirator into going to live in that desert that stretches
to horizon.

- 8C. 那个愚蠢的国王以为这个阴险狡猾的大臣和他的同谋没有看见自己正在准备睡觉.

nage yuchunde guowang yiwei zhege yinxianjiaohuade
that foolish king think this sinister sly
dachen he tade tongmou meiyou kanjian ziji
minister and his conspirator not see self
zhengzai zhunbei shuijiao.
prog. Asp. prepare sleep

That foolish king though that this sinister and sly minister
and his conspirator didn't see that he was preparing to sleep.

- 9A. 那个大胆记者这个新闻报社的社长和他的主编派了两次到那个非洲国家去采访。

nage dadande jize zhege xiweng baoshede shezhang
that bold reporter this newspaper corporation chairman
he tade zhubian paile liangci dao nage feizhou
and his chief-editor send twice to that African
guojia qu caifang.
country go interview

That bold reporter this newspaper corporation chairman and his
chief-editor have sent twice to go to cover that African count

- 9B. 那个大胆记者被这新闻报社的社长和他的主编派了两次到那个非洲国家去采访。

nage dadande jizhe bei zhe xinwen baoshede
that bold reporter Pass. this newspaper Corp.
shezhang he tade zhubian paile liangci dao nage
chairman and his chief-editor send twice to that
feizhou guojia qu caifang.
African country go interview

That bold reporter has been sent twice to cover that African country
by the chairman of that newspaper Corp. and his chief-editor.

- 9C. 那个大胆记者以为这个新闻报社的社长和他的主编没有看见自己正在准备采访。

nage dadande jizhe yiwei zhege xinwenbaoshede shezhang
that bold reporter think this newspaper Corp. chairman
he tade zhubian meiyou kanjian ziji zhengzai
and his chief-editor not see self progressive Asp.
zhengzai zhunbei caifang.

progressive Asp. prepare interview

That bold reporter thought that this newspaper Corp. chairman and
his chief-editor didn't see him preparing to interview.

10A 那个过路的锁匠这个急于回家的小孩和他的弟弟拦了到那马路对面的家里去开门。

nage guolude suojiang zhege jiyuhuijiade xiaohai
that passing lockersmith this eager-to-go-home kid
he tade didi lanle dao na maluduimiande jiaoli
and his brother stop to that across street home
qu kaimen.
go open door

That passing-by lockersmith this eager-to-go-home kid and his brother
have stopped to go to the house across the street to open the door.

10B. 那个过路的锁匠被这急于回家的小孩和他的弟弟拦了到那马路对面的家里去开门。

nage guolude suojiang bei zhe jiyuhuijiade xiaohai
that passing lockersmith Pass. this eager-to-go-home kid
he tade didi lanle dao na maluduimiande jiaoli
and his brother stop to that across street home
qu kaimen.
go open door

That passing-by lockersmith has been stopped by this eager-to-go-home
kid and his brother to go to the house across the street to open
the door.

10C. 那个过路的锁匠以为这个急于回家的小孩和他的弟弟没有看见自己正在准备开门。

nage guolude suojiang yiwei zhege jiyuhuijiade
that passing lockersmith think this eager-to-go-home
xiaohai he tade didi meiyou kanjian ziji
kid and his brother not see self
zhengzai zhunbei kaimen.
prog. Asp. prepare open door

That passing-by lockersmith thought that this eager-to-go-home
kid and his brother didn't see him preparing to open the door.

- 11A. 那个精明的律师这个无理取闹的事主和他的家属逼了数次到他的律师楼去拿文件.

nage jīnmíngde lushi zhege wulíqunaode shizhu
 that shrewd lawyer this troublesome client
 he tade jiashu bile shuci dao tade
 and his relative force several times to his
 lushi lou qu na wénjiàn.
 law firm go get documents

That shrewd lawyer this unreasonable and troublesome client and his
 relatives have forced several times to go to get documents in
 his law firm.

- 11B. 那个精明的律师被这无理取闹的事主和他的家属逼了数次到他的律师楼去拿文件.

nage jīnmíngde lushi bei zhe wulíqunaode shizhu
 that shrewd lawyer Pass. this troublesome client
 he tade jiashu bile shuci dao tade
 and his relative force several times to his
 lushi lou qu na wénjiàn.
 law firm go get documents

That shrewd lawyer this unreasonable and troublesome client and his
 relatives have forced several times to go to get documents in
 his law firm.

- 11C. 那个精明的律师以为这个无理取闹的事主和他的家属没有看见自己正在准备离开.

nage jīnmíngde lushi yíwei zhege wulíqunaode shizhu
 that shrewd lawyer think this troublesome client
 he tade jiashu méiyǒu kànjiā zìjǐ zhèngzài
 and his relative not see self prog. Asp.
 zhūnbèi líkai.
 prepare leave

That shrewd lawyer thought that this unreasonable and troublesome
 client and his relatives didn't see him preparing to go out.

- 12A. 那个可爱的幼儿这个善良诚实的修女和她的姐妹领了到那座社区教堂里去生活.

nage keaide youer zhe shanliangde xiouyu he
 that lovely baby this kind honest nun and
 tade jiemei linle dao nazhuo shequ
 her sister take to that community
 jiaotang li qu shenghuo
 church in go live
 That lovely baby this honest and kind nun and her sister have
 brought to live in that community church.

- 12B. 那个可爱的幼儿被这善良诚实的修女和她的姐妹领了到那座社区教堂里去生活.

nage keaide youer bei zhe shanliangde xiouyu
 that lovely kid Pass. this kind honest nun
 he tade jiemei linle dao nazhuo shequ
 and her sister take to that community
 jiaotang li qu shenghuo
 church in go live
 That lovely kid has been brought by this honest and kind nun
 and her sister to live in that community church.

- 12C. 那个可爱的幼儿以为这个善良诚实的修女和她的姐妹没有看见自己正在准备起来.

neige keaide youer yiwei zhege shanliangde
 that lovely kid think this kind honest
 xiounu he tade jiemei meiyou kanjian ziji
 nun and her sister not see self
 zhengzai zhunbei qilai.
 prog. Asp. prepare get up
 That lovely kid thought that this honest and kind nun and
 her sister didn't see her preparing to get up.

- 13A. 那个能干的裁缝这个喜欢打扮的妇人和她的丈夫请了十五次到他们家里去做衣服。

nage nengande caifong zhege xihuandabande furen
 that capable tailer this like dressing up woman
 he tade zhangfu gule shiwuci dao tamenjiali
 and her hunsband hire fifteen times to their home
 qu zuoyifu.
 go make cloth

That capable tailer this woman who likes to dress up and her
 husband have hired fifteen times to make cloth at their home.

- 13B. 那个能干的裁缝被这喜欢打扮的妇人和她的丈夫请了十五次到他们家里去做衣服。

nage nengande caifong bei zhe xihuandabande
 that capable tailer Pass. this like dressing up
 furen he tade zhangfu gule shiwuci dao
 woman and her hunsband hire fifteen times to
 tamenjiali qu zuoyifu.
 their home go make cloth

That capable tailer has been hired by this woman who likes to
 dress up and her husband fifteen times to make cloth at their
 home.

- 13C. 那个能干的裁缝以为这个喜欢打扮的妇人和她的丈夫没有看见自己正在准备工作。

nage nengande caifong yiwei zhege xihuandabande
 that capable tailer think this like dressing up
 furen he tade zhangfu meiyou kanjian ziji
 woman and her hunsband not see self
 zhengzai zhunbei gongzuo.
 prog. Asp prepare work

That capable tailer thought that this woman who likes to dress
 up and her husband didn't see him preparing to work.

- 14A. 那个多产的作家这个财力雄厚的商人和他的经理藏了到一个安静的地方去写新书.

nage duocande zuojia zhege cailixionghoude shangren
that productive writer this very rich businessman
he tade jingli cangle dao yige anjingde
and his manager hide to a quite
difang qu xiexingshu.
place go write new book

That productive writer this very rich businessman and his
manager have hid in a quite place to write a new book.

- 14B. 那个多产的作家被这财力雄厚的商人和他的经理藏了到一个安静的地方去写新书.

neige duocande zuojia bei zhege cailixionghoude
that productive writer Pass. this very rich
shangren he tade jingli cangle dao yige
businessman and his manager hide to a
anjingde difang qu xiexingshu.
quite place go write new book

That productive writer has been hid by this very rich businessman
and his manager in a quite place to write a new book.

- 14C. 那个多产的作家以为这个财力雄厚的商人和他的经理没有看见自己正在准备写作.

neige duocande zuojia yiwei zhege cailixionghoude
that productive writer think this very rich
shangren he tade jingli meiyou kanjian ziji
businessman and his manager not see self
zhengzai zhunbei xiezu.
prog. Asp prepare write

That productive writer thought that this very rich businessman
and his manager didn't see him preparing to write

- 15A. 那个仔细的会计这个投资公司的总裁和他的副手选了七次到那个附属公司去查账

nage zixide kuaiji zhege touzhigongside
that careful accountant this investment Co.
zongcai he tade fushou xuanle qici
president and his vice president select seven times
dao nage fushugongsi qu cazhang.
to that affiliated company go audit
That careful accountant this investment Co.'s president and
his vice president have selected seven times to go to audit in
that affiliated company.

- 15B. 那个仔细的会计被这投资公司的总裁和他的副手选了七次到那个附属公司去查账

nage zixide kuaiji bei zhege touzhigongside
that careful accountant Pass. this investment Co.
zongcai he tade fushou xuanle qici
president and his vice president select seven times
dao nage fushugongsi qu cazhang.
to that affiliated company go audit
That careful accountant has been selected by this investment
Co.'s president and his vice president seven times to go to
audit in that affiliated company.

- 15C. 那个仔细的会计以为这个投资公司的总裁和他的副手没有看见自己正在准备查账

nage zixide kuaiji yiwei zhege touzhigongside
that careful accountant think this investment Co.
zongcai he tade fushou meiyou kanjian
president and his vice president not see
ziji zhengzai zhunbei cazhang.
self prog. Asp. prepare audit
That careful accountant thought that this investment Co.'s
president and his vice president didn't see her preparing
to audit.

16A. 那个受伤的球员这个只想赚钱的老板和他的经纪卖了到那一支外国的球队去打球

nage shoushangde qiuyuan zhege zixiangzuanqiande
that injured player this only want money
laoban he tade jingji maile dao nayizi
owner and his agent sell to that one
waiguodeqioudei qu daqiu.
foreign ball club go play

That injured player this ball club owner who only wants to make money and his agent have sold to a foreign ball club to play.

16B. 那个受伤的球员被这只想赚钱的老板和他的经纪卖了到那一支外国的球队去打球

nage shoushangde qiuyuan bei zhe zixiangzuanqiande
that injured player Pass. this only want money
laoban he tade jingji maile dao nayizi
owner and his agent sell to that one
waiguodeqioudei qu daqiu.
foreign ball club go play

That injured player has been sold by this ball club owner who only wants to make money and his agent to a foreign ball club to play.

16C. 那个受伤的球员以为这个只想赚钱的老板和他的经纪没有看见自己正在准备打球

nage shoushangde qiuyuan yiwei zhege
that injured player think this
zixiangzuanqiande laoban he tade jingji meyou
only want money owner and his agent not
kanjian ziji zhengzai zhunbei daqiu.
see self prog. Asp. prepare play ball

That injured player thought that this ball club owner who only wants to make money and his agent didn't see that he was preparing to play ball.

- 17A. 那个无照的司机这个执法严厉的法官和他的陪审罚了他居住的那个社区去劳动.

neige wuzhaode siji zhege zhifayanlide faguan
 that no license driver this enforce law strictly judge
 he tade peisheng fale dao ta juzude nage
 and his jury fine to his live that
 shequ qu laodong.
 community go work
 This driver who has no license this judge who enforces law
 strictly and his jury have ordered to do community work at
 where he lives as a punishment.

- 17B. 那个无照的司机被这执法严厉的法官和他的陪审罚了他居住的那个社区去劳动.

neige wuzhaode siji bei zhe zhifayanlide
 that no license driver Pass. this enforce law strictly
 faguan he tade peisheng fale dao ta juzude
 judge and his jury fine to his live
 neige shequ qu laodong.
 that community go work
 This driver who has no license has been ordered by this judge
 who enforces law strictly and his jury to do community work at
 where he lives as punishment.

- 17C. 那个无照的司机以为这个执法严厉的法官和他的陪审没有看见自己正在准备劳动.

neige wuzhaode siji yiwei zhege
 that no license driver think this
 zhifayanlide faguan he tade peisheng
 enfocer law strictly judge and his jury
 meiyou kanjian ziji zhengzai zhunbei laodong.
 not see self prog. Asp prepare work
 That driver who has no license thought that this judge who
 enforces law strictly and his jury did not see him preparing
 to work.

- 18A. 那个差劲的厨师这个讲究美食的经理和他的哥哥调到了那餐馆的停车场去看车子。

nage cājīngde chushi zhege jiāngjūmeishide jīnli
 that terrible chef this like gourmet manager
 he tade gege diaole dao nācānguānde tīnchēchang
 and his brother transfer to that restaunt parking lot
 qu kan chezi.
 go look after car
 That terrible chef this gourmet loving manager and his brother
 have transfered to that restaunt's parking lot to look after cars.

- 18B. 那个差劲的厨师被这讲究美食的经理和他的哥哥调到了那餐馆的停车场去看车子。

nage cājīngde chushi bei zhe jiāngjūmeishide
 that terrible chef Pass. this like gourmet
 jīnli he tade gege diaole dao nācānguānde
 manager and his brother transfer to that restaunt
 tīnchēchang qu kan chezi.
 parking lot go look after car
 That terrible chef has been transfered by this gourmet loving
 manager and his brother to that restaunt's parking lot to look
 after cars.

- 18C. 那个差劲的厨师以为这个讲究美食的经理和他的哥哥没有看见自己正在准备做饭。

nage cājīngde chushi yiwei zhege jiāngjūmeishide
 that terrible chef think this like gourmet
 jīnli he tade gege meiyǒu kànjiàn zìjǐ zhèngzài
 manager and his brother not see self prog. Asp.
 zhūnbèi zuǒfàn.
 prepare cook
 That terrible chef thought that this gourmet loving manager and
 his brother didn't see him preparing to cook.

- 19A. 那个憋脚的导游这个非常气愤的游客和他的游伴扔了六次到那冰凉的海里去游泳。

nage biejiade daoyou zhege feichangqifengde
that bad guide this very angry
youke he tade youban rengle liuci dao
tourist and his partner throw six times to
nabinliangde haili qu youyong.
cold sea go swim

That bad guide this very angry tourist and his fellow tourist have
thrown six times into the cold sea to swim.

- 19B. 那个憋脚的导游被这非常气愤的游客和他的游伴扔了六次到那冰凉的海里去游泳。

nage biejiade daoyou bei zhe feichangqifengde
that bad guide Pass. this very angry
youke he tade youban rengle liuci dao
tourist and his partner throw six times to
nabinliangde haili qu youyong.
cold sea go swim

This bad guide has been thrown six times by this very angry
tourist and his fellow tourist into the cold sea to swim.

- 19C. 那个憋脚的导游以为这个非常气愤的游客和他的游伴没有看见自己正在准备游泳。

neige biejiade daoyou yiwei zhege feichangqifengde
that bad guide think this very angry
youke he tade youban meiyou kanjian ziji
tourist and his partner not see self
zhengzai zhunbei youyong.
prog. Asp. prepare swim

This bad guide thought that this very angry tourist and his
fellow tourist didn't see him preparing to swim.

20A. 那个机智的侦探这个技术高明的法医和他的助手领了到那个医院的化验室去查看.

nage jizide zhengtan zhege jishugaomingde
that resourceful detective this experienced
fayi he tade zhushou lingle dao
forensic doctor and his aid take to
neige yiyuande huayanshi qu chakan.
that hospital lab go examine
That resourceful detective this experienced forensic doctor and
his aid have taken to the lab of that hospital to examine.

20B. 那个机智的侦探被这技术高明的法医和他的助手领了到那个医院的化验室去查看.

nage jizide zhengtan bei zhe jishugaomingde
that resourceful detective Pass. this experienced
fayi he tade zhushou lingle dao
forensic doctor and his aid take to
nage yiyuande huayanshi qu chakan.
that hospital lab go examine
That resourceful detective has been taken to the lab of that
hospital by this experienced forensic doctor and his aid to examine.

20C. 那个机智的侦探以为这个技术高明的法医和他的助手没有看见自己正在准备查看.

neige jizide zhengtan yiwei zhege jishugaomingde
that resourceful detective think this experienced
fayi he tade zhushou meiyou kanjian
forensic doctor and his aid not see
ziji zhengzai zhunbei chakan.
self prog.Asp. prepare examine
That resourceful detective thought that this experienced
forensic doctor and his aid didn't see him preparing to examine.

- 21 A. 那个谨慎的秘书这个喜欢奉承的校长和他的主任升了两次到校长的办公室去工作.

nage jingshende mishu zhege xihuanfengchengde
that prudent secretary this like flatter
xiaozhang he tade zhuren shengle liangci dao
president and his director promote twice to
xiaozhang bangongshi qu gongzuo.
president's office go work

That prudent secretary this president who likes flattering and
his director have promoted twice to president's office to work.

- 21 B. 那个谨慎的秘书被这喜欢奉承的校长和他的主任升了两次到校长的办公室去工作.

nage jingshende mishu bei zhe
that prudent secretary Pass. this
xihuanfengchengde xiaozhang he tade zhuren shengle
like flatter president and his director promote
liangci dao xiaozhang bangongshi qu gongzuo.
twice to president's office go work

That prudent secretary has been promoted twice by this president
who likes flattering and his director to work in the president's
office.

- 21 C. 那个谨慎的秘书以为这个喜欢奉承的校长和他的主任没有看见自己正在准备打字.

nage jingshende mishu yiwei zhege
that prudent secretary think this
xihuanfengchengde xiaozhang he tade zhuren
like flatter president and his director
meiyou kanjian ziji zhengzai zhunbei dazi.
not see self prog. Asp. prepare type

That prudent secretary thought that this president who likes
flattering and his director didn't see that he was preparing to type.

- 22A. 那个温和的园丁这个脾气古怪的贵妇和他的管家赶到了那个乡下的农庄里去种菜。

nage wenhede yuanding zhege piqiguguaide guifu he
that gentle gardener this of bad temper lady and
tade guanjia ganle dao nage xiangxiade
her housekeeper drive to that country
nongzhuangli qu zhongcai.
farm go grow vegetable

That gentle gardener this noble lady of bad temper and her
housekeeper have driven to that country farm to grow vegetables.

- 22B. 那个温和的园丁被这脾气古怪的贵妇和他的管家赶到了那个乡下的农庄里去种菜。

nage wenhede yuanding bei zhe piqiguguaide
that gentle gardener this of bad temper
guifu he tade guanjia ganle dao nage
lady and her housekeeper drive to that
xiangxiade nongzhuangli qu zhongcai.
country farm go grow vegetable

That gentle gardener has been driven by this noble lady of bad
temper and her housekeeper to that country farm to grow vegetables.

- 22C. 那个温和的园丁以为这个脾气古怪的贵妇和他的管家没有看见自己正在准备出门。

nage wenhede yuanding yiwei zhege piqiguguaide
that gentle gardener think this of bad temper
guifu he tade guanjia meiyou kanjian ziji
lady and her housekeeper not see self
zhengzai zhunbei chumen.
prog. Asp. prepare go out

That gentle gardener thought that this noble lady of bad temper
and her housekeeper didn't see that he was preparing to go out.

- 23A. 那个熟练的翻译这个刚刚上任的主管和他的助理派了数次到联合国去作中文翻译

neige shuliande fanyi zhege ganggangshangrende
that skillful interpreter this newly come
zhuguan he tade zhuli paile shuci dao
executive and his assistant send several times to
lianheguo qu zuo zhongwenfanyi.
United Nation go do Chinese translation
That skillful interpreter this newly come executive and his assistant
have send several times to United Nation to do Chinese translation.

- 23B. 那个熟练的翻译被这刚刚上任的主管和他的助理派了数次到联合国去作中文翻译

nage shuliande fanyi bei zhege
that skillful interpreter Pass. this
ganggangshangrende zhuguan he tade zhuli paile
newly come executive and his assistant send
shuci dao lianheguo qu zuo zhongwenfanyi.
several times to United Nation go do Chinese translation
That skillful interpreter this newly come executive and his
assistant have send several times to United Nation to do Chinese
translation.

- 23C. 那个熟练的翻译以为这个刚刚上任的主管和他的助理没有看见自己正在准备回家

nage shuliande fanyi yiwei zhege
that skillful interpreter this
ganggangshangrende zhuguan he tade zhuli
newly come executive and his assistant
meiyou kanjian ziji zhengzai zhunbei huijia.
not see self prog. Asp. prepare go home
That skillful interpreter thought that this newly come executive
and his assistant didn't see him preparing to go home.

- 24A. 那个好赌的海员这个狡猾的赌场老板和他的司机接了多次到他的那个赌场去赌钱

nage haodude haiyuan zhege jiaohuade duchang
 that like gamble seaman this cunning casino
 laoban he tade siji jiele duoci dao tade
 owner and his chauffeur take many times to his
 nage duchang qu duqian.
 that casino go gamble

That seaman fonding of gambling this cunning casino owner and his
 cauffeur have accommodated many times to his casino to gamble.

- 24B. 那个好赌的海员被这狡猾的赌场老板和他的司机接了多次到他的那个赌场去赌钱

nage haodude haiyuan bei zhe jiaohuade duchang
 that like gamble seaman Pass. this cunning casino
 laoban he tade siji jiele duoci dao tade
 owner and his chauffeur take many times to his
 nage duchang qu duqian.
 that casino go gamble

That seaman fonding of gambling this cunning casino owner and his
 cauffeur have accommodated many times to his casino to gamble.

- 24C. 那个好赌的海员以为这个狡猾的赌场老板和他的司机没有看见自己正在准备赌钱

nage haodude haiyuan yiwei zhege jiaohuade
 that like gamble seaman think this cunning
 duchang laoban laoban he tade siji meiyou
 casino owner owner and his chauffeur not
 kanjian ziji zhengzai duqian.
 see self prog. Asp. gamble

That seaman fonding of gambling thought that this cunning casino
 owner and his cauffeur didn't see him preparing to gamble.

Probe Words:

1. 彩色 color 2. 手铐 handcuff 3. 考试 exam 4. 步枪 rifle
5. 诊断 diagnose 6. 宫殿 palace 7. 诉讼 lawsuit 8. 奶瓶 bottle
9. 剪刀 scissors 10. 小说 fiction 11. 支出 expense
12. 篮球 basketball 13. 新闻 news 14. 钥匙 key 15. 化妆 makeup
16. 大学 college 17. 卡车 truck 18. 锅子 wok 19. 风景 scenery
20. 犯罪 crime 21. 文件 document 22. 鲜花 flower 23. 语言 language
24. 轮船 ship

Bibliography

- Barss, A. (1993) Transparency and visibility: Sentence processing and the grammar of anaphora. In G. T. M. Altmann and R. Shillcock (eds.) Cognitive Models of Speech Processing: The Sperlonga Meeting II. Hove: Hillsdale, NJ: Lawrence Erlbaum.
- Bates, E., and MacWhinney, B. (1989) The Crosslinguistic Study of Sentence Processing, New York: Cambridge University Press.
- Battistella, E. (1989) Chinese reflexivization: A movement to Infl approach. Linguistics, 27, 987-1012.
- Bever, T. G., and McElree, B. (1988) Empty categories access their antecedent during comprehension. Linguistic Inquiry, 19, 35-45.
- Boland, J. E. (1993) The role of verb argument structure in sentence processing: Distinguishing between syntactic and semantic effects. Journal of Psycholinguistic Research, 22, 133-152.
- Bresnan, J. (1982) (ed.) The Mental Representation of Grammatical Relations, Cambridge, MA: MIT Press.
- Chomsky, N. (1957) Syntactic Structures, Cambridge, MA: MIT Press.
- Chomsky, N. (1965) Aspects of the Theory of Syntax, Cambridge, MA: MIT Press.
- Chomsky, N. (1980) On binding. Linguistic Inquiry 11, 1-46.
- 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, Massachusetts: MIT Press.
- Chomsky, N. (1986a) Barriers, Cambridge, Massachusetts: MIT Press.

- Chomsky, N. (1986b) Knowledge of Language: Its Nature, Origin, and Use, New York: Praeger.
- Chao, Y-R. (1968) A Grammar of Spoken Chinese. Berkeley: University of California Press.
- Cole, P., Hermon, G., and Sung, L. M. (1990) Principles and parameters of long-distance reflexives. Linguistic Inquiry, 21, 1-22.
- Corbett, A. T., and Chang, F. R. (1983) Pronoun disambiguation: Accessing potential antecedents. Memory and Cognition, 11, 283-294.
- Crain, S. and Fodor, J. D. (1985) How can grammars help parsers? In D. Dowty, L. Karttunen, and A. Zwicky (eds.) Natural Language Parsing: Psychological, Computational, and Theoretical Perspectives, Cambridge: Cambridge University Press.
- Fiengo, R. W. (1974) Semantic Conditions on Surface Structure, Doctoral dissertation, MIT.
- Fodor, J. A. (1983) The Modularity of Mind, Cambridge, MA: MIT Press.
- Fodor, J. D. (1989) Empty categories in sentence processing. Language and Cognitive Processes, 4.3/4, SI 155-209.
- Fodor, J. D. (1991) Sentence processing and the mental grammar. In P. Sells, S. M. Shieber, and T. Wasow (eds.) Foundational Issues in Natural Language, Cambridge, MA: MIT Press.
- Fodor, J. D. (1993) Processing empty categories: A question of visibility. In G. T. M. Altmann and R. Shillcock (eds.) Cognitive Models of Speech Processing: The Sperlonga Meeting II. Hove: Hillsdale, NJ: Lawrence Erlbaum.
- Frazier, L., Clifton, C. Jr., and Randall, J. (1983) Filling gaps: Decision principles and structure in sentence comprehension. Cognition, 13, 187-222.

- Frazier, L. (1987) Theories of syntactic processing. In Garfield, J. L. (ed.), Modularity in Knowledge Representation and Natural Language Processing, Cambridge, MA: MIT Press.
- Frazier, L. and Clifton, C. (1989) Successive cyclicity in the grammar and parser. Language and Cognitive Processes 4.2, 93-126.
- Gazdar, G., Klein, E., Pullum, G. K., and Sag, I. A. (1985) Generalized Phrase Structure Grammar, Cambridge, MA, Harvard University Press.
- Huang, C.-T. J. (1982) Logical relations in Chinese and the theory of grammar. Doctoral dissertation, MIT, Cambridge, Massachusetts.
- Huang, C.-T. J. (1984) On the distribution and reference of empty pronouns. Linguistic Inquiry 15, 531-574.
- Huang, C.-T. J. (1987) Remarks on free empty categories in Chinese. Linguistic Inquiry 18, 321-338.
- Kang, B. M. (1988) Unbounded reflexives. Linguistics and Philosophy 11, 415-456.
- Kaplan, R. M. and Zaenen, A. (1989) Long-distance dependencies, constituent structure, and functional uncertainty. In M. R. Baltin and A. S. Kroch (eds.) Alternative Conceptions of Phrase Structure, Chicago: The University of Chicago Press.
- Li, P., Bates, E., and MacWhinney, B. (1993) Processing a language without inflections: A reaction time study of sentence interpretation in Chinese. Journal of Memory and Language, 32, 169-192.
- Li, P. (in press) Understanding the time course of sentence comprehension: A sentence gating study in Mandarin Chinese.
- MacDonald, M. C. (1989) Priming effects from gaps to antecedents. Language and Cognitive Processes, 4, 1-72.

- McElree, B., and Bever, T. G. (1989) The psychological reality of linguistically defined gaps. Journal of Psycholinguistic Research, 18, 21-36.
- McKoon, G., Ratcliff, R., and Ward, G. (1994) Testing theories of language processing: An empirical investigation of the on-line lexical decision task. Journal of Experimental Psychology: Learning, Memory, and Cognition, 20, No. 5, 1219-1229.
- Meyer, D. E., and Schvaneveldt, R. W. (1971) Facilitation in recognizing pairs of words: Evidence of a dependence between retrieval operations. Journal of Experimental Psychology, 90, 227-234.
- Nicol, J. (1988) Coreference processing during sentence comprehension. Doctoral dissertation. MIT, Cambridge, Massachusetts.
- Nicol, J. and Swinney, D. A. (1989) The role of structures in coreference assignment during sentence comprehension. Journal of Psycholinguistic Research, 18, 5-20.
- Nicol, J., Fodor, D. J., and Swinney, D. (1994) Using cross-modal lexical decision tasks to investigate sentence processing. Journal of Experimental Psychology: Learning, Memory, and Cognition, 20, No. 5, 1229-1239.
- Osterhout, L. and Swinney, D. A. (1993) On the temporal course of gap-filling during comprehension of verbal passives. Journal of Psycholinguistic Research, 22, 273-287.
- Pollard, C., and Sag, I. (1987) Information-Based Syntax and Semantics. Stanford University.
- Pollard, C and Sag, I. (1994) Head-Driven Phrase Structure Grammar. The University of Chicago Press.
- Ren, X. L. (1981) A Comparative Grammar of Chinese-English. Beijing: Academy of Social Science.
- Riemsdijk, H. van., and Williams, E. (1986) Introduction to the Theory of Grammar. Cambridge, Massachusetts, MIT Press.

- Riemsdijk, H. van., and Williams, E. (1981) NP-structure. The Linguistic Review, 1, 17.
- Sag, I., and Fodor, J. D. (1994) Extraction without trace. In Proceedings of the West Coast Conference on Formal Linguistics.
- Sag, I., and Fodor, J. D. (1993) Agreement coindexing and reactivation: A reply to Barss. In G. T. M. Altmann and R. Shillcock (eds.) Cognitive Models of Speech Processing: The Sperlonga Meeting II. Hove: Hillsdale, NJ: Lawrence Erlbaum.
- Stowe, L. A. (1986) Evidence for on-line gap locations. Language and Cognitive Processes, 1, 227-245.
- Swinney, D. (1979) Lexical access during sentence comprehension: (Re)consideration of context effects. Journal of Verbal Learning and Verbal Behavior, 18, 645-659.
- Swinney, D., Ford, M., and Bresnan, J. (1988) On the temporal course of gap-filling and antecedent assignment during sentence comprehension. In B. Grosz, R. Kaplan, M. Macken, and I. Sag (eds), Language Structure and Processing. Stanford, CA: CSLI.
- Tanenhaus, M. K., Boland, J., Garnsey, S., & Carlson, G. N. (1989) Lexical structure in parsing long-distance dependencies. Journal of Psycholinguistic research, 18, 37-50.
- Wang, L. (1982) Principles of Chinese Grammar, Shanghai: Education Publishing House.
- Xu, L. (1986) Free empty categories. Linguistic Inquiry 17, 75-93.
- Xu, L. and Langendoen, D. T. (1985) Topic structures in Chinese. Language 61, 1-27.