How Do Mandarin Chinese Children Build Bridges?

A Syntax-Discourse Processing Model of Referential Dependencies and its Application

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Hoe Bouwen Mandarijn-Chinese Kinderen Bruggen?

Een Syntaxis-Discourse Verwerkingsmodel van Referentiële Afhankelijkheden en zijn Toepassing

(met een samenvatting in het Nederlands)

Proefschrift

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door

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te Chenzhou, Hunan province, China

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Abbreviations

ASP	Aspect
DE	Chinese DE construction
SFP	Sentence final particle
BA	Chinese BA construction
COP	Copular
Q	Question
pro	pronoun (not the little *pro*)

Acknowledgements

It is sunny today. While I am starting to write something down on this page, I suddenly realize that it is really time to say goodbye to my PhD journey. Am I feeling excited? Absolutely, I finally did it! But at the same time, I do feel a bit sad, because I know that it is easy to say goodbye to a journey, but waving my hands to my supervisors, my teachers, my colleagues, and my friends in Utrecht is the thing that I am reluctant to do.

There are so many people to whom I would like to express my sincere thanks; there are so many precious memories that emerge in my mind even if I am now far away from Utrecht. But let me start with something different. Here is a puzzle that I read in the book *thinking, fast and slow*:

"A bat and ball cost $1.10.
The bat costs one dollar more than the ball.
How much does the ball cost?"

(Kahneman, 2011)

Without too much thinking, you may say that the ball costs $1. But if you take a moment to get your answers, you may give the right one: $1.05. To the former situation, your way of thinking is fast but intuitive while in the latter situation, you think in a slower and more careful way. The two types of thinking remind me of the process of doing research: intuition is important but sometimes unreliable. What is more critical is a rigorous academic attitude.

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Chapter 1

Introduction

This dissertation aims to explore how Mandarin Chinese[1]children from 3 to 6 years old acquire knowledge of referential dependencies at the syntax-discourse interface. In order to achieve this goal, I will first develop a Syntax-Discourse-Processing (S-D-P) model to describe the mechanisms of referential dependencies in Chinese, and then conduct two experiments to test Chinese children's knowledge of referential dependencies under such a model. As the proposed S-D-P model is an extension of the file change semantics proposed by Heim (1982) and the syntax-discourse interface model built by Avrutin (1999) and Schumacher et al. (2010), I will start to build the S-D-P model on the basis of English and Dutch data and then extend it to that of Chinese. In addition, since the two experimental studies that I conduct are studies that are, in their core approaches, parallel to those conducted by Avrutin & Coopmans (2000) and Coopmans et al. (2004), I will also compare, in general terms, Chinese children's performance with that of their Dutch counterparts in order to better capture the similarities and differences between these languages as well as their corresponding acquisition profiles.

In this chapter, I will first introduce the concept of referential dependency and its instantiations, and then point out children's knowledge of these referential dependencies at the syntax-discourse interface. I will also illustrate the motivations for building the S-D-P model. I will conclude this chapter by presenting an overview of the contents of the following chapters.

[1] In this study, Mandarin Chinese will be referred to as Chinese for reasons of simplicity.

1.1 On Referential Dependencies

Her words
are like a golden thread that binds our
family.
Her wisdom,
like an art that shares so generously.
Her feelings
like a quilt that warms us like no other.
The hands
of one so dear the one we call
Grandmother.
(Barnett, 2006)

The poem presented above was written by Sheria S. Barnett published online in 2006. In the poem there are words like *words*, *thread, wisdom, quilt* etc. There are also words like *her*, a pronoun. Words in the former set are independently interpretable because they are nouns with specific contents. The word *her*, however, is itself uninterpretable because its referential assignment cannot be determined yet; in other words, we do not know who *her* refers to (e.g. whose words, whose wisdom, etc.) until a (dependency) relation is established between *her* and *grandmother*. This relation built between a dependent element *her* and its antecedent *grandmother* is known as a referential dependency.

In addition to personal pronouns like *her*, reflexives are also referentially dependent elements that are uninterpretable by themselves. Forms of reflexives (and pronouns) are varied in different languages. For example, English reflexives all share one self-base form: *himself* or *herself*. Dutch has two: the SE anaphor[2] *zich* and the SELF anaphor *zichzelf*. Chinese also has two forms of reflexives: *ziji* (self-N) and *taziji* (pro-self-N)[3]. The questions arise what the differences among these different forms of dependent elements are, what constitutes such differences, and how they are

[2] SE anaphor refers to a dependent element that is in a simplex form and has very few morphosyntactic features, such as Dutch *zich*. To some degree it contrasts with the SELF anaphor (*himself/herself*).

[3] In this dissertation, *ziji* is regarded as bi-morphemic reflexive and *taziji* is treated as tri-morphemic reflexive. Details will be presented in Chapter 2**.**

used in a variety of sentential constructions. All of these will be discussed in detail in the following chapters.

On the other hand, definite DPs (e.g. *the dog*) are also dependent elements that must have an antecedent to be connected to. For instance, in the sequence *A dog was swimming in the river. It/The dog was doing so very happily*, the definite DP *the dog*, like the pronoun *it*, is uninterpretable by itself, and it must link to the previous indefinite DP *a dog* (or *a dog* in a visual context) for interpretation. The relation between the definite DP with its antecedent may not necessarily be direct. For example, in the sequence *A book is on the desk. The author is a Ph.D candidate from UiL OTS*, we can easily connect the definite DP *the author* with the indefinite DP *a book* as its antecedent, even though there is no direct mention of any author in the previous context. Such a phenomenon has been labelled "bridging" (Clark, 1977) or "associative anaphora" (Hawkins, 1978). In this study I will classify them as referential dependencies, too, as these examples also concern the dependency relation built between a referential expression and its antecedent[4]. This type of referential dependency is one of the linguistic phenomena that I am interested in and will be discussed extensively in the following chapters.

1.2 Children's Knowledge of Referential Dependencies at the Syntax-Discourse Interface

1.2.1 Who is *himself/ziji*?

Imagine that one day – in the past – you (a linguist) were walking down the street with your 3-year-old child when, suddenly, four clowns (a red clown with his father, and a blue clown with his father) popped out in front of you and began a performance with a series of funny behaviors: the red clown's father scratching the red clown, the blue clown's father washing the blue clown. You, as a linguist, suddenly came up with an idea: you wanted to have a better understanding of your child's linguistic knowledge

[4] Strictly speaking, the relation between a definite DP and its antecedent is not normally considered a relation that is accounted for by theories of referential dependencies. In this dissertation I attempt to argue that it can be classified as such, given a particular implementation of the S-D-P model.

of reflexives. So you designed a little impromptu test, and you said to her with a happy voice:

(1) "Look, **the father** of the red clown is scratching **himself**."

And imagine that your 3-year-old child in this situation refused to accept your statement, saying that the father of the red clown was not scratching himself but the red clown. It seemed that your child passed your test.

The performance continued. The four clowns were walking along a river but suddenly it began to rain. The red clown and his father each had an umbrella, so each held his umbrella above himself. However, the blue clown and his father only had one umbrella. What were they going to do? Look! the father of the blue clown opened the umbrella and held it above his child. The father really loved his child very much and he did not want his child to get wet. At that time, wanting to know more about your child's knowledge of reflexives, you turned to your child and said:

(2) "Look, **the father** of the blue clown is holding an umbrella above **himself**."

Your 3-year-old child in this case, however, failed to point out your mistake. You wondered why your child was unable to correct you this time. You rushed back home, opened your laptop, and downloaded a series of papers on how children acquire pronouns and reflexives from Google scholar. You could not wait to read them all. After several days of reading papers, you finally understood that your child's comprehension of the construction in (2) was not as good as that of the construction in (1) because the interpretation of the referential dependency in (2) is harder than in (1). Experimental studies (Avrutin, 1997; Coopmans, et al., 2004) have shown that English and Dutch young children perform worse in constructions such as (2) compared to (1). The reason is that the referential dependency in (1) is regulated by purely syntactic mechanisms, while the referential dependency in (2) is established on a higher level – the level of discourse, with the morphosyntactic information sent to the discourse level for interpretation (hence, involving knowledge at the syntax-discourse interface). Reflexives occurring in constructions like (1) are known as

anaphors (Chomsky, 1981) while those appearing in constructions like (2) are called logophors (Clements, 1975; Sells, 1987; Reinhart & Reuland, 1993).[5]

In Chinese, the dependency established between the reflexive *ziji*[6] and its antecedent shows a similar distributional pattern:

(3) 红色的小丑的爸爸正在挠自己。
Hongse de xiaochou de **baba** zhengzai nao **ziji**.
Red DE clown DE father ASP scratch self-N
"The red clown's father is scratching himself."

(4) 蓝色的小丑的爸爸正在把伞打在自己头上。
Lanse de xiaochou de **baba** zhengzai ba san dazai **ziji** toushang.
Blue DE clown DE father ASP BA umbrella hold self-N head-above
"The blue clown's father is holding the umbrella above himself."

The constructions in (3) and (4) are the corresponding translations of (1) and (2). Like in the English examples, the referential dependency established between *ziji* and *...de baba* (the father of...) in (3) is purely syntactic while in (4) the dependency involves discourse information.

Chinese reflexive *ziji* is different from both English *himself* and Dutch *zich/ zichzelf* in many respects. First, the Chinese reflexive *ziji* is an element that is underspecified in morphosyntactic phi-features (i.e. lacking person, gender, and number features) compared to English *himself*. Secondly, Chinese *ziji*, has many logophoric uses that are different from those of English *himself*. The question arises: how do the featural differences and differing discourse roles of *ziji* influence Chinese children's interpretation of the referential dependencies established between *ziji* and its antecedent. Considering the fact that there are various crosslinguistic differences among reflexive elements, and given that previous experimental evidence has shown that Dutch and English children performed worse in the logophoric construction than

[5] The definition of *logophor* in Clements (1975) and Sells (1987) represents the mental attitude/perspective of the speaker; the anaphor-logophor distinction, according to Reinhart & Reuland (1993) is based on argument structure. The common point of these two proposals is that a logophor is an element that will build a dependency with its antecedent via discourse mechanisms.

[6] Although Chinese has two forms of reflexives: *ziji* and *taziji*, I only focus on the uses of *ziji* in this dissertation. The mechanism of *taziji* is briefly discussed in Chapter 6 for future research.

in the anaphoric construction, I intend to investigate how Chinese children perform in the two different constructions: what they know and what they do not know regarding properties at the syntax-discourse interface, and how such knowledge develops between the ages of 3 to 6. Therefore, the first research question that I would like to pose in this study is formulated as follows, with three corresponding subquestions.

Research Question 1:

How do Chinese 3-to-6-year-old children build a referential dependency between *ziji* and its antecedent?

a. How do they establish a dependency between a logophoric *ziji* and its antecedent?
b. How do they establish a dependency between an anaphoric *ziji* and its antecedent?
c. What is the developmental path of such knowledge in 3-to-6-year-old Chinese children?

To answer these questions, an experimental study has been carried out on Chinese children from 3 to 6 years old, and details will be reported in Chapter 5.

1.2.2 What can *the pocket* be connected to?

Imagine that today is your 3-year-old child's birthday and you have decided to buy a gift for her. Since she loves to dance, you decided to buy her a new dress. After you came back from the shopping center this morning, you could not wait to let her to put it on:

(5) Come, I bought a dress for you. Look, the pocket is yellow.

In (5) *the pocket* refers to the pocket of the dress mentioned in the previous sentence. In other words, a dependent relation is established between the definite DP *the pocket* and the indefinite DP *a dress*. However, such a connection is indirect and it involves inferencing: you and your child should share the common background knowledge that a pocket can be a part of a dress, and the child must also have sufficient

inferential capacity to build the same dependency as you do (the antecedent *a dress* is mentioned in the previous linguistic context).

Suppose that you also bought a new coat for your child in the shopping center and the new coat also had a pocket, but of a different color, let's say blue. When you uttered the sequence of (5) to the 3-year-old, she might not necessarily know which pocket you were referring to. If she were uncertain about which pocket you were referring to (that is, if she were unable to build the same dependency as you did) and if she was more interested in the coat, she might argue with you that the pocket is blue, not yellow. If she had sufficient inferential capacity to successfully build the same dependency as you, she would understand that what you meant by the pocket was the pocket of the dress, not the pocket of the coat. In this situation, she might say something like "the coat also has a pocket, but it is blue".

The establishment of this dependency (bridging) belongs to the syntax-discourse interface. To successfully connect a definite DP (the pocket) with its antecedent (a dress), the speaker and the addressee not only need to know the basic syntactic structures of the sentences, the morphosyntactic features of the DPs, and the lexical meanings of the words involved, they should also have some shared background knowledge (or presuppositions) and have sufficient inferential capacity to make sure that they will both build the same dependency and be mutually understood.

An experimental study on how children bridge a definite DP to its antecedent was carried out by Avrutin & Coopmans' (2000). The results showed that neither English nor Dutch children at ages 3 to 4 were able to build such dependencies, with around chance-level performance. Dutch and English are languages that have overt article systems. Chinese, on the other hand, does not have overt determiners. Example (6) below is the Chinese translation of (5), and shows how Chinese encodes definite nominal phrases in the absence of an overt determiner:

(6) 过来，我给你买了一条裙子。看，口袋是黄色的。
Guolai, wo gei ni mai-le yi-tiao qunzi. Kan, koudai shi huangse de.
Come, I for you buy-LE one-Cl dress. Look, pocket COP yellow DE.
"Come, I bought a dress for you. Look, the pocket is yellow."

In (6), the definite DP *the pocket* is expressed as a bare form that occurs in preverbal position. This crosslinguistic difference plus the existing first language acquisition studies on Dutch and English children raise the question of how their Chinese counterparts would behave in a similar bridging task. In addition, since the

discourse prominence of the antecedent (triggered, for example, by its specificity feature[7]) is a factor that may facilitate bridging (as suggested by the results of the Avrutin & Coopmans (2000) experiment), I would like to explore whether or not and to what degree specificity will affect the bridging process between a definite DP and its antecedent in Chinese. Therefore, the second research question of this dissertation, with its relevant subquestions, will be:

Research Question 2:

How do 3-to-6-year-old Chinese children build a dependency between a definite DP and its antecedent (bridging)?

a. How do they build such dependencies in nonspecific as well as specific conditions?

b. What is the developmental path of their ability in establishing bridging?

To sum up, this dissertation aims to deal with how Chinese 3-to-6-year-old children build the following two types of referential dependencies: (1) between a reflexive and its antecedent; (2) between a definite DP and its antecedent, as these two types of referential dependencies both draw on the syntax-discourse interface.

As child language acquisition studies often go together with research on linguistic theories, the two types of referential dependencies on the syntax-discourse interface mentioned above clearly need the support of linguistic theories. How children have grasped the knowledge of referential dependencies has mainly been explained from purely syntactic theories. However, the traditional purely syntactic approaches are not sufficient to account for dependencies that are established through discourse mechanisms. Thus, I will need to build a syntax-discourse interface model that aims to explain the mechanisms of referential dependencies established at the interface, with acquisition data to provide appropriate evidence for the feasibility of the model. In addition to purely linguistic considerations (morphosyntax, discourse), the model will also focus on the processing mechanisms through which such linguistic rules are implemented. This relates to the third, and theoretical, research question of this dissertation, which will be presented in the following section.

[7] Specificity is regarded as a property of the antecedent (the indefinite DPs in this dissertation). A specific antecedent is usually more prominent in discourse than a nonspecific one (see details in Chapter 2).

1.3 A Model of Referential Dependencies at the Syntax-Discourse Interface

Child acquisition studies of anaphoric dependencies have been explored predominantly from a syntax-theoretical perspective (e.g. binding theory (Chomsky, 1981), reflexivity theory (Reinhart & Reuland, 1993), and primitives of binding (Reuland, 2001), among others). However, syntax alone cannot explain all such phenomena, for some of these dependencies are established at the discourse level. Notable examples are reflexives and pronouns in picture NPs such as *A picture of myself/me would look good on that wall*; *John saw a picture of himself/him* on the wall; and reflexives/pronouns as objects of locative PPs: *John saw a snake near himself/him*, etc.), where the complementary distribution between reflexives and pronouns breaks down, and discourse information becomes especially relevant in determining the appropriateness of the utterance. This is especially true in Chinese, where, Chinese reflexive *ziji* (self-N) does not necessarily obey purely syntactic constraints but importantly relies on discourse properties such as speaker's perspective.

How a child acquires another type of referential dependency (a bridging relation established between a definite DP and its antecedent) was accounted for by Avrutin's (1999) syntax-discourse interface model, in which he argued that this referential dependency is an operation that involves inference; that is, not only must the child have the lexical knowledge of the linguistic elements (e.g. the semantic connection between the definite DP and its antecedent) but she must also be equipped with the corresponding inferential capacity to create the referential link between a definite DP and its antecedent. Nevertheless, Avrutin's (1999) syntax-discourse model can be further extended by taking the morphosyntactic features of the definite DPs into consideration, since they have a role to play in the building of such dependencies. For instance, some languages have overt determiners and the definiteness of DPs is encoded by overt lexical devices (English *the*), while others (like Chinese) lack such overt markers, and the encoding of definiteness is done through word order or some other device such as context information. The overtness of the morphosyntactic markers and the ways in which definiteness is encoded in a DP are potential factors that may finally influence the establishment of dependencies.

What I would like to point out is that purely syntactic theories are not sufficient for the explanations of the two types of dependencies, especially if we take Chinese

into account. The establishment of these dependencies instead involves both morphosyntactic features and discourse information and takes place at the syntax-discourse interface, with modular information coming from different levels: words with morphosyntactic compositions are combined by syntactic mechanisms, constituting syntactic structures, which are translated onto the level of discourse for further interpretation.

The interpretation of referential dependencies, however, also involves the participation of processing resources such as memory, attention, vision, etc. Various theories have extensively discussed the role of relevant processing resources. Centering theory (Walker, Joshi & Prince, 1998), for example, treats pronouns (and their antecedents) as centers of attention. The dependency established between a pronoun and its antecedent is the result of the operations of the centers. Accessibility theory (Ariel, 1990) regards dependent elements (like pronouns/reflexives/definite DPs) as different types of memory accessibility markers that can mark how accessible their antecedents are in our memory. A potential disadvantage of these theories is that they have not given sufficient attention to the morphosyntactic features of the dependent elements themselves. As such dependencies are established at the syntax - discourse interface (in other words, as morphosyntactic features are sent to the interface in preparation for the final representation and interpretation processes), it is then necessary to take both morphosyntactic features and discourse information, together with the processing resources (e.g. memory, attention), into consideration. The third research question will therefore focus on the main properties and operations of the proposed Syntax-Discourse-Processing (S-D-P) model.

Research Question 3

What does the Syntax-Discourse-Processing (S-D-P) model of referential dependencies look like?

a. What are the basic units of the S-D-P model?
b. How do the basic units interact with each other (i.e. what are the rules of operation)?
c. What are the processing mechanisms involved in the S-D-P model?

1.4 Overview of the Chapters

In Chapter 2, I will review existing syntactic and discourse theories on the two types of referential dependencies that are established at the syntax-discourse interface. The first type of dependency is built between a reflexive/pronoun and its antecedent; the second is built between a definite DP and its antecedent. By doing this, I aim to point out the merits and drawbacks in previous theories and provide possible solutions for the problems that have arisen for these theories, and which constitute the motivation for building the S-D-P model.

Chapter 3 will illustrate the Syntax-Discourse-Processing (S-D-P) model of referential dependencies in detail with English, Dutch, and Chinese data. This model is an extension of Heim's (1982) file change semantics and Avrutin (1999) and Schumacher et al.'s (2010) syntax-discourse interface model. Briefly speaking, the S-D-P model includes: (1) various forms of basic components called file cards; (2) a set of operational rules on how these file cards interact with each other in discourse. Something that should be mentioned here is that Chapter 3 only focuses on the linguistic aspect of the model.

Chapter 4 will discuss the nonlinguistic aspect of the S-D-P model – the processing mechanisms of referential dependencies established between a pronoun/ reflexive/definite DP and its antecedent. As the interpretation of referential dependencies involves the participation of memory, I will start by presenting some basic facts of memory and showing how the operational rules mentioned in Chapter 3 are implemented by processing mechanisms.

Chapter 5 will demonstrate how Chinese children from 3 to 6 years old acquire the two types of referential dependencies. The details of two experimental studies will be provided and their results will be interpreted and explained under the S-D-P model.

Chapter 6 contains the conclusion and discussion, including what new information has been learned in this dissertation, what the implications are for some existing theories, and what should be further explored in future research.[8]

[8] A final remark is that I am aware of the fact that another recent Ph.D dissertation written by Sally Wong at UiL OTS also focuses on the topic of Chinese *ziji*, but my approach on the part of *ziji* is very different from hers because she investigates the syntactic properties of *ziji* while I focus on the discourse representation and the processing mechanisms of *ziji*.

Chapter 2

The Establishment of Referential Dependencies on the Syntax-Discourse Interface

2.1 Introduction

In this chapter, I will present influential syntactic and discourse theories on the two types of referential dependencies: (1) referential dependencies established between a reflexive/pronoun and its antecedent (e.g. Mary likes herself), (2) referential dependencies established between a definite DP and its antecedent (e.g. I saw a bus. The door was open.). By doing this, I aim to emphasize: (1) with respect to the first type of referential dependency, earlier-proposed, purely syntactic theories are not sufficient to account for all referential dependencies, for some of these dependencies are established on the level of discourse (e.g. logophors) while proposed discourse theories rarely acknowledge the role of the morphosyntactic features of the dependent elements (pronouns/reflexives); (2) with respect to the second type of referential dependency, the process of successfully connecting a definite DP with an indirectly-mentioned antecedent is determined by the morphosyntactic features of the (in)definite DP as well as by discourse mechanisms (e.g. shared knowledge between the speaker and the addressee). In addition, I will argue that the interpretation of both types of referential dependencies involves the participation of processing resources, such as memory, attention, etc. All of these facts constitute the motivation for building the syntax-discourse-processing model that will be discussed in detail in Chapter 3.

This chapter is dedicated to illustrating previous syntactic and discourse theories, problems and possible solutions for the two types of dependencies.

2.2 Dependencies Established between a Reflexive/Pronoun and its Antecedent(s)

2.2.1 C-command/ locality constraints and their violations

One of the most influential theories in the 1980s that explained how a dependency was established between a reflexive/pronoun and its antecedent was Chomsky's (1981) binding theory (Principle A and B[9]), by which he argued that an anaphor must be locally c-commanded[10] by its antecedent while a pronoun cannot. Such a formulation contains two main structural constraints: locality and c-command:

(1) Locality Constraint

a. Lily_k says that [Mary_i likes $\text{herself}_{i/*k}$].

b. Lily_k thinks that [Mary_i believes [$\text{herself}_{i/*k}$ to be the best]].

(2) C-command Constraint

a. John_i's father_j likes $\text{himself}_{*i/j}$.

b. Bill_k, who knows Mike_j, admires $\text{himself}_{*j/k}$.

In examples (1a) and (1b), the reflexive *herself* can only refer to the local antecedent *Mary* rather than the distant antecedent *Lily*. In (2a), the potential

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[9] Principle A: An anaphor must be bound in its governing category.
Principle B: A pronoun must be free in its governing category.
"Its governing category" in these formulations is defined as the minimal IP or NP containing the anaphor/pronoun and an accessible subject (for further details, see Chomsky (1981)). This captures the locality restriction on binding. "Free" in the definition of Principle B means "not-bound".

[10] C-command: a node A c-commands a node B if and only if
(i) A does not dominate B;
(ii) B does not dominate A;
(iii) the first branching node dominating A also dominates B.
(Reinhart, 1981, in Haegeman, 2004: 134)

antecedents *John* and *John's father* both satisfy the locality constraint but only *John's father* c-commands the reflexive *himself*, so only *John's father* is the proper antecedent for the reflexive *himself*. Similarly, in (2b), only the antecedent *Bill* c-commands the reflexive *himself*.

Chinese, however, provides us with numerous examples that violate the two constraints above, for example:

(3) 张三$_j$说[李四$_i$喜欢自己$_{i/j}$]。
Zhangsan$_j$ shuo [Lisi$_i$ xihuan ziji$_{i/j}$].
Zhangsan say Lisi like self-N
"Zhangsan says that Lisi likes himself/him."

(4) 李四$_i$的狗$_j$咬了自己$_{i/j}$。
Lisi$_i$ de gou$_j$ yao-le ziji$_{i/j}$.
Lisi DE dog bite-Le self-N
"Lisi's dog bit him/itself."
(Pollard & Xue,2000:337)

In (3), *ziji* can either refer to the local antecedent *Lisi* or the distant antecedent *Zhangsan*, violating the constraint of locality. In (4), *ziji* can either refer to the c-commander *gou* (dog) or the non-c-commander *Lisi*, an instance of the violation of c-command.

The violation of the locality constraint in Chinese (giving rise to instances of so-called "long distance dependency") used to be explained in the framework of Government and Binding (GB) by showing the involvement of processes such as INFL-to-INFL movement (Battistella, 1989), head-to-head movement (Cole & Sung, 1994), or the feature copy and reindexing rule (Huang & Tang, 1991). The central point of such proposals was that example (3) in Chinese does not, in fact, violate the locality constraint. On the contrary, it obeys such a constraint through a series of movements at LF. The general idea is that *ziji* is essentially an anaphoric element that undergoes abstract successive cyclic movement to a position closer (local) to its antecedent, making it possible to refer to the seemingly distant antecedent *Zhangsan*. Nevertheless, there have been many research proposals arguing that the phenomenon of long distance dependency in Chinese is not regulated by syntactic components but is instead manipulated by discourse factors, such as the perspective or mental attitudes of the speaker (Huang & Liu, 2001). According to Sells (1987), the antecedents of

reflexives /pronouns can have three primitive (predicate)-discourse roles in a long-distance dependency:

> **SOURCE**: one who is the intentional agent of the communication.
> **SELF**: one whose mental state or attitude the content of the proposition describes.
> **PIVOT**: one with respect to whose (space-time) location the content of the proposition is evaluated.
> (Sells, 1987: 457)

Reflexives/pronouns occurring in such contexts are used logophorically, meaning that the dependencies established between a reflexive/pronoun and its antecedent are regulated by discourse information. For example, in (3), the distant antecedent *Zhangsan* represents the Source of the message (e.g. the agent of communication). Likewise, violation of the c-command constraint in Chinese may also be explained by the primitive discourse roles, as the non-c-commanding antecedent *Lisi* represents the Pivot/Self (e.g. the perspective/mental attitude of *Lisi*) of the dependency.[11]

In addition to the violation of locality and c-command examples, some other special phenomena of the referential dependency established between Chinese *ziji* and its antecedent include the blocking effect and subject-orientation. The two phenomena have been accounted for by both syntactic theories and discourse theories.

(5) Blocking Effect
张三$_i$觉得我$_j$在批评自己$_{*i/j}$。
Zhangsan$_i$ jude wo$_j$ zai piping ziji $_{*i/j}$.
Zhangsan feel I prep criticize self-N
"Zhangsan feels that I am criticizing myself."

[11] I assume that the antecedent *Zhangsan* carries the perspective/mental attitude of the event of biting as if he were mentally concerned about the event that he was bitten by the dog (disbelief, disappointment, anger, etc.); Otherwise, an alternative pronoun *ta* (him) would be appropriate (if he were not concerned about such event or the event is purely described from a third party perspective.)

(6) Subject Orientation
张三 $_i$ 告诉了李四$_{*j}$自己 $_{i/*j}$的故事。
Zhangsan$_i$ gaosu le Lisi$_{*j}$ ziji$_{i/*j}$-de gushi.
Zhangsan tell LE Lisi self-N-DE story
"Zhangsan told Lisi about his own story."

In (5), the intermediate antecedent *wo* blocks the dependency between *ziji* and the matrix subject *Zhangsan*. In (6), *ziji* can only refer to the subject *Zhangsan*. As to the blocking effect, syntactic accounts (e.g. Battistella, 1989) have argued that such an effect arises from the feature conflict between the subject and AGR while discourse proposals (e.g. Liu & Huang, 2001) have ascribed the blocking effect to perspective conflicts within the sentence. As to subject-orientation, syntactic theories (including Battistella,1989) have argued that the reason for such a phenomenon is that, at LF only, the subject is the c-commanding antecedent for *ziji*, whereas discourse proposals have argued that the subject-orientation of *ziji* is due to the fact that the subject carries the Source of communication in the sentence (Sells, 1987) or the subject is more prominent than the object (Hu & Pan, 2002).

What I would like to emphasize here is that Chinese has many examples that seem to violate the two main constraints of locality and c-command, and that some of them have been accounted for from a syntactic perspective or via a discourse approach, but there are, nevertheless, other examples in Chinese that can only be explained from a discourse perspective:

(7) Inter-clausal dependency
因为李四 $_j$ 批评了自己 $_{i/j}$，所以张三 $_i$ 很生气。
Yinwei Lisi$_j$ piping-Le ziji$_{i/j}$, suoyi Zhangsan$_i$ hen shengqi.
Because Lisi criticize-LE self-N, so Zhangsan very angry.
"Because Lisi criticized him, Zhangsan was very angry."

(8) Sentence-free dependency
这个想法，除了自己，只有三个人赞成。
Zhege xiangfa, chule ziji, zhiyou san-ge ren zancheng.
This-Cl idea, except for self-N, only three-Cl person favor
"This idea, except for myself, is only favored by three people."

In (7), *ziji* can refer to an antecedent that is in another clause — *Zhangsan*. In that sentence, the antecedent *Zhangsan* felt angry because he realized or was aware of the event that *Lisi* criticized *him* (being *Zhangsan*), known as the consciousness effect (Liu & Huang, 2001). In (8), *ziji* can refer to a sentence-free antecedent because *ziji* here refers to the speaker, which acts as an independent discourse role. These are examples of referential dependencies that only seem to be explainable from a discourse perspective.

Referential dependencies in prepositional phrase constructions like those in (9) are also believed to be established on the level of discourse:

(9) John$_{i/k}$ hid a pen behind him$_{i}$/himself$_{k}$.

In (9), both the pronoun and the reflexive can occur in the same PP construction, which is in conflict with traditional binding theory, as the complementary distribution regulated by principles A and B of that theory breaks down in this environment. (Reinhart & Reuland, 1991, 1993). Partially triggered by this issue, Reinhart & Reuland (1991, 1993) proposed the concept of coargumenthood. Briefly speaking, in (9), the NPs *John*, *a pen* and the locative PP *behind him/himself* are coarguments of the predicate *hid*. The pronoun *him* or the reflexive *himself* are themselves not coarguments of the predicate of *hid* because they are complements of the locative P, operating as an independent predicate. Referential dependencies between a dependent element and its antecedent that are not in a coargumenthood relation are believed to be established on the level of discourse, not subject to syntactic binding constraints. Reflexives in such environments are called logophors (Reinhart & Reuland,1991, 1993).

In Chinese, too, this problem of complementarity breakdown is observed in PP constructions (10). Moreover, such a phenomenon can also be seen in possessive constructions like (11).

(10) 张三 $_{i/j}$踢了在他 $_{i}$/自己 $_{j}$旁边的一个球。
Zhangsan$_{i/j}$ ti-le zai ta$_{i}$/ziji$_{j}$ pangbian de yi-ge qiu.
Zhangsan kick-LE Prep pro/self-N next to DE one-CL ball.
“Zhangsan kicked a ball next to him/himself.

(11) 张三 $_{i/j}$找到了他 $_{i}$/自己 $_{j}$的书。
Zhangsan$_{i/j}$ zhaodao-le ta$_{i}$/ziji$_{j}$-de shu.
Zhangsan find- LE self-N/pro-De book.
"Zhangsan found his own/his book."

In (10) and (11), both the pronoun *ta* and the reflexive *ziji* can occur in the same sentential environment, which means that they are not in complementary distribution. They are not the coarguments of the potential antecedent *Zhangsan*, either. The facts in (10) and (11) reveal that here (at least) the dependency between Chinese *ziji* and its antecedent are also established on the discourse level. Moreover, Chinese *ziji* has many other logophoric uses, as it can also occur in the subject position, referring to the speaker or addressee:

(12) 自己知道还问别人。
Ziji$_{\text{speaker/addressee}}$ zhidao hai wen bieren.
Self-N know still ask others.
"I/You myself/yourself know it, but I/you still ask others. "

To summarize, Chinese reflexive *ziji*, with its large number of logophoric uses (e.g. violations of constraints of locality, c-command, complementarity) indicates that syntax alone is insufficient in the explanation of referential dependencies, because some of them must arise from the operations of discourse mechanisms.

2.2.2 Reflexivity and the structure of reflexives

As mentioned above, the problem of non-complementarity was accounted for by Reinhart & Reuland's (1993) proposal of coargumenthood[12]. In other words, as long as the reflexive and its antecedent are not coarguments of the shared predicate, their dependent relation is then regulated by discourse mechanisms. For elements that are in a coargument relation, referential dependencies are established through syntactic

[12] One thing to be mentioned is that in the sentence "John$_{i/*j}$ talked about himself$_{i}$/him$_{j}$", the reflexive *himself* and the pronoun *him* are in complementary distribution even if they occur after a preposition *about*. This is because the P *about* selects its argument largely in the conjunction with the verb *talk*. What I focus on in this study is the situation when the P acts as an independent predicate with its own argument structure, see example (10).

mechanisms. According to Reinhart & Reuland's (1993) reflexivity theory, the mechanisms of referential dependency rely on the reflexivity of the predicates, which is licensed by two types of markers: lexically-marked or syntactically-marked (see details in Reinhart & Reuland, 1993). Once the reflexivity of the predicate is licensed, coindexation of the reflexive and its antecedent is then licit, and a (syntactic) dependency is established.

This reflexivity theory can not only account for a dependency established between a SELF anaphor (like English *himself*, Dutch *zichzelf*) and its antecedent but also explains how a SE anaphor (e.g. Dutch zich) is connected with its antecedent, for instance:

(13) a. Jan$_i$ schaamt zich$_i$.
John shames SE
"John is ashamed of himself."

b. Jan$_i$ slaat zichzelf$_i$.
John hit zich-SELF
"John hit himself."

In (13a), the predicate *schaamt* (shames) is inherently reflexive. In reflexivity theory, this means that it is lexically reflexive-marked, thereby licensing the reflexivity of the predicate, and the coindexation between *zich* and *Jan* is therefore felicitous. In (13b), the predicate *slaat* (hit) is syntactically reflexive-marked because one argument is a SELF anaphor *zichzelf*. In reflexivity theory, this is the other way of licensing the reflexivity of a predicate, ensuring that the coindexation of *zichzelf* and *Jan* is licit, too.

The two examples above are instances of the two types of marking for the licensing process of the reflexivity of a predicate. When it comes to the foundations for the licensing processes, the question arises: what do notions like lexically reflexive-marked and syntactically reflexive-marked mean?

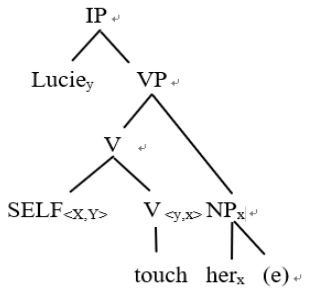
As for the SE anaphor *zich*, we observe that it occurs in an environment where the predicate is inherently reflexive. According to Reuland (2017), the dependency established between *zich* and its antecedent reflects a bundling mechanism, in which "any process ensuring that two roles of a predicate end up on one argument will do to represent reflexivity." (p.34)

(14) a. Jan$_i$ wast zich$_i$
b. John washed.
(1) Vacc (θ_1, θ_2) $\longrightarrow$ R$_s$ (V) ($\theta_{1,2}$)
(2) V[Agent]$_1$ [Theme]$_2$ $\longrightarrow$ V [Agent-Theme]$_1$
(Reuland, 2017: 34)

The essence of the bundling mechanism can be seen in (14). In (14a) and (14b), *Jan/John* plays two thematic roles: the washer (agent) and the washee (theme). These two roles are bundled together as agent-theme role that ends up in one argument — *Jan/John*. It is important to note here that *zich* does not have argument status but only acts as a residue case marker to check the bundling mechanism (Reinhart & Siloni,1995; Reuland, 2017).

As to the SELF anaphor *zichzelf/herself*, reflexivity theory claims that SELF is a syntactic marker for the reflexivity of the predicate because SELF, at LF, adjoins with the verb through movement (Reinhart & Reuland, 1991):

(15) a. Lucie$_i$ touches herself$_i$
b.



(Reinhart & Reuland, 1991:291)

Since SELF, the head of NP, is defective in nature (Reinhart & Reuland, 1991), it will move to the head of VP (head-to-head movement) and adjoin with the verb, making the verb reflexive-marked (an identity relation).

There are, however, some cases where the SELF part of the reflexive cannot move to the verb:

(16) Max$_i$ boasted that the queen invited [Lucie and himself$_i$] for a drink.

In (16), SELF in *himself* cannot move and adjoin with the verb *invited* for structural reasons, yet a dependency can be established – suggesting that some other mechanism must be at play here. Notice that *himself* and *Max* are not coarguments of *boast*, meaning that the reflexive is connected to its antecedent on the level of discourse rather than in syntax (Reinhart & Reuland, 1993). The fact is that even in example (15), the reflexive *herself* can also be connected to *Lucie* on a discourse level in a special context:

(17) Context: Lucie went to a wax museum and there is a statue of Lucie in it.
Lucie went towards the statue and then touched the statue. In this case, we can. say:

Lucie touched **herself**[13].

In this case, *herself* refers to the statue, which is a representation of *Lucie*. The dependency between *herself* and the statue is established on a discourse level because *herself* is interpreted as the statue rather than the antecedent *Lucie* within the sentence. The statue example has also been described as a proxy-relation that involves compositional semantic information and pragmatic information (see details in Reuland & Winter, 2009; Reuland, 2017).

The observations above show that reflexivity theory as a purely syntactic theory cannot explain all the dependencies established between a reflexive and its antecedent, because some of them are established in discourse.

The reflexivity theory can also be used to account for some of the dependencies established between Chinese reflexive *ziji* and its antecedent, for example:

(18)
a. 张三$_i$ 自$_i$ 爱。
Zhangsan$_i$ zi$_i$-ai.
Zhangsan self-love.
“Zhangsan loves himself.”
b. 张三$_i$爱自己$_i$。
Zhangsan$_i$ ai ziji$_i$.
Zhangsan love self-N
“Zhangsan loves himself.”

[13] In this dissertation, I use bold face markings instead of italics to represent the dependencies that are established via discourse mechanisms.

The reflexive *ziji* is a bi-morphemic reflexive with the morpheme *zi* functioning as SELF (referring to a very local antecedent [14]) and *ji* acting as the Det (referring to an antecedent in long distance[15]) (Dong, 2002; Reuland, Wong & Everaert, 2020). In (18a) and (18b), *zi* functions as a SELF type of marker to license the reflexivity of the predicate. The dependency between *ziji* and *Zhangsan* is therefore regulated by purely syntactic constraints.

However, the use of *ziji* in the following construction is different from that in (18b). In (19), it is regarded as an element subject to discourse operations:

(19) **我**爱**自己**。**张三**也一样。
Wo ai **ziji**. **Zhangsan** ye yi-yang.
I love self-N. Zhangsan also the same
"I love myself. So does Zhangsan."

---

[14] *Zi* (self) in ancient Chinese means *nose*, which can be interpreted as a reflexive anaphor. In most cases, its antecedent is within the local domain. In the following example, *zi* refers to *bi* (they):

(i). 彼必释赵而自救。
bi bi shi zhao er zi jiu.
they will give up siege State Zhao and self save
"They will give up sieging the State Zhao and save themselves"
(*Collected Stories of Sunzi and Wuqi*, in Dong (2002:70))

[15] Different from *zi*(self), the original meaning of *ji* (-N) is the function of an object — a rope. *ji* has the property of pronouns, referring to the long-distance antecedent (in most cases). In the following example, *ji* refers to the long distance antecedent *Chenyu* instead of the local *Xiangyu*.

(ii). 陈余$_i$怨项羽弗王己$_i$也。
Chenyu$_i$ yuan xiangyu fu wang ji$_i$ ye.
Chenyu complain xiangyu not make..an emperor -N FP.
"Chenyu complaint that Xiangyu didn't make Chenyu as the emperor"
(*Biographic sketches of the First Han emperor*, in Dong (2002:73))

In English, the morphosyntactic structure of a SELF anaphor is as follows [$_{NP/DP}$ Det$_{i:}$ him [$_{N'}$...N(x$_i$): self...]] (Reinhart & Reuland, 1991: 286); In Chinese, the distributional pattern of bi-morphemic *ziji* is [Det: ji [N: zi]]. [ji[zi]] is the original order of *ziji*. According to Dong (2002), *jizi* changed to *ziji* in the Three Kingdoms Period, when coordinated compound words prevailed in ancient Chinese.

In (19), the second sentence has two interpretations: (1) I love myself and Zhangsan loves himself; (2) I love myself and Zhangsan loves me, too. The second interpretation suggests that Chinese *ziji* has a discourse representation and the connection between *wo* and *ziji* is modulated by some discourse mechanism.

In addition, in the framework of reflexivity theory, reflexives are treated as logophors as long as they do not share the same predicate with their antecedents. With this logic, Chinese *ziji* must have a large number of logophoric uses, including the examples mentioned in section 2.2.1 (e.g. violations of locality and c-command, sentence free dependencies, PP construction, possessive construction, etc.). They are all, therefore, believed to be established on a discourse level.

2.2.3 Primitives of binding

The further extension of the Reinhart & Reuland (1993) theory that concerns the dependencies established between a reflexive/pronoun and its antecedent is "primitives of binding" (Reuland, 2001). According to Reuland (2001), the two canonical conditions (Principle A and B) in Chomsky's (1981) binding theory were essentially descriptive and they did not reveal the true nature of binding, since binding in Chomsky's traditional binding theory was realized through coindexation (i.e. indices), which is a (semantic) concept that is no longer available in the computational system of human language (C_{HL}) (Reuland, 2001). Also, the traditional binding theory cannot explain the contrast between a SE anaphor and a SELF anaphor, as the former can be completely locally bound yet illicit (e.g. Jan$_{*i}$ haatte zich$_i$, for explanations, see below). For these reasons, among others, Reuland (2001) regards pronouns, SE anaphors, and SELF anaphors as feature bundles (e.g. person, gender, number) and argues that the dependencies established between such feature bundles and their antecedents are the result of the properties of the grammatical system. Under this proposal, dependencies established between a dependent element (a SE anaphor, a complex (SELF) anaphor, or a pronoun) and its antecedent are regulated by different mechanisms on different levels: CHAIN or chain conditions[16], variable binding, or discourse-linking.

---

[16] Generalized chain definition:

$C = (\alpha_1...,\alpha_n)$ is a chain iff C is the maximal sequence such that

a. there is an index i such that for all j, $1<j<n$, α_j carries that index, and

b. For all j, $1 <j <n$, α_j governs α_{j+1}

The dependencies between a SE anaphor (e.g. Dutch *zich*) and its antecedent are encoded in C_{HL} in narrow syntax (Anagnostopoulou & Everaert,1999; Reuland, 2001), for example:

(20) a. Jan$_i$ schaamt zich$_i$.
John shames SE
"John is ashamed of himself."
b. *Jan$_i$ haat zich$_i$.
John hate SE
"John hated himself."

In (20a), *zich* can refer to *Jan* because these two elements can form a derivation CHAIN (feature checking mechanism, see details in Reuland, 2001) or a chain - two occurrences of one object (*zich* is underspecified for phi-features). After such a chain[17] is formed, the arity requirement is satisfied because *schaamt* is inherently reflexive, requiring only one object. In (20b), *Jan* and *zich* can also form a chain, but the final result violates the arity requirement, because *haat* requires two semantic arguments.

On the other hand, why a pronoun cannot be connected with its antecedent can be explained by the chain condition as well as by variable binding, for instance:

(21) *Willem$_i$ schaamt hem$_i$.
Willem shames him
"Willem is ashamed of himself."

Willem and *hem* cannot form a chain because *hem* is a pronominal element with fully specified phi-features. Note that in (20a) *zich* is deficient for phi-features (i.e. a 3rd person feature only); therefore a chain can be formed between *zich* and *Jan* in (20a) but no chain can be formed between *hem* and *Willem* in (21). If no chain is formed, the arity requirement is then violated since *schaamt* is inherently reflexive and only

According to Reuland (2001), a chain can only be formed when the referentially dependent element is not fully specified for phi features (person, gender, number). This is why Dutch *zich* can form a chain with its antecedent while a pronoun cannot. See details in the following discussions.

[17] I will only use *chain* to explain the examples (20a) and (20b). See also the details of the CHAIN explanation in Reuland (2001).

requires one object, but in sentence (21) there happen to be two. In the following example, however, the pronoun and its antecedent do not form a chain, so no arity of the predicate is violated, yet *him* still cannot refer to *Bill*:

(22) **Bill* adores *him*.
a. Bill λx (x adores x)
b. Bill λx (x adores a)
(Reuland, 2001: 447)

In (22), the pronoun *him* could be inspected for interpretations: (a) acting as a bound variable, or (b) getting a value from discourse. The interpretation (a) is ruled out by Principle B. The interpretation (b) means that the coreference between pronoun *him* and its antecedent *Bill* is possible (x=a), but unacceptable. However, coreference between *him* and *Bill* in some exceptional cases is acceptable. In the following example, the pronoun *him* gets a value from discourse and the value is *Bill*:

(23) I know what Mary and Bill have in common. Mary adores him and Bill adores him, too.
Mary λx (x adores a) & Bill λx (x adores a, a = Bill)
(Reuland, 2001: 448)

The question then is why coreferentiality is not acceptable in (22b) but accidentally allowed in (23). Reinhart (1983) and Grodzinsky & Reinhart (1993) formulated a rule that can answer the two questions above: Rule I[18] — a rule that blocks common intrasentential conference between a pronoun and its antecedent but at the same time allows the accidental coreference option. In other words, the intrasentential coreferential relation between a pronoun and its antecedent is not allowed when the pronoun is interpreted as a variable and bound by its antecedent. Therefore, the pronoun cannot co-refer to the intra-sentential antecedent (i.e. *him* cannot refer to *Bill* in (22b)). The accidental coreferential case (23), however, is

[18] *Rule I: "*NP A cannot corefer with NP B if replacing A with C, C a variable A-bound by B, yields an indistinguishable interpretation" (Reuland, 2001: 448). Later, Reuland (2001) revised Rule I as Rule BV: "NP A cannot be A-bound by NP B if replacing A with C, C an NP such that B *R* C, yields an indistinguishable interface representation" (p.450). *R* represents a syntactic relation established between a dependent element and its antecedent, such as *zich* and *Oscar* in *Oscar voelde [zich wegglijden].* See details in Reuland (2001).

allowed because there is no bound-variable interpretation of the pronoun *him*. Instead, *him* only gets a value (Bill) from discourse.

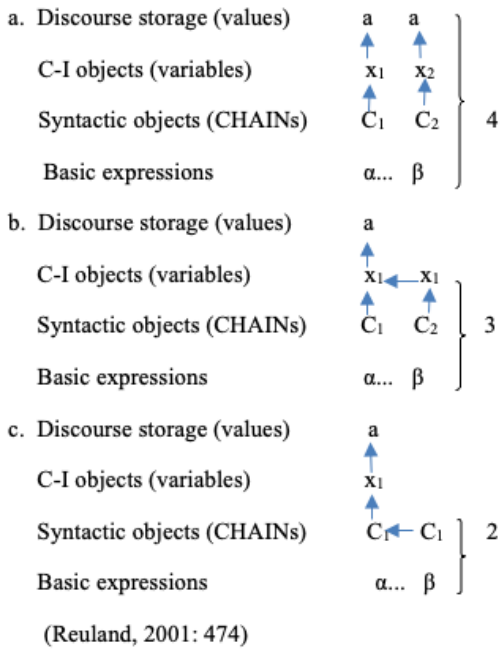
As to the SELF anaphor, Reuland (2001) argues that the SELF part of the reflexive shows an identity relation among the arguments — the SELF part is moved and adjoined to the verb, licensing the reflexivity of the predicate. But in addition to that, the SELF part of the reflexive also represents "a duplicate of the pronoun, an element designating a body part, a focus marker" (Reuland, 2001: 480). Such a SELF part acts as a protective strategy to preserve the arity relation of the dependency:

(24) **John** hates **himself**.

Arity preservation is realized through the following process: the SELF anaphor represents a value of the antecedent x, realized by f(x). In this way, the predicate hate has two arguments: one is x — John, and the other is the representation of x — John, the f(x) (e.g. a value from discourse).

By combining the mechanisms of how a dependency is built between a dependent element (SE anaphor, SELF anaphor, pronoun) and its antecedent, it can be shown that the interpretation of a dependency is modular, crossing from narrow syntax, to variable binding, and then to discourse storage:

(25)



(Reuland, 2001: 474)

According to primitives of binding (Reuland, 2001), the interpretive procedures are cross-modular (the arrows represent the routes of modular crosses from C (syntactic CHAINs) to x (variable binding), and then to a (discourse storage)). In (c), dependencies are established in C_{HL} (C: syntactic CHAINS) and the cost is the lowest (=2: two modules from the basic expression to syntactic objects). In (b), the primitive acts as the C-I object (x: variables), and the cost is 3 (three modules from the basic expressions to C-I objects). In (a), the cost is the highest for the operation goes through three modules before it reaches to the level of discourse (=4: four modules from the basic expression to discourse storage).

Such a modular interpretive procedure further reflects an economy principle, with the cheapest operations being the dependencies encoded in C_{HL} and the most expensive ones being the dependencies established at the discourse level. At the same time, such a modular procedure also supports the idea that some of the dependencies indeed happen in discourse, where syntax cannot account for them. This is the same for pronouns as well as for reflexives. For example, the body part meaning of SELF and the f(x) are facts showing that a SELF anaphor has a discourse representation (recall the wax museum in example (17)), and in my opinion, it is very likely the SELF (i.e. body part) of the reflexive that contributes to its logophoric uses.

2.2.4 Interim summary

To sum up, in this section, I have reviewed certain influential syntactic theories (binding theory, reflexivity theory, and primitives of binding) on the mechanisms of referential dependencies established between a reflexive/pronoun and its antecedent. By pointing out the potential problems facing these theories, I have provided some support for the observation that syntactic theories alone cannot explain all the dependencies, because some of them must be established at the discourse level.

2.3 Dependencies Established between a Definite DP and its Antecedent

2.3.1 On the syntax-discourse interface

Like reflexives and pronouns, definite DPs can also be regarded as dependent elements that must link to other elements for interpretation. For instance, in the

sequence *I saw a house. The chimney was yellow.*, the definite DP *the chimney* is uninterpretable without the presence of the previous part of the sequence. *The chimney* must somehow be linked to another element (here *a house*) in order to be fully interpreted. The dependent relation between *the chimney* and *a house* in this sequence is known as "bridging" (Hawkins, 1978; Clark, 1977), an operation that links a definite DP to an antecedent that acts as an indirect referent of the definite DP.

Bridging is an operation that happens at the discourse level. To successfully build a bridge between a definite DP and its antecedent, the speaker and the addressee should both have not only the morphosyntactic and lexical knowledge of the words and phrases in the sequences (individual internal knowledge: the lexical meanings of *house* and *chimney*, the functional meanings of *the*, *a* etc.), but also be able to build the same bridge (conversational knowledge): they both should have the relevant knowledge that a chimney is a part of a house (if the addressee does not have the same relevant knowledge as the speaker, for example, the addressee lives in a country where the houses do not have chimneys, they may fail to build the same bridge as the speaker does). Moreover, to connect chimney with house, the addressee must also have sufficient processing resources (e.g. inferential abilities and sufficient working memory capacity) to be able to build such a bridge. Avrutin (1999), in his syntax-discourse interface model, formulated a rule to explain the mechanisms of bridging mentioned above — "When bridging two file cards[19], make sure that other participants in the conversation will be able to build the same bridge" (p.86).

What, so far, has not been extensively discussed in the syntax-discourse interface model (Avrutin, 1999) are the morphosyntactic factors that may also contribute to the interpretation of bridging. Clearly, bridging between a definite DP and its antecedent is influenced by discourse information (e.g. shared knowledge), the basic morphosyntactic features of the definite and indefinite DPs, as well as the syntactic structures of the sentence (e.g. word order). This is especially true when we consider crosslinguistic differences. For example, Chinese is a determinerless language and the (in)definiteness of DPs is encoded by word order rather than by lexical markers such as articles like *the* and *a*. Such a fact presents an interesting question on how the morphosyntactic properties of definite and indefinite DPs in Chinese, together with

[19] The concept of file card was proposed by Heim (1982) in File Change Semantics, in which indefinite and definite DPs can be represented as individual file cards that store and update information as the discourse unfolds (see details in the next chapter).

the relevant discourse information, will influence the establishment of a bridging relation between a definite DP and its antecedent.

In the following sections, I will first illustrate the encoding of definiteness (i.e. the uses of the definite DPs) and the semantic association between the definite DP and its antecedent in bridging in English, and then extend this to Chinese, with a detailed discussion on how (in)definite DPs are expressed and how a bridging relation between a definite DP and its antecedent is established in Chinese, given that this language has no corresponding overt determiners.

2.3.2 The dependent element: definiteness and the uses of definite DPs

A traditional description of a definite DP is that it refers to an entity that is "assumed by the speaker to be uniquely identifiable to the hearer" and that an indefinite DP is "not so assumed" (Givon, 1978, in Von Heusinger, 2002: 8):

(26) (Pointing) Lock the door, please.

In example (26), *the door* is identifiable to both the speaker and the addressee (or the speaker assumes that the addressee can identify *the door*), satisfying the description above. However, in the following construction, the definite expression could be unidentifiable:

(27) I bought a book yesterday. The book is really amazing.

In (27), *the book* is not necessarily identifiable to the addressees if they have not seen it before. However, another criterion, that of familiarity, can account for (27). According to Lyons (1999)[20], a DP is definite if both the speaker and the addressee (or the speaker assumes so of the addressee) are familiar with that entity. Otherwise, it must be indefinite. The example (27) then can be explained as that both the speaker and the addressee are familiar with *the book* because it was mentioned in the previous utterance.

Yet the criteria of familiarity and identifiability, according to Lyons (1999), are still not sufficient to explain the use of the definite DP in the following example:

[20] The original idea of *familiarity* comes from Hawkins (1978).

(28) I've just been to a wedding. The bride wore blue.
(Lyons, 1999: 7)

In (28), the speaker and the addressee may not be familiar with the bride. They cannot identify the bride if they have not met the person before and if there are other people such as bridemaids, who also wear exquisite dresses. Thus, another criterion, that of uniqueness, is put forward to account for the phenomenon in (28): the bride is the unique entity in the context. Here is another example about uniqueness:

(29) I wonder who the anaesthetist is today.
(Lyons, 1999: 7)

In (29), *the anaesthetist* refers to the unique anaesthetist in the hospital who satisfies the criterion of being present during a specific operation.

Uniqueness seems to be a preferred criterion in judging whether a DP is definite or not. However, Lyons (1999) further pointed out that those criteria are not always interchangeable. For example, in (26), *the door* is not necessarily unique because the addressee might just lock one of several doors in a room. In that sense, any single criterion, among familiarity, identifiability, or uniqueness, is not sufficient to include the various different uses of definite DPs. I therefore suggest to develop a discourse-link point of view to have a unified description of the uses of definite DPs in various contexts. Briefly, a definite DP is an element that must link to other elements in discourse in order to be interpreted.

Such a discourse-link point of view of definite DPs can be further analyzed into three sub-types: (1) linking to a previously-mentioned entity; (2) linking to encyclopedic knowledge; (3) linking to the immediate visual context (Avrutin, 1999).

(30) Previously-Mentioned Entity
a. I saw a book on the desk. The book was closed.
b. *The book was lost.

In (30a), use of *the book* is felicitous because there is already a corresponding indefinite DP mentioned in the previous context. This is in line with how discourse unfolds when we introduce entities into it: when we first introduce a new entity into discourse, we tend to use an indefinite DP since it is independently interpretable. A definite DP, rather, is a dependent element that relies on other elements for

interpretation (e.g. here, it relies on the previously-mentioned indefinite DP *a book*). In (30b), the use of the definite DP *the book* is infelicitous because there is nothing for it to rely on — it is unknown which book is being referred to. In other words, in (30b), *the book* is uninterpretable.

The second and third types are the ones that link to encyclopedic knowledge and immediate visual context, respectively, in which there is no need to mention the corresponding indefinite DPs in the previous context:

(31) a. Encyclopedic Knowledge:
The moon is shining.
b. Immediate (Visual) Situation
(Pointing) The dog is barking.

The plausibility of (31a) is based on (shared) encyclopedic knowledge, and (31b) on a shared visual situation between the speaker and the addressee. In (31a) the definite DP *the moon* is acceptable because there is only one unique moon in the solar system that orbits the earth ("larger situation use", Hawkins, 1978 in Avrutin, 1999) and such a fact is known by both the speaker and the addressee, so the definite DP *the moon* is interpretable. In (31b) the definite DP *the dog* is interpretable because of visual information shared by both the speaker and the addressee ("the immediate situation", Hawkins, 1978 in Avrutin, 1999), so the definite DP *the dog* is also interpretable, even without mention of a corresponding indefinite DP *a dog* in the previous context.

Likewise, a bridging example follows the same logic. Although there is no explicit mention of a corresponding indefinite DP in the previous linguistic context, the definite DP can be linked to the implicit antecedent via bridging:

(32) I entered a room. The door was yellow.

The reason that *the door* can be bridged to *a room* is that both the speaker and the addressee have the shared knowledge that *door* is semantically connected with *room* and the addressee has sufficient inferential capacity to build the same bridge as the one that has been built by the speaker. One thing to be emphasized is that the discourse linking mechanism operating in (32) is affected by the determiner system as well as by the types and degrees of the semantic association between the definite DP and the indefinite DP. This will be discussed in detail in the following section.

2.3.3 Semantic associations between the definite DP and its antecedent

In (32), *door* and *room* are in a part-whole relation, which provides for the possibility of a bridging operation between these two elements. In situations where the semantic association between the definite DP and its antecedent is very weak, bridging is difficult (or unlikely to happen), as in (33):

(33) ? A car is parking on the roadside. The table has been cleaned up.

In (33), bridging the definite DP *the table* to the indefinite DP *a car* is difficult since there is no semantic association between *car* and *table*. In a bridging environment, the definite DP and its antecedent should be semantically connected to each other (or at least presupposed by the speakers to be so). According to Charolles (1999), the semantic association between the definite DP and its antecedent is under two constraints: (1) stereotypicality and (2) non-transitivity. Here are some examples:

(34) a. Stereotypicality
A letter was awaiting Sherlock Holmes. The address was illegible.
b. Non-transitivity
? A letter was awaiting Sherlock Holmes. The picture showed a cathedral.
(Charolles, 1999:314-316)

Stereotypicality means that the lexical part (N) of the definite DP is "a stereotypical part of the entity denoted by the preceding NP" (Charolles, 1999: 316). In (34a), *address* is a stereotypical component of *letter*, so bridging between them is possible. Non-transitivity refers to the fact that bridging cannot make a leap without a transition in discourse (Charolles, 1999). In (34b), the connection between *picture* and *letter* includes a leap (letter — stamp — picture), making it hard to build a bridge between those two elements. Notice that the constraint of non-transitivity is in fact derivable from stereotypicality, when we observe that *picture* is not a stereotypical component of *letter*.

The problem of stererotypicality and non-transitivity is that they are themselves too general to be treated as clear-cut constraints. In the following examples, the semantic associations between the definite DPs and their antecedents may not be regarded as stereotypical or transitional:

(35) a. We drove into the village. The church was standing on a hill.
b. There was a suitcase on the bed. The leather was stained.
c. There was a bicycle in the yard. The spokes were bent.
d. A letter was awaiting Sherlock Holmes. The p's were strange.
(Kleiber, 1999: 340-350; Charolles, 1999: 317-318)

In (35a), *church* is not necessarily a compulsory and stereotypical component of *village*. In (35b), *leather* is one of the possible materials of the *suitcase*, but not necessarily a stereotypical one. In (35c), *spokes* are parts of *wheels*, which in turn, are parts of a *bicycle*, violating the non-transitivity constraint. In (35d), the connection between *p* and *letter* (mail) is not direct, either.

The problem of stereotypicality disappears if the semantic association between the definite DP and its antecedent is explained with the criterion of alienability — whether the definite DP is an separable component of its antecedent or not. According to Kleiber (1999), there are three types of relations under the constraint of alienability: (1) alienable: dog — snow (two components that are separable); (2) optionally alienable (two components that are optionally separable): chimney — house; (3) inalienable: trunk — tree (two components that are not separable). With this criterion, the examples in (35a) church — village, (35d) letter (mail) — p, and (35b) suitcase — leather belong to the second category while those in (35c) bicycle — spoke then belong to the third one.

One aspect to be mentioned here is that a stereotypical or an inalienable relation between the definite DP and its antecedent does not necessarily mean that a bridging relation between such two elements is easier to be established, because bridging is influenced both by the morphosyntactic features and the semantic connection of the elements as well as by discourse mechanisms (e.g. shared knowledge). In addition, the discourse prominence of the antecedent itself also plays a role in bridging, which will be discussed in the following section.

2.3.4 The antecedent: the specificity of indefinite DPs

The antecedent of a definite DP in bridging can be either a definite or an indefinite DP. In this dissertation, I focus on indefinite DP antecedents. Empirical evidence has shown that the specificity of indefinite DPs will affect the bridging process, with a specific DP requiring less processing resources than a nonspecific one (Avrutin & Coopmans, 2000). Specificity, in their study, is used more or less interchangeably

with discourse prominence. That is, a specific DP makes the DP more discourse prominent while a nonspecific one is less so.

However, the traditional definition of specificity seems to be non-replaceable with discourse prominence. Traditionally, a specific reading of a DP refers to the "'certainty of the speaker about the identity of the referent', 'the speaker has the referent in mind', or 'the speaker can identify the referent' " (Von Heusinger, 2002:245) while a non-specific DP entails that the speaker is uncertain about the referent. Such a definition contains two points: first, whether a DP gets a specific or nonspecific reading is decided by the speaker only, unlike definiteness which involves roles for both the speaker and the addressee. Second, the specific or nonspecific reading is derived from the criterion of identifiability and the mental representation of the speaker. With such a definition, whether or not an indefinite DP has a specific or a non-specific reading is affected by scope or context, for example:

(36) **Scope**

John wants to marry a Norwegian.

a. There is a Norwegian, and John wants to marry her.
b. John wants that [there is a Norwegian and he marries her].

(Von Heusinger, 2002: 259)

(37) **Context**

a. A dog was in here last night — it's called Lulu and Fred always let it sit by the fire on wet nights.
b. A dog was in here last night — there's no other explanation for all these hairs and scratch marks.

(Lyons, 1999: 171)

In (36a), the indefinite DP *a Norwegian* gets a wide scope reading and it is identifiable by the speaker, therefore, specific; otherwise, it is nonspecific, as is shown in (36b). In (37), *a dog* is either specific (37a) or nonspecific (37b) according to the context, provided by the accompanying information in the follow-up sentence.

From the two examples above, it can be seen that a specific entity is relatively more prominent in discourse; that is, an entity that has some specific properties rather than a random one, while a nonspecific entity (that is, a random entity that lacks specific characteristics) is less prominent. I therefore regard specificity as a factor that contributes to discourse prominence. One last remark to be made here is that, although

specificity is a concept that is applicable to both definite and indefinite DPs, it is in general (at least in Chinese) regarded as a subcategory of indefinite DPs (Sybesma & Sio, 2008). In this dissertation, I therefore focus on the specificity of indefinite DPs.

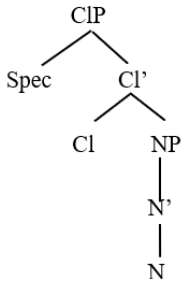
2.3.5 Bridging in Chinese: the definite DP and its antecedent

Considering the fact that Chinese is a language without overt determiners, several questions need to be answered before I explore how a definite DP bridges to an indefinite DP in Chinese: (1) do Chinese definite expressions have DP projections? (2) how is definiteness encoded in Chinese in the absence of overt articles? The following sections are dedicated to answering these two questions. In addition, I will also briefly discuss the alternative choice of using demonstratives in the expression of definiteness and the specificity of the antecedent (i.e. indefinite DPs) in bridging.

(1) DP or DP-like projections

Definite DPs in many Indo-European languages are marked with determiners while in Chinese, there are no such lexical markers. The first question, then, is whether definite noun phrases in Chinese have DP projections or not. According to Cheng & Sybesma (1999), Chinese indeed has a DP or DP-like projection (i.e. ClP) above NP, being realized with bare forms.

(38)

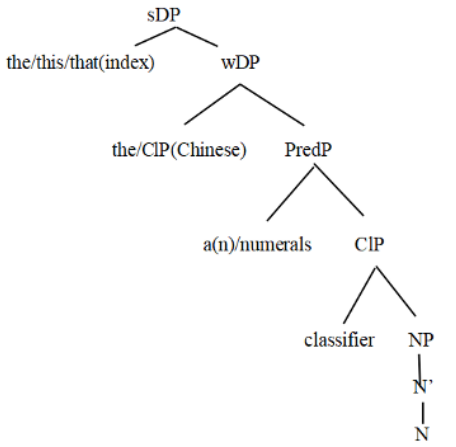


A ClP is a classifier phrase that can be used as a unit of measurement for mass nouns. For example, in the phrase *yi-bei shui* (one-Cl_{glass}-water: a glass of water), the classifier *bei* (Cl_{glass}) is used to measure the mass noun *water* (a unit). It may also simply be used for a description of count nouns. For instance, in the phrase *yi-tiao yu* (one-Cl_{shape}-fish: a fish), the classifier *tiao* (Cl_{shape}) is used to describe the shape of the

fish. The position of a classifier is usually the location for the grammatical number feature of the nouns: *yi-xie yu* (one-Cl_{plural} yu: many fishes) /*yi-tiao yu* (one-$Cl_{singular}$ yu: a fish). This grammatical function of Cl is like that of D in many languages that have the individualization function: "A classifier singles out one entity from the plurality of entities provided by the semantic representation of the noun in the lexicon." (Cheng & Sybesma, 2005: 13). Also, a proposal of N-to-Cl movement that is triggered by an iota operator — a type-shifter that has a similar function to that of definite articles (Chierchia, 1998) — supports the view that Chinese ClP is indeed a DP-like projection.

In addition to the ClP proposal, some researchers (Cheng, Heycock and Zamparelli, 2017) have argued that there is a DP layer above the ClP in Chinese, and that DP layer has two levels: strong DP and weak DP.

(39)

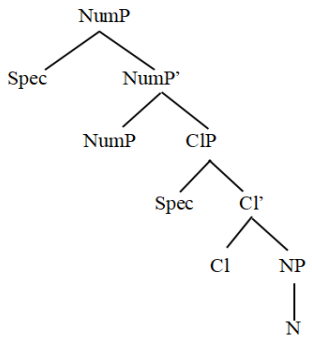


(Cheng, Heycock and Zamparelli, 2017: 12, a reduced version)

Under the proposal of Cheng, Heycock and Zamparelli (2017), a strong DP shows an anaphoric relation with a referent mentioned in discourse (e.g. I saw a cat. The tail is long.) while a weak DP becomes an argument via the mechanism of MAX — "a free type-shifting operator that is available to take singleton/maximal properties and return their unique/maximal element" (p.11) (e.g. the sun, the president of Russia). What I want to emphasize here is that a two-level DP projection proposal also supports the idea of Chinese definite expressions having a DP projection.

On the other hand, indefinite DPs in Chinese can either be bare or not bare. The projection of an indefinite expression in Chinese is assumed to be like the following:

(40)



(Cheng & Sybesma, 1999: 529)

It can be seen that there is always a NumP projection (or PredP in (39)) above ClP (e.g. *yi-zhi-gou*: a dog). Such a NumP projection is the place where the indefinite interpretation of a nominal expression in Chinese resides, because nouns with numerals are always interpreted as indefinite. The NumP is a higher level than ClP, so it will undo the definiteness of ClP (Cheng & Sybesma, 1999). In that sense, indefiniteness in Chinese is encoded in NumP. The question is whether or not there is still a higher layer — a DP projection — above the NumP. Some researchers (Simpson, 2005; Sio, 2006) have proposed that there is a DP or FP projection above NumP:

(41) a. Indefinite: $[_{DP}D^0[_{NumP}\ Nume^0\ [_{ClP}\ Cl^0\ [_{NP}\ N^0]]]]$
(Simpson, 2005, in Cheng & Sybesma, 2012: 635)

b. Indefinite $[_{FP}F^0\ [_{NumP}\ Nume^0\ [_{ClP}\ Cl^0\ [_{NP}\ N^0]]]]$
(Sio, 2006, in Cheng & Sybesma, 2012: 646)

The proposal of a DP projection suggests that the indefinite expression (not-bare in form) is encoded in the NumP because the D^0 is inactivated (Simpson, 2005, in Cheng & Sybesma, 2012). A similar proposal for an FP projection assumes that there is a kind of feature agreement between F^0 and Num^0 (+indefinite, Sio, 2006, in Cheng & Sybesma, 2012). What is common among these proposals is that the functional projection of an indefinite expression always includes a NumP and a higher functional element D or F preceding it.

I have briefly touched upon some theoretical proposals that support the idea that Chinese has a DP or DP-like projection. The next question is what the constraints or distributional patterns of the (in)definite DPs are in a sentential environment. After all, the (in)definiteness of DPs in Chinese is not encoded by overt determiners, but instead by syntactic positions (word order). This will be illustrated in some detail in the following section.

(2) The encoding of definiteness in Chinese

English encodes (in)definiteness through lexical devices: the articles *the* (definite) and *a/an* (indefinite). As a dependent element, a definite DP must link to another element in discourse. An indefinite DP, on the contrary, is independently interpretable. That is why it can be used to introduce new entities into the discourse. A definite DP in Chinese is bare in form and has a tendency to occur in preverbal position while an indefinite DP in Chinese can either be bare or not bare, and it usually occurs in postverbal position (Chao, 1968; Xu, 1995):

(42) Definite DPs — Preverbal Position (Strong Tendency)
客人来了
Keren lai le.
Guest come LE
"The guest(s) is/are coming."

(43) Indefinite DPs — Postverbal Position (Strong Tendency)
a. 来了客人。
Lai-le Keren.
Come-LE guest
"A guest/Guests is/are coming."
b. 来了（一）位客人。
Lai-le (yi)-wei keren.
Come-LE (one)-Cl guest
"Here comes a guest."

In (42), *Keren* (the guest(s)) is a definite DP, as preverbal position highly correlates with a definite reading of the bare DP. In (43a) and (43b), *Keren* (a guest(s)) and *(yi)-wei keren* (a guest) are both indefinite DPs (with either a bare or not bare

form) as indefinite readings of DPs correlate with postverbal positions. Clearly, the definite or indefinite interpretation of a Chinese DP relies heavily on word order information.

Nevertheless, the preverbal syntactic position distribution of definite DPs is only a strong tendency, which means that there are some cases in which definite DPs can occur in the postverbal positions, for example:

(44) Definite DPs — Postverbal Position

a. Bounded Event

他喝完了汤。

Ta he-wan-le tang.

She drink-finish-LE soup.

"She finished the soup."

(Sybesma & Cheng, 1999)

b. Unique Nouns

-你在找谁？

Ni zai zhao shui?

You Prep look who

"Who are you looking for?"

-我在找经理。

Wo zai zhao jingli.

I Prep look manager

"I am looking for the manager."

c. Context

the speaker and the addressee know that Lily is going to buy the book "Walden", and the speaker is asking the addressee if Lily has bought the book or not:

-莉莉书买了没有？

Lily shu mai-le meiyou ?

Lily book buy-LE not?

"Has Lily bought the book?"

-买了。

Mai-le (shu).

buy-LE (book)

"Lily has bought the book."

In (44a) *he-wan-le* (finish drinking) describes a bounded event [21] which presupposes that the postverbal bare NP *tang* (soup) has been mentioned in the previous context (Sybesma, 1999). In (44b) *jingli* (manager) is interpreted as definite because it is known by both the speaker and the addressee so that it can be linked to their common knowledge (e.g. there is only one unique manager for the store in their shared knowledge). In (44c) the (second) *shu* (book) in *mai-le shu* (bought the book) is definite because it has been mentioned before (the first *shu* is also definite because it is known by both the speaker and the addressee). Such examples demonstrate that DPs occurring in the postverbal positions can have definite interpretations, yet they are not common and their occurrence is due to other semantic or pragmatic constraints (e.g. presupposition, context, etc.).

I have introduced here how the (in)definiteness of DPs is encoded in Chinese, with definite DPs having a strong tendency to occur in preverbal position. I also mentioned that there are also cases which do not follow this tendency: definite DPs can sometimes also occur in postverbal position in special circumstances.

(3) Bare form definites or demonstratives

On the basis of the analysis in the sections above, a typical bridging example in Chinese is shown in (45), in which the definite DP occurs in the preverbal position with a bare form and an indefinite DP (its antecedent) appears in a postverbal position with the form of (numeral) +classifier +noun:

(45) 我买了（一）本书。作者很有名。
Wo mai-le (yi)-ben shu. Zuozhe hen you-ming.
I buy-LE (one)-Cl book. Author very well-known
"I bought a book. The author is well-known."

The definite DP *zuozhe* (the author) bridges to the indefinite DP *(yi)-ben shu* (a book) as they are semantically connected (books have authors and such knowledge is known by both the speaker and the addressee).

[21] The property of the boundedness of an event plays a critical role in the encoding of definiteness of a DP in many determinerless languages. However, since my main focus in this study is the relation between word order and the definiteness of a DP in Chinese, the boundedness of an event is beyond the scope of this research and will not be discussed further.

Someone may wonder if demonstratives in Chinese can also have functions similar to that those of the determiner the in English, since demonstrative DPs in Chinese are also definite expressions that can link with a previous entity in discourse.

(46) Deictic:
我想买那本书。
Wo xiang mai na-ben shu. (pointing)
I want buy that-CL book.
"I want to buy that book."

(47) Anaphoric:
我买了（一）本书。那本书非常有趣。
Wo mai-le (yi) ben shu. na-ben shu fei-chang youqu.
I buy-LE (one) CL book. That-CL book very interesting.
"I bought a book. That book is very interesting."
(Sybesma & Sio, 2008)

In (46) the demonstrative *na* (that) is deictic (i.e. linking to an entity that is in the visual domain. In (47), *na* (that) is anaphoric, linking to an entity that has been mentioned in the previous linguistic utterance. However, demonstratives are less acceptable in the bridging context:

(48) 张三买了（一）本书。？那个作者很有名。
Zhangsan mai-le (yi)-ben shu. ?Na-ge zuozhe hen you-ming[22].
Zhangsan buy-LE (one)-Cl book. That-Cl author very well-known
"Zhangsan bought a book. That author is well-known."

According to Jenks (2018), demonstratives "only occur in familiar or anaphoric definite environments, requiring explicitly mentioned discourse antecedents" (p.506). In (48), there is no explicit mention of the antecedent of *zuozhe* (the author) in the previous context, so using a demonstrative is relatively less acceptable (it can refer to

[22] In the following example, bridging between a demonstrative DP and its antecedent is totally unacceptable, probably because of the animacy feature of the antecedent:

*我看见了一只猫。那条尾巴很短。
*Wo kanjian-le yi-zhi mao. Na-tiao weiba hen duan.
I see LE one-Cl cat. That-Cl tail very short
"I saw a cat. That tail is very short."

the author of another book but not necessarily the author of the book that *Zhangsan* bought). The fundamental reason for the distinction between bare expressions and demonstratives is that the former is a unique definite while the latter is an anaphoric definite (Jenks, 2018). In other words, it is the bare DP rather than the demonstrative that is the appropriate definite expression to be used in the bridging context.

(4) The specificity of indefinite DPs

In section 2.3.4, I mentioned that specificity, even if it is applicable to both definite and indefinite DPs, is usually regarded as a subcategory of indefinite DPs (Sybesma & Sio, 2008). I also discussed the relation between specificity and discourse prominence and the role of scope and context in determining whether the reading of an indefinite DP (in English) is specific or nonspecific. In Chinese, however, the specificity of indefinite DPs is further encoded by lexical markers, such as the numeral *yi* (one) (e.g. Cheng & Sybesma, 1999; Chen, 2004). The presence of *yi* is directly related to the specificity of indefinite DPs, "when *yi* is overtly present, the larger *yi-CL-N* construction itself already carries the discourse function of indexing the saliency of the N as a prominent discourse participant" (Biq, 2004: 1666). Here are some examples:

(49) a. specific
他喝完了一碗汤。
Ta he wan-le yi-wan tang.
He drink finish-LE one-Cl soup
"He finished drinking a bowl of soup"

b. specific or nonspecific
他去年买了（一）幢房子。
Ta qunian mai le (yi)-zhuang fangzi.
he last year buy LE one-Cl house
"He bought a house last year."

c. nonspecific
他想买幢房子。
Ta xiang mai zhuang fangzi, shenme fangzi dou xing.
he want buy Cl house any house all do
"He wants to buy a house; any house will do."
(Cheng & Sybesma, 1999; Chen, 2004, modified)

In (49a) *yi-wan tang* (a bowl of soup) is specific, and the numeral *yi* cannot be omitted. In (49b) *(yi)-zhuang fangzi* (a house) can either be specific or nonspecific. It is more likely to have a specific reading when the numeral *yi* is not omitted, and a nonspecific reading when *yi* is omitted. In (49c) *zhuang fangzi* (a house) has a tendency to be interpreted as nonspecific because the numeral *yi* is omitted. From these three examples, it can be seen that the more specific an indefinite DP is, the more likely that *yi* will be present, contributing to its discourse prominence.

Another lexical marker for the specific reading of an indefinite DP is the demonstrative *this*[23]. This is similar in English as well as in Chinese. Ionin (2006) has suggested that the word *this* is a marker for specific indefinite DPs because it denotes the noteworthy property of the DP:

(50) There is this man who lives upstairs from me who is driving me mad because he jumps rope at 2 a.m. every night.
(Maclaran, 1982, in Ionin, 2006: 176)

(51) a. #Mary wants to see this new movie; I don't know which movie it is.
b. Mary wants to see this new movie; I don't know which movie it is, but she's been all excited about seeing it for weeks now.
(Ionin, 2006: 183)

According to Ionin (2006), in (50) *this man* is a specific indefinite. The specific reading of *this man* arises from the following description of the man, which makes it noteworthy. The phenomenon of noteworthiness can further be seen in the two examples of (51). The demonstrative *this* is more appropriate in (51b) than in (51a). The difference between them is that (51b) has some description of the movie, which makes it noteworthy and more specific. The noteworthy property of *this* also suits Chinese data with the numeral *yi* (one) after it:

[23] The demonstrative *this* functions more like *such,* and this is similar in Chinese, too. *This* in the dissertation equals to *such*.

(52) 图书馆里有这样一个人。她学习很用功。
Tushuguan li you zheyang yi-ge ren, Ta xuexi hen yonggong.
Library in have this one-CL-person, she study very hard.
"There is this person in the library. She studies very hard."

In (52), *zheyang yi-ge-ren* (this person) is specific (indefinite). In addition, the numeral *yi* (one) cannot be omitted, which also provides evidence for the view that *yi* is a lexical marker for the specificity of indefinite DPs.

Thus, the encoding of specificity in Chinese indefinite DPs can be summarized as follows:

(53)

CL+ bare NP	usually non-specific
Numeral *yi* +CL + bare NP	usually specific
Zheyang(this)+ Num +CL +bare NP	specific

To sum up, specificity in this study is seen as the discourse prominence of indefinite DPs. In Chinese, the more markers (e.g. *yi* or *zheyang*) a DP has, the higher the probability that it can have a specific interpretation.

2.3.6 Interim summary

In this section, I discussed the second type of dependency: bridging — an operation between a definite DP and its antecedent. I presented how the (in)definiteness of DPs is encoded in Chinese, given that Chinese does not have overt determiners, and then I illustrated how a definite DP is semantically connected to its antecedent in a bridging relation. Finally, I pointed out how the specificity of indefinite DPs (i.e. in this dissertation the antecedents of the definite DPs) is encoded via lexical devices such as this and *yi* (one). All of these factors together are expected to affect the bridging process.

2.4 The Representation and Interpretation of Referential Dependencies

In the above two sections, I illustrated theoretical properties of two types of dependencies, as well as some empirical problems. One dependency focuses on a

reflexive/pronoun and its antecedent. The other involves a definite DP and its antecedent. I further pointed out that the establishment of these two types of dependencies involves both morphosyntactic and discourse information. The representation of such independencies finally occurs in discourse (with phonological/morphosyntactic information either directly or indirectly sent to discourse), where memory/attention aspects and other cognitive resources are involved in the final interpretation:

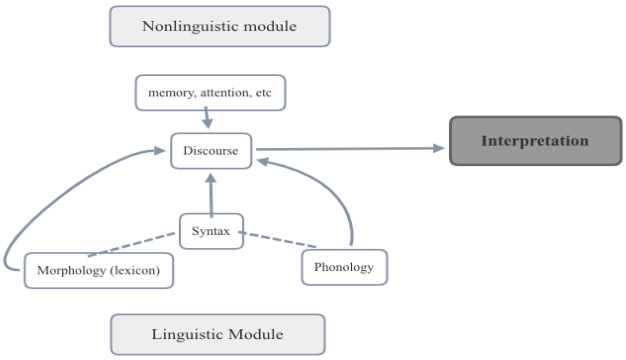


Figure 2. 1 The interpretation of referential dependencies

As is shown in the schema, the interpretation of dependencies not only includes linguistic information but also requires the participation of nonlinguistic factors, such as memory, attention etc. Here is an example:

(54) A young woman near a little girl was picking apples. She (the woman) pricked herself.

The successful interpretation of the referential dependencies (a woman — she/ herself) clearly requires the speaker and addressee to have not only the relevant morphosyntactic knowledge of the elements in the sentence (the, woman, etc.) but also a relatively good working memory to make sure that they are able to build such dependencies (e.g. to hold the antecedent a woman in working memory). Unlike purely syntactic theories that explain how a referential dependency is established via a morphosyntactic computational mechanism, discourse theories account for the interpretation of referential dependencies by making use of aspects of attention

(centering theory, Walker, Joshi & Prince, 1998), memory accessibility (accessibility theory, Ariel, 1990), and mental discourse unfolding mechanisms (discourse representation theory, Kamp, 1981). In this section, I will review three such discourse theories, aiming to point out the pros and cons of each, and to provide possible solutions for the problems that have not been resolved.

2.4.1 Centering theory

"Centering is a model of how the center of attention of a set of conversants is retained or shifted as a discourse unfolds. It is a model that concerns the relationship between attentional state, inferential complexity, and forms of referring expressions" (Walker, Joshi & Prince, 1998: 1). Specifically, it is a theory of discourse representation that focuses on the cognitive status of pronouns and how they are distributed and interpreted in discourse.

There are three key concepts in this theory: (1) Centers (cx), (2) Utterances (U), (3) Discourse segments (D). Centers are semantic entities denoting varying degrees of attention in utterances. The pronoun and its potential antecedents are centers of different types: Cf (forward-looking center: antecedents); Cb (backward-looking center: pronouns); Cp (preferred center: highest-ranked member of all the antecedents). All the centers are realized in utterances (U_1, U_2...U_N), which can be grouped together into a discourse segment (D). Centers in utterances or discourse segments are subject to constraints:

Constraints of Centers

For each utterance U_i in a discourse segment D consisting of utterances U_i,...,U_m:

1. There is precisely one backward-looking center Cb (U_i, D).
2. Every element of the forward centers, Cf (U_i, D), must be realized in U_i.
3. The center, Cb (U_i, D), is the highest-ranked element of Cf (U_{i-1}, D) that is realized in U_i.

(Walker, Joshi & Prince, 1998:3-6)

Here is an example of the application of centering theory:

(55) (a) Amy helped Jane cook the dinner.
Cb: [?] Cp: [Amy] Cf: [Amy, Jane, dinner] No Cb
(b) She poured oil into the pan as Jane washed the vegetables.
Cb: [Amy] Cp:[Amy] Cf: [Amy, oil, Jane, vegetables] Continue

In (55a) there are no backward-looking centers (Cbs: pronouns) in the utterance U_a. The forward-looking centers (Cfs) include *Amy*, *Jane*, *dinner*, which act as the potential antecedents for a backward-looking center (i.e. pronoun) in the following utterance. Among the three forward-looking centers, *Amy* is the preferred center (Cp), the highest-ranked in U_a, simply because it occurs in the subject position and no other extra factors will affect the ranks of centers in a neutral context such as in (55a). In (55b), the pronoun *She* is a backward-looking center (Cb) that can find *Amy* as its antecedent because *Amy* is the preferred center of the preceding utterance (i.e. the center with the highest attention). From utterance (a) to utterance (b), firstly, the backward-looking center in U_b (Cb: *Amy*) is the same as the preferred center in U_a (Cp: *Amy*) (i.e. $Cb(U_i) = Cp(U_{i-1})$); secondly, the backward-looking center in U_b (Cb: *Amy*) is also the preferred center in U_b (Cp: *Amy*) (i.e. $Cb(U_i) = Cp(U_i)$). According to the center transition rules, the required transition is Continue. There are center transition rules other than Continue, such as Shift and Retain. See below:

Center Transition Rules:

For each U_i in a discourse segment D consisting of utterances $U_i,...,U_m$,

	$Cb(U_i) = Cp(U_{i-1})$ OR $Cb(U_{i-1}) = [?]$	$Cb(U_i) \neq Cp(U_{i-1})$
$Cb(U_i) = Cp(U_i)$	Continue	Smooth-shift
$Cb(U_i) \neq Cp(U_i)$	Retain	Rough-shift

Transition states are ordered. The Continue Transition is preferred to the Retain Transition, which is preferred to the Smooth-Shift transition, which is preferred to the Rough-Shift transition.

The ranks of forward-looking centers (Cfs) are affected not only by syntactic positions (as in (55)) but also by factors such as event structure (e.g. properties of verbs) and discourse coherence:

(56) a. Properties of Verbs:
Patty and Carmella went to the bookstore.
Afterwards, Carmella saw her sister Rachel.
She looked pale.

b. Discourse Coherence:
Patty took Carmella to the bookstore.
Afterwards, Carmella gave her sister Rachel a new book.
?She's a true bibliophile.
(Passonneau, 1998: 329-332)

In (56a) the pronoun *she* refers to *Rachel*. The reason lies in the properties of the perceptual verbs *see* and *look*, which represent perspective information. In the event of *seeing*, the attention is on *Rachel* (Cp), so the following pronoun *she* is realized by *Rachel* (even though it is in an object position, and normally we would expect the entity in the subject position to receive the highest attention).

In (56b), *she* is ambiguous, because it can link to *Carmella*, *Rachel*, or even *Patty*. If it links to *Carmella*, then it means that the Cb in the current utterance is *Carmella* ($Cb(U_i)$ = *Carmella*). The Cp (U_{i-1}) and Cb (U_i) is the same — *Carmella*, so the transition is Continue; If it links to *Rachel*, then the center transition is Smooth Shift because the original preferred center is *Carmella* (subject) but now it is shifted to *Rachel* (i.e. $Cb(U_i)_{\text{Rachel}} \neq Cp(U_{i-1})_{\text{Carmella}}$; $Cb(U_i)_{\text{Rachel}} = Cp(U_i)_{\text{Rachel}}$). For the sake of discourse coherence or to decrease the processing load of the addressee, she is more likely to be interpreted as *Carmella* (Continue).

It can be seen from the analysis above that centering theory can account for how a pronoun is linked to its antecedent in discourse through the mechanisms of attention-ranking, maintaining, and shifting. These are based on the salience of the entities (ranks of attention) and on discourse coherence (attention transition). However, this theory cannot explain dependencies established within a sentence, such as in (57)

(57) The woman next to the boy finds a brush next to him.

Although the pronoun *him* and its antecedent *the boy* occur in the same sentence, the referential dependency between them is established in discourse (Reinhart & Reuland, 1991, 1993). Centering theory in this case is not applicable because the minimal discourse segment is the sentence as a whole (e.g. U_n). The pronoun *him* as a Cb must be realized by an antecedent in a previous discourse segment (e.g. U_{n-1}). The further division of discourse segment within the sentence relies greatly on morphosyntactic information provided by syntactic structure which was not taken into account in centering theory.

2.4.2 Accessibility theory

Another well-known discourse theory is Ariel's (1990) accessibility theory, which explores the accessibility of noun-phrase antecedents. The accessibility status of the antecedents is roughly decided by the following four factors: (1) the recency of mention (distance); (2) the importance of physical salience (topic or non-topic); (3) competition (antecedents); (4) boundaries (coherence). On the other hand, dependent elements (i.e. definite DPs, pronouns, reflexives) are markers of how accessible their antecedent are. For example, pronouns are high accessibility markers, which means that their antecedents are highly accessible. In contrast, definite DPs (i.e. full noun phrases) are low accessibility markers, indicating that their antecedents are not as accessible as those of pronouns. There are, in general, three types of accessibility markers:

1. Low Accessibility Markers: proper names, definite descriptions
2. Intermediate Accessibility Markers: deictics/demonstratives
3. High Accessibility Markers: pronouns/gaps/reflexives

(Ariel, 1990: 28-29)

Some examples to illustrate the differences among the three types of markers:

(58) a. Mary dressed the baby. The clothes were made of pink wool.
b. ?? Mary dressed the baby. They were made of pink wool.

(59) a. I saw a boy. The pants are cool.
b. ?? I saw a boy. That pants are cool.

(Ariel, 1990:189)

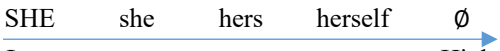
In (58), the event *dressing* contains a hidden entity *clothes*, which acts as the potential antecedent for the following accessibility marker — a pronoun or a full noun phrase. Since the hidden antecedent *clothes* is not highly accessible (e.g. it is not overtly presented in the sequence), a relatively low accessibility marker, a full noun phrase *the clothes* (e.g. (58a)) rather than a pronoun *they* (e.g. (58b)) should be used in the sequence.

In (59), the demonstrative phrase *that pants* is an intermediate accessibility marker. The definite DP *the pants* is a lower accessibility marker. The intermediate

marker *that pants* is less preferred than a lower marker *the pants* in (59) because the antecedent *a boy* is not highly accessible in this bridging context (not explicitly mentioned).

Alongside the three main categories of accessibility markers, Ariel (1990) also provided a scale of accessibility markers, in which pronouns and reflexives in their various forms are different from one another:

(60)



(Ariel, 1990: 70, modified)

Within this system, a stressed pronoun is a lower marker than a pronoun, which in turn is lower than a reflexive. Thus, the phenomenon of stressed pronouns is easily captured via accessibility theory:

(61) *Mary* kissed **Jane** and then *she*/**SHE** kissed Harry.
(Ariel, 1990: 183)

The stressed pronoun SHE is a lower accessibility marker compared to unstressed *she*, so SHE refers to the less-accessible referent — the object *Jane*. The unstressed pronoun *she* is a higher accessibility marker and it links to the more accessible referent—the subject *Mary*.

However, there is an issue of complementarity in the PP construction, which cannot be explained by accessibility theory:

(62) a. ***Mary** touched **her.**
b. **Mary** touched **herself**.
c. **John** put a book behind **him**.
d. **John** put a book behind **himself**.

In (62a) *her* cannot refer to *Mary*. In (62b) *herself* must refer to *Mary*. According to the accessibility theory, *her* is a slightly lower accessibility marker than *herself*, so it should be connected with a less accessible antecedent. Thus, the ungrammaticality of (62a) may lie in the fact that the degree of accessibility of *Mary* as an antecedent is so high that it can only be connected with a high-accessibility marker — a reflexive rather than a pronoun. However, both *him* and *himself* are acceptable in the examples

of (62c) and (62d). This runs counter to accessibility theory if we regard *himself* and *him* as accessibility markers of different degrees. In other words, the issue of complementarity in binding theory remains unresolved by accessibility theory, too. The resolution for such a problem may lie in a series of combinatory factors. For example, perhaps we should reconsider factors such as morphosyntactic features of dependent elements (pronouns and reflexives), the syntactic structures of the PP construction, and the discourse information that is involved in the interpretation of those constructions in order to solve the problem of complementarity. This will be explained in detail in Chapter 4.

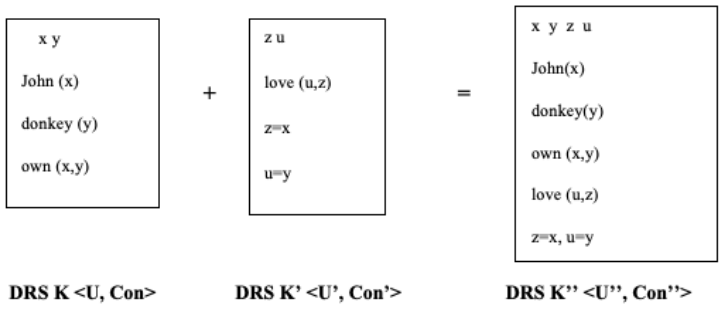
2.4.3 Discourse representation theory

Discourse representation theory (DRT) (Kamp, 1981; Kamp, Van Genabith & Reyle, 2011) is a theory of how discourse is mentally represented in the minds of the hearer as a discourse unfolds. It focuses on the logical structures of sentences, treats every single sentence as a basic information unit, and expresses the view that the meanings of the discourse are represented by a process of information growth (sentence by sentence). According to DRT, a sentence as a unit of information will prompt a mental representation, called Context (K), which has its own structure (DRS), composed of referents and conditions. Referents are entities in discourse. Conditions are functions that show the constraints (relations, properties) of these entities. For example, in the sentence *John likes Mary*, there are two referents in the sentence (x = John, y = Mary), and three conditions: like (x, y), John (x), Mary (y). Referents and conditions combined together are propositions which, semantically, have their truth values.

Information will grow (or be updated) in the unit of a sentence. Once a sentence triggers a mental representation (DRS K), the new incoming sentence will then prompt a new mental representation, causing the changing of context (a new DRS K'). This process is called information addition, turning discourse representation into a dynamic process. How a pronoun is connected with its antecedent (referent) can thus be explained by this dynamic mechanism.

(63) a. **John** owns *a donkey*. *It* loves **him**.

b.

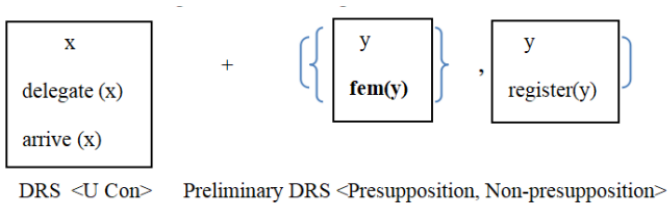


(Kamp, Van Genabith & Reyle, 2011: 159)

The dynamic information growth in (63) is called merging (Kamp, Van Genabith & Reyle, 2011). The DRS K <U, Con> (the first box) is a representation of the former part of the sequence, with x and y representing two different entities and John (x), donkey(y), and own (x, y) representing the functions. The DRS K' <U', Con'> (the second box) is the mental representation of the latter part of the sequence, in which z and u represent two other entities and love (z, u), another function. The second box will then undergo a merging process with the first box so that dependencies among the entities (John-he, donkey-it) are established, making them interpretable in discourse.

The questions then arise of how and why the entities, *John* and *a donkey* are connected to *he* and *it* respectively. In other words, how do we know that z(him)=x(John) and u(it)=y (donkey)? This has to do with presupposition. DRT states that each DRS is further attached by a preliminary DRS which is composed of two parts: presupposition and non-presupposition. The presupposition part contains the properties of the pronouns (person, gender, number feature), as in (64):

(64) a. **A delegate** arrived. **She** registered.



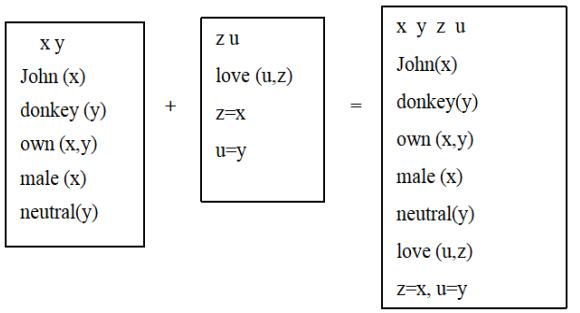
(Kamp, Van Genabith & Reyle, 2011: 141)

The second sentence in (64) will trigger a preliminary DRS, including the presupposition information (the gender feature of the pronoun *she*) and the non-presupposition information (someone registered). In the preliminary DRS, both the presupposition and non-presupposition part need to be verified in the DRS. After the verification, the pronouns can then get their interpretations.

With the same logic, the interpretation of the pronouns in (63) (repeated here as (65a) requires the presupposition information — the gender feature.

(65) a. **John** owns *a donkey*. *It* loves **him**.

b.



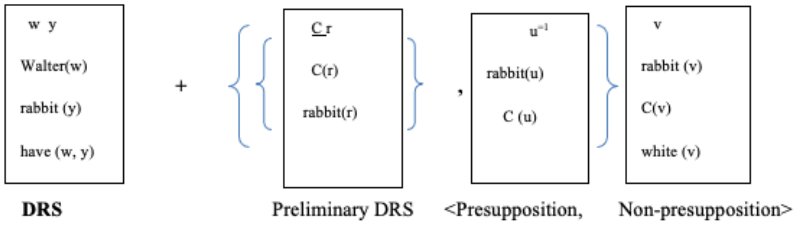
DRS K <U, Con> **DRS K' <U', Con'>** **DRS K'' <U'', Con''>**

DRT can apply not only to the representation and interpretation of pronouns, it is also applicable to the interpretation of definite DPs, as shown for example in (66).

(66) a. Walter has a rabbit and a guinea pig. The rabbit is white.
(Kamp, Van Genabith & Reyle, 2011: 262)

In (66a) the definite DP *the rabbit* should be linked to the indefinite DP *a rabbit*. The required merging process proceeds as follows:

b.



DRS Preliminary DRS <Presupposition, Non-presupposition>

(Kamp, Van Genabith & Reyle, 2011:265)

Firstly, *the rabbit* as a definite DP presupposes that there is one and only one unique rabbit that satisfies the definite description (existence and uniqueness presupposition, $u^{=1}$). Secondly, the unique *rabbit* is not the unique one in the whole universe but the one among the set of rabbits mentioned in the linguistic context (i.e., a rabbit and a guinea pig), and this linguistic context is also counted as a presupposition (context restriction C presupposition, C). The non-presupposition part is rabbit(v) and C(v). Such a preliminary DRS will merge with a previous DRS, represented by the first sentence in (66), for verification, After the merging process, the dependency between the definite DP and indefinite DP is established.

One of the potential problems in DRT is that it does not pay sufficient attention to the morphosyntactic features of the dependent elements themselves. DRT treats them as presupposition information, meaning that the phi-features of a pronoun and the uniqueness feature of a definite DP all belong to presupposition information, which could possibly blur their differences in processing cost. In addition, DRT lacks explanations on reflexives (e.g. herself/himself) which also clearly have discourse representations.

To sum up, I have illustrated in this section three major discourse theories (centering theory, accessibility theory and DRT) on the interpretation of referential dependencies. Each theory has its merits and drawbacks. For example, these three theories have explored how a dependent element is connected with its antecedent from the perspective of attention, from the aspect of memory accessibility, or from the logical structure of the sentence, with each of them contributing to a deeper understanding of the mechanisms of referential dependencies. Yet, none of them is capable of explaining how a reflexive is connected to its antecedent in various sentential environments, which also constitutes the common potential drawback among these three theories.

2.5 Summary of Chapter 2

In this chapter, I discussed the syntactic and discourse theories on two types of referential dependencies that are established on the syntax-discourse interface. The first type of dependency is built between a reflexive/pronoun and its antecedent. The second is built between a definite DP and its antecedent (bridging).

The first type of dependency has been predominantly explored in the framework of syntactic theory (those discussed here are GB theory, the framework of reflexivity,

and primitives of binding). Yet these purely syntactic theories alone cannot explain all the dependencies, for some of them (like logophoric constructions) happen in discourse. On the other hand, purely discourse theories (centering theory, accessibility theory, DRT) lack sufficient attention to the morphosyntactic composition of the dependent elements, making them unable to 1) account for intra-sentential dependencies (again, like logophoric constructions) and 2) to explain the differences among different forms of dependent elements (SELF anaphor and SE anaphor, pronouns). The second type of dependency (bridging) involves speaker/addressee-internal knowledge as well as conversational-internal knowledge, meaning that such an operation is influenced by the morphosyntactic features and discourse prominence of the (in)definite DPs, for instance, the encoding of definiteness in English is through lexical markers while in Chinese it relies on word order information. Discourse prominence (specificity) of the antecedents affects the bridging process as well.

The main goal of this chapter was to emphasize that both types of dependencies are established at the syntax-discourse interface, with morphosyntactic features of the dependent elements sent to the level of discourse for representation and interpretation. The representation and interpretation of dependencies in discourse will further involve the participation of processing resources such as memory, vision, attention, etc. In view of this fact, I intend to build a syntax-discourse interface processing model to combine all these things (morphosyntactic features, discourse factors, processing resources) in order to have a unified mechanism to account for both types of dependency. This should also provide the solution to potential problems that have not yet been fully answered in the existing syntactic and discourse theories.

Chapter 3

A Syntax-Discourse-Processing (S-D-P) Model of Referential Dependencies

3.1 Introduction

In Chapter 2, I reviewed certain syntactic and discourse theories of the two types of referential dependencies and pointed out that a potential problem among those theories is that one single explanatory mechanism (either purely syntactic or purely discourse) is not sufficient to account for the referential dependencies under discussion. In the current chapter, I will present a syntax-discourse interface model of referential dependencies — a model that takes both morphosyntactic features and discourse information into consideration for a better account of the two types of referential dependencies.

Words, composed of a set of morphemes, can be regarded as the basic units that can form a sentence through the syntactic machinery — a set of syntactic rules. The question is what the basic units are on the level of discourse and how these basic units interact with each other on that level. In the syntax-discourse interface model that I am going to present in this chapter, I suggest that the basic units are file cards, which are connected to each other by a set of discourse operations. More specifically, a file card is a discourse representation of, for example, a DP (e.g. reflexives, pronouns, definite DPs) or a TP (e.g. events), which is composed of a frame (a bunch of functional features, projected by the functional category D or T) and a heading (a series of lexical features, projected by the lexical category NP or VP). The establishment of referential dependencies, therefore, is the result of the interaction

between those file cards by a set of discourse operations, including: (1) bridging (for a dependency established between a reflexive/a definite DP and its antecedent); (2) copy-and-paste (for a dependency established between a pronoun and its antecedent); (3) cut-and-paste (for a dependency established between a SE anaphor *zich* and its antecedent).

The concepts of file card, frame, heading, copy-and-paste, etc., originate from File Change Semantics (Heim, 1982) and the Syntax-Discourse model (Avrutin, 1999; Schumacher et al., 2010). Therefore, the syntax-discourse interface model of referential dependencies that I am going to build is an extension of the two models. In this chapter, I will start to build the model with English and Dutch data, and then extend it to Chinese, as Chinese is different from Dutch and English in many aspects, such as this substantial reliance on discourse information, and deficiency in morphosyntactic markings (e.g. the reflexive *ziji* is underspecified for features of person, gender, and number; the definite DPs are in bare form, without overt definite articles like English *the*, etc.). Such differences present an interesting question about the syntax-discourse interface while imposing a challenge on previous syntax-discourse interface models.

The interpretation of referential dependencies not only relies on linguistic information (e.g. morphosyntactic features, discourse factors) but is also determined by nonlinguistic factors such as memory and attention, as we first need to hold the antecedent of a dependent element (reflexive/pronoun/definite DP) in working memory and then link the dependent element with it, creating a dependency. Such a process clearly requires the participation of memory. I will therefore also explore what role memory plays in the establishment of referential dependencies and try to capture the underlying processing mechanism. It is for this reason that I call the model a Syntax-Discourse-Processing (S-D-P) model.

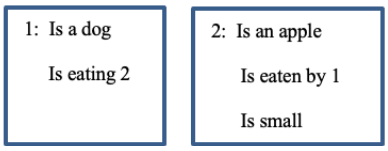
In a word, the S-D-P model that I begin to build here is an attempt towards a psycholinguistic model that takes both morphosyntactic and discourse features into consideration and demonstrates the processing mechanisms of referential dependencies established between a definite DP/reflexive/pronoun and its antecedent in English, Dutch and Chinese[24].

[24] It would be unrealistic for such a model to aim to explain all the data in all the three languages . Since the S-D-P model that I am going to present is an extension of previous models that are built upon English/Dutch data, I start with English/Dutch data, and then extend it to Chinese.

3.2 From File Change Semantics to a Syntax-Discourse-Processing Model

The syntax-discourse processing (S-D-P) model that I am going to build is an extension of File Change Semantics (FCS) (Heim, 1982) and the Syntax-Discourse Interface Model (e.g. Avrutin,1999; Schumacher, et al., 2010). File Change Semantics (FCS) is a model of the information exchange between a speaker and an addressee in a conversation: when the speaker utters something, they are conveying some information to the addressee. The addressee, in order to keep track of the information, will in their own mind create a set of file cards with sequential numbers on the cards. In this way, information is recorded and updated on file cards (like the catalogue system in a library), for example:

(1) a. A dog_x is eating an $apple_y$. The apple is small.

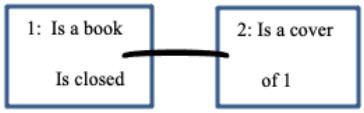
b. 

In the mini-discourse above, the indefinite DPs *a dog* and *an apple* in the first part of the sequence introduce two new file cards (a Dog card and an Apple card) because they introduce two new entities on the discourse level. The Dog card denotes a set of dogs (dog_x) and the Apple card denotes a set of apples ($apple_y$). The indices x and y mean that the set of dogs and apples are variables, so they need to be instantiated (or anchored) in discourse, otherwise they are uninterpretable (i.e. we do not know which dog/apple the respective NPs refer to). The instantiation process is achieved by representing the variable on a file card with a number on it, such as 1 and 2 above. Thus, there are two file cards in (1): a Dog card and an Apple card. The definite DP *the apple* in the second sentence just updates information on the Apple card because the definite DP *the apple* is still describing something about Apple. Therefore, the definite DP *the apple* will not introduce a new file card but instead will be connected with the previous Apple card. Information is then updated (Card 2 is updated).

In the following examples, however, definite DPs introduce new file cards into discourse (Avrutin,1999):

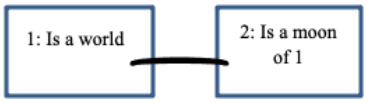
(2) a. A book is closed. The cover is red.[25]

b.



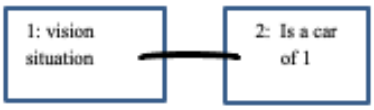
(3) a. The moon is hanging on the branches of a tall tree.

b.



(4) a. (Pointing/looking at) The car is fancy.

b.



Definite DPs (*the cover*, *the moon*, *the car*) will each introduce a new file card into the discourse representation because they are new entities in the discourse. Yet, such new entities are dependent elements as they must be linked with something that has either been mentioned previously or is already known by both the speaker and the addressee. For example, in (2a), *the cover* must link with *a book*. In (3a), *the moon* is linked with the world knowledge shared by both the speaker and the addressee (there is one unique moon that orbits our earth in our world knowledge). In (4a), *the car* is linked with the car in the visual domain of both the speaker and the addressee by pointing. These three examples demonstrate that information is updated on the file cards by a linking mechanism known as bridging: the second file card will bridge onto a previous card (Avrutin, 1999).

Not only definite and indefinite DPs, but TPs, too, can introduce file cards. DPs are individual file cards that may act as the participants in an event, such as *the moon* in the event of *hanging* in (2b). The events or eventualities[26] (TPs) themselves can

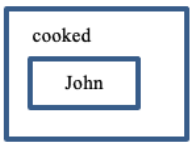
[25] The symbols of bridges in the images here illustrate that the operations between the two file cards as instances of bridging.

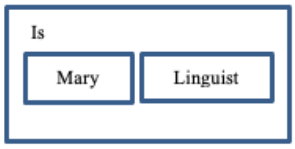
[26] Eventuality is a more inclusive term that covers both the action-verbs and the state-verbs such as *be*-type verbs. In this dissertation, I will use event to represent both event and eventuality.

introduce event file cards (Avrutin, 1999). Here are some illustrations of event file cards:

(5) a. John cooked yesterday. It was strange.
b. Mary is a linguist. It is amazing.

In (5a), the pronoun *it* represents *the event of cooking by John*. In (5b), the pronoun *it* refers to the eventuality of *Mary being a linguist*. The two examples simply show that an event can be treated as one piece of information, in other words, one file card. The representations of (5a) and (5b) are as in the following (for just the first part of the sequence)[27]:

(5a): 

(5b): 

The individual file cards are embedded in the event file card. According to Schumacher et al. (2010), both DPs and TPs can trigger file cards, with TP representing events and DP representing individuals. An event entity (e.g. cook) is a variable x_{event} that denotes a set of possible events that could happen at any time, so it receives its interpretation by being located in time. On the level of discourse, the event entity introduced by the predicate needs to be instantiated on the file card for interpretation. The two examples in (5) are tensed TPs that can introduce independent event file cards and have their own temporal interpretations. The situation of untensed TPs is different, however, for they cannot have temporal interpretations on their own. Let's say the representations of a tensed TP resemble that of an indefinite DP, then the representation of an untensed TP would parallel that of a definite DP, which must link to another card to obtain its interpretation. Untensed TPs are uninterpretable by themselves and they must link to another card (e.g. a presupposed card or a relevant world knowledge card) for interpretation, for example:

[27] In Avrutin's (1999) syntax-discourse interface model, file cards are no longer instantiated with numbers on them, as the individual cards (DPs) are further embedded within the event card. Therefore, file cards with numbers belong to FCS while those without numbers belong to the syntax-discourse interface model.

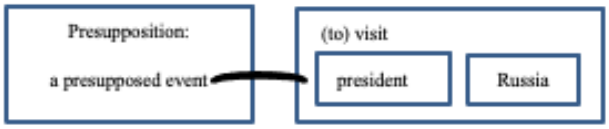
(6) **Common Infinitive Clause**
*John to eat an apple.

(7) **Headline Register**
Present to visit Russia

(8) **Mad Magazine Register**
John dance? Never in a million years!
(Avrutin, 1997: 2-11)

Sentence (6) is ungrammatical and uninterpretable because the event entity *to eat* cannot be grounded in time (technically, no syntactic T-chain coindexation at LF[28], or the subject NP *John* violates the case filter constraint). Example (7) is a headline in a newspaper. In this special register, the temporal interpretation of the event is implemented by a [+irrealis] feature assigned by *to* (Avrutin, 1999), which is further interpreted as [-past] in the sense of temporal interpretation, although it does not denote any time interval (Guéron & Hoekstra, 1995). The [-past] temporal interpretation presupposes that there is another event preceding this one and the current event *to visit Russia* is the result of the preceding one. In other words, the headline usually describes the consequences of the other events discussed in the text or the culmination of other events, so it should bridge onto a presupposed card[29] (i.e. some presupposed events described under the headline) in discourse.

The representation of (7):



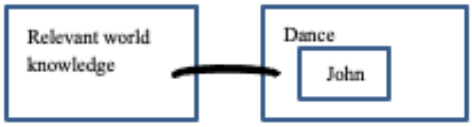
In (8), the temporal interpretation of the event relies on world knowledge information, which refers to the information that is shared both by the speaker and the addressee. The example (8) therefore can be explained by the fact that *dancing, for John, is too unusual to happen*. The marker *to* can be dropped here because such an event card does not denote any specific moment of an event. Instead, the question that *John cannot or is unwilling to dance for any reason* is part of the relevant world

[28] See details in Hyams (1996).

[29] The presupposed card is an event card.

knowledge. A bridging process happens between the Dance card and the Initial World Knowledge card[30] (Avrutin, 1997).

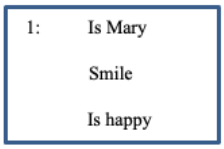
The representation of (8):



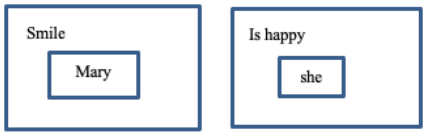
What I have illustrated above are the representations of DPs and TPs on file cards and the operations of bridging on discourse. Notice that the information updating process above focuses on the representation of definite DPs and untensed TPs. In fact, pronouns can also show a similar process of information updating. For instance:

(9) a. **Mary** smiles. **She** is happy.

b. File Change Semantics:



c. Syntax-Discourse Interface Model:



The pronoun *she* can be connected with *Mary*. (9b) and (9c) are the discourse representations of (9a) under different models (on the left side — FCS; on the right side — Syntax-Discourse Interface model). According to FCS, the sequence in (9) will introduce one file card only: *Mary*. The pronoun *she* only updates information on #Mary[31]. However, according to Avrutin's (1999) syntax-discourse interface model, example (9) will be represented as two event file cards created by two TPs: #Smile (event)[32] and #Is (eventuality). The pronoun *she* will trigger another file card embedded within the event card #Is. The question, then, is how the file card created by the pronoun *she* interacts with other cards. To answer this question (and some

[30] The initial world knowledge card is also an event card, that is, *John never dances*.

[31] I use # in the main text as a marker for file cards.

[32] The whole event file card is *#Mary smiles*, which, includes the embedded individual card #Mary. However, I will only use the predicate of the event with the marker # in the text to represent the whole event card.

others), Schumacher et al. (2010) further extended the syntax-discourse interface model by taking the morphosyntactic features of the dependent elements (definite DPs, pronouns, reflexives) into consideration, for example, the file card for *she* can be connected with its antecedent card #Mary[33] because they do not show any feature conflicts: the morphosyntactic features of the pronoun (she: third person, female, singular) are the same with those of #Mary, therefore information updating is possible between them.

The extended syntax-discourse interface model (Schumacher et al., 2010) claims that a dependent element (a DP), being either a definite DP or a pronoun/reflexive, is composed of two parts: a functional category D and a lexical category NP, which can be translated onto a file card, with D being translated to the frame of the file card, and NP, the heading of it:

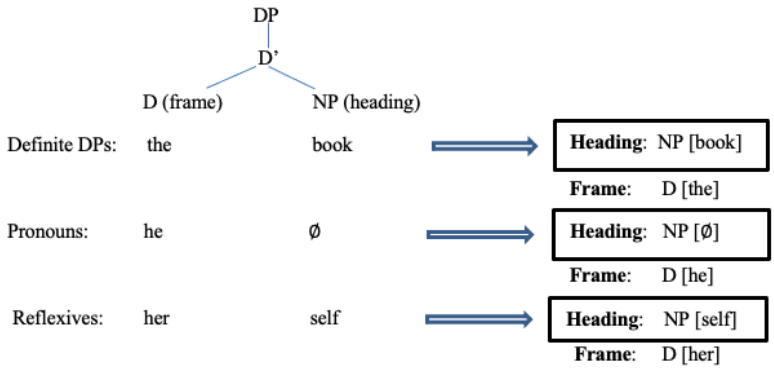


Figure 3. 1 From DPs to file cards

Such a frame/heading point of view creates one system for definite DPs, reflexives and pronouns by taking the morphosyntactic features into consideration. A frame projected by the functional category D is composed of functional features, which includes the phi-features (e.g. person, gender, number, and categorial features in generative grammar) and a definite DP including the feature [+definite]. A heading projected by a NP contains lexical content information, and the lexical content of a reflexive is a variable *self*. It is a variable because *self* itself does not have a specific content and must be linked with other elements. The lexical content of a pronoun is

[33] The antecedent card is also an embedded individual card within an event card, but they are independent DP cards. See details in the following sections.

empty, while that of a full-form DP is a constant rather than a variable because it has specific content (e.g. *dog* in the dog).

In addition to DPs, TPs are also composed of frames and headings, as in Figure 3.2:

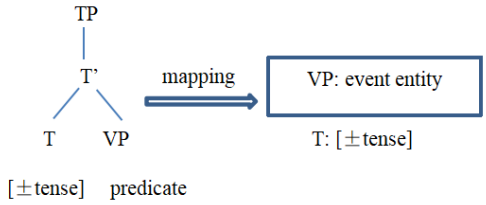
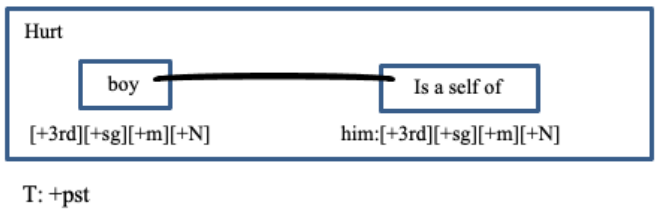


Figure 3. 2 From TPs to file cards

The frame of an event file card is translated from a T, with the feature [±tense]; its heading is a VP — the event (eventuality) denoted by the predicate. With the frames/headings division, we can show the discourse operation upon the reflexive by the file card system, as follows:

(10) **The boy** hurt **himself**.[34]



The event file card is #Hurt with a past tense feature. Within the event file card, there are two individual cards: #boy and #himself. The frame features of the two individual cards do not conflict with each other; the headings of the two cards also have some semantic connections since the *self* part of a reflexive usually denotes a body part, such as rib, soul, nose, etc. (Yu, 2000). Such an operation is bridging-like: a body part of the boy.

[34] In the following representation: 3rd: 3rd person features; sg: singular; m: male; pst: past tense. The black line between #boy and #himself denotes that there is a bridging relation between them.

Example (10) illustrates the central idea of the syntax-discourse interface model built by Avrutin (1999) and Schumacher et al. (2010): translating the morphosyntactic features onto the level of discourse for representation and interpretation. Yet, not mentioned in this model are the specific constraints on discourse; for instance: what do syntactic constraints such as locality or c-command mean in the syntax-discourse model? Speaking crosslinguistically, how are different DPs represented on file cards and what are the specific operations of the file cards in discourse, considering that some languages don't have overt definite determiners and reflexives/pronouns can be underspecified for phi-features? What are the file card representations of the tensed and untensed TPs respectively on the level of discourse? In the following sections, I will spell out these questions and provide answers for them with English data, combined with Dutch and then extend these to Chinese. The final goal is to extend the syntax-discourse interface model to a new syntax-discourse processing model that takes morphological features, syntactic constraints and discourse factors into consideration on the basis of crosslinguistic data, and further show the underlying processing mechanism of referential dependencies.

3.3 A Syntax-Discourse-Processing (S-D-P) Model

The components of the S-D-P model include:

(1) A set of file cards
   a. the morphosyntactic features of the frames (e.g. functional category of D/T)
   b. the lexical features of the headings (e.g. lexical category of NP/VP)

(2) A series of discourse operations on the file cards
   a. bridging
   b. copy-and-paste
   c. cut-and-paste

Two questions need to be answered in the process of model construction. The first is how universal the model is. The second is whether the data is representative or not. The S-D-P model that I am going to build takes both Indo-European (English and Dutch) and non-Indo-European (Chinese) languages into consideration and will show the underlying processing mechanism of referential dependencies in those languages,

which is thought to be universal[35]. Also, the data is relatively representative as it is an extension of previous models and relies on some background theories (e.g. binding theory, accessibility theory, FCS, the syntax-discourse interface model, etc.).

3.3.1 File card representation

(1) Frames, headings, and features

File cards are translated from DPs or from TPs. Roughly speaking, they can be divided into two types: Independent File Cards (IFCs) and Dependent File Cards (DFCs). Independent cards are cards that can be interpreted independently. For example, the indefinite DP *a dog*, or the tensed TP *John kicked the ball*, are independently interpretable, because the file card #dog can be anchored in discourse (to introduce a new entity a dog) and the event file card #kick also has temporal interpretation (to know the time when the event is happening). Their interpretations do not rely on other cards. Such cards are Independent File Cards (IFCs). On the other hand, dependent file cards are uninterpretable by themselves, for instance, the definite DP *the dog*, the reflexive *herself*, the pronoun *her*, and the untensed TP in special registers *John dance* (i.e. example (8)), rely on other file cards in order to be interpreted (e.g. which dog it is, who is himself/her, etc.).

One way to distinguish a DFC from an IFC is to look at their featural compositions. File cards are composed of two parts: frames and headings. A frame (translated by D/T in a DP/TP) is composed of a set of functional features (i.e. person, gender, number, categorial) while a heading (translated by an NP /VP in a DP/TP) consists of a set of lexical features. The features of the frame or heading of a DFC are often underspecified. For example, the file card translated by a pronoun has an empty heading (no specific lexical content); the heading of a reflexive, *self*, is a variable because *self* represents a body part (i.e. rib, soul, nose, etc.) and lacks a specific meaning (underspecified lexical content). The feature of the frame of an untensed TP is [-tense], which is also underspecified. An IFC, on the contrary, is fully-specified for both its frame and heading features. For instance, a tensed TP file card has the frame feature [+tense] and an indefinite DP file card has the frame feature

[35] The processing constraints are universal, and they are presented in detail in Chapter 4.

[+indefinite], which are fully specified[36]. The feature [+indefinite], however, is not a primitive feature like those of gender, person, and number in a pronoun/reflexive, as it can be further described as familiarity, identifiability, and uniqueness (see details in Chapter 2). In order to have a unified file card system for all kinds of DPs, I suggest that the fully-specified primitive feature of an indefinite DP can be redefined as the feature [+discourse change potential], which means that an indefinite DP can introduce a new entity into discourse and it will thus independently cause some changes on discourse, while a definite DP with the feature [-discourse change potential] cannot introduce a brand-new entity[37] into discourse and it must link to an entity introduced in the previous context. It should be mentioned that the term *discourse change potential* is developed from *context change potential* (Stalnaker, 2014; Stokke, 2014), a term used in dynamic semantics, referring to the changes that are imposed upon conversation with the introduction of new sentences. The term *discourse change potential* in this dissertation instead refers to changes to discourse made by introducing new entities.

The featural make-ups of the frames and headings of the file cards (e.g. pronouns/ reflexives/definite DPs) in different languages may differ from each other, for example, the frame features (phi-features: person, gender, number, category) of a pronoun/reflexive file card in English are fully specified, which is very different from the SE anaphor *zich* (with a third-person feature only) in a language like Dutch. It is also different from the reflexive *ziji* in Chinese, which is underspecified for nearly all the phi-features. On the other hand, the frame feature of a definite DP [-discourse change potential] is defective, because it is unable to cause such discourse changes independently and must link to an entity that has been introduced previously in discourse. In view of such differences in the featural make-ups of the dependent file cards (DFCs), I propose a further classification of file cards with a binary concept of strong and weak[38]:

---

[36] The feature [+tense] ensures that the TP card is independently interpretable, so such a feature alone is fully-specified. This is similar in terms of the feature [+indefinite] to DPs.

[37] Even if the definite DP in the bridging situation can introduce a new entity into discourse, such an entity is not brand-new because it has some hidden connection with another entity introduced in the previous context.

[38] The concept of *strong* and *weak* is proposed on the basis of the strength of file cards, which are determined by their morphosyntactic features and are further related to the processing of such morphosyntactic features. See the definitions below and see more details in Chapter 4.

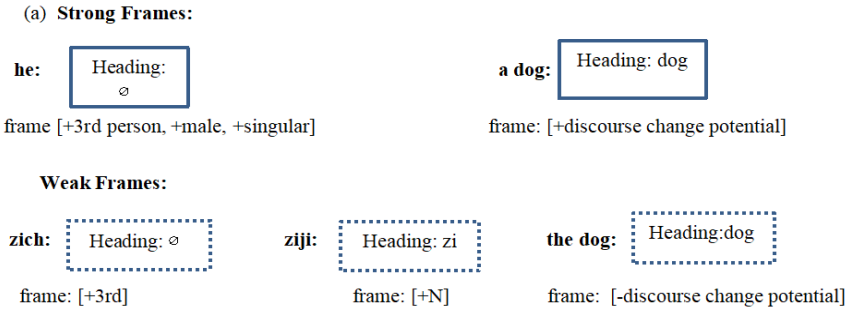
Definition 1: Frames and Headings of the File Cards (DPs)

I. The representation of DPs (reflexives, SE anaphors, pronouns, and (in)definite DPs)

(a) A frame is strong iff it has the fully specified phi-features: [+person] [+gender][+number][+categorial] [39] or it contains the feature [+discourse change potential][40]; otherwise, it is weak.

(b) A heading is strong iff it has a specific content meaning; otherwise, it is weak[41].

(11) The file card representation of DPs: examples



Note: straight lines: strong frame; dotted lines: weak frame. Ø: empty heading.

(b) **Strong Headings:**

See the graphs of *a dog, the dog* in (11a)

Weak Headings:

See the graphs of *he, zich, ziji* in (11a)

II. the representation of a TP (tensed TP and untensed TP in special registers)

(a) A frame is strong iff it contains the feature [+tense]; otherwise, it is weak.

(b) A heading is strong iff it contains the specific content of an event entity; otherwise, it is weak.

---

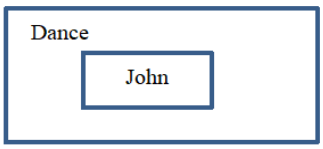
[39] Case feature is not taken into consideration because it does not have the function of distinguishing one element from another (e.g. the difference between *her* and *zich* is that the former has person, gender, and number features while the latter only has a person feature.

[40] The gender feature is not mandatory for a strong frame, for example, in spoken Chinese, the gender feature of the pronoun *ta* is underspecified.

[41] A weak heading contains two situations: an empty heading or a *self* variable heading.

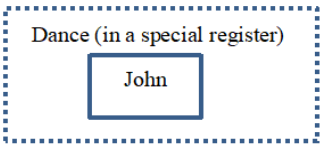
(12) The file card representation of TPs: examples

a. John dances.



tensed TP: T [+tense]

b. John dance? Never in a million years!



untensed TP: T [-tense]

From the examples above, it can be seen that the independent file cards (the DP file card #a dog and the TP file card #dance) have strong frames and strong headings. The rest of the cards are dependent file cards, with weak frames or weak headings (or both). Whether a file card is strong or weak is determined by the amount and the nature of the morphosyntactic features (frame) as well as the lexical content features (heading). It can be seen from Definition 1 that the more features a frame has, the stronger the frame will be, and the more specific the lexical content feature is, the stronger the heading will be. Such a mapping relation between the features and the category of a file card (i.e. strong or weak) is not arbitrary but instead has its foundation in processing, which will be outlined in detail in the next chapter.

To sum up, a file card is composed of two parts: a frame and a heading, both of which can be either strong or weak. Combining the category of the frame and the heading, I suggest that the category of a file card can be further defined as follows:

Definition 2: The Category of the File Cards
A Strong File Card (SFC) is a file card that contains:
(a) a strong frame;
and (b) a strong or an empty heading[42];
Otherwise, it is a Weak File Card (WFC).

[42] As per Definition 1, an empty heading belongs to the category of weak heading, so does a *self*-variable heading. They are both weak headings because they both lack (overt) specific lexical content. Nevertheless, there are some differences between an empty heading (e.g. a pronoun) and a *self* heading (e.g. an anaphor). Following Reinhart &Reuland (1993), I assume that the element containing *self* is referentially defective (e.g. *himself*) but not the one with an empty heading (e.g. *him*).

From Definition 2, it can be seen that all the independent file cards are Strong File Cards (SFCs), as they have strong frames and strong headings. Among the dependent file cards, a pronoun is a strong file card because it has a strong frame and an empty heading; a reflexive is a Weak File Card (WFC) because it contains a variable heading (the variable *self*); a definite DP and an untensed TP in special registers are weak file cards because they contain weak frames.

3.3.2 Discourse operations of file cards

In the previous section, I have shown the file card representations of DPs ((in)definite DPs, reflexives, pronouns) and TPs (tensed and untensed events), which can be classified as dependent file cards (DFCs) and independent file cards (IFCs). A DFC (weak or strong) itself is uninterpretable and it must be connected with an IFC in order to be interpreted. The question is how a DFC is connected with an IFC on the level of discourse (e.g. what discourse constraints they will undergo in the establishment of referential dependencies). In the S-D-P model, I argue that there are three types of discourse operations between a dependent file card and an independent one: bridging (for the interpretation of definite DPs and reflexives), copy-and-paste (for the interpretation of pronouns), cut-and-paste (for the interpretation of SE anaphors such as Dutch *zich*).

(1) Bridging

A definite DP and its antecedent

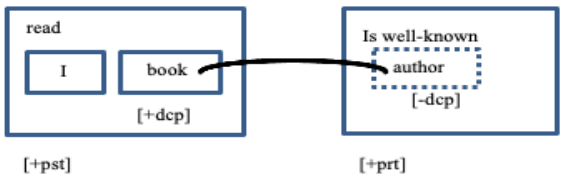
The term *bridging* stands for a process of construction comprehension in which the listener draws an inference (i.e. an implicature) between a referring expression and its intended referent (Clark, 1977). One instance of *bridging* is the discourse operation between a definite DP and its antecedent:

(13) a. I read a book. The author is well-known.

The sequence in (13) can introduce two event file cards (#Read #Is), triggered by the tensed TPs. The indefinite DP *a book* introduces a new file card and the definite DP *the author* also introduces a new file card. Since the file card introduced by *the*

author is a dependent file card, it must link with an independent card for interpretation. The discourse operation between the two event cards proceeds as follows[43]:

b.



The connection between *the author* and *a book* in (13) is realized through the semantic connection between the headings: a book will always have at least one author. In addition, the frame feature of *the author* [-discourse change potential] denotes that it must link to an independent file card (i.e. the antecedent)[44]. Such an operation is called bridging, which is summarized as follows:

> *Rule I: bridging (definite DP-its antecedent)*
> A definite DP file card will bridge onto its antecedent card iff the headings of both have some indirect (lexically semantic) connections.

A Reflexive and Its Antecedent

A reflexive demonstrates a kind of bridging process similar to what has been shown for the definite DP, because the *self* (i.e. heading) part of the reflexive, in many languages, indicates an inalienable semantic possession relation with its antecedent (e.g. a body part, Yu, 2000). The questions arise: how is this bridging process realized by file cards, and what constraints might there be on such an operation?

Locality and c-command are two syntactic constraints that regulate how a referential dependency is established between a reflexive/pronoun and its antecedent in English (and in many other Indo-European languages). Chinese, however, does not

[43] The meanings of the abbreviations in the illustration are as follows: dcp: discourse change potential; pst:past tense; prt: present tense; the bridge symbol: the operation of the two cards.

[44] The antecedent card can either be an indefinite DP with the feature [+discourse change potential] or a definite DP with the feature [-discourse change potential]. If the antecedent card is a definite DP, it must be further linked to an independent card (e.g. a presupposed card or world knowledge card).

necessarily obey these syntactic constraints. Locality, in the government and binding theory, has been defined as a minimal domain that contains a governor and an accessible subject/Subject (Chomsky, 1981). In the minimalist program, the local relation between a dependent element and its antecedent is realized through merge and move by a feature-checking mechanism (i.e. Agree) (Chomsky, 1995; Reuland, 2001). The common point of these two proposals is that locality has been defined in the framework of syntax, which may not be applicable to a discourse-oriented language such as Chinese. For example, the locality constraint in the minimalist program relies on agreement, "[It] is plausible to regard the relation between a reflexive and its antecedent as involving agreement. Since agreement is generally a strictly local phenomenon, the reflexive must move to a position sufficiently near its antecedent." (Chomsky & Lasnik, 1995, in Stroik, 2009: 8). However, the concept of agreement may not exist in Chinese at all, since there is no morphological marker on the reflexive *ziji* or its antecedent.

On the other hand, c-command is another syntactic constraint that regulates how a dependent element is connected with its antecedent. According to Reinhart (1976), c-command denotes a minimal syntactic domain in which the head of the domain (i.e. the first branching node) constituent-commands the other nodes within that domain and carries the highest prominence, "if a rule assigns some kind of prominence to any of the given nodes within a minimal domain it assigns it to a head of the domain, namely, to a node that c-commands the others" (Reinhart, 1976:183). In this sense, c-command represents a hierarchical structural prominence (nodes of a tree). Nevertheless, the prominence of an antecedent can also be assigned by semantic or discourse factors such as topicality, center of consciousness, etc. For example, Chinese reflexive *ziji* can refer to an antecedent that is not a c-commander, which indicates that a purely syntactic concept of c-command is not sufficient to account for the mechanisms of referential dependencies in Chinese.

Even though locality and c-command are two well-known syntactic constraints that can explain a majority of referential dependencies in English (and many other European languages), we are still unclear about the nature of these two constraints. Rizzi (2013) suggested that locality plays the functional role of "limiting the computational resources needed to perform complex computations" resulting in "minimal search in the linguistic computation" (p.183-184). Reinhart (1976) suggested that c-command domains "reflect the processing ability of the mind, which means that it is psychologically difficult to process nodes that are not within a minimal domain." (p.200). The common point of those two assumptions is that locality and c-

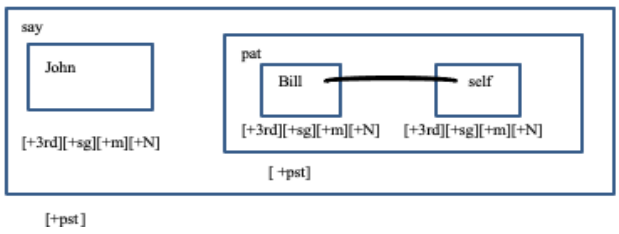
command are regarded as two economy constraints or resource-saving devices. If the resource-saving view is true, we may wonder why such resource-saving devices are applicable to English but not to Chinese given that the general cognitive capacity of human beings is universal.

To answer such questions, I will build a S-D-P model to represent the discourse implementation of locality and c-command by means of the file card system and to investigate how referential dependencies are interpreted in English, Dutch, and Chinese. The final goal is to explore the underlying processing mechanisms of referential dependencies in these languages (see Chapter 4). What I would like to emphasize here is that syntactic structures, morphological features, and discourse factors will all make their own contributions to the final interpretation of referential dependencies.

Let's begin with the locality constraint in binding theory[45]. In (14a), the reflexive *himself* refers to the local antecedent *Bill*:

(14) a. John said that **Bill** patted **himself**.

b.



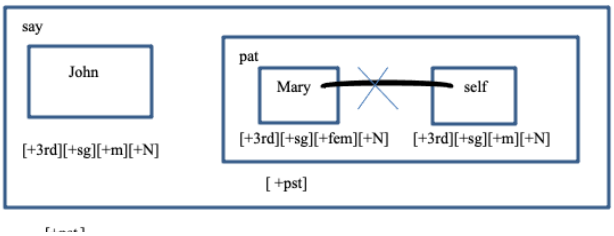
The file card representation of this local dependency contains two event file cards: #say and #pat, with #pat being embedded in the event card. Within each event file card, there are individual file cards: #John, #Bill and #himself. The two file cards triggered by *himself* and *Bill* are connected to each other through reflexive-bridging because there is a hidden semantic connection of the headings (*self* is inalienable to *Bill*) and they occur in the same and the more deeply-embedded event file card #pat, demonstrating the implementation of locality.

In addition, the reflexive-bridging process must meet the requirement that there be no feature conflict between the frames of the file cards; for example:

[45] I am aware that the term *locality* in binding theory was used in the pre-minimalist era (with a series of constraints such as distance, subject, and government relation). In this dissertation, I regard it as a background theory or a starting point to build a syntax-discoure processing model.

(15) a. * John said that **Mary** patted **himself**.

b.



In (15), although the file cards #himself and #Mary occur in the same and the more deeply-embedded event file card #pat, #Mary is still an infelicitous antecedent card for the #himself card because the [+female] feature of #Mary is in conflict with the [+male] feature of #himself. Therefore, no referential dependency can be established.

Examples (14) and (15) show that bridging happens in the more embedded event file card on the condition that there are no feature conflicts between the frames of the reflexive card and its antecedent. It can also be seen that the operation happens in the more deeply-embedded event file card, which here represents the discourse implementation of the locality constraint. Since the locality constraint is further regarded as a resource-saving device (Rizzi, 2013), I assume that the more deeply-embedded event file card #pat is also a resource-saving device. Due to the fact that resource-saving is related to processing, I will further call this resource-saving device the minimal processing unit in order to better represent the discourse implementation of locality and the operations of file cards. The definition of a processing unit can be formulated as follows:

Definition 3: (Minimal) Processing Unit

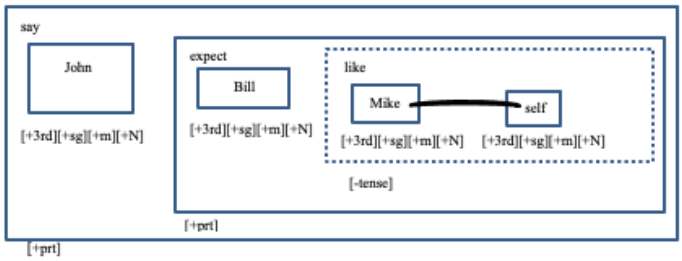
A processing unit is an event file card which contains the dependent card as well as the (potential) antecedent card of the dependent card; the minimal processing unit is the more/most deeply-embedded event file card that directly[46] contains the dependent card as well as its (potential) antecedent card.

[46]By *directly* I mean that the individual cards within the event card are the participants of the event. So, two elements that are coarguments in syntax will be translated as co-participants in the file card system. If there are only two event cards in discourse, then the minimal processing

Looking again at example (14), bridging, in this case, happens within the same and the minimal processing unit. Example (14) is a tensed clause. When it comes to untensed clauses, the situation becomes more complex:

(16) a. John says that Bill expects **Mike** to like **himself**.

b.

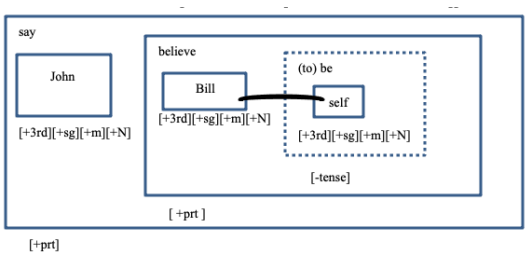


It can be seen in (16b) that the reflexive card #himself bridges onto the antecedent card #Mike. The bridging process occurs in the most deeply-embedded event file card, #like, which is a weak card because it contains an infinitive clause. This begs a question: can a weak event file card be treated as the minimal processing unit?

Let us suppose that being a minimal processing unit has nothing to do with the category of the file card as weak or strong; that is, as long as the event file card is the most deeply-embedded, it can be treated as a minimal processing unit. By this logic, the weak event card #like is also the minimal processing unit. However, the weak event file card #be in the following construction seems to be different from that in (16b):

(17) a. John says that **Bill** believes **himself** to be the kindest.

b.



unit refers to the more deeply-embedded event card; if there are more than two event file cards in discourse, then the minimal processing unit refers to the most deeply-embedded card.

The sentence in (17a) will introduce three event file cards: #say, #believe, and #be. Bridging in this construction does not happen in the most embedded event file card #be but in a higher event card #believe. The reason is that the most deeply-embedded card #be is not the minimal processing unit, because it has no potential antecedent card within it. The minimal processing unit in (17b), therefore, extends to the next-higher event card, #believe, in which the potential antecedent card #Bill is found. Notice that #be is itself uninterpretable ([-tense]) and therefore a weak card that must bridge onto another event card — #believe. Thus, the discourse implementation of locality can be formulated as follows:

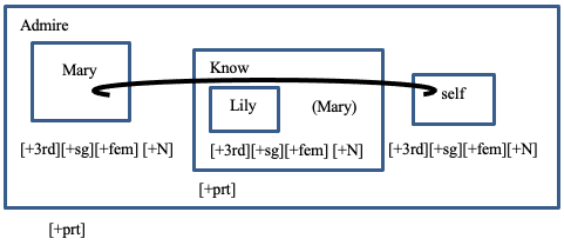
> *Discourse implementation of locality*
> A reflexive file card will bridge onto an antecedent file card in the minimal processing unit given that there is no feature conflict between the two cards.

Beside locality, another well-known constraint on the dependency established between a reflexive and its antecedent is c-command (e.g. a reflexive is locally c-commanded by its antecedent). In the following examples, only the potential antecedent that c-commands the reflexive (in the local domain) can be the appropriate antecedent for the reflexive, for example:

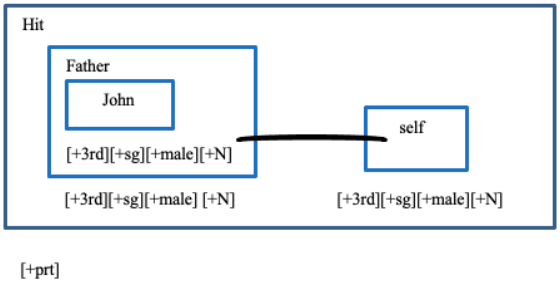
(18) a. [**Mary** [whom Lily knows]] admires **herself**.
b. [[John]'s **father**] hit **himself**.

C-command denotes a hierarchical relation in a syntactic domain in which the head of the domain is the most prominent element. This hierarchical relation invalidates the linear requirement between a reflexive and its antecedent. In (18a), the reflexive *herself* refers to the linearly distant but structurally higher antecedent *Mary* rather than the linearly closer but structurally lower antecedent *Lily*. Similarly, in (18b), the reflexive *himself* can only refer to *John's father* but not *John* because the former is hierarchically higher than the latter. Translated onto file cards, this hierarchical relation looks like the following:

The representation of (18a): [**Mary** [whom Lily knows]] admires **herself**.



The representation of (18b): [[John's **father**]] hit **himself**.



From the two illustrations, it can be seen that the c-commanders of the reflexives, *Mary* for *herself*, *John's father* for *himself*, are the individual cards in the same event file card with their respective reflexive cards (e.g. #admire, #hit). In addition, when two potential antecedent cards are both in the same event file card with the reflexive card (#John, #Father), only the one that is on a higher level (the outermost layer) is the appropriate one for the final dependency.

As I have mentioned in the previous sections, Reinhart (1976) proposed that the nature of c-command is that the c-command domain reflects the processing ability of the brain, and it is harder to process nodes that are not within that domain. Just like what I have presented in the illustrations, the reflexive card (c-commandee) and its antecedent card (c-commander) occur in the same event card, and the c-commander is the outermost antecedent card (e.g. #Father) if there are multiple potential antecedent cards within that event card. Therefore, the discourse implementation of c-command can be summarized as follows:

Discourse implementation of c-command
A reflexive card will bridge onto the **outermost** antecedent card within the same processing unit given that there is no feature conflict between the two cards.

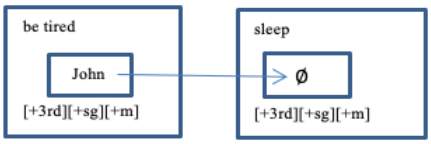
Combining the discourse implementation of locality and c-command, a further rule that regulates how a reflexive card bridges onto its antecedent card is as follows:

> *Rule II: Reflexive-bridging*
> A reflexive card will bridge onto the **outermost** antecedent card within the **minimal** processing unit given that there is no feature conflict between the two cards.

(2) Copy-and-Paste

Like reflexives, pronouns are dependent elements and are represented as dependent file cards. The dependent file card introduced by an English pronoun *he/she* has a strong frame and an empty heading (see (11a)). Having an empty heading means that it must get information from other cards in order to be interpreted. The discourse operation between a pronominal card[47] and its antecedent card is defined here as copy-and-paste[48]:

(19) a. **John** is tired. **He** is sleeping.



In (19), the file card triggered by the pronoun *he* does not have a heading, so it should get some information from other cards in order to be interpreted. The frame features of the file card representing #he are not in conflict with those of the file card #John, therefore, information is copied from #John and pasted onto #he (reasons for copy-and-paste to operate in this direction will be shown in the following paragraphs).

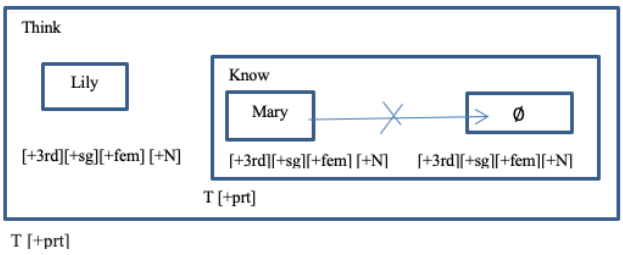
The process of copy-and-paste, like bridging, is subject to linguistic constraints such that pronouns within a sentence cannot be locally c-commanded by their antecedent(s), for example:

---

[47] In this dissertation, the term *pronominal* is used only as an adjectival form of *pronoun.*

[48] In the file card representation in (19), +prt represents present tense; +prct represents present continuous tense; the arrow shows the direction of copy-and-paste.

(20) *Lily thinks that **Mary** knows **her**.



It can be seen that the pronoun *her* cannot refer to the local c-commander *Mary*. In our discourse terms: the pronominal card #her cannot copy information from the card #Mary. Notice that #Mary and #her are in the more deeply-embedded event file card #know; that is, they both occur within the minimal processing unit. Thus, a rule of copy-and-paste can initially be formulated as follows:

> *Rule III: Copy-and-Paste (Initial)*
> A pronominal card cannot copy-and-paste information from an antecedent card within its minimal processing unit.

Rule III appears to be in conflict with Rule II (reflexive-bridging). If we keep following the proposals that locality and c-command are resource-saving devices, we may wonder why pronouns cannot be connected with an antecedent in a resource-saving way (i.e. within the minimal processing unit). The reason, I suggest, lies in the morphosyntactic features, which determine the strength of the file cards. In other words, a pronominal card is stronger than a reflexive card so that it can only be connected to a distant and weaker antecedent card. The mechanisms of strong (dependent card) versus weak (antecedent card) will be discussed in detail in the next chapter. What I would like to emphasize here is that the discourse operation of file cards is affected by the morphosyntactic composition (strength) of the file cards.

The c-command constraint on pronouns is shown by the fact that pronouns cannot be (locally) c-commanded by their antecedent, for example:

(21) a. **John**'s father likes **him**.
b. People who know **him** like **John**.

As I mentioned in the section on bridging (a reflexive and its antecedent), the c-command constraint represents a mechanism of discourse prominence, with the c-commander being the outermost individual card in an event card. In (21a), *him* can refer to *John*. In (21b), *him* can also refer to *John*. Notice that the two *Johns* in the examples above are not the c-commanders of the pronoun *him*, which also means that #John is not the outermost antecedent card in the event cards #like and #know. Thus, the copy-and-paste rule can be revised as follows:

> *Rule III: Copy-and-Paste* ***(revised)***
> A pronominal card cannot copy-and-paste information from the outermost antecedent card within the minimal processing unit.

It seems that the referential dependencies established between the pronominal card #him and its antecedent card #John in (21a) and (21b) do not resort to resource-saving devices (i.e local c-command), either. The reason is similar to what has been shown already for locality; that is, the pronominal card is relatively strong, unlike a reflexive card, so that they undergo different mechanisms in connecting to local and distant antecedent cards[49].

Another phenomenon to be discussed in copy-and-paste is directionality. The c-commander, being the outermost card in an event file card, is more prominent than its c-commandee — the pronominal card. This is the foundation for the direction of copy-and-paste (from the commander to the commandee); for example:

(22) a. ***She** says that **Mary** is leaving.
b. ***She** likes the people **Mary** works with.

In (22a) and (22b), the card representing *she* cannot copy information from the #Mary card. Notice that *she* (c-commander) is more prominent than *Mary* (c-commandee). Copy-and-paste is forbidden because the dependent card is more prominent than the antecedent card. The reason that copy-and-paste can only happen

[49] The specific reasons will be provided in the next chapter.

from a more prominent card to a less prominent one will be discussed in detail in Chapter 4[50].

(4) Reflexive-bridging and Copy-and-Paste in PP constructions

I have introduced the discourse operations taking place between a reflexive /pronoun and its antecedent by focusing on how two main constraints — locality and c-command — are represented in the file card system. There is another construction which these two main syntactic constraints cannot explain (they encounter the problem of complementarity, see details in Chapter 2) — the prepositional phrase (PP). Referential dependencies established between a reflexive and its antecedent in the PP construction are believed to be logophoric (Reinhart & Reuland, 1993). The question is how such a phenomenon is represented in the file card system and how those file cards operate with each other when discourse implementations of locality and c-command are inapplicable. (23) and (24) are examples of PP constructions:

(23) **John** is looking for a jacket behind **himself**.
(24) **John** is looking for a jacket behind **him**.

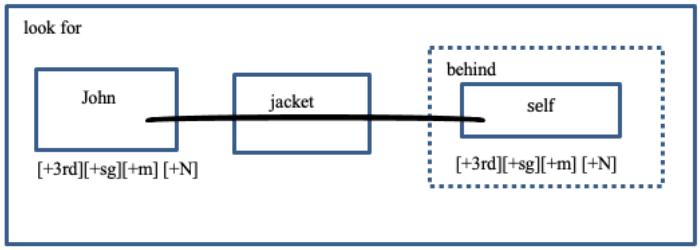
To show the operations applying to the PP construction above, we need to know how the PP construction itself is represented on the discourse level; in other words, we need to know the category of P. The syntactic category of P seems to reach across the conventionally primitive syntactic category (Pretorius, 2017). Unlike V-particles (e.g. take out, pick up, etc.), "locative PPs are referential entities that denote place" (Jackendoff, 1983, in Pretorius, 2017:176), which also means that locative PPs as referential entities can have file card representations in discourse. However, the P in a locative PP is not a functional category, so the P cannot be translated as the frame of the location card. I therefore assume that there is another function layer—a S(pace)P[51] that is higher than PP. SP can be translated to a file card with a frame (S)

[50] Notice that the exclusion of copy-and-paste in these two examples is not caused by a linearity or precedence effect, as in some constructions. The dependency can be established even if the pronoun occurs before its antecedent, e.g. Behind **him**, **John** saw a snake.

[51] The idea of a SpaceP assumption comes from "little p" proposals. Scholars (Van Riemsdijk, 1990; Cinque 1999; Pretorius, 2017) have argued that there is an additional projection layer above PP — the little *p*. The existence of little p (or functional p) has also been found in post or circumpositional PPs and such a functional projection essentially renders the PP referential

and a heading (PP). The frame S is weak as it does not have phonological support; the heading PP denotes lexical information (i.e. place). The file card representation of (23) is shown as follows:

The representation of (23): **John** is looking for a jacket behind **himself**.



It can be seen that there is no minimal processing unit in the image because the reflexive card #himself and the potential antecedent card #John are not both the immediate individual cards (co-participants) of the event card #look for. Therefore, there is no discourse implementation of locality in this construction. Bridging instead operates on the level of discourse directly (without resorting to the structural constraint *locality*). The file card #himself will bridge onto the antecedent card #John in the event card #look for, because the frame features of #himself are not in conflict with those of #John and there is a semantic connection between *self* and *John*. Such a bridging operation also indicates that the whole event is reported from the perspective of *John* (i.e. the pivot of *John*, and *self* is inalienable to *John*). Meanwhile, the whole event is also expressed from the pivot and the mental attitude of the external speaker (i.e. someone outside of the sentence, such as the speaker/reader, Rooryck & Vanden Wyngaerd, 2011), who "will in some way 'take the part' of someone in the sentence", "standing in someone's shoes" (Sells, 1987: 456). In other words, the external speaker shows some empathy with the internal speaker and holds the same perspective with the internal speaker *John*.

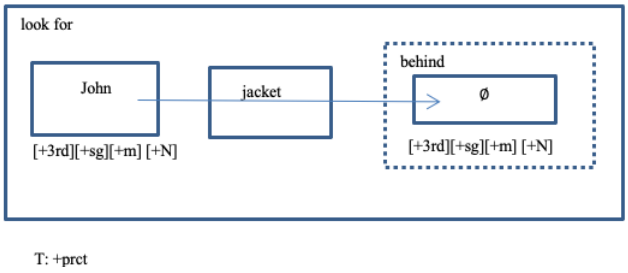
In addition to the bridging operation between #John and #himself, there is another bridging process occurring in the sentential environment — that is, the

(Pretorius, 2017). On the level of discourse, I suggest that there is also a higher projection with the location information that needs to be anchored for interpretation (the location of an event, the perspective information, etc.). The projection of SP is like this: [SP [Spec S' [S PP]]].

bridging between the SP card and the event card, as location information is a part of an event [52] .Therefore, dependencies established between a reflexive in a PP construction and its antecedent undergo the bridging process twice, and there is no implementation of locality in this construction[53].

On the other hand, the file card representation of a copy-and-paste in the PP construction is similar to the representation of bridging, except for differences in the dependent card (here, a pronominal card), as in the representation of (24) below:

The representation of (24): **John** is looking for a jacket behind **him**.



Since there is no minimal processing unit in this construction, the rule of copy-and-paste does not apply. The discourse operation in (24) instead involves two kinds of processes: the first is bridging, as the space (SP) file card will bridge onto the event file card (the location of the event). The second is copy-and-paste, in which the individual file card #him in the event file card copies information from #John. Notice that the difference between *himself* and *him* in the PP construction lies in the *self* feature. In the reflexive-bridging example, the event is reported from the internal speaker *John* as well as the external speaker. In the copy-and-paste example, the pivot information, however, is not conveyed from the point of view of *John* because there

[52] Other reasons that an SP card will bridge onto an event TP card include: (i) they have similar file card structures, with each having its own individual card within the TP/SP card (in syntactic terms, each can take its own argument(s)), so bridging is allowed (notice that bridging between *himself* and *John* is DP to DP); (ii) the frame of the SP card is weak, so it needs to find support for the final interpretation. Nevertheless, the bridging operation between a PP card and a TP card is my assumption, which, I believe, makes sense and may reflect the time-space unity in the conceptual representation of events.

[53] The c-command constraint still holds; for example, *John's father hid a book behind himself* means that John's father hid a book behind John's father, not behind John. A construction like this is interpreted based on discourse prominence (the implementation of c-command).

is no bridging relation between *John* and *him*. The whole event, instead, is reported from the perspective of the external speaker only and the external speaker does not show empathy with the internal speaker or stand in the internal speaker's shoes (again, no bridging relation between *him* and *John*).

To sum up, bridging and copy-and-paste in PP constructions operate directly on the discourse level due to the lack of a minimal processing unit.

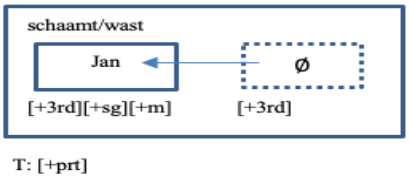
(3) Cut-and-Paste

Along with the SELF-anaphors (i.e. anaphoric reflexives in syntactic studies), there is another type of element, SE-anaphors, which may undergo an operation other than copy-and-paste. The Dutch *zich* is one such anaphor. The file card translated by Dutch *zich* has a weak frame, with a third-person feature only, and an empty heading. How can the file card representing *zich* interact with its antecedent card and establish a referential dependency? Here are some examples:

(25) a. **Jan** schaamt **zich**.
John shames SE
"John is ashamed."
b. **Jan** wast **zich**.
John washes SE
"John washes himself/John washes."

In (25a), the predicate *schaamt* is intransitive (inherently reflexive), which means that only one participant role is required. In (25b), the predicate *wast* follows the same logic as that of *schaamt* after the bundling mechanism — the agent (e.g. the washer) and the theme (e.g. the washee) are bundled together as an [agent-theme] role and end up on one argument (Reinhart & Siloni,1995; Reuland, 2017). In this way, the two file cards in the event file card introduced by schaamt/*wast* are fused into one.

The representation of (25a/b)[54]:



It can be seen in the image above that the file card represented by *zich* fuses onto its antecedent card *Jan*, ending up on one file card only (Schumacher et al, 2010). This sort of operation of file cards is called cut-and-paste.

There is other evidence that *zich* does not have an independent discourse representation, as we can see from the example of the wax-museum story (also called a guise test) (See details in Reuland & Winter, 2009):

Context: In a wax museum, there is a statue of Maria, a staff of the museum. One day, she is washing her statue:

(26) a. Maria wast zich.
b. Maria wast zichzelf.

In (26a), *zich* cannot refer to *the statue of Maria*, which means that it cannot have a new guise and therefore does not have an independent representation in discourse. In (26b), *zichzelf* can refer to *the statue of Maria* (*a guise of Maria*), meaning that it has a discourse representation. In addition to the guise test, there is other evidence for *zich* lacking a discourse representation. For example, according to Schumacher et al. (2010), *zich* cannot be stressed and "unstressed anaphors cannot participate in topicalization" (p. 1740). All of these show that *zich* lacks an independent discourse representation.

The reason for the absence of representation of Dutch *zich* on discourse, I suggest, lies in its underspecified features (a third-person feature only), weak frame, and empty heading. In other words, *zich* is too weak to have an independent file card representation.

Therefore, the rule of cut-and-paste can be formulated as follows:

[54] The arrow represents the direction of cut-and-paste.

Rule IV: Rule of Cut-and-Paste:

A dependent file card will be cut and pasted onto an antecedent card iff the dependent card is weak (i.e. weak frame/empty heading) and iff only one individual card is required in the event card given that there is no feature conflict between the two file cards.

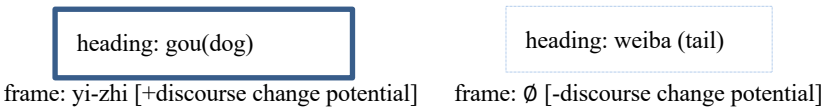
3.4 The Application of the S-D-P Model in Chinese

The S-D-P model above has been formulated on the basis of English and Dutch data. What remains unexplored is whether this model suits Chinese data, as Chinese definite DPs do not have overt (in)definite articles and the reflexive *ziji* is underspecified for morphosyntactic features. In this section, I will show the application of the S-D-P model to Chinese.

3.4.1 Bridging in Chinese

A Definite DP and Its Antecedent

Bridging in Chinese is, to some extent, different from that in English. This is partly due to the lack of (in)definite articles in Chinese. As I illustrated in Chapter 2, there is a DP or DP-like functional projection in Chinese for both definite and indefinite expressions. The file card representations of (i). an indefinite DP, and (ii). a definite DP in Chinese are as follows:



frame: yi-zhi [+discourse change potential] frame: ∅ [-discourse change potential]

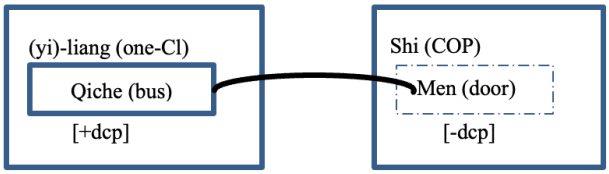
The frame of the indefinite DP *yi-zhi-gou* (one-Cl dog) is introduced by a classifier-numeral system, that is, a strong frame with the feature [+discourse change potential]; its heading is also strong, filled by the lexical entry *gou* (dog). The frame of the definite DP *weiba* (tail), on the contrary, is weak, because of the feature [-discourse change potential]. Moreover, the definite DP frame is even weaker than a

corresponding English definite DP frame because the Chinese definite DP lacks the phonological support for the morphosyntactic features. I further suggest that the phonological composition of a dependent element will also influence the interpretation process of dependencies (recall the role of stress and the role of numeral *yi* mentioned in Chapter 2). Thus, lacking phonological make-up, the file card translated by a Chinese definite DP is weaker than the one translated by a corresponding definite DP in English. (27) is an example of bridging in Chinese:

(27) a. 有辆汽车在马路上， 门是黄色的。
You liang qiche zai malu shang. Men shi huangse de.
Have CL bus Prep road on. Door COP yellow DE
"There is a bus on the road. The door is yellow."

In (27a), *Men* (door) is definite because it is bare in form and it occurs in a preverbal position. The frame of a Chinese definite DP file card in discourse is weak because of the feature [-discourse change potential] as well as the lack of phonological support. The strength of the file card translated by the definite DP *Men* is also expected to be lower than that of a corresponding English definite DP. The bridging operation of the file cards is as follows:

b.



The file card *Men* (door) will bridge onto the antecedent card *liang-qiche* (classifier-bus) because of the semantic connection between the headings of the two file cards. In this sense, the bridging rule that regulates how a definite DP is connected to its antecedent is similar to that in English. The difference in Chinese, then, lies in the strength of the cards representing the definite DP. This crosslinguistic difference may result in a difference in the processing cost of the bridging operation. This will be discussed in detail in the next chapter.

A Reflexive and its Antecedent

I argued in section 3.3.2 that the operation between a reflexive file card and its antecedent card can be treated as a form of bridging. In English, this process will, in most cases, obey the discourse implementation of the locality and c-command constraints, with relatively few exceptions (and those are regulated by other discourse mechanisms). In Chinese, however, dependencies established between a reflexive *ziji* and its antecedent show a different pattern from those in English, for Chinese has many cases that appear to violate the locality and c-command constraints. It also has some special phenomena such as the blocking effect, subject orientation, sentence-free uses, etc. Hence, the specific implementation of the operation of bridging in Chinese is expected to be different, too:

(28) **Violation of locality**:

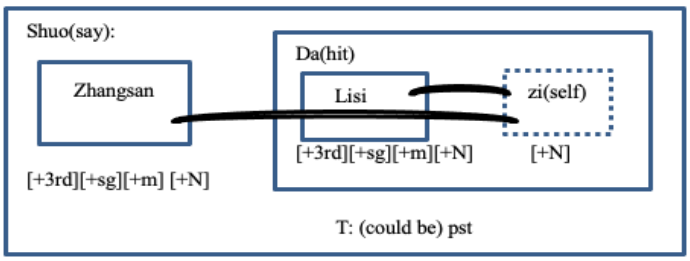
a. 张三说**李四**打了**自己**。
Zhangsan shuo **Lisi** da-le **ziji**.
Zhangsan say Lisi hit-LE self-N
"Zhangsan said that Lisi hit himself/him."

b. 张三相信**李四**对**自己**的描述。
Zhangsan xiangxin **Lisi** dui **ziji** de miaoshu.
Zhangsan believe Lisi of self-N DE description
"Zhangsan believes Lisi's description of himself/him."

In (28), the reflexive *ziji* can either refer to the local antecedent *Lisi* or the distant antecedent *Zhangsan*, with the latter violating the locality constraint. The discourse representation for (28a) is as follows:

The representation of (28a): **Zhangsan** shuo **Lisi** da-le **ziji**.

c.



T: (could be) pst

The event cards are translated by TPs. The first question is whether or not there are any TPs in Chinese. According to Sybesma (2007), Chinese has a tense node, because the T node is universal to all natural languages that can be observed linguistically by temporal adverbials (sometimes accompanied by the perfective particle *le*). Lin (2015) also supported such a view by showing the finiteness property of clauses in Chinese (e.g. object fronting in finite clauses and no object fronting in nonfinite clauses)[55]. With their proposals, I assume that the event file cards in Chinese are also translated from TPs.

In the S-D-P model of English data, a reflexive card can bridge onto its outermost antecedent card in the minimal processing unit. In (28a), it can be seen that bridging in Chinese takes place either in the more embedded event file card #da (hit) or a higher event card #believe, which is not the case in English. It seems that bridging in Chinese is extended to a higher event file card.

One possible explanation for this phenomenon is that bridging in Chinese is affected but not restricted by the discourse implementation of locality. Instead, bridging in Chinese is heavily influenced by discourse factors, for example, the distant antecedent card #Zhangsan is beyond the more embedded file card (locality: the minimal processing unit), and #ziji can still be linked to it through a discourse mechanism — Pivot or Self (Sells, 1987). In other words, *ziji* has two uses: the anaphoric *ziji* and the logophoric *ziji*. As a result, the anaphoric *ziji* bridges to *Lisi* and the logophoric *ziji* bridges to *Zhangsan*.

As I have mentioned in section 3.3.2, the locality constraint has been regarded as a resource-saving device in the interpretation of referential dependencies, and the discourse implementation of locality is realized within the minimal processing unit. In (28a), however, the card representing *ziji* can bridge onto an antecedent card in a larger processing unit: #shuo (said). Suppose that the larger processing unit in Chinese also acts as a resource-saving device, the question then is why, in Chinese, can a larger processing unit (instead of the minimal one) have the function of resource-saving. The reason, I suggest, lies in the featural compositions of the file card for *ziji*. First and foremost, #ziji is a weak card with a weak frame and a weak heading, which differs from the English #himself/herself. Second, *ziji* in Chinese has many logophoric uses, and the strengths of the file cards translated by the anaphoric *ziji* and the logophoric

[55] See details in Lin (2015) section 2.2.1 on page 323.

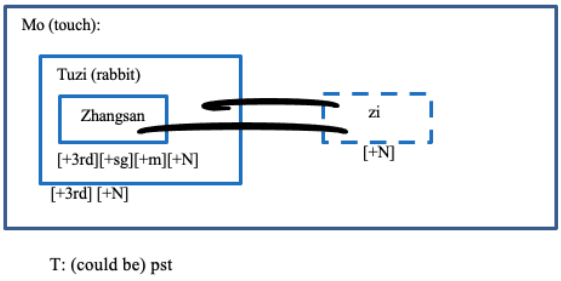
ziji are different, as the latter may carry more features (e.g. +pivot) than the former[56]. It is the featural composition/strength of the file card #ziji that determines how it is connected to its antecedent card in a larger processing unit (details will be further illustrated in the next chapter).

Chinese also has a large quantity of examples that appear to violate the c-command constraint, for example:

(29) **Violation of c-command:**

a. 张三的兔子摸了自己。
Zhangsan de **tuzi** mo-le **ziji**.
Zhangsan DE rabbit touch-LE self-N
"Zhangsan's rabbit touched him/itself."

b.



It can be seen that *Zhangsan* in (29a) does not stand in a c-command relation with *ziji*, yet *ziji* can refer to *Zhangsan*. According to the discourse implementation of c-command, the c-commander card #tuzi (rabbit)[57] will carry the highest prominence scale in the c-command domain (the event card #mo (touch)) and it is therefore more prominent than the other potential antecedent card #Zhangsan. In this case, #ziji will bridge onto the outermost card #tuzi (rabbit).

The question is why #ziji can also bridge onto the structurally less prominent and non-c-commanding #Zhangsan. I suggest the underlying reason is the semantic

[56] Why a logophoric use of *ziji* has more features than an anaphoric use of *ziji* will be presented in detail in the next chapter.

[57] *Zhangsan de tuzi* (Zhangsan's rabbit) is abbreviated as *tuzi* (rabbit). This abbreviation also applies to the three examples of (30).

featural hierarchical system: human > animate > inanimate (Ariel, 2000: 206)[58]. Compare:

(30) a. 张三的**爸爸**拍了**自己**。
Zhangsan de **baba** pai-le **ziji**.
Zhangsan DE father pat-LE self-N
"Zhangsan's father patted himself."

b. **张三**的**狗狗**咬了**自己**。
Zhangsan de **gougou** yao-le **ziji**.
Zhangsan DE dog bite-LE self-N
"Zhangsan's dog bit him/itself."

c. **张三**的骄傲害了**自己**。
Zhangsan de jiaoao hai-le **ziji**.
Zhangsan DE pride hurt-LE self-N
"Zhangsan's pride hurt him."

These three examples demonstrate the effect of featural hierarchy and discourse prominence. In (30a), since the c-commander *baba* (father) and the non-c-commander *Zhangsan* both carry the feature [+human], #ziji can only bridge onto the c-commander, the outermost individual card #*baba* (father), as it is structurally more prominent. In (30c), since the c-commander *jiaoao* (pride) carries the features [-human, -animate], which conflicts with the feature of *ziji*, as *zi* denotes a body part of a creature [+animate], so #ziji can only bridge onto #Zhangsan. In (30b), the c-commander *gougou* (dog) has the feature [-human, +animate], which is hierarchically lower than the features [+human, +animate] of the non-c-commander *Zhangsan*, so #gougou (dog) is less available to be the antecedent card for #ziji than #Zhangsan in the system of featural hierarchy. Such a feature difference makes it possible that the non-c-commander #Zhangsan is an acceptable antecedent card for #ziji. However, as #gougou (dog) is the c-commander and is structurally more prominent than #Zhangsan, it is therefore also a licit antecedent card for #ziji. Therefore, #ziji can either bridge onto #Zhangsan or #gougou (dog), with one link established through structural prominence (i.e. the implementation of c-command) and the other directly established via the discourse mechanism of featural hierarchy. In other words, *ziji* in

[58] These semantic features are not discussed in the file card system, but technically speaking, they belong to the lexical heading feature of the antecedent file cards.

(30b) can be treated as an anaphor as well as a logophor. The logophoric use of *ziji* is realized by the feature-hierarchical difference between *Zhangsan* ([+human]) and *gougou* ([-human]), in which only *Zhangsan* carries the perspective and mental attitude information of the event.

C-command, as I mentioned in the previous section, is a resource-saving device, because it is psychologically harder to process nodes outside of the c-command domain (Reinhart, 1976). Also, the c-commander is the outermost antecedent card that carries the highest prominence scale within the processing unit. In Chinese, it can be seen from (30b) that the antecedent card #Zhangsan is not the outermost card within the event card #mo (touch), yet bridging between the #ziji card and the #Zhangsan card is possible. This suggests that there must be some resource saving devices (e.g. discourse factors) in Chinese other than c-command that make it possible to link *ziji* with a non-c-commanding antecedent. In other words, resource-saving can be realized through the discourse-level implementation of syntactic structural information (i.e. c-command), but it can also be a direct contribution of discourse factors.

The examples of the violation of c-command in Chinese illustrated above provide evidence for the fact that Chinese not only relies on syntactic information but also on discourse mechanisms for the interpretation of referential dependencies. The influence of discourse information on the establishment of referential dependencies in Chinese is further seen in the following examples:

(31) 因为**李四**批评了**自己**，**张三**感到很伤心。
Yinwei **Lisi** piping le **ziji**, **Zhangsan** gandao hen shangxin.
because Lisi criticize LE self-N, Zhangsan feel very sad
"Zhangsan is sad because Lisi criticized him/himself."

(32) **自己**的小孩得奖的消息使**张三**很高兴。
Ziji-de xiaohai dejiang de xiaoxi shi **Zhangsan** hen gaoxing.
Self-N child get-prize DE news make Zhangsan very happy
"The news that his child got prizes makes Zhangsan happy."

In (31), #ziji can bridge onto the antecedent card #Zhangsan, which expresses the Pivot (perspective) and Self (mental state) information of the event. In (32), #ziji can also bridge onto #Zhangsan because it represents the Self (mental state) of the event. These two typically logophoric uses of reflexive *ziji* are very commonly seen in Chinese. The question, then, is why there are so many logophoric uses of *ziji* in Chinese. I suggest that this is related to the properties of *ziji* — the logophoric nature

of *zi* (nose) and the hidden discourse features that *ziji* has — being a speaker or an addressee:

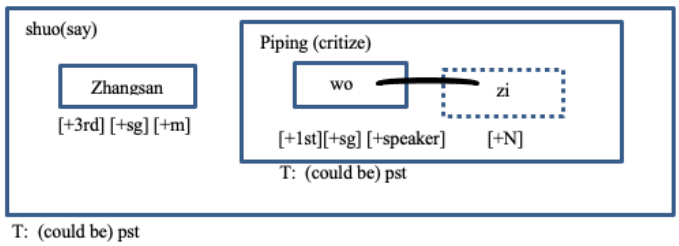
(33) **Speaker**
我不会骑车，也不觉得**自己**能够学会。
Wo buhui qiche, ye bu juede **ziji** nenggou xuehui.
I cannot ride-bike, also not think self-N can learn
"I cannot ride a bike, and I do not think that I can learn it."

(34) **Addressee**
你要不要**自己**在家里称一下行李？
Ni yaobuyao **ziji** zai jia cheng yi-xia xingli?
You want-not-want self-N prep home weigh one-CL luggage
"Do you want yourself to weigh your luggage at home?"

(35) **Speaker /Addressee**
a. 照顾好自己。
Zhaogu hao ziji.
Takecare good self-N
"Take good care of yourself."
b. 自己的事情自己做。
Ziji de shiqing ziji zuo.
Self-N DE thing self-N do
"I am/You are responsible for my/your own business."

In (33) and (34), the file card #ziji bridges onto the card #wo (I) (speaker) and the card #ni (you) (addressee) respectively. In (35a) and (35b), there is no overt antecedent for *ziji*, yet it still refers to the speaker or addressee. Such a sentence-free dependency established between *ziji* and the discourse role of speaker or addressee in this dissertation is also regarded as logophoric usage. It is perhaps just this discourse property of *ziji* that causes the blocking effect:

(36) Zhangsan shuo **wo** piping-le **ziji**.
Zhangsan say I criticize-LE self-N
"Zhangsan said that I criticized myself."

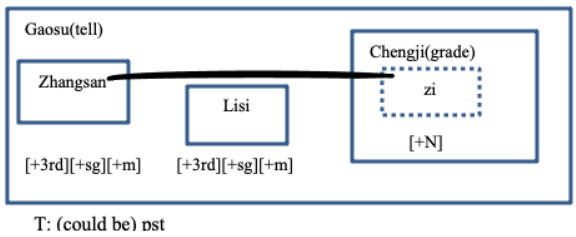


In (36), the card #ziji can only bridge onto #wo (I). The reason for this blocking effect, I suggest, lies in the speaker role of *ziji*. As discussed above, *ziji* in Chinese can act either as an anaphor or a logophor. As an anaphor, #ziji will bridge onto #wo (I) (the more deeply-embedded event file card); as a logophor, #ziji can bridge onto either #Zhangsan (Source/SELF) or #wo (speaker). Yet, since the first-person feature is on a higher hierarchical scale than the third-person feature[59], the logophoric #ziji will then bridge onto #wo (I) rather than #Zhangsan. As a result, #ziji, being either an anaphoric or a logophoric card can only bridge onto #wo, causing the blocking effect.

In the subject-orientation construction (#ziji can only bridge onto the subject and not the object), the connection between #ziji and its antecedent card is also regulated by discourse information, for example:

(37) a. **张三**告诉了李四**自己**的成绩。
Zhangsan gaosu-le Lisi **ziji** -de chengji.
Zhangsan tell LE Lisi self-N-de grade
"Zhangsan told Lisi his own grade."

b.



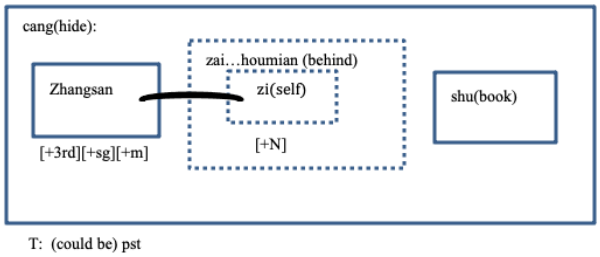
[59] The person hierarchy has some empirical support, too. See details in Ariel (2000).

In (37b), the card #ziji bridges onto the antecedent #Zhangsan rather than #Lisi, because *Zhangsan* is more prominent than *Lisi* (in neutral context) (although they both c-command *ziji*). Notice that *ziji* here is logophoric (i.e. the source of the event).

Finally, as to the logophoric uses of reflexives in the PP construction, Chinese shows a similar pattern to that of English:

(38) a. 张三在自己后面藏了一本书。
Zhangsan zai **ziji** houmian cang-le yi-ben shu.
Zhangsan prep self-N behind hide-LE one-CL book
"Zhangsan hid a book behind himself."

b.



Bridging in the Chinese example above is similar to that in English, except that Chinese has circumpositional PPs, yet a circumpostional PP will not impose any substantial difference for the locative PP, because there is always a higher functional projection — SpaceP[60] above the PP itself, regardless of its compositions. Like in the English examples, bridging happens twice in (38). The first step is that the locative PP file card bridges onto the event card #cang (hide). The second step is bridging between #ziji and #Zhangsan, which is realized through the hidden semantic connection between the heading *zi* (nose) and the person *Zhangsan*. Altogether, the dependency established between *ziji* and *Zhangsan* in the PP construction expresses a view that the event is expressed from the perspective of the internal speaker *Zhangsan* (i.e. the connection between *zi* — a body part of *Zhangsan*) as well as the external speaker who stands in *Zhangsan*'s shoes.

From the analysis above, the bridging rule in Chinese can be summarized as follows:

[60] According to Van Riemsdijk (1990), post positional or circumpositional PP involves a little p projection above PP, because of head to head movement. Therefore, I also assume that there is a SpaceP above PP.

Rule V: reflexive-bridging in Chinese

Route 1:

The #ziji card will bridge onto the *outermost* antecedent card in the *minimal* processing unit given that there is no feature conflict between the two cards.

Route 2:

The #ziji card will bridge onto an antecedent card in a larger processing unit iff (i) the antecedent card is prominent in discourse; or (ii) the event is reported from the mental activities (e.g. perspective, mental attitude, consciousness, attention, etc.) of the antecedent.

As can be seen from this rule, although Chinese often appears to violate the constraints of locality and c-command, it does not mean that Chinese is exempt from these constraints. Rather, they contribute to the final establishment of referential dependencies. The point is that Chinese is not as restricted by the c-command and locality constraints as, for example, English, but these constraints can influence and be implemented within discourse mechanisms (e.g. pivot, self, source), and can independently activate discourse mechanisms (as in sentence-free dependencies). This also means that a difference between Chinese and English is the weight of syntactic and discourse constraints. To be more specific, structural constraints have higher importance than discourse mechanisms in English, but in Chinese it is the other way around; at least, the importance of syntactic constraints will not surpass the status of discourse constraints, as there are referential dependencies (e.g. dependencies established across sentences) that rely purely on discourse mechanisms.

One last remark is that the modular view of *ziji* has been proposed by several scholars (e.g. Liu & Huang, 2001), and I do not aim to repeat their proposals. My intention is to explain the underlying processing mechanisms of referential dependencies within a unified framework — a set of file cards on the level of discourse. By doing this, I aim to show why there are two types of links between *ziji* and its antecedent (i.e why this distribution) and why such links are resource-saving. This will be further illustrated in the next chapter.

3.4.2 Copy-and-Paste

The operation of copy-and-paste in Chinese is, in many cases, similar to that in English, so I am not going to show the details of such an operation in Chinese. Here I only mention two special phenomena seen in the uses of pronouns in Chinese. The first is the phenomenon of the zero pronoun. The second is in regards to the precedence effect of full pronouns.

(39) a. 张三吉他弹得很好，会唱歌，舞跳得也很棒。
Zhangsan jita tan-de hen hao, (gap) hui changge, (gap) wu tiao-de ye hen-bang.
Zhangsan guita play-adv very good, can singing, dance jump-adv also very-good
"Zhangsan is good at playing guitar. He can sing. He also dances very well."
b. —你认识李四吗？
— Ni renshi Lisi ma?
You know Lisi Q
"Do you know Lisi?"
—认识。
— Renshi
Know
"I know him."

A zero pronoun is like a gap in a sequence, which usually refers to an antecedent preceding it. In (39a), the zero pronoun occurs in a series of subject positions, referring to *Zhangsan*. In (39b), the zero pronoun occurs in the object position and refers to the antecedent in the previous clause. This is a copy-and-paste process, regulated by discourse information, such as topicality, which makes the antecedent prominent enough to be linked with the zero pronoun. The zero pronoun, when translated into a file card, is weaker than a full pronominal card, as it lacks the phonological support for the card.

Another phenomenon is the precedence effect of pronouns in Chinese, which is somewhat different from that in English:

(40) a. **His** teacher praised **John**.
b. *他的老师表扬了**张三**。
*__Ta__-de laoshi biaoyang-le **Zhangsan**.
pro-DE teacher praise-LE Zhangsan.

In (40a), copy-and-paste between *his* and *John* is allowed because there is no c-command relation between them. In other words, it is unknown whether *John* or *his* is more prominent. As long as no other discourse factors are involved, such an operation is acceptable. Chinese, however, seems to have some discourse constraints on the uses of pronouns, and it can be seen that in (40b) copy-and-paste is not allowed. This may be due to the sentence-initial position of the Chinese pronoun *ta*, which makes it more prominent on the discourse level (e.g. topicality) than its potential antecedent *Zhangsan*, resulting in breaking the dependencies. In that sense, although copy-and-paste in English and Chinese is regulated by syntactic as well as discourse information, Chinese seems to be more reliant on discourse mechanisms whereas English prefers to rely on syntactic information. Notice that the use of pronouns in Chinese in (40b) is more restricted than that in English in (40a), and this is different from the use of reflexives, in which the use of *ziji* has less restrictions than the use of, say, *herself*. In other words, it is not the case that Chinese is a more flexible language than English but Chinese is more regulated by discourse information rather than by syntactic structural information.

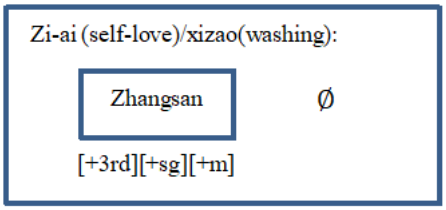
3.4.3 Cut-and-Paste

An example of the discourse operation of cut-and-paste can be seen in the manifestations of Dutch *zich*, as was shown in the second part of section 3.3.2. This operation does not typically occur in Chinese, but there are cases that are similar:

(41) **张**三很**自**爱**。**
Zhangsan hen **zi**-ai.
Zhangsan very self-love
“Zhangsan loves himself.”

(42) 张三洗澡了。
Zhangsan xizao le.
Zhangsan wash LE
“Zhangsan washes himself.”

The representation of (41/42):



In (41), *zi* (self) occurs together with the predicate *ai* (love), and such a predicate requires one participant (individual card) only (argument reduction, see more details in Reuland, Wong & Everaert, 2020). However, there is no overt marker like Dutch *zich* in the object position and the position is empty. This is similar in (42), in which the predicate *xizao* (washing) shows a bundling mechanism of agent-theme role washer-washee. The two cases demonstrate that only one file card representation is needed on the level of discourse[61].

3.5 Summary of Chapter 3

In this chapter, I introduced a syntax-discourse-processing (S-D-P) model to account for referential dependencies in English, Dutch and Chinese. This model is an extension of File Change Semantics (Heim, 1982), and the syntax-discourse interface model (Avrutin, 1999; Schumacher et al., 2010). The central idea of the S-D-P model is that the establishment of a referential dependency is regulated by a set of discourse operations (e.g. bridging, cut-and-paste, copy-and-paste) of file cards that are translated by bundles of morphosyntactic features (e.g. functional and lexical features). In that sense, the S-D-P model takes both the morphosyntactic features and discourse information into consideration.

As a unified mechanism for the representation and interpretation of referential dependencies this model has some potential advantages. The most evident advantage is that it can account for various types of referential dependencies (syntactic or

[61] The focus of this dissertation and model is bridging. The Chinese data for cut-and-paste and for copy-and-paste presented in this dissertation is too small to conclude a rule of cut-and-paste or copy-and-paste in Chinese. What I would like to illustrate here in this section is a rough contrast between Chinese, English and Dutch in the phenomena of cut-and-paste and copy-and-paste.

discourse) within a single system and is applicable to crosslinguistic data. For example, English reflexives and pronouns, in many cases, will obey the two well-known constraints of locality and c-command (i.e. the implementation of locality and c-command), through which reflexive-bridging happens within the minimal processing unit. Chinese, however, shows apparent violations of the two constraints, as reflexive-bridging in Chinese can occur in a larger processing unit. Why Chinese reflexive *ziji* can link to an antecedent in a larger processing unit can be accounted for by discourse mechanisms, which are rooted in the morphosyntactic composition of *ziji*. More specifically, when it comes to the question of how a reflexive is connected to its antecedent, syntactic structural information in Chinese is not as important as it is in English and Dutch. Instead, Chinese relies more on discourse information than English or Dutch for the operation and interpretation of reflexive-bridging. Thus, referential dependencies on the level of discourse can be unified in one system (i.e. file cards), in which different linguistic components (e.g. syntax, discourse) work together to contribute to the final interpretation of the dependencies, with a difference manifested by the proportionality of the different linguistic components that are involved.

Another key point of the S-D-P model is that the manner in which a dependent card is connected to its antecedent card is determined by the strength of the file cards, which are decided by their morphosyntactic features. Dependent cards in different languages may have different morphosyntactic compositions and, as a result, they may undergo different operations with other file cards and thus link to different antecedent cards. The strength of the antecedent card, which is affected by the prominence level of the card, is an aspect of this model that I have not yet discussed. As one part of the referential link, the strength of the antecedent card is expected to be in a specific distributional pattern with the strength of dependent cards. This will be illustrated in detail in the next chapter.

Finally, the S-D-P model takes both linguistic and nonlinguistic modules into consideration. The linguistic module focuses on morphosyntactic and discourse information of the dependent elements while the nonlinguistic module attends mainly to how such elements are processed and what kind of processing resources (e.g. memory, attention) are involved in the interpretation of referential dependencies. This chapter has illustrated the linguistic aspect of the model (e.g. morphosyntactic composition and discourse operations of file cards). The nonlinguistic aspect of the model (e.g. processing resources) that focuses on how the morphosyntactic features

of the file cards are processed and how memory and/or attention affect interpretation procedures, will be discussed in detail in the next chapter.

Chapter 4

The Processing of Referential Dependencies

4.1 Introduction

When a three-year-old child begins to learn kinship terms, they will probably be interested in the subject and quick to learn that their mom's brother is their *uncle* and their mom's sister is their *aunt*. However, if one day you ask them, "what do you call the son of Mom's dad?" they will probably ignore your question and divert your attention away from that question because they cannot answer it. Even an adult needs a moment in order to arrive at the answer. The reason is that the processing of language relies not only on linguistic factors but also on non-linguistic ones. To know that the son of your mom's dad is your uncle, you first need to have basic linguistic knowledge of the phrase. You should also have a good enough working memory[62]to hold *son*, *mom*, *dad* in mind and also do the computation unless a kinship calculator is at hand.

Similarly, the processing of referential dependencies involves the participation of linguistic as well as non-linguistic factors. The syntax-discourse-processing (S-D-P) model is a model that takes both linguistic factors (morphosyntactic features) and nonlinguistic factors (memory) into consideration. In the previous chapter, I explained

[62] Details about working memory will be discussed in section 4.2.

how a referential dependency is established between a dependent element (pronoun, reflexive, or definite DP) and its antecedent in the framework of a file card system. In this chapter, I focus on the processing mechanism for different types of referential dependencies, and I aim to answer the following questions:

(1) What kinds of memory are involved in the interpretation of referential dependencies, and how are they involved?

(2) What are the processing mechanisms of referential dependencies (i.e. by means of a file card system) that operate on discourse representations?

i. How do morphosyntactic features affect the processing of referential dependencies?

ii. How are the syntactic constraints of locality and c-command processed in the establishment of referential dependencies?

iii. How does discourse prominence influence the processing of referential dependencies?

The goal of this chapter is to show how the processing of referential dependencies is modulated by factors such as memory.

4.2 Memory and Referential Dependencies

Referential dependencies concern the relation between two elements — the dependent element and its antecedent, which are usually not immediately adjacent to each other. Instead, they occur in different positions within or across sentences. In order to interpret such dependent relations, memory is required; for example:

(1) **Mary** is the only classmate who John saw **[gap]** yesterday in the library.

In (1), there is a dependent relation between *Mary* and the gap. The processing of this dependent relation requires the participation of working memory: the antecedent *Mary* is held in working memory till the gap position is encountered. Likewise, a dependent relation established between a full-form definite DP (2), a pronoun (3), or a reflexive (4) and their respective antecedents also involves the participation of working memory:

(2) **A bike** is on the grassland. **The wheels** are yellow.
(3) **The girl** is going to submit the manuscript of her Ph.D dissertation in March. **She** is very happy about it.
(4) **The boy's brother** is baking a cake by **himself**.

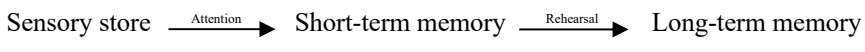
It can be seen that the interpretation of *the wheels* requires us to hold its antecedent *a bike* in our working memory and then link them together. To interpret *her/she*, the antecedent *the girl* should also be kept in working memory for the later linking process. Likewise for *himself* and *the boy's brother* in (4).

The memory that takes part in the processing of referential dependencies in the examples above mainly includes Working Memory (WM), which refers to "a system for holding information that we need to perform a task" (Anderson, 2009: 152). WM is a cognitive system for temporary storage of information as well as information manipulation. Its capacity is both time-limited (e.g. lasting for a short time) and item-limited (e.g. about 5±2 chunks). That is why the distance between *the wheels* and *a bike*, *she* and *the girl*, or *himself* and *(the boy's) brother* is not that large. If the dependent element and its antecedent are too far away from each other, the referential dependencies may break down, partly due to the limited capacity of WM and the interference effect[63]. A specific theory of working memory was proposed by Baddeley (1986), in which he argued that there are two slave systems in working memory — a visuospatial sketchpad and a phonological loop, controlled by a central executive that can determine which system is to be used. The basic idea of this theory is that information may be held in either the visuospatial sketchpad or the phonological loop, and it is the central executive that finally determines which system is to be used. Similarly, this theory also argued that the capacity is limited. In other words, if one attempts to hold too many items in the working memory system, some of the items will be lost.

In addition to working memory, other types of memory may also have a role to play in the processing of dependencies, such as Short-term Memory (STM) and Long-term Memory (LTM). STM is similar to WM in the sense of it being for the temporary storage of information, but it does not have the function of information manipulation (e.g. performing tasks). LTM is responsible for storing information that is

[63] According to Anderson (2009), the maintaining of an item in working memory is strongly impacted by interfering materials.

strengthened or (elaboratively) rehearsed from STM, as is shown in the following model:



(Atkinson & Shiffrin, 1968)

According to Atkinson & Shiffrin (1968), only the information in the sensory store (meaning the visual or auditory information, not involving the processing of linguistic forms) that is attended to can be sent to STM, and when information in STM is rehearsed, it can then be further sent to LTM. The storage capacity of STM is highly limited while LTM has a large capacity, both temporally and in terms of volume.

A further distinction can be made between two different types of LTM: Declarative Memory (DM) and Procedural Memory (PM). DM concerns explicit knowledge of, say, facts and events while PM contains implicit procedural motor and cognitive skills, such as bike-riding (Ullman, 2001).

Among these different types of memories (WM, STM, LTM, DM, PM), some only last for a very short time (e.g. WM, STM), while others can even last for a lifetime (LTM, DM, PM). Thus, types of memory can be divided into two categories in terms of time duration. What will be more relevant for further discussion, however, is the connection between memory and activation along the lines proposed by Anderson, Reder & Lebiere (1996): "Elements in declarative memory have activation levels associated with them and access to these elements is a function of their level of activation. Roughly, working memory can be equated with the portion of declarative memory above a threshold of activation" (p.221). In other words, items in declarative memory will always carry a certain amount of activation. Such activation may be either under the threshold value (inactivated) or above it (activated). Working memory thus contains items with a level of activation above the threshold value.

Consider the processing of the referential dependency established between *the girl* and the pronoun *she* in example (3) (i.e. *The girl* is going to submit the manuscript of her Ph.D. dissertation in March. *She* is very happy about it.). First, the antecedent *the girl* is retrieved from the lexicon (which is part of long-term memory) with a certain level of activation and, once the level of activation is above the threshold value, *the girl* will be active in working memory. The same happens with the pronoun *she*; that is, once its degree of activation is above the threshold value, it will be active in working memory. Now that *she* and *the girl* are available for manipulation in working memory, they can be connected with each other: the morphosyntactic features of the

pronoun *she* act as the cues to identify the antecedent *the girl* in the working memory. Thus, a referential dependency between *she* and *the girl* is established[64].

Example (3) demonstrates a cue-based model of how a pronoun is connected with its antecedent. Similar cue-based memory retrieval models have also been used to explain referential dependencies established between a reflexive and its antecedent (e.g. Runner, Sussman & Tanenhaus, 2006; Dillon, et al., 2014; Jäger, Engelmann & Vasishth, 2015). The specialty of these cue-based memory retrieval models is that they offer a way to classify the retrieval cues: structural versus nonstructural. For example, they suggest that locality and c-command are structural cues for the retrieval of the potential antecedent(s). In contrast, other morphosyntactic features, like phi-features, are nonstructural cues for the retrieval of the target antecedents:

(5) John said that **Bill** criticized **himself**.

In (5), *John* and *Bill* are two items that have received activation. The nature of reflexive *himself* as a dependent element demands the retrieval of an antecedent from among the activated elements in working memory. The nonstructural cues, the phi-features of *himself* (i.e. third person, male, singular), can retrieve both *John* and *Bill*. However, the structural cue, locality, will only retrieve *Bill*, an antecedent that is within the local domain of *himself*. The antecedent that will ultimately be retrieved, taking both types of retrieval cues into account, is *Bill*.

The problem is that some empirical studies (Jäger, Engelmann, Vasishth, 2015; Badecker and Straub, 2002 in Cunnings & Felser, 2013) have shown that the structural retrieval cues (e.g. c-command and locality) in some cases cannot filter antecedents which are, in fact, structurally illicit (at least in the initial stage). This can happen both in English and Chinese:

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[64] This referential dependency may not be successfully built if the activation level of *the girl* decreases to below-threshold value (no longer active). For example, there may be other items active in working memory at the same time that have similar features to *the girl* (e.g. mother: +3rd, +female, +singular), causing an interference effect, or the pronoun *she* may be too far away from its antecedent *the girl* (the activation of the girl has faded away).

(6) a. **The surgeon** who treated Jonathan had pricked **himself**.
b. John thought that **Bill** owed **himself** another opportunity to solve the problem.
(Examples from Jäger, Engelmann & Vasishth, 2015; Cunnings & Felser, 2013)

(7) **小丽**让**小张**不要伪装**自己**。
Xiaoli rang **Xiaozhang** buyao weizhuang **ziji**.
Xiaoli ask Xiaozhang not disguise self-N
"Xiaoli asked Xiaozhang not to disguise himself/him."
(Examples from Li & Zhou, 2010)

In (6a), although *Jonathan* is a structurally illicit antecedent (violating the c-command cue), it was misretrieved because there is an interference effect of the phi-features of *Jonathan* (+masculine, +singular) with those of *the surgeon* (also +masculine, +singular), resulting in a reactivation of the illicit antecedent (Jäger, Engelmann, Vasishth, 2015). In (6b), *John* violates the structure cue of locality, yet it was misretrieved due to the phi-feature matching mechanism (Cunnings & Felser, 2013). This is similar in Chinese. (7) is an example of an ERP study on the processing of the reflexive *ziji*, and the results showed that the responses to the distant antecedent *Xiaoli* were more positive than that for the very local *Xiaozhang* (Li & Zhou, 2010), which means that the distant antecedent was also retrieved (at greater processing cost, though).

The above examples demonstrate that structural cues (e.g. c-command /locality) are not immediate filters for structurally illicit antecedents. This is also known as the Defeasible Filter Hypothesis, which states that "binding principles apply early to restrict the formation of anaphoric dependencies, but are defeasible during later stages of processing when a structurally inaccessible antecedent may also be considered" (Cunnings & Felser, 2013:192). A similar point of view was also put forward by Craik & Tulving (1975), who claimed that "structural analysis may precede semantic analysis, but a full structural analysis is not usually carried out" (p.290). This is similar in both English and Chinese, which suggests that the retrieval of the antecedents does not rely on the structural cues alone. I therefore suggest that locality and c-command are two structural configurations that may facilitate processing but are not watertight in the sense that they don't exclude other mechanisms for building a dependency relation.

In view of the potential problems with the cue-based models (especially regarding structural cues), I will outline a new proposal to account for the processing

of referential dependencies within the file card system (featural bundles), drawing also on accessibility theory (Ariel, 1990), in combination with insights from information theory (Shannon, 1948) and the hypothesis of uniform information density (Jaeger & Levy, 2007).

4.3 Processing Patterns of Referential Dependencies: A New Proposal

As I mentioned in Chapter 2, how a dependency is established between a dependent element and its antecedent has not only been discussed by syntacticians but also in various discourse theories. One such theory is the accessibility theory, proposed by Ariel (1990). Ariel argues that dependent elements (reflexives, pronouns, full noun phrases) are markers for the degree of accessibility of their antecedents. This theory can be extended by taking crosslinguistic data into consideration, as the dependent elements naturally differ from each other in terms of their morphosyntactic composition. Moreover, the small differences among high and extremely-high accessibility markers, either within one language or crosslinguistically, reside in their morphosyntactic features. For these reasons, I will incorporate the accessibility theory into the S-D-P model, in which the dependent elements (as accessibility markers) are represented by file cards with sets of morphosyntactic features and show the underlying process of referential dependencies crosslinguistically.

4.3.1 Accessibility theory revisited

The main idea of Ariel's (1990) accessibility theory is that dependent elements (e.g. pronouns, reflexives, full noun phrases) are accessibility markers that can mark the degree of accessibility of their antecedents:

A classification of the accessibility markers

1. Low Accessibility Markers: proper nouns, definite descriptions
2. Intermediate Accessibility Markers: deictics/demonstratives
3. High Accessibility Markers: pronouns/gaps/reflexives

(Ariel, 1990, 28-29)

As can be noted, definite descriptions are low accessibility markers while pronouns and reflexives are high accessibility markers. The question is why and what the criteria are for this classification. According to Ariel (1990, 2000), this classification is related to the contents (i.e. informativeness, rigidity, attenuation[65]) of the three types of markers and the cost that is required to process the corresponding referential dependencies. In a conversation, a speaker tends to hint to the addressee how much cost will be involved in the successful interpretation of a dependency, which means that if the antecedent of a dependent element is highly accessible, the speaker will tend to use a pronoun/reflexive (less content) as if telling the addressee that the cost is low, and if the antecedent of a dependent element is not that accessible, then the speaker is inclined to use a full noun phrase (more content) to imply that the processing cost of such a dependency is relatively high.

Such a content-oriented point of view with the three criteria (i.e. informativeness, rigidity, attenuation) can be modified and extended. In addition to the three criteria mentioned above, there could be other criteria that also have the function of distinguishing one accessibility marker from another. More importantly, the differences among the high accessibility markers – Self anaphors, logophors, and SE-anaphors – have not been discussed in accessibility theory. It is hard to say which has more content and which has less without a specific standard.

The differences among those high accessibility markers, I suggest, are related to the featural composition of referentially dependent elements reflected in the discourse as the properties of corresponding file cards. For this reason, I intend to provide a detailed analysis of the features of the accessibility markers in order to show their underlying processing mechanism, which may further influence the strength of the file cards, and finally affect the establishment of referential dependencies. This will be discussed in detail in section 4.3.2.

Another key concept in accessibility theory is the degree of accessibility of the antecedents. Although markers (pronouns, definite descriptions, reflexives) can mark how accessible their antecedents are, the degree of accessibility of their antecedents is determined by the antecedents' own status regarding topicality, grammatical roles, etc. According to Ariel (1990), there are at least four factors that may affect the accessibility status of an antecedent: distance, competition, saliency, and boundary.

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[65] According to Ariel (2000), "lower accessibility markers are more informative (calculated according to the amount of lexical material), more rigid (i.e. they identify a mental entity relatively uniquely), and less attenuated (they are lengthier or accented)" (p. 204).

For example, antecedents with fewer competitors (competition) or which are the topic of the sentence (saliency) are inherently more highly activated in memory and more accessible. Antecedents that are closer to their dependent elements (distance) or are more coherent with the dependent elements (boundary) are expected to have more chances to be kept in a highly activated state in memory and, therefore, more accessible.

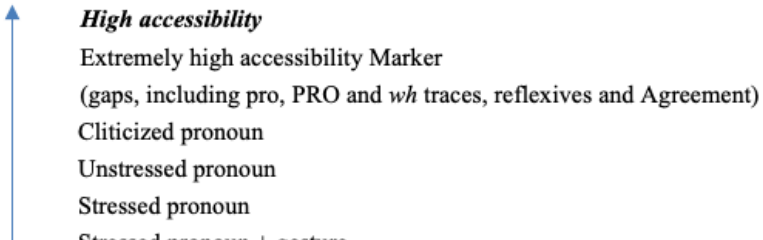
How accessible an item is can be measured by its degree of activation. A highly-activated item is also highly accessible. The definition of memory activation in Ariel's (1990) accessibility theory comes from Parallel Distributed Processing (PDP) (McClelland & Rumelhart, 1986). It is the excitation of a set of processing units (e.g. features, words, concepts, etc.), which are weighted by their connectivity with other units. This is essentially a neurologically-based definition. I will adopt a similar, but more explicit, definition of memory activation: memory activation is defined as a commodity for storage and processing, and where once the activation level of an item is above some threshold value, the item is then active and becomes available for further operation (Just & Carpenter, 1992). By this definition, there is no need to distinguish whether it is working memory or declarative memory that is involved in the processing mechanism, because all kinds of memories are regarded as processing resources and are measured by activation levels.

In other words, the discourse salience of antecedents affects their degree of accessibility, which is modulated by the degree of memory activation: the more salient an antecedent is, the higher its degree of activation, and the more accessible it is.

The list of factors mentioned above, however, is just a fragment of the potential list of factors that may influence the degree of accessibility of antecedents. I therefore intend to enrich the list, using especially morphosyntactic features to further show the processing of referential dependencies established within or beyond sentences. This will be illustrated in detail in section 4.3.3.

4.3.2 Accessibility markers and the strength of dependent file cards

Accessibility markers are divided into three major types in accessibility theory (low, intermediate, and high). There are, however, some further distinctions among the accessibility markers within each category, which can be rendered into a finer accessibility-marking scale (Ariel, 1990):



High accessibility
Extremely high accessibility Marker
(gaps, including pro, PRO and *wh* traces, reflexives and Agreement)
Cliticized pronoun
Unstressed pronoun
Stressed pronoun
Stressed pronoun + gesture
…
Short definite description
Long definite description
Full name
Full name + modifier
Low Accessibility

(Ariel, 1990: 73, modified)

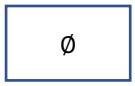
Figure 4. 1 Accessibility marking scale

It can be seen in Figure 4.1 that a definite description is lower on the scale than a pronoun (within which the stressed pronoun is lower on the scale than an unstressed pronoun), which is even lower on the scale than a reflexive. This distribution pattern can be captured by the morphosyntactic features of the dependent file cards in the S-D-P model.

In this model, a file card is composed of a frame and a heading, the frame being composed of a set of functional features (phi-features: person, gender, number), and the heading consisting of a bundle of lexical features (lexical meaning). As accessibility markers are dependent elements, they can be translated into dependent cards with bundles of features. The observation is that a dependent file card translated from an accessibility marker that is lower on the scale will have more features than a dependent file card translated from an accessibility marker that is higher on the scale. For example, comparing the features of a file card representing reflexive *herself* with those of a file card representing pronoun *her*, it is observed that their frame features are identical, both with a feature bundle [+3rd person, +singular, +female, +nominal]. Their heading feature, however, is different. The lexical feature (NP: self) of the reflexive *herself* is defective (Reinhart & Reuland, 1993). Here I treat the defective *self* as a variable since the specific lexical meaning of *self* is underspecified, marked as [-constant]. The lexical feature of a pronoun is empty because of the empty NP.

Here I have marked it as [Ø]. Although the heading of a pronoun is empty, it is still a constant and it can be used deictically (Reinhart & Reuland, 1993). In the file card system, I therefore mark the defective heading feature as [-constant] and the empty heading feature [Ø] as [+constant^{Ø}][66]:

Heading: self [-constant]



Heading: Ø [+constant^{Ø}]

Thus, even if a pronominal card *her* and a reflexive card *herself* have identical frame features, the nature of their heading feature is different, the latter being more defective than the former. Therefore, we can put these dependent file cards onto a featural ranking scale depending on the number of their frame features and the nature of their heading feature. See below:

Featural Ranking of Dependent File Cards

English: reflexive (e.g. *himself/herself*) < pronoun (e.g. *him/her*)
Chinese: simplex reflexive (e.g. *ziji*) < complex reflexive (e.g. *taziji*) < pronoun (e.g. *ta*)

The featural ranking of dependent file cards denotes that a reflexive card ranks lower than a corresponding pronominal card in English as well as in Chinese, as the *self*-part of the reflexive has a defective feature ([-constant]). A card translated from a complex reflexive ranks higher than a simplex reflexive, as it can be seen that in Chinese the complex reflexive card *taziji* has more features than one translated from a simplex reflexive *ziji* (*taziji*: frame:[+person, +number, +N]; heading: [-constant]; *ziji*: frame: [+N]; heading: [-constant]).

There is another type of accessibility marker: the SE anaphor. Taking Dutch *zich* as an example, the first question to answer is whether *zich* is a reflexive-like or a pronominal-like element. According to Reuland (2017), *zich* is essentially a pronominal-like element because its syntactic structure is similar to that of a pronoun (i.e. *zich* occupies the D position). However, *zich* does not behave like a pronoun because it is underspecified for phi-features, having a 3rd person feature only. In

[66] The dotted line in the image indicates that the heading is weak.

addition, *zich* (and SE expressions in Scandinavian languages) can have logophoric uses, too. In this sense, the status of the featural ranking of the *zich* file card is complex and cannot be determined without further specification of the distinction between anaphoric and logophoric uses of *zich*. Since they are both beyond the scope of this dissertation, I will leave this open for future discussion[67].

In Chapter 3, I mentioned that the strength of a file card is closely related to its featural make-up: the more features a dependent file card has, the stronger the card is. What I have not yet discussed is why a dependent file card that has more features is stronger. The reason lies in the processing mechanism: the more features a dependent file card has, the more effort is required to process it, and the higher the demand on processing resources, the stronger the memory trace[68]. The relation between processing effort and the strength of a memory trace has been supported by Craik & Lockhart's (1972) depth of processing theory which argues that, "deeper levels of analysis is associated with more elaborate, longer lasting and stronger trace" (p.675). In that sense, a dependent file card translated from a pronoun (e.g. *her* in English; *ta* in Chinese) will be stronger than a card translated from a reflexive (e.g. *herself* in English; *ziji/taziji* in Chinese, within which the complex reflexive *taziji* card is stronger than a simplex reflexive *ziji* card).

I would like to emphasize two points: first, the number and nature of morphosyntactic features of file cards underpins the effort needed to process it, which results in a memory trace of different strengths. Second, the concept of the strength of a memory trace can map onto the strength of a file card, because file cards are essentially discourse representations of feature bundles, and the strength of a file card is determined by its featural composition. File cards that have more features are

[67] My assumption of the featural scale of *zichzelf*, *zich*, and *haar (her)* is as follows: SE anaphor (e.g. zich) < SELF anaphor (e.g. *zichzelf*) ＜ SE logophor (e.g. *zich*) < pronoun (e.g. *hem/haar*). Such a feature ranking of dependent file cards treats the logophor *zich* as a pronominal element with an empty heading [+constant$^{\emptyset}$], probably with an additional pivot feature in the heading. Therefore, the card representing logophor *zich* will be higher on the scale than the card representing *zichzelf* [-constant]. The SE anaphor card, however, will be lower on the scale than the card for *zichzelf*, because SE anaphor *zich* cannot have an independent status (e.g. it occurs in a sentential context where the predicate is inherently reflexive.).

[68] Memory trace represents a pattern of neural network connections in different brain areas (e.g. prefrontal cortex, sensory cortices) (McClelland et al. 1995, in De Brigard, 2014).

stronger while cards with fewer features are weaker[69]. This distributional pattern mapping the number of features onto the strength of a file card is consistent with that mapping number of features onto the strength of a memory trace. Therefore, in the S-D-P model, I will use the concept of the strength of a file card to represent the concept of the strength of a memory trace.

To sum up, accessibility markers can be divided into different types in the file card system on the basis of their morphosyntactic features: high accessibility markers are file cards with fewer morphosyntactic features, and low accessibility markers are file cards with more features. On the other hand, the processing of dependent file cards is determined by their featural compositions, with fewer features resulting in weaker cards and more features, stronger cards, described as follows:

The Relation between Features and the Strength of File Cards

a. Higher accessibility markers (fewer features)＝Weaker file cards
b. Lower accessibility markers (more features)＝Stronger file cards

The function of an accessibility marker is to indicate the degree of accessibility of its antecedent: if a marker ranks high on the accessibility scale, its antecedent will be highly accessible, and vice versa. As accessibility markers are dependent file cards in the file card system, their functions can also be described as follows: the weaker a dependent card, the more accessible its antecedent card will be. The pattern of referential dependencies can therefore be summarized as follows:

Distributional Pattern of Referential Dependency (DPRD) (Initial)

Referential dependencies established between a dependent element and its antecedent follow a distributional pattern: the weaker the dependent file card, the more accessible its antecedent card will be.

[69] When two cards have identical frame features, the one that has a more defective heading feature is weaker than the other one. Such an argument, in general, is an assumption.

4.3.3 Degree of accessibility, memory activation, and the strength of antecedent file cards

The degree of the activation or accessibility of the antecedent, according to Ariel (1990), is affected by factors such as competition, salience, distance, and boundary (as I mentioned in section 4.3.1). These four factors include two dimensions: entity salience and unity (Ariel, 2000). *Entity salience* refers to the saliency of the antecedents while *unity* refers to the degree of the connectivity between the accessibility marker and its antecedent. Ariel (2000) further provided a list of the factors that may influence the salience of the entities:

(a) Speaker > addressee > nonparticipant (third person)
(b) High physical salience > low physical salience
(c) Topic > nontopic
(d) Grammatical subject > nonsubject
(e) Human > animate > inanimate
(f) Repeated references > few previous references > first mention
(g) No intervening/competing referents > many intervening/competing referents

(Ariel, 2000: 206)

That these factors contribute to the salience scale of the entities has empirical support. For example, the person hierarchy has both theoretical (e.g. Lyons, 1977) and empirical support (e.g. Ariel, 1990). The main claims of these studies are: a first/second person feature is more salient than the third-person feature because it is more likely to be emphasized/topicalized than the third-person feature. Also, in terms of the salience scale of topicality (topic vs. nontopic) and the grammatical role (subject vs. nonsubject), experimental evidence has shown that subjects/topics are more easily recalled in memory tasks than the nonsubjects/nontopics (Arnold, 1998 in Song & Fisher, 2005; Van Rij, Van Rijn, & Hendriks, 2013).

I would like to extend the second dimension: the unity between an accessibility marker and its antecedent. Factors such as *distance* and *boundary* will affect the unity between them. Syntactic structures such as locality, c-command, and coargumenthood will also influence the unity between an accessibility marker and its antecedent. Yet, this factor has not been addressed in accessibility theory. I would therefore like to

extend the factors that may affect the accessibility of the antecedents by taking the syntactic structures into account.

First, the locality constraint[70] is related to the structural distance on the syntactic level, which can contribute to the unity between the accessibility marker and its antecedent and enhance the degree of accessibility of the antecedent, for example:

(8) The teacher said that **the student** painted **herself**.

In (8), the reflexive *herself* can only refer to the local antecedent *the student*. Such examples obey the constraint of locality, which means that unity between the local antecedent and the reflexive is strong, resulting in a higher activation of the antecedent *the student*, making it highly accessible.

Second, an accessibility marker and its antecedent that are in a c-command relation[71] also show some degree of unity, for example:

(9) a. The boy's **father** is patting **himself**.
b. **The thief** [who saw the policeman] hid **himself**.

As can be seen in (9a) and (9b), only the c-commanding antecedent *the boy's father/the thief (who saw the policeman)* can be the proper antecedent for *himself*. This is probably because of the stronger unity between the reflexive and its antecedent brought about by the c-command relation, resulting in a higher activation and higher degree of accessibility of the antecedent. In addition, the antecedent (the c-commander) is also regarded as having the highest entity salience, and this will also contribute to its activation and accessibility.

Third, the unity between an accessibility marker and its antecedent can also be realized by the argument relation between them, such as coargumenthood relation:

(10) a. **The boxer** hit **himself**.
b. **The woman** is holding an umbrella above **herself**.

In (10a) the reflexive *himself* and its antecedent *the boxer* are in a coargument relation. In (10b), the reflexive *herself* and *the woman* are not coarguments. I suggest

[70] Also a resource-saving device, as mentioned in Chapter 3.

[71] Another resource-saving device.

that such a coargumenthood relation also affects the unity between the reflexive and its antecedent: unity is stronger if the dependent element and its antecedent are coarguments of the same predicate.

There are other factors that may also influence the degree of accessibility/ activation of the antecedent. Here I focus on the three that were discussed in detail in Chapter 3: co-argumenthood, locality and c-command.

To sum up, the degree of accessibility/activation of an antecedent mainly depends on the following factors:

I. The Salience of the Antecedent:
person feature, topicality, grammatical roles, animacy, repetition, presence of competing antecedents, physical salience, etc.

II. Unity between a Dependent Element and Its Antecedent:
distance, locality, c-command, coargumenthood, etc.

The processing of an antecedent is influenced by the factors mentioned above: the more factors involved, the more salient the antecedent. In the S-D-P model, antecedents are independent file cards. The salience of antecedent will affect the strength of its antecedent file card, and the more salient an antecedent is, the stronger the antecedent's file card will be, leading also to higher activation of that card. This is related to the depth of processing. It follows therefore that an antecedent that is more salient (e.g. topic, speaker, highly physical salience, subject) is more likely to undergo a deeper level of processing, in other words, "a greater degree of semantic and cognitive analysis" (Craik & Lockhart, 1972: 675), compared to less-salient ones[72]. The result of deeper processing is a stronger memory trace (which translates to a stronger file card in the S-D-P model).

[72] Deeper level processing means that a (salient) antecedent itself will usually involve greater cognitive analysis, so more effort is needed to process it. For example, a sentence-initial subject is usually harder to process than an object as it occurs at the beginning of a sentence and no information has been provided yet, so more effort is required to process such an element. As a result, a stronger memory trace can be formed. Therefore, it is highly activated and easy to retrieve during the establishment of a referential dependency at the later stage.

4.3.4 A balance: the strength of the dependent card and its antecedent card

In the two sections above, I have shown that the strength of dependent cards is related to the amount of features that they have (e.g. the fewer features a dependent element has, the weaker the file card will be). On the other hand, the strength of antecedent cards is related to the salience of the antecedents and the unity between the dependent elements and their antecedents (e.g. the more salient the antecedent is and the stronger the unity, the stronger the antecedent file card will be).

Combining the strength of the dependent card and that of its antecedent card, it can be seen that the weaker the dependent card, the more accessible its antecedent will be (as per DPRD). Once the antecedent is highly accessible, it presupposes that the antecedent is also highly salient, which means that the antecedent card is very strong. Thus, the strength of the dependent card and that of its antecedent card are in complementary distribution: *the weaker the dependent card, the stronger its antecedent card*. The DPRD then can be unified in the file card system, revised as below:

> **Distributional Pattern of Referential Dependency (DPRD) (revised)**
> Referential dependencies established between a dependent element and its antecedent follow a distributional pattern: the weaker the dependent file card, the stronger its antecedent card will be.

4.4 File Cards and Information

The Distributional Pattern of Referential Dependency (DPRD) summarized above is an observational finding of referential dependencies under the framework of the file card system, which shows a balanced distributional pattern between a dependent file card and its antecedent card. I also argued that this balanced distribution among the file cards is related to depth of processing. How strong a file card is depends on how deeply the element has been processed: for example, a dependent file card that has fewer features will require less effort to process it, resulting in a lower level of strength for that card. On the other hand, an antecedent card that is more salient will have a

higher level of strength because more effort is initially involved in processing it (e.g. greater semantic/cognitive analysis). In other words, the card in this case is more deeply processed. The next question is why there is such a balanced distribution of the strength of file cards (DPRD). In this section, I suggest that the underlying mechanism for DPRD can be explained by information theory (Shannon, 1948) and the hypothesis of uniform information density (Jaeger & Levy, 2007).

4.4.1 Information and information theory

The term *information* as used here is different from the term we commonly see and use (i.e. facts provided or learned about something or someone). Instead, *information* here is used as in Shannon's (1948) information theory, in which *information* represents uncertainty, and can be calculated by the logarithm of the probability of an event. The information of an individual element can be calculated by the following formula:

$$\text{Formula 1:} \quad U = \log_2 k$$

(k: possible outcomes; U: uncertainty)

In Formula 1, U means uncertainty. k represents the possible outcomes of an event. The more possible outcomes an event has, the more uncertain it is, thus the higher amount of information it contains. Here is an example: suppose that one day you are playing basketball with your child and you are competing with each other in shooting baskets. You play for three rounds, each of you shooting once per round. There are two possible outcomes in each round (hit/miss) for each of you. Let's first determine the possible outcomes for your child. You don't know what her level of shooting is. She could be an excellent shot, and may make a basket in all three rounds, in which case the outcome would be [1,1,1] (1: hit/ 0: miss). Alternatively, she may not be very good, and she may not make even one basket, in which case the outcome would be [0,0,0]. In addition to these two extreme cases, there are six other possible outcomes for her shooting: [1,1,0] [1,0,1] [0,1,1] [0,0,1] [0,1,0] [1,0,0]. The information of your child's shooting results, according to Formula 1, is $U = \log_2 (6+2) = 3$. The amount of the information is 3 bits. Now it's your turn. Suppose that you are really trained for free throws and you (ideally) always hit the target. In this case, there will only one possible outcome [1,1,1] for your three shots, so the information is $\log_2 1 = 0$. The information then is 0 bit, which means that there is no uncertainty about

your shooting event. Notice that the base of the log is 2 because the shooting event above involves two equally possible outcomes: hit/miss.

Adapting the concept of information to the file card system, I suggest that the strength of file cards can be related to the concept of information. Although we cannot directly measure individual information of the file cards by the log function, we can still make a conceptual connection between file cards and information. For example, a dependent file card (e.g. a reflexive /pronoun /definite DP) that has fewer features will also have fewer cues for retrieving its antecedent card under the memory-based retrieval model (Jäger, Engelmann, Vasishth, 2015), which means that it will be harder to successfully retrieve the antecedent from memory if we only take the retrieval cues into account, and the uncertainty of the dependent file card itself will be correspondingly higher. On the other hand, since the information of the dependent card is high, in order to reduce the information and uncertainty (and to retrieve the antecedent successfully), the antecedent card is expected to have lower information and less uncertainty. Thus, a more salient antecedent is needed because it will increase the chance of being retrieved. Thus, a weaker dependent file card is connected with a stronger antecedent card during the establishment of a referential dependency. A balanced distribution of file cards is, in essence, a balanced distribution of information. Such information distribution patterns appear to be related to uniform information density (UID), which I will explain in the next section.

4.4.2 Uniform information density

It is commonly seen in language production that, if a word has a complex phonological structure or contains complex phonemes, the speaker is likely to produce it more slowly (in order to let the addressee fully understand it). If a verbal phrase has both a full and an abbreviated form (e.g. have not vs. haven't), the speaker is more likely to produce the full form rather than the abbreviation in an unexpected context (Levy & Jaeger, 2007). Such observations, among others, have contributed to the proposal of Uniform Information Density (UID) (Levy & Jaeger, 2007).

The basic idea of UID is that speakers tend to optimize their utterances and uniformly distribute information across the utterances in order to efficiently convey messages. If the amount of information contained in an element is too high, the speaker then will lower information by spreading it as evenly as possible.

In a dependency relation, the dependent element and its antecedent form a continuum (i.e. a referential link). Thus, I postulate that this referential link is a

linguistic object that obeys constraints on processing, including the uniform distribution of information. Following the basic tenets of UID, the information of the referential link should be uniformly distributed with that of other linguistic objects within the sentence. Suppose we have a dependent element with high information, and its antecedent, also with high information (notated as High (antecedent)-High (dependent element)). The information of the referential link (a linguistic object) of this pair will be very high, thus increasing the chances of forming an information peak when processing a sentence. If the referential link consists of a Low (antecedent)-Low (dependent element) pair, the resulting object carries very low information, and it is possible that the information of the next object submitted to interpretation will not be low, which will result in an information trough. In order to avoid such conflicts, the referential link, as a linguistic object, should not be of High-High or Low-Low pairs; rather it should constitute a balancing of information between the antecedent and the dependent element (a High-Low or Low-High pattern). In other words, languages have developed a universal processing mechanism that establishes referential links in such a way that the link and, indeed, the whole sentential context are unlikely to violate UID.

To sum up, the processing of referential dependencies reflects a balance of the strength of file cards, which is further supported by a balance of information.

4.5 Processing of Referential Dependencies: Examples and Explanations

In Chapter 3, I proposed a syntax-discourse-processing model of referential dependencies on the basis of English and Dutch data and showed its application to Chinese. In the S-D-P model, there are three types of operations: (1) bridging; (2) cut-and-paste; (3) copy-and-paste. For each operation, the English, Dutch, and Chinese data show different patterns. For example, in bridging (linking reflexives to their antecedents), the two main syntactic constraints — locality and c-command — are, in many cases, applicable to English and Dutch data, but not to the Chinese data. Chinese, instead, relies not only on syntactic structures but also on the discourse mechanisms (e.g. prominence, perspective) to establish these dependencies. In addition, the Chinese reflexive *ziji* has fewer features than the English reflexive *himself/herself*. Dutch *zich* also has very few morphosyntactic features and it will undergo a cut-and-

paste process. Pronouns, on the other hand, have more features than SE anaphors (*zich*), and the dependency operation between a pronoun and its antecedent in English as well as in Chinese is copy-and-paste.

As mentioned throughout this dissertation, the morphosyntactic features of dependent elements (definite DPs, reflexives, pronouns) in various languages differ from each other. The relative contributions of syntactic constraints and discourse characteristics to establish a referential link are also different in these languages: some rely more on syntactic constraints while others rely more on discourse. Nevertheless, the morphosyntactic features of the dependent elements, the syntactic constraints, and the discourse factors can be unified by the file card system and can be further explored from the perspective of processing. More specifically, the various crosslinguistic data appear explicable in terms of the distributional pattern of referential dependencies (DPRD) presented in the previous sections. This section is therefore dedicated to the manner in which the S-D-P model incorporates processing, supported by crosslinguistic data.

4.5.1 The underlying processing mechanism of bridging

(1) Bridging between a definite DP and its antecedent

The processing of referential dependencies established between a definite DP file card and its antecedent card, following DPRD, shows some differences when we compare English with Chinese:

(11) a. There is a girl on the snowfield. The pants are green.
b. 有个女孩在雪地里。裤子是绿色的。
You ge nvhai zai xuedi li. Kuzi shi lvse de.
Have Cl girl Prep snowfield in. Pant COP green DE
"There is a girl on the snowfield. The pants are green."

In (11), the frame feature of the file card *the pants* (the: the feature [-discourse change potential] is marked by the overt article *the* in English while the frame feature of the Chinese file card *kuzi* (pants) does not have this marker, although the Chinese definite DP also has the feature of [-discourse change potential]. The difference between an English definite DP card and a Chinese one lies in whether or not there is a phonological realization of the morphosyntactic marker (the determiner). The

phonological feature is not included in the S-D-P model. Yet, there is evidence that, on the level of discourse, phonological properties such as stress also have a role to play in the interpretation of referential dependencies (Ariel, 1990; Biq, 2004).

The relation between the phonological realization of a linguistic form and its interpretation on the discourse level can be seen in Chinese, too. For example, Chinese indefinite DPs with a numeral *yi* (one) ([one-Cl + NP]) have a tendency to be more prominent than those without it:

(12) a. 我想买个杯子。
Wo xiang mai-ge beizi.
I want buy-Cl cup
"I want to buy a cup."
b. 我想买一个杯子。
Wo xiang mai yi-ge beizi.
I want buy one-Cl cup
"I want to buy a (specific) cup."

It can be seen from these two examples that *yi-ge beizi* (one-Cl cup) — a (specific) cup is expected to be more salient than *-ge beizi* (Cl cup) — a cup. (12b) has the phonological realization (*yi*: one) while (12a) does not have an overt phonological form. This supports the view that the phonological realization of a linguistic form can affect the interpretation of a dependency. In view of this data, I suggest that the strength of a file card translated from a definite DP should differ according to their phonological realization. The file cards for items with overt phonological forms are stronger than for items without phonological realization.

Thus, the dependent file card — a Chinese definite DP *kuzi* (pants) itself is relatively weak. It is probably weaker than that of a corresponding English definite DP due to the lack of overt phonological realizations of the lexical markers. According to DPRD, the antecedent card of a Chinese definite DP file card should therefore be relatively strong (i.e. weak dependent file card — strong antecedent card). A strong antecedent card also means the antecedent should have a relatively high degree of memory activation/accessibility. In (11b), the activation/accessibility of antecedent — *ge nvhai* (a girl) is relatively high because of its salience (e.g. no other potential antecedents that are in a competitive relation with the antecedent *a girl*), so it is possible to establish a referential link between *kuzi* (the pants) and *(yi)-ge nvhai* (a girl).

Combining UID and DPRD, we can see that a Chinese definite DP is a weak file card, so its information is relatively high, and in order to satisfy UID, the information of the antecedent card should be relatively low, which means that the antecedent will be salient and highly activated.

(2) A reflexive and its antecedent

In the S-D-P model, a dependency established between a reflexive and its antecedent is realized in the minimal processing unit (i.e. the more/most deeply-embedded event file card, the discourse implementation of locality) in English, while in Chinese, such an implementation of locality in some cases seems to be inapplicable. This data leads to two questions: 1)Why does this sort of dependency in the majority of cases in English happen in the more/most deeply-embedded event file card? 2) How can we explain the differences between Chinese and English in this type of dependency? In the following sections, I will address these two questions from the perspective of processing, in terms of DPRD and UID.

In English, a reflexive dependent file card bridges onto its antecedent card in the more /most deeply-embedded event file card, for example:

(14) Oliver said that **William** punched **himself**.

In (14), the reflexive card *himself* is weak (high information), which means that the antecedent card should be strong (low information, by DPRD and UID). When an antecedent card is strong, it means that the antecedent is salient and has a relatively high activation level. Thus, the question is which of the two potential antecedents, *Oliver* or *William*, or even both, satisfy this requirement.

In section 4.3.3, I presented a list of factors that may affect the degree of activation of antecedents on the basis of Ariel's (1990, 2000) proposal, which claims that the activation of the antecedents is determined by the discourse salience of the antecedents in two dimensions, i.e. entity salience and the degree of the unity between the items in the dependency.

As memory activation is regarded, in this dissertation, as a commodity for processing (see section 4.3.1) and the activation of an antecedent is decided by its salience, I further claim that the total activation of the antecedent is composed of 1) entity activation (i.e. the single activation of the antecedent itself, which is affected by the salience of factors such as subjecthood, topicality of the antecedents, etc.) and

2) unity activation (i.e. the associative activation of the dependent element and its antecedent, which is determined by the degree of unity, depending in turn on distance, coargumenthood, etc. between a dependent element and its antecedent). In (14), suppose that *William* and *Oliver* have similar entity activation levels (because both of them occur in the subject position), we can still observe that their unity activation is different, with the local *William* higher than the distant *Oliver* because of the factor of distance.

Yet, it may be argued that the distant *Oliver* and the local *William* have different entity activation levels because *Oliver* occurs in the overall sentence-initial position and takes longer to process, resulting in a higher strength and higher activation. This phenomenon is known as the advantage of first mention (Aaronson & Ferres, 1983). However, such an advantage can be cancelled if the competing antecedent has the same syntactic status, such as subjecthood (Gernsbacher & Hargreaves, 1988). In other words, "the first-mentioned participant(s)' advantage did not derive simply from their being the initial words in their stimulus sentences. Rather, the advantage depended on each participant's position relative to the other participants" (Gernsbacher & Hargreaves, 1988: 15). In (14), since both *Oliver* and *William* occur in the subject position, there is no first mention advantage for *Oliver* because they have similar status in terms of syntactic position. Therefore, *Oliver* and *William* have equal entity activation. However, their unity activation is different, with *Oliver* (distant) having a lower unity activation than *William* (local). Thus, the overall activation level of distant *Oliver* is lower than that of the local *William*.

The activation level of the antecedent, however, may fluctuate due to the memory interference effect, causing weakening or strengthening of some items. According to the response competition theory (McGeoch, 1942) and some similar proposals on competing association mechanisms (Anderson, 1983; Mensink & Raajimakers, 1988), items connected to the same retrieval cues will compete with each other. Strengthening one association (e.g. item 1 — retrieval cue 1) will jeopardize the others (e.g. item 2 — retrieval cue 2), causing weakening of the impaired ones. This process is retrieval-induced, which means that successful retrieval of one item will decrease the chance of the retrieval of other items (Anderson, Bjork, & Bjork, 1994; Anderson, Bjork, & Bjork, 2000; Storm et al., 2006). With such theories, it can be seen that the two links [William-himself] and [Oliver-himself] will compete with each other because they are connected to the same retrieval cues — *himself*. *Himself* as a weak card is looking for a strong antecedent card with high activation. Since the overall activation level of *William* is higher than that of *Oliver*, *William* is the antecedent that

is retrieved. Moreover, the association between *William* and *himself* will be strengthened during the actual retrieval process, further weakening the alternative association between the distant *Oliver* and *himself*.

However, several researchers (Osgood, 1946; Bäuml, 1997; Anderson, 2003) have argued that strengthening some associations may not necessarily cause the passive weakening of the less-strengthened ones. Rather, they argue that there is an active suppression process of unwanted items from the initial set of potential antecedents before the association is established in order to avoid memory interference. "The suppression process helped to reduce proactive interference caused by the initial list, and to effectively 'shift' into a 'response set' more appropriate to the current task." (Anderson, 2003:441). Such suppression proposals have emphasized the role of a central executive, which has the control function in performing tasks (which antecedent is to be inhibited/suppressed). In that sense, it is possible that the less-activated, distant *Oliver* has been suppressed in memory so that a dependency between *himself* and *Oliver* is illicit.

On the basis of the above analysis, it is only the card *William* that can successfully be connected to the dependent card *himself*. What about the data in Chinese? The following is an example of the use of Chinese *ziji* in the same construction (a corresponding translation of (14)):

(15) **张三**说**李四**捶了**自己**。
Zhangsan shuo **Lisi** chui-le **ziji**.
Zhangsan say Lisi punch-LE self-N
"Zhangsan said that Lisi punched himself/him."

In (15), the dependent file card *ziji* can link to the antecedent card *Lisi* or *Zhangsan*. The question is why both of them are proper antecedents for *ziji*, or why *ziji* can link to an antecedent card in the more embedded file card as well as to an antecedent card on a higher level. As I mentioned in Chapter 3, the two links are established through a discourse implementation of locality and a discourse mechanism of perspective-anchoring respectively (see details in Chapter 3). This view essentially admits that *ziji* has two uses: anaphoric and logophoric:

(16) a. **张三**画了**自己**。
Zhangsan hua-le **ziji**.
Zhangsan paint-LE self-N
"Zhangsan painted himself."
b. **张三**说雨落在了**自己**身上。
Zhangsan shuo yu luo zai le **ziji** shenshang.
Zhangsan say rain fell Prep LE Self-N body-on
"Zhangsan said that the rain fell on him."
c. ***Oliver** said that the rain fell on **himself**.

In (16a), the reflexive *ziji* is used as an anaphor, referring to the local antecedent *Zhangsan*. In (16b), the reflexive *ziji* is a used as a logophor, referring to the distant antecedent *Zhangsan*. This sort of logophoric use of a reflexive is impossible in English, as can be seen in (16c), which requires a pronoun *him*. However, we cannot say that the logophoric use of *ziji* is equal to the use of the pronoun *ta*, because there are still some differences between the logophoric *ziji* and the pronoun *ta*, for example:

(17) a. 小红的**妈妈**很开心，因为老师表扬了**自己**。
Xiaohong de **mama** hen kaixin, yinwei laoshi biaoyang-le **ziji**.
Xiaohong de mom very happy, because teacher praise-LE self-N.
"Xiaohong's mom is very happy, because the teacher praised her (Xiaohong's mom)/herself (the teacher)."
b. **小红**的**妈妈**很开心，因为老师表扬了**她**。
Xiaohong de **mama** hen kaixin, yinwei laoshi biaoyang-le **ta**.
Xiaohong de mom veryhappy because teacher praise-LE her
"Xiaohong's mom is very happy, because the teacher praised her (Xiaohong/Xiaohong's mom)."

In (17a), *ziji* is treated as a logophor[73] and so can only refer to *Xiaohong de mama* (Xiaohong's mom). The heading *zi* (self) denotes a body part *nose* and carries the SELF (mental attitude) and PIVOT (perspective) of *Xiaohong de mama* (Xiaohong's mom), thus making it possible to refer to an antecedent that occurs in another sentence. In (17b), the pronoun *ta*, however, can either refer to *Xiaohong* or

[73] It can also have the anaphoric use, referring to the teacher.

Xiaohong's mom. This difference between the logophoric *ziji* and the pronoun *ta* indicates that the logophoric use of *ziji* is more restricted than the use of *ta*, although the logophoric *ziji* sometimes behaves like a pronoun.

If we map the logophoric *ziji*, anaphoric *ziji*, and the pronoun *ta* onto the ranks of features, strength of file cards, and accessibility-marking scale, we find the following distributional patterns:

Featural Ranking of file cards:	pronoun *ta*	>	logophoric *ziji*	>	anaphoric *ziji*
Strength of File Cards:	pronoun *ta*	>	logophoric *ziji*	>	anaphoric *ziji*
Accessibility Marking Scale:	pronoun *ta*	<	logophoric *ziji*	<	anaphoric *ziji*

The logophoric *ziji* is a reflexive but behaves as a pronominal-like element. A logophoric reflexive, under the definition of Sells (1987), has the function of being connected to an antecedent that expresses the pivot/self/source information of the event. In other words, [+pivot] [+self] [+source] can be regarded as three features assigned to a logophoric element that need to be anchored onto discourse for interpretation. The Chinese logophoric *ziji*, however, does not necessarily carry these three features. Instead, the logophoric *ziji* has to link to an antecedent that is the center of consciousness, or the focus of the sentence. In that sense, the feature of a logophoric element seems to be inconsistent in different languages. Considering this data, I propose that the logophoric *ziji*, after being translated onto a file card, will carry a feature [+Log] [74], which is an inclusive term that contains concepts such as consciousness, focus, pivot, self, source, etc. Therefore, the featural make-up of the logophoric *ziji* card is like this: [-constant^{+Log}, +N]. Compared with the features of the pronominal *ta* card [+constant, + N, +person, +number] and those of the anaphoric *ziji* card [-constant^{-Log}, +N], the logophoric *ziji* card has fewer features than the pronominal *ta* card but more than the anaphoric *ziji* card[75]:

[74] The [+Log] feature may come from the speaker/addressee role that *ziji* can play in discourse (*ziji* can refer to the speaker or addressee). The other reflexive *taziji* (pro-zi-ji), instead, does not have the function of being regarded as a speaker or an addressee, so that in example (17b), *taziji* is an anaphor and it cannot refer to *Xiaohong's mom*.

[75] The dotted lines in the images indicate that the heading is a variable (and weak). The more dotted lines the image contains, the weaker the heading is.

ta [+constant, + N, +person, +number] logophoric *ziji* [-constant^{+Log}, +N] anaphoric *ziji* [-constant^{-Log}, +N]

The file card *ta* is therefore stronger than the logophoric *ziji* card, which is in turn stronger than an anaphoric *ziji* card. This is because more features means that more effort is involved in processing them, resulting in stronger file cards. The accessibility marking scale shows the reverse pattern, however, with the anaphoric *ziji* being the highest accessibility marker, followed by the logophoric *ziji* and the pronoun *ta*. What I would like to emphasize here is that the logophoric *ziji* occupies a position on the ranking scale between the pronoun *ta* and the anaphoric *ziji*.

As I mentioned in Chapter 3, referential dependencies established between Chinese *ziji* and its antecedent(s) may undergo two routes: one route is [anaphoric *ziji* — antecedent]; the other is [logophoric *ziji* — antecedent]. I also mentioned that my aim is not to reiterate a modular view, but to illustrate the underlying processing mechanisms of each of the two routes. Briefly speaking, the two links obey both the DPRD and UID, fundamentally regulated by the properties of *ziji* and the salience of its antecedent(s).

In the following example, *ziji* is treated as an anaphor and as a logophor as well. In both cases, DPRD and UID apply, as shown in example (15), here repeated as (18):

(18) **张三**说**李四**捶了**自己**。
Zhangsan shuo **Lisi** chui-le **ziji** .
Zhangsan say Lisi punch-LE self-N
"Zhangsan said that Lisi punched himself/him."

Suppose that *ziji* here is an anaphoric element. The anaphoric *ziji* card is very weak with few morphosyntactic features, so it should be connected to a relatively strong antecedent card (DPRD). Also, because the information of the anaphoric *ziji* card is high, the information of its antecedent card should be low in order to satisfy the UID (the high-low pair requirement).

What the weak anaphoric *ziji* card looks for is a strong antecedent card. This also means that the antecedent should be salient and have high activation. Considering the fact that the local *Lisi* is closer to *ziji* than *Zhangsan*, and since there is no advantage of first mention, the overall activation level of the local *Lisi* is higher than that of

distant *Zhangsan*. *Lisi* is therefore the proper antecedent for the anaphoric *ziji*. In this sense, the mechanism of the referential link [anaphoric ziji-Lisi] is similar to the link [himself-William][76]in English.

Ziji in (18) can also be regarded as a logophor. Since the logophoric *ziji* card is stronger than the anaphoric *ziji* card, it should be connected to a weaker antecedent card (at least weaker than the antecedent card of the anaphoric *ziji* card). The antecedent of the logophoric *ziji* should therefore have relatively lower activation (lower activation in the sense of the anaphoric vs. logophoric distinction). Following this logic, the distant *Zhangsan* is the proper antecedent for the logophoric *ziji*. The local antecedent card *Lisi*, on the other hand, is too strong to be a licit antecedent card for the logophoric *ziji* card. In other words, the distribution pattern between the logophoric *ziji* card and its antecedent card *Lisi* violates DPRD and UID[77]. Due to the violation of DPRD and UID, the local antecedent *Lisi* is actively suppressed and, as Anderson (2003) argued, retrieval will recruit the executive control process to suppress the unwanted response(s).

In the outline of the S-D-P model, I stated that referential dependencies established between a reflexive and its antecedent are subject to the c-command constraint, and that this is related to discourse salience (the reflexive card is connected to the outermost antecedent card in an event file card). English examples tend to obey this constraint, while Chinese may either obey or violate it[78]. In the following examples, both English reflexive *himself* and Chinese *ziji* obey the c-command constraint:

(19) a. **Emily's mother** judged **herself**.
b. **花花的妈妈**评判了**自己**。
Huahua de mama pingpan-le **ziji**.
Huahua de mother judge-LE self-N
"Huahua's mother judged herself."

[76] From example (14) : Oliver said that **William** punched **himself**.

[77] The file card representing the logophoric *ziji* is stronger than the card representing anaphoric *ziji*. At the same time, the local antecedent card *Lisi* is also stronger than the distant antecedent card *Zhangsan*, such a distribution is strong-strong pair, violating DPRD (and UID).

[78] As I have repeatedly mentioned in the previous chapters, The uses of Chinese reflexive *ziji* do not necessarily obey the c-command constraint (and it is very common).

Since a reflexive file card is weak, it should be linked to a strong antecedent card (DPRD). The antecedent should therefore have a high activation level and be relatively salient. In (19a) and (19b), *Emily's mother* and *Huahua-de mama* are the c-commanders of the reflexives, which means that they are salient and have high activation levels, meeting the requirement of the DPRD. Also, both examples satisfy the requirement of UID, given that the information of the dependent cards *anaphoric ziji/herself* is high (i.e. weak cards with few features), and the information of their antecedent cards *Emily's mother/Huahua de mama* is low (highly salient), forming a high-low pair. Following the proposals of competition theories, the association between *Emily's mother/Huahua de mama* and *herself/ziji* will be strengthened and the alternative association between *Emily/Huahua* and *herself/ziji* is weakened. Notice that *ziji* can only be used as an anaphor. The reason is that it is in a neutral context where the potential antecedent *Huahua* is unlikely to be the pivot or center of the event[79]. In some cases, however, Chinese *ziji* does not obey the c-command constraint and can refer to the non-c-commander, for example:

(20) a. **花花**的**狗狗**咬了**自己**。
Huahua de **gougou** yao-le **ziji**.
Huahua de dog bite-LE self-N
"Huahua's dog bit her/itself.

b. **John's dog** bites **himself**.

In (20a), the overall activation of *Huahua-de gougou* (Huahua's dog) is slightly higher than that of *Huahua* because of the unity activation (c-command) and entity activation (subject). What needs to be focused on is the featural hierarchy between *Huahua de gougou* [-human] and *Huahua* [+human]. As I mentioned in Chapter 3, the reason why *ziji* can link to the non-c-commander *Huahua* is because the c-commander *gougou* (dog) is less available as an antecedent for *ziji* because of the [-human] feature. The presence of feature-hierarchy provides a context in which *ziji* can be treated as a logophor (i.e. the pivot and mental attitude of a human being). In other words, *ziji* is used both as a logophor and an anaphor in (20a) and two referential links can be formed: (1) Huahua de gougou (Huahua's dog) — anaphoric *ziji*; (2) Huahua — logophoric *ziji*.

[79] If such a sentence occurs in a larger context where *Huahua* is the topic of the whole discourse, *ziji* can marginally refer to *Huahua*, which is a logophoric use. However, this usage is very rare.

With the DPRD and UID, the anaphoric *ziji* card is weak, so it should be linked to a strong antecedent card, meaning that the activation of the antecedent is relatively high. Thus, the anaphoric *ziji* is linked to *Huahua-de gougou*, an antecedent with high activation. On the other hand, the logophoric *ziji* card functions as a pronominal-like card that is relatively strong, so it should be connected to a relatively weak antecedent card, thus, the non-c-commander *Huahua* is the proper antecedent for the logophoric *ziji*, as its overall activation level is lower than *Huahua-de gougou*.

The referential link built between the logophoric *ziji* and its potential antecedent is also observable in the following construction (traditionally defined as subject-orientation):

(21) 张三告诉了李四自己的成绩。
Zhangsan gaosu le Lisi **ziji**-de chengji.
Zhangsan tell LE Lisi self-N-DE grade
"Zhangsan told Lisi about his own grade."

In (21), the reflexive *ziji* is used as a logophor in this construction, as *Zhangsan* can represent the source (e.g. tell) of the event, while *Lisi* can convey the pivot message of the event.[80]

The logophoric *ziji* card is relatively strong (i.e. stronger than the anaphoric *ziji* card), and to meet the requirements of DPRD and UID, it will look for an antecedent card that is relatively weak. In (21), both *Zhangsan* and *Lisi* are relatively weak cards because they are both outside of the minimal processing unit. So, two potential logophoric referential links — [Zhangsan-logophoric *ziji*] and [Lisi-logophoric *ziji*] can be formed. Thus they will compete with each other since they are connected to the same retrieval cues — the logophoric *ziji*. The entity activation of *Zhangsan* (subject) is higher than that of *Lisi* (object). The unity activation of *Zhangsan* is similar to that of *Lisi* because they both c-command *ziji*. Altogether, the activation of *Zhangsan* is higher than that of *Lisi*, so *ziji* will only form a link with *Zhangsan*.

Another relevant phenomenon is the blocking effect (see details in Chapter 2 and 3), and this too can be explained by the means of the DPRD and UID, as in (22):

[80] When the whole event is seen from the perspective of *Lisi*, or when *Lisi* acts as the center of the event.

(22) **张三**认为**我**表扬了**自己**。
Zhangsan renwei **wo** biaoyang-le **ziji**.
Zhangsan think I praise-LE self-N
"Zhangsan thinks that I praised myself."

In (22), *ziji* can be treated as an anaphor or a logophor. When it is treated as an anaphor, it is a very weak card that should link to a very strong antecedent card in order to meet the requirement of the DPRD and UID. Only the local antecedent card *wo* is strong enough to meet that requirement because it is closer in distance and has the first person feature. When it is treated as a logophor, it cannot link to the local *wo* because the card *wo* is too strong. Yet, there are still two potential antecedents for the logophoric *ziji* to link to: one is [Zhangsan-ziji]; the other is [wo-ziji][81]. These two referential links will compete with each other because they are both retrieved by the same retrieval cues (the logophoric *ziji*). Due to the person-hierarchical difference, the referential link [wo-ziji] will win the competition and the other link [Zhangsan-ziji] will be weakened. The final result is that only one referential link is established [wo-ziji], causing the blocking effect.

When *wo* occurs in the matrix subject position, the blocking effect disappears:

(23) **我**以为**张三**表扬了**自己**。
Wo yiwei **Zhangsan** biaoyang-le **ziji**.
I think Zhangsan praise-LE self-N
"I think that Zhangsan praised me/himself."

In (23), *ziji* can either refer to *Zhangsan* or *wo*. Such referential dependencies involve two types of referential links: anaphoric and logophoric. In terms of the anaphoric referential link, anaphoric *ziji* card is weak, so it should connect to a strong antecedent card. Although the entity activation of *wo* is higher than that of *Zhangsan* due to the person feature hierarchy, the unity activation of *wo* is lower than that of *Zhangsan* because of distance (*Zhangsan* is closer to *ziji*). Therefore, the overall activation levels of *Zhangsan* and *wo* are roughly equal, and both of them are available for linking. In terms of the logophoric referential link, *ziji* as a logophoric element will retrieve only *wo*. The final result is that no blocking effect is observed because

[81] *Wo* here refers to the external speaker. In other words, *wo* has two roles: the internal referent in the sentence and the discourse role as an external speaker.

both antecedents can establish dependencies with *ziji* (one is an anaphoric link and the other is logophoric).

Finally, let us consider the bridging phenomenon (reflexive-antecedent) in the PP construction, which also obeys the DPRD and UID:

(24) a. **Mary** is holding an umbrella above **herself**.
b. **张三**把伞打在了**自己**头上。
Zhangsan ba san da zai le **ziji** toushang.
Zhangsan BA umbrella hold prep LE self-N head-above
"Zhangsan is holding the umbrella above himself."

As I mentioned in the outline of the S-D-P model in Chapter 3, reflexive cards in PP constructions, whether English or Chinese, are connected to antecedent cards by undergoing the bridging process twice, representing the perspective/mental attitude of the internal referent — *John/Zhangsan* and also the external speaker. Reflexives in PP constructions (24) are treated as logophors, which are pronominal-like elements (at least in Chinese), so they are stronger file cards than anaphoric reflexive file cards, and their antecedent cards should be relatively weaker (according to the DPRD and UID). That is to say, the activation levels of *Mary* and *Zhangsan* should be relatively low (compared with the activation of the antecedents of anaphoric reflexives). The question is: how do we characterize the activation levels of the antecedents in the PP constructions?

To answer this question, we need to take the concept of coargumenthood into consideration. In section 4.3.3 and 4.5.1 (2), I stated that coargumenthood is a factor that contributes to the unity activation of the antecedent. Namely, when a reflexive (anaphor) is in a coargument relation with its antecedent, the activation level of the antecedent will be high; when it is not, the unity activation of the antecedent is lower. The rationale behind this hypothesis is that coarguments of the same predicate participate in the formation of the same eventuality file card in discourse, thus an active status is required of the antecedent in order to complete the process of eventuality card formation. When the dependent element is not a coargument of its antecedent, the antecedent does not necessarily stay in an active state because the process of discourse representation of the antecedent itself has been completed before the reflexive completes its own discourse representation. To make it more clear, in (24) for example, *Mary*, *umbrella*, *above herself* are coarguments and they are represented in the same event file card at the same level. The discourse representation

is then completed and the reflexive card *herself* embedded in the PP file card will not directly participate in the formation of the eventuality card. Following this logic, the activation levels of *Mary* and *Zhangsan* are relatively low because they are not in coargument relationships with the reflexives but, rather, with the whole prepositional phrase. If their activation level is low, then they satisfy the requirement of the DPRD and UID.

Another issue to be discussed is the noncomplementary distribution of pronouns and reflexives in the PP construction. How can we account for such a phenomenon from these underlying processing mechanisms?

(25) a. **Mary** is holding an umbrella above **herself**.
b. **Mary** is holding an umbrella above **her**.

Since the pronominal card *her* and the logophoric card *herself* (pronominal-like element) are both relatively strong in comparison with anaphoric cards, they should both be connected to a relatively weak antecedent card due to the lack of a coargumenthood relation. The difference between (25a) and (25b), therefore, lies only in interpretation (the underlying DPRD and UID are similar). In (25a), the antecedent carries the pivot message of the event (expressed by the SELF part of a reflexive: logophor *herself* [+pivot]), so the event is described from the perspective of *Mary* (internal speaker). Also, notice that the whole event is also reported from the perspective of the external speaker, as the external speaker empathizes with the internal speaker (see details in Chapter 3). In (25b), the dependent element does not have the SELF part, so the event is not demonstrated from the perspective of *Mary* but only from the perspective of an external speaker.

4.5.2 The underlying processing mechanism of cut-and-paste

The operation of cut-and-paste underlies the dependency between a SE anaphor, such as Dutch *zich*, and its antecedent. Although *zich* has a structure similar to a pronoun (occupying the D position in a DP), it is different from a pronoun in that it only has a third-person feature, whereas pronouns have fully-specified phi-features. The uses of the SE anaphor *zich* and the Dutch pronoun *hem* are different from each other:

(26) **Jan** waste **zich** /***hem**.
John wash SE/him
"John washed/John washed him."

In (26), the file card *zich* will undergo a cut-and-paste operation with its antecedent card while *hem* cannot. Such a difference essentially arises from the features that *zich* and *hem* have, which, in turn, determine the strength of the file card. The *zich* and *hem* file cards are of different strengths: the former is a weak card while the latter is strong. According to the DPRD, the antecedent card of *zich* therefore should be strong and that of *hem* should be relatively weak. That is to say, the activation of the antecedent of *zich* is relatively high, while that of *hem* is relatively low. In (26), the antecedent *Jan* is highly activated (short distance/ local), so that only *zich* satisfies the requirement of the DPRD[82].

In Chinese, as discussed in Chapter 3, an operation that is similar to cut-and-paste is seen in the following examples:

(27) **张三**很**自**爱。
Zhangsan hen **zi**-ai.
Zhangsan very self-love
"Zhangsan loves himself very much."

(28) 张三洗澡了。
Zhangsan xizao le.
Zhangsan wash LE
"Zhangsan washes himself."

In both (27) and (28), there is no overt marker such as *zich* in the object position, so I assume that the dependent card (before it is cut) is extremely weak due to the lack of phonological support (and also underspecified features). Following the DPRD, since the empty card is very weak, its antecedent card should be very strong. In these examples, *Zhangsan* meets such a requirement.

[82] According to Everaert (1986) and Reuland (2017), in some languages (e.g. Frisian), a pronominal can also occur in a construction like (26). One explanation is that the interpretation of the pronominal lies in the properties of the pronominal in that language and the predicate context it can occur in. In the file card system, such a pronominal card therefore could be weak, depending on its specific features, thus obeying the DPRD.

4.5.3 The underlying processing mechanism of copy-and-paste

Pronouns in English and Chinese are strong dependent file cards with fully specified frame features and empty headings. The discourse operation underlying the relationship between a pronominal dependent file card and its antecedent card is copy-and-paste. The use of pronouns in Chinese and English is similar, so I use mainly English data, and will give Chinese examples when the languages differ, in accounting for the processing of the copy-and-paste operation. This operation includes two rules. The first is that the dependent card and its antecedent card cannot occur in a minimal processing unit; for example:

(29) **John** says that Bill likes **him**.

In (29), the pronoun *him* can refer to *John* or other potential antecedents in discourse, but not to the local antecedent *Bill*. The application of DPRD and UID also have the same result. The file card *him* is relatively strong (at least compared to a reflexive's), which means that its antecedent card should be relatively weak (at least compared with the antecedent of a reflexive). In that sense, the activation of the proper antecedent for *him* should also be relatively low. As I have illustrated in the bridging examples, the activation of *John* is lower than that of *Bill* due to distance and the lack of first-mention advantage, so *John* is the proper antecedent for *him*. With the inhibitory control mechanism, the local antecedent *Bill* with higher activation level is suppressed because it is the unwanted item under the DPRD and UID (e.g. the card is too strong and the information is too low). As a result, the distant *John* is the proper antecedent for *him* in this sentential context.

Another key point for the rule of copy-and-paste in the S-D-P model is the discourse implementation of the c-command constraint which, in essence, demonstrates a mechanism of discourse prominence, with the c-commanding card being the most prominent (outermost) antecedent card in an event. Such constraints can also be explained by DPRD and UID:

(30) **Emily**'s mother likes **her**.

The pronoun *her* represented on discourse is a strong card and it should be connected to a relatively weak card. In (30), the pronoun *her* occurs in object position.

Emily and *Emily's mother* occur in the specifier-of-subject and subject position respectively. The potential antecedent card *Emily* is weaker than the card *Emily's mother* because of its status as a non-c-commander, meaning that it is less salient than a c-commander. In other words, the activation of *Emily* is lower than *Emily's mother*'s, so *Emily* is the proper antecedent for *her*. With the inhibitory control mechanism, the antecedent *Emily's mother* is suppressed because it is the undesired antecedent.

However, in the following constructions, Chinese is different from English:

(31) a. ***她**的妈妈喜欢**艾米丽**。
***Ta**-de mama xihuan **Aimili**.
pro-DE mom like Emily
b. **Her** mother likes **Emily**.

In (31a), *ta*-de cannot copy information from *Aimili*. In (31b), a corresponding translation of (31a), *her* can copy information from *Emily*. As I have mentioned in Chapter 3, as long as there is no c-command relation between the pronoun and its antecedent and no other extra discourse factors involved, copy-and-paste is allowed because the prominence scale of the pronoun and its antecedent is unknown. In Chinese, however, since the sentence-initial position is very likely to be prominent in discourse[83], copy-and-paste is not allowed.

The underlying reason for this phenomenon can, I suggest, be explained with the help of the concept of information (uncertainty). A dependent file card, whether a pronoun, a reflexive, or a definite DP, has the feature of [-discourse change potential][84], so that it cannot reduce the information of the context because the dependent card itself is high-information. If, in this situation, the antecedent card is not prominent (i.e. high-information), then the link formed between a dependent card and its antecedent card will consist of a pair of cards that are both high-information, which contains the potential risk of violating UID. In other words, the antecedent card should be highly prominent and low information, so that a potentially licit referential link can be formed. In (31a), the antecedent *Aimili* is not prominent enough (at least

[83] Elements occur in sentence-initial positions are usually the topic in Chinese.

[84] In Chapter 3, I mentioned that the feature [-discourse change potential] is a primitive feature of full-formed definite DPs. Since pronouns/reflexives are also definite DPs, here I suggest dependent file cards translated by definite DPs will all carry such a feature.

less prominent than the pronoun *ta*), which also means that the information of *Aimili* is relatively high. However, the information of the pronoun *ta* is also relatively high[85], so a high — high information pair is formed, violating the UID. In (31b), *Emily* is not less prominent than the pronoun *her*, thus prominent enough. This indicates that the information of *Emily* is relatively low, and *Emily-her* will form a low-high information pair, obeying UID.

In addition to the difference shown between Chinese and English in example (31), Chinese has another use of pronouns that is different from English, as in the following example:

(32) 李四正在看书，手里拿着一个杯子，在喝水。
Lisi zhengzai kanshu, shouli na-zhe yi-ge beizi, zai heshui.
Lisi ASP read-book, hand-in hold-ASP one-Cl cup, ASP drink-water.
"Lisi is reading. He is holding a cup in his hand. He is drinking water."

(32) demonstrates the phenomenon of the zero pronoun in Chinese, which obeys the DPRD and UID. The antecedent *Lisi* occurs in the sentence-initial position and it is the topic for the whole sequence, so the card representing *Lisi* is very strong, or low information. On the other hand, the zero pronoun is relatively weak, or high information. The strong-weak/low-high distribution obeys the DPRD and UID. In addition, the zero-pronoun in (32) can also be replaced by an overt pronoun, and the distribution pattern between an overt pronominal card and its antecedent card still obeys the DPRD and UID, as pronouns in general, compared to full noun phrases, are high-information elements (in other words, they are high accessibility markers), so that the information of their antecedents should be low. The information of *Lisi* is very low because it is highly salient.

[85] In the S-D-P model, I argue that pronouns are strong cards with low information. What I mean by this is that the pronominal card is relatively stronger than that of a reflexive, or the information of a pronoun is lower than that of a reflexive. Compared to noun phrases (i.e. *a dog*/*John*), pronominal cards are much weaker and their information is much higher than that of the noun phrase cards. This view is also in line with Ariel's (1990) accessibility theory, in which pronouns/reflexives are high accessibility markers while full noun phrases are low accessibility markers.

4.5.4 Acceptability, grammaticality, and processing constraints

In the previous sections, I have illustrated the underlying processing mechanisms for each discourse rule. I argued that Chinese constructions that were traditionally defined as ungrammatical due to violations of locality and c-command can be accounted for from the perspective of processing. Instead of using the term "grammaticality", it is perhaps more appropriate to use the term "acceptability". Whether a construction is grammatical or ungrammatical for certain linguistic phenomena, like referential dependency, is not so clear-cut in a discourse-oriented language such as Chinese. It is the interpretation of an utterance on the level of discourse that finally determines whether an expression is acceptable or not. What I would like to emphasize here is that processing constraints in Chinese are as important for judging whether an expression is acceptable or not as structural constraints are in English and Dutch. Also, as far as the linguistic data that I have presented in this chapter, English and Dutch also obey the processing constraints of DPRD and UID, with the structural constraints of locality and c-command being two factors that contribute to processing. Taking the processing of reflexives (either English *herself* or Chinese *ziji*) as an example, a reflexive is a weak card in the file card system and a high information element. From the perspective of processing, it requires a strong and low-information antecedent card under the generalization of DPRD and UID. The two structural constraints of locality and c-command contribute to lowering the amount of information of the antecedent, satisfying the two processing constraints.

To sum up, the information or the strength of file cards in Chinese, Dutch, and English may have different sources: relying more on syntactic factors or more on discourse factors but, on the level of interpretation, all three languages follow the same processing constraints — DPRD and UID.

4.6 Summary of Chapter 4

In this chapter, I have shown the processing of referential dependencies established between dependent elements (reflexives, pronouns, definite DPs) and their antecedents. Starting with the introduction of different types of memory (short-term memory, long-term memory, working memory), I have argued that the processing of dependencies involves the participation of memory. I have further argued that some of the previous memory retrieval-based models of dependencies were problematic

because of, for example, their treatment of c-command and locality as structural retrieval cues. I then put forward a new proposal — the Distributional Pattern of Referential Dependencies (DPRD): the weaker a dependent file card is, the stronger its antecedent card will be — to explain referential dependencies cross-linguistically. This new proposal is an extension of Ariel's (1990) accessibility theory and has support from uniform information density (Jaeger & Levy, 2007).

There are two major extensions in the new proposal. The central idea is that morphosyntactic features, syntactic constraints and discourse factors are all inserted into the file card system, in which interpretation is further affected by memory. More specifically, I first explored the different types of accessibility markers (dependent file cards: reflexives, pronouns, definite DPs) by looking at their featural make-up. Second, I enriched the list of factors that may affect the salience of antecedent cards by including both discourse factors (such as perspective) and syntactic constraints (such as locality, c-command, coargumenthood). The processing of referential dependencies involves two steps: 1) the processing of dependent file cards and their antecedent cards respectively; 2) the link between a dependent card and its antecedent card.

How the file cards will be processed can be accounted by the theory of depth of processing (Craik, 1972). The more effort required to process a file card, the stronger the card will be. In terms of dependent file cards, the more features it contains, the more effort is needed to process it, also resulting in a stronger file card. In terms of antecedent cards, the more salient an antecedent is, the more cognitive analysis is involved, resulting in a relatively strong antecedent card. As a result, a balance of the strength of file cards between a dependent file card and its antecedent file card is achieved (DPRD).

This distributional pattern of file cards in the establishment of referential dependencies (DPRD) is further supported by information theory (e.g. Shannon, 1948) and uniform information density (e.g. Levy & Jaeger, 2007). Information in information theory is related to the concept of uncertainty. Higher uncertainty means higher information. The balance of the strength of file cards is further supported by a balance of information such that a stronger card is lower-information, and a weaker card is higher-information. This distribution pattern of high-low information pairs will finally guarantee that the overall information of the referential link formed between the dependent element and its antecedent will not be too high or too low, which is consistent with the uniform information density hypothesis (Levy & Jaeger, 2007).

The underlying processing mechanism of the S-D-P model is instantiated by the processing of file cards and the operations of those file cards (e.g. bridging, copy-and-paste, cut-and-paste), which is, in essence, the processing of information with the participation of memory. With a set of examples in English as well as in Chinese, I have further shown that the DPRD/UID is applicable to both languages. Most importantly, in the processing model, the two constraints of locality and c-command are regarded as neither retrieval cues nor syntactic rules. Instead, locality and c-command, are treated as two factors that may contribute to the salience and activation-level of the antecedent which, in turn, influence the establishment of dependencies. Alongside those two factors, morphosyntactic features and discourse factors, together with memory, will finally determine how a referential dependency is interpreted.

Chapter 5

Development of Syntax-Discourse Interface Knowledge in 3-to-6-Year-Old Mandarin Chinese Children

— ***Experimental Evidence for the S-D-P model***

5.1 Introduction

The principles and parameters framework of Universal Grammar had led to various syntactic models aiming to explain child language acquisition data, mainly for sentence-level grammar (Wexler & Chien, 1985; Chien & Wexler, 1990). Sometimes, however, purely syntactic models remain insufficient in accounting for acquisition of discourse-level phenomena. In this case, discourse models are needed to further explain how the knowledge is or can be acquired by a child.

The knowledge that a child has of syntax or discourse (or at their interface) generally belongs to linguistic competence. Whether a child has the ability to implement such knowledge is, however, influenced by factors from other nonlinguistic systems or modules, such as memory, attention, etc. It is highly possible that a child has already acquired the corresponding linguistic knowledge but that she is just not able yet to implement such knowledge due to the lack of processing resources, such as limited working memory capacity and attention (Avrutin, 1999).Therefore, a model that includes both linguistic and nonlinguistic modules is

ultimately needed for a better and fuller explanation of the child language acquisition data. With such a model, we can then pin down and explain the possible errors that children may make in the acquisition of a specific language phenomenon, show that these are correlated with linguistic or non-linguistic factors, and determine whether they belong to syntax, discourse or the syntax-discourse interface.

In this chapter, I will adopt the S-D-P model that I have built in the previous chapters as the theoretical foundation to explain the empirical evidence, as the model takes the two modules (linguistic and nonlinguistic) and features on two levels (morphosyntax and discourse) into consideration. With the S-D-P model, I aim to explore the development of syntax-discourse interface knowledge in 3-to-6-year-old Mandarin Chinese children by conducting two experiments. These have the three goals of revealing the developmental paths concerning this knowledge, of figuring out which level the possible mistakes belong to, and of providing the explanations for such mistakes. More concretely, the two experiments that I have conducted aim to answer the following two questions:

(1) Experiment 1: How do Chinese children build a dependency relation between *ziji* and its antecedent?
(2) Experiment 2: How do Chinese children build a dependency relation between a definite DP and its antecedent?

As I showed in Chapters 3 and 4, referential dependencies in the S-D-P model are established through a set of operations of file cards which are subject to certain processing constraints. File cards with different morphosyntactic compositions and salience scales have different degrees of strength. The strength of a dependent file card and that of its antecedent card in a referential dependency demonstrate a specific distributional pattern (DPRD): the weaker the dependent file card, the stronger its antecedent card will be. In Chinese, the dependent file cards translated from the reflexive *ziji* and a definite DP are relatively weak due to the lack of morphosyntactic (functional) features. With the generalization of DPRD, it is therefore predicted that the antecedent card of *ziji* or of a definite DP will be relatively strong. In addition, since the logophoric *ziji* card is stronger than the anaphoric *ziji* card, the antecedent card of the logophoric *ziji* card is weaker than the antecedent card of the anaphoric *ziji* card (DPRD). Also, it can be predicted that Chinese children's performance on the two constructions (i.e. dependencies established between the logophoric /anaphoric *ziji* and their respective antecedents) will be different, with the antecedent of the

logophoric *ziji* being harder to be retrieved than the antecedent of the anaphoric *ziji* as the antecedent card of the logophoric *ziji* card is weaker. Whether Chinese children's performance will confirm such a prediction or not and to what degree this processing constraint can explain the acquisition data (or conversely, in what sense the acquisition data can provide empirical evidence for this theoretical framework) are questions to be answered.

In the first experiment, I will explore how Chinese children build a dependency between *ziji* and its antecedent. I will test their performance on the logophoric as well as the anaphoric uses of *ziji*, aiming to find out whether there is any difference in their performance in the two constructions, given that the file cards in these constructions have different degrees of strength.

In the second experiment, I will investigate how Chinese children build a dependency between a definite DP and its antecedent (as in familiar examples such as I read a book. The author is well-known). I will further test whether specificity (a property of the antecedent of a definite DP) will facilitate the establishment of a dependency, because it is a factor that contributes to discourse prominence, hence, it contributes to the strength of a file card in the S-D-P model.

5.2 Chinese Children's Acquisition of the Dependency between ziji and its Antecedent

5.2.1 Previous child language acquisition studies on reflexives

In the 1990s, studies on children's acquisition of reflexives often went together with research on the acquisition of pronouns. These elements were extensively explored in Indo-European languages, such as English (Chien & Wexler, 1990), Russian (Avrutin & Wexler, 1992), Dutch (Philip & Coopmans, 1996), Italian (McKee, 1992), Icelandic (Sigurjonsdottir & Hyams, 1992), and Spanish (Baauw, 2000). These studies revealed that children from around 4 to 5 years old begin to demonstrate knowledge of constraints on anaphoric reflexives (Principle A) but do not show such knowledge of (non-clitic) pronouns until they are 6 years old (the delay of Principe B). Theoretical explanations for the imbalanced development of principles A and B are centered around three main hypotheses: the lexical learning hypothesis (Wexler & Chien, 1985), the maturation hypothesis (Borer & Wexler, 1987), and modularity theory (Chien & Wexler, 1990; Avrutin & Wexler, 1992). The lexical learning hypothesis

(Wexler & Chien, 1985) states that principles and parameters are innate and need not be learned. Instead, it is the lexical properties of reflexives and pronouns (including the specific settings of the relevant parameter(s)) that need to be learned. Children's mistakes in reflexives and pronouns may be explained as them not having fully grasped the properties of the lexical elements rather than the principles and parameters (and they may grasp the properties of reflexives earlier than those of pronouns, leading to the imbalanced development of Principle A and Principle B). The maturation hypothesis (Borer & Wexler, 1987) holds that, although the principles themselves are innate, they may not be available immediately after birth, just like other nonlinguistic abilities. In other words, the maturation hypothesis advocated that children are endowed with principles from birth but that their capacity to correctly use such principles will undergo a gradual developmental process. It is possible that very young children lack the relevant cognitive capacity to correctly use Principle B. Modularity theory (Chien & Wexler, 1990; Avrutin & Wexler, 1992) focused on the modular structure of language, with the explanation that some mistakes that children make belong to the syntactic module, and others may belong to pragmatics. The delay of Principle B was essentially explained as a problem in the domain of pragmatics (and a processing problem in Grodzinsky & Reinhart, 1993) (Avrutin & Wexler, 1992). More recent proposals elaborating this modular approach show that the delay involves a combination of lexical, grammatical, pragmatic/processing factors (Baauw, Coopmans & Philip, 1998).

The studies listed above focused on the anaphoric uses of reflexives (SELF anaphors). There are clearly other uses of reflexives such as logophors. The logophoric uses of reflexives in some constructions cannot be straightforwardly accounted for in a syntactic principles-and-parameters framework because the operations between a logophor and its antecedent involve reference to properties at the discourse level – a higher level than syntax and a level to which the lexical and morphosyntactic features of the elements are sent for interpretation. Yet, very few studies have explored the logophoric uses of reflexives (exceptions include Sigurjonsdottir & Hyams, 1992; Avrutin & Cunningham, 1997; Coopmans & Avrutin, 2000; Coopmans, et al., 2004).

Chinese reflexive *ziji* can be used either as an anaphor or as a logophor. Studies on the anaphoric uses of *ziji* also attend to the uses of the pronoun *ta.* Like their European counterparts, Chinese children from around 4 years old have been shown to demonstrate knowledge of the anaphoric *ziji* (He, 2009). However, research on children's knowledge of the proper interpretation of pronouns has had inconsistent

results; while some children demonstrate the delay of Principle B effect (Zeng, 2013), others do not (Hao, Sheng & Gao, 2014). It should be noted that studies on the logophoric *ziji* are not few in number. There are many instances of the logophoric *ziji*, and one of the most frequently discussed phenomena involving the logophoric *ziji* is long-distance dependency, in which the distant antecedent often carries the Source or the Self information of the whole sentence:

(1) **米老鼠**梦见**大猩猩**拿着**自己**的照片。
Milaoshu mengjian **Daxingxing** na-zhe **ziji**-de zhaopian.
Mickey Mouse dream Big Gorilla hold-ASP self-De picture
"Mickey Mouse is dreaming that Big Gorilla is holding his/(his own) picture."
(Chien, Wexler & Chang, 1993)

In (1), *ziji* can either refer to *Daxingxing* or *Milaoshu*. Chien, Wexler & Chang (1993) tested 3-to-8-year-old Chinese children's interpretations of *ziji* in the construction above by means of a truth-value judgement task (TVJT) (Crain & McKee, 1985). Their results showed that children in all age groups preferred the local interpretation (acceptance rate: 75%) much more than the long-distance interpretation (acceptance rate: 41%).[86]

Chinese children's preference for the local interpretation has also been found in other empirical studies (Xu, 2010; He, 2009). Xu (2010) did a study parallel to that of Chien & Wexler (1990) by testing Chinese children's interpretations of *ziji*, and her results also showed that children's average acceptance rates for local versus long-distance interpretations were 85.74% and 36.94% respectively. He's (2009) research (by means of an act-out task) also demonstrated that the percentage at which Chinese children chose the local antecedent (65.1%) was much higher than the percentage at which they chose the long-distance antecedent (29%).

The results for the adult participants in the Chinese studies mentioned here were inconsistent, with some showing long-distance preference (He, 2009; Xu, 2010) and others demonstrating local preference (Cheng, Wexler & Chang, 1993), as can be seen from table 5.1.

[86] The acceptance rates of each age group were as the follows:
Local (from 3 to 8 years old): 80%, 75%, 66%, 66%, 80%
Long-distance (from 3 to 8 years old): 45%, 30%, 45%, 40%, 41%

Table 5. 1 The percentage of local/long-distance interpretation of *ziji*

Author(s)	Children (%)		Adults (%)	
	Local	Long	Local	Long
Chien, et al. (1993)	75	41	86.46	38.54
Xu (2010)	85.74	36.94	67.78	78.33
He (2009)	65.1	29	29	69
Li (2010)	N.A.	50	N.A.	>90

Note: Li (2010) did not test children's nor adults' performances in the local condition.

Despite showing local preference in all the studies mentioned here, Chinese children (3 to 6 years old) also allowed long-distance interpretations, with the percentages varying from 30% to 40%. The most recent study on Chinese children's long-distance interpretation of *ziji* was conducted by Li (2010) with the method of a truth-value judgement task. The results of her study indicated that children's average acceptance rate for long-distance interpretation was about 50%. Adult participants also allowed, and even preferred, the long-distance interpretation, meaning that adults as well as children can have the logophoric interpretation of *ziji.*

Another phenomenon showing up in the interpretation possibilities of the logophoric *ziji* is the blocking effect. This is where the long-distance dependency is blocked by an intermediate potential first- or second-person antecedent, a phenomenon which has been explained as a form of perspective conflict, in other words, the external speaker and the internal speaker occur in the same position (see details in Huang, 1984 and Huang & Liu, 2001). Li (2010) tested Chinese children aged from 3 to 6 to see whether or not they have the knowledge of this blocking effect by connecting *ziji* with the intermediate antecedent *ni* (you) with which a dependency takes absolute precedence:

(2) 小红说**你**拉走了**自己**的大红鱼。
Xiao-xiong shuo **ni** la-zou-le **ziji** de da hong yu.
little-bear say you drive-away-LE self DE big red fish
"The little bear said that you drove away self's big red fish."
(Li, 2010)

The results indicated that Chinese children from 4 years old onward began to show adult-like performance, predominantly successfully connecting *ziji* with the local antecedent *ni* (you). That is, they showed sensitivity to the blocking constraint (knowledge of perspective changing in the test constructions).

The blocking effect disappears when the potential blocker is a third-person antecedent, as is shown in example (3):

(3) **我**还以为**小马**踢倒了**自己**的栅栏呢。

Wo hai yiwei **xiao-ma** ti-dao-le **ziji** de zhalan ne.

I originally think little-horse kick-down-LE self DE fence SFP

"I originally thought that the little horse kicked down my fence."

(Li, 2010)

In (3), the third-person antecedent *xiao-ma* (little-horse) will not block the long-distance dependency between *ziji* and *wo* (I). Notice that the distant antecedent *wo* (I) has a different person feature from that of the local antecedent *xiao-ma* (little-horse), and such a construction differs from the long-distance example in which the local and distant antecedents are similar in their person features. In (3), the dependency between *ziji* and *wo* is realized by a contrastive effect of *ziji* in discourse (i.e. the contrast information is assigned by the word *hai* (originally): original thoughts vs. present thoughts) (Li, 2010). She learned that children from age 4 were sensitive to this contrastive use of *ziji*, and they predominantly accepted the long-distance dependency between *ziji* and *wo* (I).

The third effect in dependency relations of *ziji* is the phenomenon of subject-orientation:

(4) a. **米老鼠**告诉唐老鸭说**自己**站在一棵大树下面。

Milaoshui gaosu Tanglaoya shuo **ziji** zhanzai yi-ke dashu xiamian.

Mickey Mouse tell Donald Duck say self stand one-Cl big-tree under

"Mickey Mouse tells Donald Duck that he is standing underneath a big tree."

(Chien,1992: 337)

b. **男孩**给女孩一把**自己**的椅子。

Nanhai gei nvhai yi-ba **ziji** de yizi.

boy give girl one-CL self DE chair

"The boy gives the girl a self's chair."

(Li, 2010)

In (4a), the subject *Milaoshu* (Mickey Mouse) is the intentional speaker (the Source) of the sentence, highly suggestive of the idea that *ziji* is, in this construction, a logophor, which can only refer to the Source *Milaoshu* (Mickey Mouse) rather than the object *Tanglaoya* (Donald Duck). The results of Chien's (1992) study showed that Chinese children at the age of 4 to 5 allowed the subject interpretation (62% acceptance rates) as well as the object interpretation (55%), indicating that, at this age, they may not have fully grasped the use of the logophoric *ziji* in the subject-orientation construction (adults showed 91% acceptance rates for subject interpretation). In (4b), *ziji* can also be used as a logophor[87] and it can only refer to the subject *Nanhai* (the boy). Li (2010) found that, at age 4, Chinese children only showed chance-level performance in choosing the subject as the antecedent; after age 5 they began to predominantly choose the subject as the antecedent for *ziji*.

What has been illustrated above forms a brief overview of the empirical studies on Chinese children's acquisition of the logophoric uses of *ziji* in environments displaying the effects of long-distance dependency, blocking and subject orientation. In the long-distance dependency, the predictive results of existing research are sometimes in conflict with each other, that is, the performance of children older than 4 years may be either adult-like or non-adult-like. In the blocking effect construction, Chinese children in the age range of 4 to 5 appear to show adult-like performance and are sensitive to the blocking restriction. In the subject-orientation construction, children's knowledge of the logophoric uses of *ziji* may differ from adults', with only chance-level performance. Therefore, it is still unknown to what extent Chinese children are sensitive to discourse information and what the developmental path of Chinese children's knowledge of logophoricity is in different constructions.

In addition to the logophoric uses of *ziji* mentioned above, there is another construction in which reflexives can be treated as logophors. This is the construction in (5), which I call the prepositional phrase (PP) construction.

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[87] In the sentence *Nanhai gei nvhai yi-ba ziji de yizi.* (The boy gives the girl a self's chair), I treat the reflexive *ziji* as a logophor because *ziji* is not in a coargumenthood relation with its antecedent *nanhai* (boy) or *nvhai* (girl).

(5) **小兔子**把棒棒糖藏在了**自己**后面。
Xiaotuzi ba bangbangtang cang-zai le **ziji** houmian.
Little-rabbit BA lollipop hide-Prep LE self-N behind
"The little rabbit hid the lollipop behind herself."

In (5), the antecedent *Xiaotuzi* (Little-rabbit) in the PP construction carries the pivot (perspective) information of the event: *zi* (self) bridges to *Xiaotuzi* (Little-rabbit) (see details in Chapter3). The antecedent *Xiaotuzi* and *ziji* are not in a coargumenthood relation; thus, the dependency between them is established in discourse (note that by this reasoning reflexives in English and Dutch in similar PP constructions are also logophors) (Reinhart & Reuland, 1993). Acquisition research on logophoric uses of reflexives in PP constructions has been carried out with English and Dutch children (Avrutin & Cunningham,1997; Coopmans et al., 2004). For example, Coopmans et al. (2004) used a truth value judgement task to test Dutch children's acquisition of *zich* in the PP construction. The study revealed that Dutch children from 5 years old onward showed 90% accuracy rates in this type of logophoric construction. The younger group of children, ages 3 to 5[88], however, only demonstrated around 69% accuracy rates.

Aside from testing the knowledge of logophoricity of Dutch children, the experimental setup of Coopmans et al.'s (2004) study included an anaphoric use of *zich* condition as well, with the aim of seeing whether Dutch children's performance would be different in the two conditions (logophoric vs. anaphoric). The results showed that Dutch children from 3 to 5 years old (the younger group) perform significantly worse in the logophoric construction than in the anaphoric construction.

No studies have as yet been carried out examining Chinese children's acquisition of the logophoric *ziji* in the PP construction and the acquisition differences between the logophoric and anaphoric uses of *ziji*. It will be interesting to see how Chinese children perform in these two conditions, considering that Chinese is a discourse-oriented language. Therefore, in this experiment, I set out to test Chinese children's performance on both logophoric and anaphoric uses of *ziji* in order to explore the developmental path of their knowledge at the syntax-discourse interface, with the aim of seeing to what extent Chinese children are sensitive to discourse information and learning whether their performance will be different from their Dutch counterparts.

[88] The ages of the younger group range from 3.5-5.7 while those of the older group range from 5.8 to 7.9.

5.2.2 Experiment 1

In experiment 1, I tested Chinese children on building a dependency between a reflexive and its antecedent in both logophoric and anaphoric constructions, with the aim of answering the following questions:

(1) How will Chinese children behave in the logophoric and anaphoric constructions, respectively? Is there any significant difference in children's performance between the two constructions?
(2) What are the developmental paths of Chinese children's knowledge of logophoric and anaphoric uses of *ziji?*

The distinctions between logophoric and anaphoric uses of *ziji* can be predicted by the S-D-P model, which argues that the interpretation of a dependency in the linguistic module is the result of an interaction of the lexical, syntactic and discourse components. The question arises of how those components will contribute to the final interpretation of the dependencies. In other words, the weights of the contributions from different components may be different, with some contributing more and others less. English (and probably many other Indo-European languages such as Dutch), with a majority of examples showing obedience to structural constraints, relies heavily on syntax for the interpretation of dependencies. Chinese, as a discourse-oriented language may see greater contributions from discourse in establishing dependencies. As a result, the distinction between the logophoric and anaphoric uses of the reflexive in Chinese may differ from that in English and Dutch. This would be due to proportionally different contributions from the various computational components. It is also possible that Chinese children behave like their English and Dutch counterparts, as the typical syntactic structure (c-command, locality) helps to reduce processing difficulty in general and discourse, as a higher-level process, is more costly, causing a significant difference between the logophoric and anaphoric conditions.

To repeat, the goals of this experiment were: (1) to see whether Chinese children's performance will be different for logophoric versus anaphoric uses of *ziji*; (2) to detect the corresponding developmental path of Chinese children's logophoric and anaphoric uses of *ziji*; (3) to determine the general cross-linguistic differences

between Chinese children and their Dutch counterparts with respect to the relevant knowledge acquired[89].

(1) Methodology

Method

A Truth-value Judgement Task (TVJT) was adopted in this experiment. The basic idea of this method is that "it requires the child simply to make a bipolar judgement about whether a statement accurately describes a particular situation alluded to in some context or preamble" (Gordon, 1998: 211). In the TVJT paradigm, the set-up involves an experimenter, a hand-puppet (who utters the test sentences), and a child. Scenarios are presented either by pictures or toy-playing. In experiment 1, I adopted a modified version of the TVJT, with bright and colorful photoshopped electronic pictures shown on a computer screen to present the story-based scenario (details will be illustrated in the section on procedure).

This modified version of TVJT has many advantages. For example, each story is presented by a series of pictures (e.g. three in a row), which overcomes the problem of the static status of pictures. Also, in the pilot studies, I found that electronic pictures were more attractive to the Chinese children than nonelectronic ones. This enabled even the youngest group of children to focus on the story and the test sentences throughout the entire experimental process. It also improved the efficiency of testing greatly. Also, the potential confounds were carefully controlled; for example, characters in the stories had roughly equal salience; all the test sentences and fillers together provided a balance of positive (yes) and negative (no) responses. The aspect of plausible dissent was also taken into consideration by making sure that "the assertion of the test sentence (which is ultimately false) to be under consideration" is "a likely outcome at some point in the story" (Thornton, 2007, in Nakayama, Su & Huang, 2017: 23). The so-called Clever Hans effects – a situation in which the

[89] As the experimental setup testing Chinese children's knowledge of reflexives was in parallel with what has been presented in Coopmans et al.'s (2004) study on Dutch children, I will also make a general comparison between Chinese children's performance with their Dutch counterparts to determine the general cross-linguistic differences between them, with respect to the relevant knowledge acquired. In addition, although there is also a similar study conducted on English children by Avrutin & Cunningham (1997), the experimental setup was different. Therefore, I only make a general comparison between Chinese children's performance and that of their Dutch peers.

experimenter unconsciously cues the child to give the correct answer – was carefully avoided. Likewise for order effects, in which the orders of the test items are the same for different participants — was also avoided.

Participants

91 monolingual Chinese children in the age range of 3 to 6 years (M_{age} = 4.6; SD_{age} = 0.84) from a local kindergarten (Zixing kindergarten, the southeast of Hunan province where people speak Mandarin Chinese) participated in this experiment. I divided these children into three age groups (e.g. 3-4 yr, 4-5 yr and 5-6 yr), with approximately 30 children per group (group 1: M_{age} = 3.6; SD_{age}= 0.20; group 2: M_{age} = 4.5; SD_{age} = 0.23; group 3: M_{age} = 5.6; SD_{age} = 0.32). All children showed normal hearing and speech abilities and were very happy to participate in the experiment. The number of boys and girls was equally distributed. A mixed-subject design was adopted, so that each participant went through all the test conditions (within-subjects). With respect to age, one participant can be in a single age group only (between-subjects). In addition, 20 adult participants, who are from a group of first to fourth year undergraduate students (aged from 18 to 21), were recruited as a reference group in the experiment.

Materials

The stimuli included 16 test stories (8 of which contained instantiations of the logophoric uses, with 4 in a true condition and 4 in a false condition; the other half contained anaphoric uses, also with 4 true and 4 false), 19 fillers and 6 practice trials. In the logophoric condition, the reflexive *ziji* and its antecedent are not co-arguments (illustrated by examples 6 and 7). In the anaphoric condition, the reflexive *ziji* and its antecedent are co-arguments (illustrated by examples 8 and 9).

(6) *Logophoric-False*

小猪的哥哥把筷子摆在了自己面前。

Xiaozhu de **gege** ba kuaizi bai zai le **ziji** mianqian.

Little Pig DE brother BA chopsticks place prep LE self-N face-front

"The little pig's brother placed the chopsticks in front of himself."

(7) *Logophoric-True*

小象的奶奶把筷子摆在了自己面前。

Xiaoxiang de **nainai** ba kuaizi bai zai le **ziji** mianqian.

Little Elephant DE grandma BA chopsticks place prep LE self-N face-front

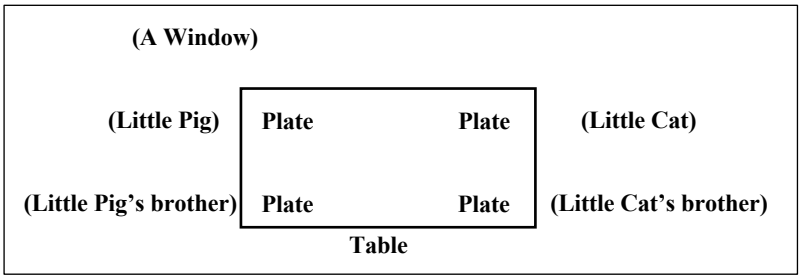
"The little elephant's grandma placed the chopsticks in front of herself."

(8) *Anaphoric-False*
小马的**爷爷**轻轻地拍了**自己**。
Xiaoma de **yeye** qingqing de pai-le **ziji**.
Little Horse DE grandpa gentle DE pat-LE self-N
"The little horse's grandpa patted himself gently."

(9) *Anaphoric-True*
小狗的**爸爸**轻轻地拍了**自己**。
Xiaogou de **baba** qingqing de pai-le **ziji**.
Little Dog DE father gentle DE pat-LE self-N
"The little dog's father patted himself gently."

The following is a demonstration of how I elicited the test condition (6), using a carefully designed story (the story is told aided by three pictures that are presented one at a time. For all the other stories of the other conditions, see Appendix B)[90]. For potential copyrights reasons, I here describe the contents of the picture with words[91]:

Pic.1



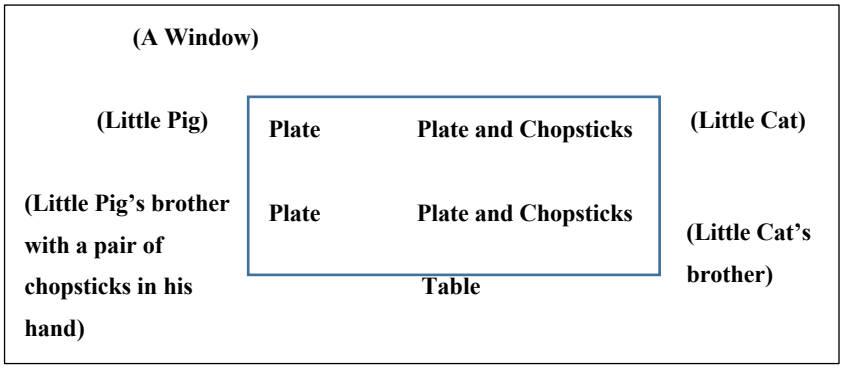
[90] Someone may wonder why there need to be four characters in the picture. The reason is that if there were only two characters in the story, let's say, Little Pig and Little Pig's brother, then the child would not need to process Little Pig at all, because there is only one brother in the picture. In other words, there would be no difference in the following two sentences:

(1) The little pig's **brother** placed the chopsticks in front of **himself.**
(2) **The brother** placed the chopsticks in front of **himself.**

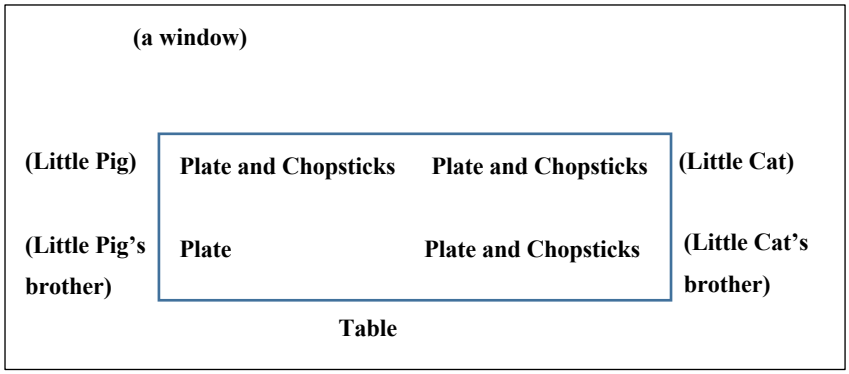
In this case, Little Pig no longer acts as a potential antecedent for the reflexive anymore, which would constitute a potential mistake in the experimental design. Also, Chinese *ziji* does not have the gender feature, so the gender of the characters would not constitute a confound in the experiment. I assign different genders to the characters in order not to confuse the children; that is, they know who the brother is and who Little Pig is.

[91] For those of you who are interested in knowing more about the experiments and those who would like to see the pictures, please contact me via emails: (1) y.xie@uu.nl; (2) idealist2021@126.com.

Pic.2



Pic.3



实验者：这是小猪，这是小猪的哥哥。这是小猫，这是小猫的哥哥。一天，他们准备吃早餐，却发现桌上没有筷子（图 1）。于是小猫和小猫的哥哥拿来了筷子摆在了面前。小猪的哥哥也去拿了一双筷子准备把筷子摆一摆。小猪想：哥哥会把筷子摆在谁面前呢？这里？还是这里（图 2）？我们来看看发生了什么（图 3）。

手偶：我来猜猜: 动物们正在摆筷子...**小猪的哥哥把筷子摆在了自己面前。**

Experimenter:

This is Little Pig; this is Little Pig's brother; this is Little Cat; this is Little Cat's brother. One day, they were going to have breakfast, but there were no chopsticks on the table (pic.1). So Little Cat and Little Cat's brother took two pairs of chopsticks and placed (them) on the table. Little Pig's brother also took a pair of chopsticks and is going to place (it) on the table. Little Pig wondered, "In front of whom will my brother place the chopsticks? Here or there?" (pic.2). Let's see what happened (pic.3).

Handpuppet:

Let me guess. Little animals were placing chopsticks. **Little Pig's brother placed the chopsticks in front of ziji.**

As shown in the third picture, the brother placed the chopsticks in front of Little Pig. This is clearly False (test sentence (6): the little pig's brother placed the chopsticks in front of himself).

The other three examples show the other three conditions, respectively: In the logophoric-true condition (example 7) the agent placed the chopsticks in front of herself-True. In example (8), the event visually displayed is that the grandpa patted Little Horse, making the verbal description presented False (the grandpa is not doing it to himself). In the True counterpart condition the action is directed at himself (example 9). In total, there are 2 (logophoric/anaphoric) *2 (True/False) conditions. The experimental setup with these 4 conditions invited the children to either approve or disapprove of the hand-puppet's guesses.

Procedures

The whole experiment was divided into three sessions. For each session, an experimenter (a hand-puppet acted out by a student assistant) and a child sat next to each other, playing the *guessing game*: the experimenter told a set of stories to the child, aided by pictures on the computer screen and, at the end of the stories, there was a specific scenario for the puppet to make a guess about, which the hand-puppet would do by uttering the test sentences for the child to judge as correct or incorrect descriptions of the outcome. The children could directly say yes or no to the puppet's guessing. Alternatively, a very shy child could respond by using gestures, such as touching the hand-puppet's head ("reward") or patting the hand-puppet's hand gently ("punishment"). Before the actual testing, there were three practice trials for the child to familiarize herself with the game and also to see whether the child could make judgements or not (that is, saying yes/no or responding in another way). The data of those who passed the three practice trials were collected in the final data analysis. Of those who failed in the practice session or during the testing, the data were excluded. The experiment was conducted in a specific classroom in a local kindergarten. Testing environments were quiet with simple but cozy decorations to avoid potential distractions, and at the same time to make the child feel comfortable.

Coding

Coding was done during the testing. The experimenter and the hand-puppet (student assistant) wrote down the child's answers immediately during the experiment and for any inconsistencies between the experimenter and the student assistant, a double-

check was performed using video/audio recordings after the testing. The student assistant was a BA graduate.

(2) Results

Children's accuracy rates in the logophoric and anaphoric conditions

In this experiment, Chinese children made no mistakes in the filler conditions, so I will present here only their accuracy rates in the four experimental conditions:[92]

Table 5. 2 Chinese children's accuracy rates: anaphoric and logophoric uses of *ziji*

	Anaphoric (%)		Logophoric (%)	
Age Group	True	False	True	False
group1 (3-to-4)	82.50	76.67	80.83	83.33
group2 (4-to-5)	95.83	90.83	97.50	94.17
group3 (5-to-6)	98.39	99.19	94.35	97.58
all children	92.24	88.89	90.89	91.69
adults	98.75	98.75	100	100

Note: Number of participants: Group1: N=30; Group2: N=30; Group3: N=31; Adults: N=20

As can be seen in Table 5.2, Chinese children from 4 years old onwards showed very high accuracy rates in all conditions (above 90%, ceiling effect). Among all of these figures, the lowest one (76.67%) demonstrated by the youngest age group is still high. However, we cannot directly draw a conclusion arguing that Chinese children at age 3 are able to build a logophoric/anaphoric bridge, because the accuracy rates shown above are the experimental results on the basis of raw data, which cannot be

[92] As I mentioned in the methodology section, in the anaphoric construction, there are 8 test items in total, 4 of which are in the true condition and 4 are in the false condition. The number of children (participants) for each age group is 30 (group1), 30 (group2), and 31 (group 3), respectively. The accuracy rates are calculated on the raw data. Taking the percentage 82.5% (group1-anaphoric-true) as an example: the total number of children's answers is 120: 30 (the number of children)* 4 (anaphoric-true test items) = 120. Among the 120 answers, 99 of them were correct and 21 of them were incorrect. Therefore, the accuracy rate for this condition is 99/120 = 0.825. The rest of the percentages in the other conditions were calculated in a similar way.

generalized to apply to the whole population without statistical analysis. In order to know whether or not children at different ages really have grasped the knowledge of reflexives (i.e. whether they perform above chance level), we need a statistical model to analyze the relevant evidence and come to a conclusion.

Also, as the main goals of this experiment are to find out whether there are any significant differences between the logophoric and anaphoric uses of *ziji* in Chinese children's performance as well as to explore developmental paths toward knowledge of these two uses of *ziji*, a systematic statistical analysis needs to be carried out. In other words, we cannot draw any conclusion simply by looking at the raw data presented in Table 5.2. I, therefore, will further illustrate the results using statistical models in the following sections.

The difference between the logophoric and anaphoric conditions

A generalized linear mixed-effect model (GLMM) with *glmer* function in *lme4* package in R (Bates et al., 2014) was adopted to analyze the data of children's performance in experiment 1. GLMM is a model that is used to analyze data for which the dependent variable is binomial. The dependent variable is *correctness* (the child's response), which is marked by 1 (correct) or 0 (incorrect). The potential explanatory variables (i.e. factors that are expected to have a predictive influence on the data) such as *agegroup* (group1/2/3), *condition* (True/False), and *reflexive* (logophoric /anaphoric) are added one step at a time through a model search process in order to select the best model through a likelihood-ratio test (i.e. model comparison: to test whether or not there is a significant improvement of the model-fit to the data by adding these factors). In the model search process, some of the potential explanatory variables may be discarded if they do not contribute to the model fit (the data). The goal is to keep only the explanatory variables that can significantly predict the variation in the dependent variable. In addition, random intercepts are modeled for *childnumber (ID)* and *items* to account for correlation between observations within subjects and test items, as random effect refers to "something that can be expected to have a non-systemic, idiosyncratic, unpredictable or random influence on your data" (Winter, 2013: 39). It is possible that some children consistently performed better than other children (i.e. variability of children); it is also very likely that children in general were good at some specific items and were bad at others (i.e. the variability of items). In order to take such variability into account, I adopt the random intercept model to generalize over variability of subject (childnumber) and variability of items. The advantage of such a model is that there is no need to "average over subjects for an

item analysis," or "average over items for a subject analysis" (Winter, 2013: 25). Table 5.3 shows the model search process step by step:

Table 5. 3 Models predicting children's response in experiment 1

	Comparison			
Models	model pairs	$\Delta\chi^2$	Δdf	*p*
M0 (base model: including random intercepts for *childnumber* and *items*)				
M1(M0+agegroup)	0 vs.1	41.658	2	<.001***
M2 (M1+reflexive)	1 vs.2	0.127	1	.721
M3 (M1+agegroup:reflexive)	1 vs.3	6.197	3	.102
M4 (M1+condition)	1 vs.4	0.801	1	.370
M5 (M1+condition:reflexive)	1 vs.5	3.087	3	.378
M6 (M1+agegroup:condition)	1 vs.6	6.892	3	.075
M7 (M1+agegroup*condition*reflexive)	1 vs.7	14.632	7	.101

(*Note*: $\Delta\chi^2$ represents the change of chi-square; Δdf represents the change of degrees of freedom; M1-M7: Model 1-Model7)

As can be seen from Table 5.3, it is only the variable *agegroup* that significantly improves the model fit ($\chi^2(2) = 41.658$, $p < .001$). All the other explanatory variables (i.e. *reflexive*, *condition*), do not, nor do the interactions between them improve the model fit. The problem is that the variable *reflexive* that I would have liked to further explore in the model search process has turned out to be a factor that does not explain the variation of the dependent variable: adding the factor *reflexive* in one form or other does not significantly improve the model fit. There is no evidence showing that there is a difference between the two categories of reflexive. Such a result is different from a parallel study (same methods, almost equal participants, etc.) conducted on Dutch speaking children by Coopmans, et al., (2004), in which the youngest age group showed a significant difference between the logophoric and anaphoric conditions.[93]

[93] The results of Coopmans et al. (2004)'s experiment is based on a t-test (p = .004). The accuracy rates in each condition can be seen in Appendix A.

How children's knowledge of reflexives develops: the effect of age group

From the above model search process, it can be seen that the best model is M1, with the factor *agegroup* having a significant contribution to the model fit. The fixed and random effects of M1 are shown as follows:

Table 5. 4 Estimated parameters of fixed and random effects: agegroup

	estimates	*SE*	z	*p*
fixed effects				
Intercept [94]	1.650	0.234	7.062	<.001***
agegroup, group2	1.729	0.373	4.636	<.001***
agegroup, group3	2.354	0.407	5.791	<.001***
random effects				
childnumber	0.844	0.919		
item	0.652	0.255		

Note: *** $p < .001$

It can be seen from Table 5.4 that the explanatory variable *agegroup* has an effect on the dependent variable. Group 2 performed significantly better than group 1 (estimate = 1.729, SE = 0.373, p <.001); group 3 also performed significantly better than group 1 (estimate = 2.354, SE = 0.407, p <.001). The difference between group 2 and group 3 cannot be seen from the table because the reference level is group 1. I therefore further adopted a Tukey post-hoc test among the three groups by using glht() in the Multcomp package (Hothorn, Bretz, & Westfall, 2008) in R in order to see the difference between group 2 and group 3 (note: changing the reference level will increase the chance of a Type I error, so here I use the Tukey post-hoc test). The result showed that the difference between group 3 and group 2 is not significant (estimate = 0.625, SE = 0.446, p = .339). Plotting M1, the graph is shown as follows:

[94] Intercept shows the result of group 1 (the reference level).

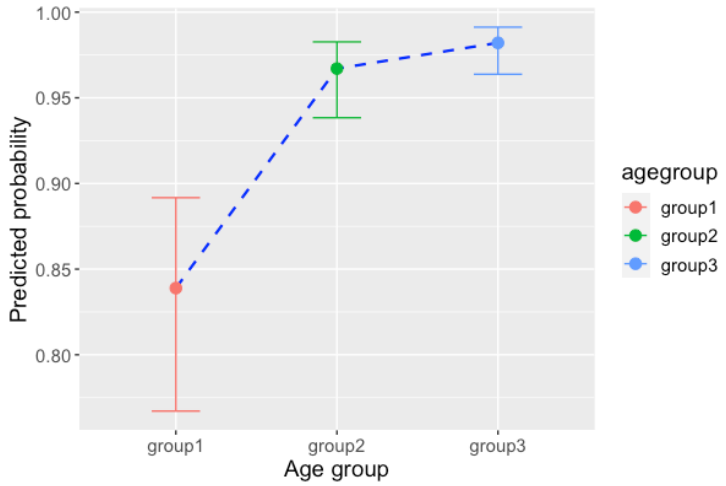


Figure 5. 1 The predicted probability of correctness for each age group in experiment 1

In Figure 5.1, the slope of the line from group 1 to group 2 is steeper than that from group 2 to group 3 (i.e. the accuracy rates of the three age groups are different from each other), suggesting that children's knowledge of reflexives develops faster in the former group-gap (i.e. from group 1 to group 2) than in the latter. Statistical analysis also confirmed this developmental trend: the difference between the overall performance of group 1 and group 2 was significant ($p < .001$, shown in Table 5.4) but not significant between group 2 and group 3 ($p = .339$, shown in Table 5.4).

The predicted probabilities of correctness for all three age groups are above 0.7, with group 1 at 95% CI [.767, .892], group 2 at 95% CI: [.938,.983], and group 3 at 95% CI: [.964, .991]. They were all above chance level[95], indicating that Chinese children already begin to know how to build logophoric and anaphoric bridges between *ziji* and its antecedent from around 3 years old. Nevertheless, their accuracy

[95] 95% CI means that we can be 95% confident that a range of values (i.e. an interval) will contain a true parameter of the population (error rate: 5%). If such an interval is above .50, statistically we can safely say that such a value is above chance level. In addition, the calculation of CI is by means of the statistical package emmeans () in R (Searle, Speed, and Milliken, 1980).

rates were still relatively low, and it is not until 4 years old that such knowledge reaches ceiling-level.

(3) Discussion

There were two major findings in the experimental study presented here: (1) Chinese children's knowledge of the logophoric and anaphoric uses of *ziji* in the test constructions was equally good, and a significant difference between the two conditions has not been detected. (2) Age had an effect on responses. The 3-to-6-year-old children demonstrated a gradually upward trend in their ability to build a dependency between a reflexive (either a logophor or an anaphor) and its antecedent, with the difference between group 1 and group 2 being significant, while that between group 2 and group 3 was insignificant.

The first finding (that there is no evidence of a difference between the logophoric and anaphoric conditions in children's performance)[96] can be accounted for by the S-D-P model. The central idea of the S-D-P model is that the interpretation of a dependency involves two modules — linguistic and non-linguistic. The linguistic module is composed of linguistic components on different levels (lexicons, syntactic structures, discourse). Each of the components will have its own contribution to the final interpretation of a dependency relation. Languages that rely heavily on hierarchical syntactic structures may see a greater contribution from the syntactic component, while those that are discourse-oriented may rely more heavily on the discourse component. It is known that the Chinese reflexive *ziji* has a large amount of logophoric uses, as it can occur in different syntactic positions (for example as subject, object, adjunct), violating syntactic constraints such as c-command and locality), and it can also refer to an antecedent that is across sentences or sentence-free (the speaker/addressee). Chinese children, therefore, are also frequently exposed to input involving the logophoric *ziji.* Such frequent exposure to the logophoric uses of *ziji* provides more opportunities for them to implement interpretation on discourse directly without resorting to some syntactic constraints (i.e. locality, c-command) and makes them more attuned to the discourse. As a result, the processing of building a dependency between the logophoric *ziji* and its antecedent is relatively easy for

[96] No evidence showing a significant difference between the logophoric and anaphoric conditions means that the null hypothesis cannot be rejected. In other words, we do not know whether there is any significant difference between the two conditions due to the lack of statistical evidence.

Chinese children. Therefore, Chinese children at all age groups showed good performance in the logophoric uses of *ziji*. Such an early grasp of the knowledge of logophoricity was consistent with previous similar studies in the exploration of Chinese children's uses of the logophoric *ziji* in constructions displaying the blocking effect (Li, 2010) or long-distance dependencies (Chien, Wexler & Chang 1993).

On the other hand, the interpretation of the dependency established between the anaphoric *ziji* and its antecedent comes from the hierarchical structure of language, that is: syntactic constraints, which are automatic and innate. Hence, the processing of them is not that resource-demanding, either. Consequently, Chinese children showed good performance in these constructions too.

Similarly, Dutch children have also demonstrated good performance in anaphoric constructions, these constructions requiring relatively less use of resources. However, their performance in logophoric constructions was much poorer than in anaphoric constructions. The reason may lie in the fact that Dutch children probably do not get as much input from discourse as their Chinese counterparts. Instead, their interpretation of a dependency comes more from the syntactic component (e.g. the hierarchical structure of a language). Therefore, the youngest age group (3.5-5.7yr) in Coopmans et al.'s study (2004) showed a significantly poorer performance in the logophoric construction than in the anaphoric one.

The gradual developmental path of the logophoric and anaphoric use of *ziji* in Chinese children can be explained by the nonlinguistic module (e.g. processing resources) of the S-D-P model. Such a gradual developmental pattern indicates that the processing resources (e.g. working memory, attention) that children can utilize increase greatly from group 1 (3-to-4 years old) to group 2 (4-to-5 years old), but not so much from group 2 (4-to-5 years old) to group 3 (5-to-6 years old)[97], suggesting that, at age 4 to 5 (group 2), there is an important stage or turning point in language development. It is possible that children after 4-to-5 years old have more processing resources than younger children. Notice that children in group 1 already showed good performance in all the experimental conditions, so the significant difference in performance between group 2 and group 1 does not arise from the relevant linguistic knowledge (even children at age 3 to 4 showed above chance-level performance), but from the gradual development of general cognitive abilities.

[97] The difference in children's overall performance is significant between group 1 and group 2 but insignificant between group 2 and group 3.

Another central idea of the S-D-P model is the file card system and the generalization of DPRD and UID (see details in Chapter 4, section 4.3 and 4.4), which can also be used to explain the results of experiment 1. According to DPRD and UID, a relatively weak dependent file card should be connected with a relatively strong card, or a dependent file card of high information should link to an antecedent card of low information. A dependent file card triggered by the logophoric *ziji* is stronger than a card triggered by the anaphoric *ziji* (see details in Chapter 4, section 4.5.1(2)), so the antecedent card of the logophoric *ziji* is weaker than that of the anaphoric *ziji*, meaning that the activation level of the antecedent of logophoric *ziji* is lower. Following this logic, it is predicted that children's performance would be worse in the logophoric construction than in the anaphoric construction. The results of Dutch children's performance (in their interpretations of *zich*) confirmed this prediction. The results of the Chinese children in the experiment described here suggest that their performance displays violation of DPRD and UID, since there is no difference between the logophoric and anaphoric uses of *ziji*. I would like to suggest that Chinese still obeys the two generalizations. The non-significant difference is masked by the fact that the Chinese children already know the use of *ziji* in both constructions very well (almost ceiling effect). This is the same for the older age groups of Dutch children, who show no significant differences between logophoric and anaphoric condition, either.

Finally, the potential problem of linearity[98] needs to be explained. Notice that the word order of the Dutch test sentences and Chinese test sentences were not exactly the same. Compare: *de vader van Rose wast zich* (the father of Rose washes himself) with Chinese *Luosi de baba pai-le ziji.* (Rose's father patted himself). In Chinese, only one word order is allowed — a centripetal structure, putting *ziji* linearly closer to the correct antecedent *baba* (father) in both conditions. It is possible that Chinese children always preferred the closer antecedent because of linearity. However, previous empirical studies have shown that children can easily choose the distant one as the antecedent of *ziji*. For example, in the long-distance dependency construction, Chinese children can link *ziji* with the distant antecedent, with percentages ranging from 29% to 50% (e.g. Chien, Wexler & Chang, 1993; He, 2009; Li, 2010). This provides empirical support for the idea that children were not always obeying linearity but instead followed the hierarchical structure of language.

[98] In Chinese, the reflexive *ziji* is always linearly closer to the correct antecedent, see examples (6-9) in the methodology part in section 5.2.2.

5.3 Chinese Children's Acquisition of the Dependency between a Definite DP and its Antecedent

5.3.1 Previous child language acquisition studies on *bridging*

The second type of dependency established between a definite DP and its antecedent is known as associative anaphora or bridging, referring to a discourse operation that allows speakers to use a definite DP without previous mention of a corresponding indefinite (e.g. in the sequence "*A ship* is on the river. *The flag* is blue.", *the flag* can be bridged to *a ship*). Children's ability to build such bridges has chiefly been explored in Dutch, English and Russian (Avrutin & Coopmans, 2000; Van Hout, De Ree & De Ree, 2007). The results from those experiments showed that Dutch and Russian children were not yet able to successfully build that kind of bridge at age 3. It was only after the age of 4 that they began to demonstrate the ability to perform the bridging operation. For example, Avrutin & Coopmans (2000) conducted bridging experiments to see whether Dutch- and Russian-speaking children from 3.5 to 6.6 years of age know how to build such bridges. Their results showed that both Dutch-speaking and Russian-speaking children were able to successfully build such bridges from 4 years old onwards (e.g. Dutch children's overall performance: accuracy rate >80.9%; Russian children's overall performance: 87.9%). Yet, at a younger age children only showed chance level performance in some test conditions (with Dutch: 46% accuracy rate; Russian: 52% accuracy rate in the crucial false condition). Van Hout, De Ree & De Ree (2007) did a similar bridging experiment testing the bridging abilities of Dutch preschoolers with a mean age of 4.9 years old and found that they tended to mistakenly bridge a definite DP to an unmentioned incorrect indefinite one with error rates around 33%.

It can be seen from these studies that younger children tended to make more mistakes than the older ones, who showed very high accuracy rates in bridging tasks. The mistakes that very young children make in such bridging experiments have usually been explained as resulting from their inability to appreciate the addressee's perspective (Van Hout, De Ree & De Ree, 2007). These researchers have argued that children's comprehension system is unidirectional while adults comprehend bidirectionally, and for children, a definite DP can be used independently of whether or not it has been previously mentioned. In other words, children's comprehension of definite DPs is from their own perspective. Furthermore, children usually have a wider

implicit common ground than adults. Especially younger ones, who have a tendency to assume that what they see or know is also seen or known by the adults, known as the Concept of Non-Shared Assumption (Schaeffer & Matthewson, 2005). Nevertheless, this pragmatic perspective-entertaining explanation has been refuted by De Cat (2013), who argued that children's misuse/misinterpretation of definite DPs was not because they were unable to take the perspective of the addressee but because they could not correctly evaluate the information status of the definite DPs and over-evaluate the cognitive state of the addressee. According to De Cat (2013), definite DPs are cognitive markers with different information status. Definite DPs are high cognitive markers with a very high amount of information that young children are incapable of dealing with. This cognitive-deficit view is consistent with the conclusion drawn by Avrutin & Coopmans (2000), who ascribed children's mistakes to a lack of processing resources.

The plausibility of these accounts may gain further support by evidence from non-Indo-European languages. To my knowledge, Mandarin Chinese children's ability to build bridges has not yet been explored. This language presents an interesting case-study due to the absence of a morphological instantiation of definiteness. Chinese does not have overt articles, by which the properties of definiteness can be expressed, and instead uses word order (i.e. preverbal position). Considering the nature of bridging as occurring at the syntax-discourse interface and the crosslinguistic morphosyntactic differences of definite DPs, it is worthwhile to explore how Chinese children build a bridge between a definite DP and its antecedent.

In addition to the properties of the definite DP, the bridging process is also affected by the characteristics of the antecedent (i.e. the indefinite DP discussed in this dissertation). Existing acquisition studies have shown that the more prominent an antecedent is, the higher accuracy rates the child can attain in bridging tasks (Avrutin & Coopmans, 2000). In other words, the discourse prominence of the antecedent indefinite DP will influence the final bridging process. One way to measure the discourse prominence of an indefinite DP is its specificity (see details in Chapter 2). Avrutin & Coopmans (2000) tested Dutch-speaking children aged 3 to 4 years old to see whether the specificity of an indefinite DP would affect bridging. The accuracy rates of the Dutch children's responses increased from 46% (nonspecific) to 87.1% (specific) in the relevant test condition, demonstrating that children are sensitive to specificity. Their low accuracy rates in the nonspecific construction have been explained as a lack of processing resources, such as limited working memory capacity, attention, etc. (Avrutin & Coopmans, 2000). If that hypothesis is correct, then the

general expectation is that Chinese children's performance will also improve in the specific construction compared to the nonspecific condition simply because relatively fewer processing resources are required in the specific constructions.

The encoding of the specificity of indefinite DPs varies from language to language. For instance, the specificity of an indefinite DP is regulated by word order in Russian (Brun, 2001) while it is encoded by lexical devices such as the numeral *yi* (one) in Chinese (e.g. Chen, 2004; Cheng & Sybesma, 1999, see details in Chapter 2). In Chinese, the more lexical markers an indefinite DP has, the higher the likelihood that it will get a specific interpretation. Considering the crosslinguistic differences between Chinese and English/Dutch alongside the hypothesis of processing resources, it would be interesting to explore whether or not specificity facilitates bridging for Chinese children. This was the reason for conducting experiment 2.

5.3.2 Experiment 2

In this experiment, I tested whether Chinese children can build a bridge between a definite DP and its antecedent, and how they perform in the following two types of constructions: specific (i.e. the antecedent is a specific indefinite DP) and nonspecific (i.e. the antecedent is a nonspecific indefinite DP). With this experiment, I aimed to answer the following questions:

(1) How will Chinese children behave in the nonspecific and specific constructions in the bridging tasks? Are there any significant differences between children's performance in the specific and nonspecific constructions?
(2) What is developmental path of Chinese children's ability to perform the bridging operation?

According to the S-D-P model, to successfully build a bridge between a definite DP and its antecedent, knowledge from both the linguistic and nonlinguistic modules are required. That is, children should not only have the relevant morphosyntactic-lexical knowledge of the definite DP and its antecedent respectively and the hidden semantic connections between them but also have sufficient processing resources to implement it. For instance, in a bridging relation such as *I bought a pair of pants. The pockets are red,* they should know the semantic connection between *pockets* and *pants*, — *pockets* are potential components of *pants*. They should also have sufficient

processing resources to implement such knowledge (e.g. a relatively good working memory, attention, the cognitive ability to monitor the speakers' intentions) [99]. Following this logic, I first conducted a bridging experiment on Chinese children at different age groups to see at what age and how well they would be able to build such bridges. After that, I further tested how they would behave in specific and nonspecific constructions.

The developmental path of Chinese children's ability to perform the bridging operation, however, may generally differ from that of their Dutch counterparts due to the morphosyntactic differences in the encoding of definiteness and specificity. According to the S-D-P model (because it incorporates DPDD/UID), a definite DP file card in Chinese is very weak (i.e. high information) due to the absence of the overt, phonological realization of the definite marker. Correspondingly, the antecedent card of the definite DP card should be strong (low information). Therefore, activation of the antecedent is high, making it highly accessible to the definite DP, and allowing for a dependency between them. The expectation is that Chinese children's performance will generally be better than that of their Dutch counterparts, given that all the other conditions are the same.

(1) Methodology

Method

A Truth-value Judgement Task (TVJT) was adopted in this experiment.

Participants

[99] Avrutin & Coopmans (2000) argued that younger children's inability to build a bridge between a definite DP and an indefinite DP is due to a lack of processing resources rather than the absence of specific linguistic knowledge. They provided experimental evidence for this hypothesis by testing English, Dutch, and Russian children's performance in specific and nonspecific constructions and found that younger children made many mistakes in the nonspecific construction while their error rates dropped dramatically in the specific construction, meaning that the children indeed knew the linguistic connection between *pants* and *pockets*. If they did not have the relevant morphosyntactic and lexical knowledge of *pant-pockets*, they would not be expected to show an improvement in the specific condition because the morphosyntactic and lexical connection between *pants* and *pockets* does not change. It is a lack of processing resources that causes them to make more mistakes in the nonspecific construction in which the antecedent is not prominent enough and more processing resources are needed. If the hypothesis of processing resources holds, Chinese children should also show an improvement in the specific condition in comparison with the nonspecific one.

The participants were exactly the same children who participated in experiment 1. 91 monolingual Chinese children, aged from 3 to 6 years old, from a local kindergarten participated in this experiment. Adult participants (for the control group) were also the same as those in experiment 1.

Materials

The materials included 16 test pictures, 18 fillers and 3 practice trials. Of the 16 test sentences, 8 included "specific" constructions, which were further divided into two conditions (true and false), consisting of 4 true and 4 false test sentences; the other half provided the "nonspecific" constructions, which also consisted of 4 true and 4 false[100]:

(10) Nonspecific-True
有辆自行车在操场上。轮胎是绿色的。
You liang zixingche zai caochang shang. Luntai shi lvse de.
Have Cl bike prep playground on. Tire COP green DE.
"There is a bike on the playground. The tires are green."

(11) Nonspecific-False
有辆汽车在马路上。门是黄色的。
You liang qiche zai malu shang. Men shi huangse de.
Have Cl bus Prep road on. Door COP yellow DE
"There is a bus on the road. The door is yellow."

(12) Specific-True
有这样一辆汽车在马路上。门是黄色的。
You zheyang yi-liang qiche zai malu shang. Men shi huangse de.
Have this one Cl bus Prep road on. Door COP yellow DE
"There is this bus on the road. The door is yellow."

(13) Specific-False
有这样一辆自行车在草地上。轮胎是蓝色的。
You zheyang yi-liang zixingche zai caodi shang. Luntai shi lanse de.
Have this one Cl bike prep grassland on. Tire COP blue DE.
"There is this bike on the playground. The tires are blue."

[100] The test items used in the specific and nonspecific conditions were controlled (i.e. a bike versus this bike); that is, the difference between specific and nonspecific condition resides only in the the presence of the lexical markers *zheyang* (this) and *yi* (one). Also, to avoid the effect of familiarity, I swapped the items in true/false condition and changed the arrangements of the items in the test pictures, see details in Appendix B.

In each condition, the test pictures used contain two indefinite DPs which could, in principle, function as antecedents, one of which would enter into a proper form of bridging. Examples (10) and (11) are instances of the nonspecific construction. In example (10), there would be two types of tires, one is a pair of green tires on a bike, so sentence (10) represents a True condition because the tires of the bike are indeed green; the other is a pair of non-green tires on a truck. In the image for sentence (11), there are two doors. The bus has a green door and the house has a non-green door, so the sentence (11) is an instance of the False condition because the door of the bus is not yellow but green. Examples (12) and (13) are the specific constructions. The same mechanism applies to examples (12) and (13), one being True and the other False. Each picture was presented to the participants one at a time. This set-up was similar to the one in the Avrutin & Coopmans' (2000) study. Examples of the stimuli for (10) and (11) are presented here (see also Appendix B)[101]:

Sentence (10)-True: The tires of the bike are green.

实验者：这是操场。操场上有卡车，还有自行车。胖胖，你能猜猜我们能看见什么吗?
手偶：我来猜猜: *自行车, 卡车*...**有辆自行车在操场上，轮胎是绿色的。**
Experimenter: Look, this is a playground. On the playground are a truck and a bike. Pangpang, could you guess what we can see?
Handpuppet: Let me guess. Bike, truck…**There is a bike on the playground. The tires are green.**

Sentence (11)- False: The door of the bus is yellow.

实验者：你看，这是马路，马路上有房子，路灯，车子。胖胖，你能猜猜我们能看见什么吗?
手偶：我来猜猜: *汽车, 房子*...**有辆汽车在马路上，门是黄色的。**
Experimenter: Look, this is the road. On the road are a house, a streetlight, and a bus. Pangpang, could you guess what we can see?
Handpuppet: Let me guess. Bus, house… **There is a bus on the road. The door is yellow.**

[101] The test pictures presented here were hand-drawn by Shuai Zhou.

Procedures and Coding were the same as those used for experiment 1.

(2) Results

The accuracy rates of children's performance in the nonspecific and specific conditions

The following table shows the accuracy rates of Chinese children's responses in the four experimental conditions on the basis of the raw data[102]:

Table 5. 5 Accuracy rates of Chinese children's performance across conditions: nonspecific / specific

	Nonspecific(%)		Specific(%)	
	True	False	True	False
group1(3-to-4)	75.83	63.33	77.50	71.67
group2(4-to-5)	89.17	84.17	92.50	90.83
group3(5-to-6)	92.74	83.87	95.97	95.16
all children	85.91	77.12	88.65	85.88
Adults	98.75	92.50	100	100

Note: Number of participants: Group1: 30; Group2: 30; Group3: 31; Adults: 20

As is shown in Table 5.5, children from 4 years old demonstrated very high accuracy rates in all conditions (> 84%). However, the youngest group's performance was not as good as that of the older groups, with a very low accuracy rate in the nonspecific-false condition (63.33%). On the other hand, it is higher than the corresponding Dutch children in the (parallel) study conducted by Avrutin & Coopmans (2000), in which their accuracy rates were 46% (see the specific accuracy rates in all the other conditions in Appendix A and see details in their paper). However, such a comparison is not very informative without further statistical analysis. Here

[102] The calculation of the accuracy rates is similar to what was shown for experiment 1. In the bridging experiment there are also 16 test sentences in total. The number of children (participants) is the same as in experiment 1. Accuracy rates are calculated using raw data. Taking the percentage 75.83% (group1-nonspecific-true) as an example. The total number of children's answers is 120: 30 (the number of children)* 4 (nonspecific-true). Of the 120 answers, 91 were correct and 29 were incorrect. Therefore, the accuracy rate for this condition is 91/120=0.7583.

what I would like to know is whether or not Chinese children's (especially the youngest ones) average performance in each of the four experimental conditions was statistically above chance-level or not (especially in the nonspecific-false condition because that percentage is the lowest and it is very close to 50%).

The effect of specificity, condition, and age-group

Similar to experiment 1, the GLMM (generalized linear mixed model) and the *glmer* function in lme4 package (Bates et al., 2014) was used in R to analyze the data. Fixed effects of the variables *agegroup*, *specificity*, *condition* and their two-way or three-way interactions were added one step at a time in order to determine the best model. Using the likelihood-ratio test, *childnumber* and *item* are treated as factors that have a random influence on the data. This is shown in the following table:

Table 5. 6 Models predicting children's performance in experiment 2

	Comparison			
Models	model pairs	$\Delta\chi^2$	Δdf	*p*
M0(base model: including random intercepts for *childnumber* and *items*)				
M1(M0+agegroup)	0 vs.1	40.378	2	<.001***
M2 (M1+specificity)	1 vs.2	10.635	1	.001**
M3 (M2+agegroup:specificity)	2 vs.3	3.821	2	.148
M4 (M2+condition)	2 vs.4	9.792	1	.002**
M5 (M4+condition:specificity)	4 vs.5	0.253	1	.615
M6 (M4+agegroup:condition)	4 vs.6	0.499	2	.779
M7 (M4+agegroup*condition*specificity)	4 vs.7	4.548	7	.715

(note: $\Delta\chi^2$ represents the change of chi-square; Δdf represents the change of degrees of freedom; M1-M7: Model 1-Model7)

It can be seen from Table 5.6 that adding the variable *agegroup* (χ^2 = 40.378, *p* <.001), *specificity* (χ^2=10.635, p=.001) and *condition* (χ^2 = 9.792, *p* = .002) significantly contributes to the model fit. The two-way interactions (specificity*condition, agegroup*specificity, condition*agegroup) or the three-way interactions (specificity*agegroup*condition) among these variables, however, do not

improve the model fit. The best model therefore is M4. The following table shows the parameter estimates of M4:

Table 5. 7 Estimated parameters of fixed and random effects of M4

	estimate	*SE*	z	*p*
fixed effects				
Intercept	0.588	0.243	2.418	.016*
specificity,specific	0.494	0.156	3.162	.002**
agegroup, group2	1.297	0.249	5.209	<.001***
agegroup, group3	1.631	0.259	6.307	<.001***
condition,TRUE	0.494	0.156	3.162	.002**
random effects				
childnumber	0.386	0.621		
item	0.194	0.440		

Table 5.7 shows that the predictors *agegroup*, *specificity* and *condition* each have a main effect on children's responses. First, there is a significant difference between the specific condition and the nonspecific condition (estimate = 0.494, SE = 0.156, p = .002). Second, the differences between *group2-group1* and *group3-group1* were also significant (*group2-group1:* p < .001; *group3-group1:* p <.001). Further post-hoc analysis[103] shows that the difference in *group 3-group 2* is insignificant (estimate=0.334, SE=0.277, p = .45). Third, children's performance in the True condition significantly differs from that in the False condition (estimate=0.494, SE=0.156, p = .002). Since there is no two- or three-way interaction among the factors of *agegroup*, *condition*, and *specificity*, I present here only the main effects of *specificity*, *agegroup*, and *condition*, plotting them in their respective graphs:

[103] Analysis of the difference between group2-group3 was made through a posthoc test using the glht function in the multcomp package (Hothorn, Bretz, & Westfall, 2008), as was shown for experiment1.

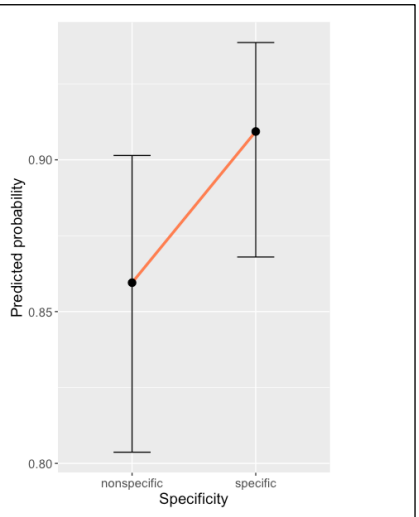


Figure 5. 2 Main effect of specificity

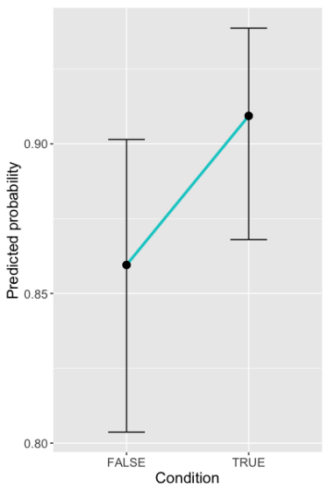


Figure 5. 3 Main effect of condition

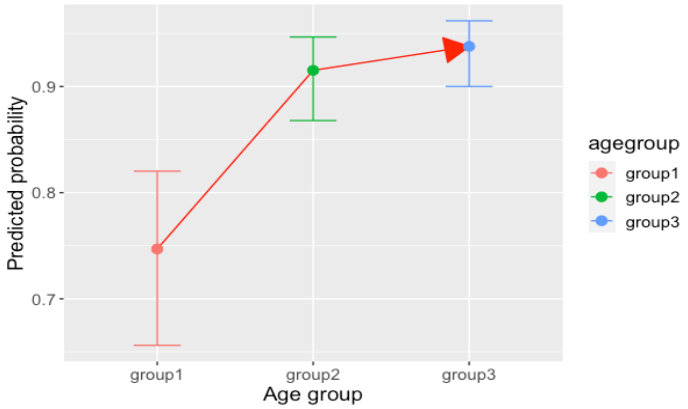


Figure 5. 4 The predicated probability of correctness for each age group in experiment 2

Figure 5.2 shows the predicted probability of correctness in the nonspecific as well as the specific condition. It can be seen that children performed significantly better in the specific condition (95% CI [.868, 939]) than in the nonspecific condition

(95% CI [.804, .901])[104], which means that specificity indeed facilitates bridging. Figure 5.3 displays the predicted probability of correctness for the true and false conditions, in which children performed significantly better in the true condition (95% CI [.868, .939]) than in the false condition (95% CI [.804, .901]), indicating that their performance may have contained some degree of guessing (they may resort to the yes-response in both the true and false condition when they do not know the answer and, as a result, the accuracy rate in the true condition is higher than the false condition). However, it may also simply mean that the false condition is more difficult to process than the true condition. Figure 5.4 indicates the predicted probability of correctness for the three age groups: group1 (95% CI [.656, .820]), group 2 (95% CI [.868, .947]), group3 (95% CI [.900, .962]), which means that children's ability to engage in the bridging process is greatly enhanced from group 1 to group 2 but slower from group 2 to group 3 (probably because their performance already reached ceiling effect after age 4). Notice also that all of these figures are above chance level [.50], which means that even the youngest children already have the ability to successfully build a bridge between a definite DP and its antecedent.

As was presented in Table 5.6, the youngest children showed a relatively low accuracy rate in the nonspecific-false condition (63.33%), and I would like to explore whether their performance in this condition was above chance-level. However, the statistical results presented in the tables above indicate that such a question has no answer, because there is no interaction effect among the three variables *agegroup*, *specificity*, and *condition*. Therefore, it is impossible to determine the results of this particular interaction effect. What can be determined from the statistical analysis are the main effects of *agegroup*, *specificity*, and *condition* respectively; that is, the overall performance for each group, the overall performance for each specificity condition, and the overall performance in the true/false condition. In that sense, I can say that, on the basis of the raw data, the accuracy rate in the nonspecific-false condition for Chinese children (63.33%) at the youngest age group is higher than the performance of Dutch children (46%)[105], given that I designed this study in a way parallel to that of Avrutin & Coopmans (2000).

[104] Statistical parameters such as estimates, SE, z, and p-value were mentioned in the previous sections immediately below Table 5.7. That's why I have decided not to repeat them here, and I only report the predicted probability of the 95% CI of each condition.

[105] The Dutch children were of exactly the same age-group as the Chinese children. See details in Appendix A.

The Developmental Path of the knowledge of bridging

Since this experiment also aims to explore the developmental path of children's ability to perform the bridging process, I would also like to present the gradual developmental process of children's ability to create bridges in detail. It can be seen from Figure 5.4 that Chinese children's performance (correct responses) on bridging shows an upward trend between 3 and 6 years old, meaning that their ability to build bridges increases with age. For example, a child at the age 3-to-4 demonstrates an accuracy rate of around 75% while, at age 4-to-5, the accuracy rate is above 90%, and a 5-to-6-year-old child would also show an accuracy rate above 90%.[106] The difference among these three percentages also indicates that children's ability to build bridges is greatly enhanced between group 1 (3-to-4 yr) and group 2 (4-to-5 yr). After that stage, their bridging ability reaches the ceiling effect (adult-like).

(3) Discussion

In this second experiment, I tested the ability of Chinese children to build a bridge between a definite DP and its indefinite antecedent in the specific and nonspecific conditions, as well as possible developmental paths toward bridging abilities. There are two major findings from this experiment. The first is that the performance of Chinese children as a whole was significantly better in the specific condition than in the nonspecific condition. The second is that children from around 3-to-4 years old onwards began to show knowledge of how to build a bridge between a definite DP and its antecedent.

These findings are explicable under the S-D-P model. With this model, children's mistakes in the nonspecific condition are classified as belonging to either the linguistic module (lexical-morphosyntactic features) or to the nonlinguistic module (processing resources). In this experiment, children (as a whole) made more mistakes in the nonspecific condition than in the specific condition, indicating that their mistakes do not entirely reside in the linguistic module, rather seeming to lie more in the nonlinguistic module. This is because the semantic connection between the definite DP and its antecedent was the same in both conditions, and if they did not have the relevant linguistic knowledge (i.e., the lexical connections between *door-house*), they should have performed equally poorly in both conditions. It is most probably a lack of processing resources that caused them to make more mistakes in the nonspecific

[106] Those figures (the average accuracy rates for each group) can be seen from Figure 5.4 (the dots in the middle of the bars).

condition. In other words, the antecedents of definite DPs in the nonspecific condition are not salient enough, and the processing of them is resource-demanding. Although definite DPs are incomplete descriptions that must connect with another element to create a referential link, entailing that the antecedent (a previously-introduced entity) "still has sufficient prominence for both speaker and listener to have it present in their focus of attention or, at least, to be semi-active in the listener's consciousness," (Charolles, 1999: 312), the entity introduced by the definite DP in a bridging relation has not been explicitly mentioned before. So, it is not extremely salient and is not in explicit focus (Bosch & Geurts, 1990, in Charolles, 1999). In addition, in the bridging task, there is another competitive deictic antecedent from the visual domain, making it harder to successfully link the definite DP with its antecedent. Children (especially the younger ones) fail to process the antecedent that was not in explicit focus and are unable to successfully build a bridge due to insufficient processing resources. For example, their working memory capacity is still very limited, so that a less salient item in their working memory is more likely to be forgotten because of interference and inhibition effects. With the discourse prominence of the antecedent increased in the specific condition, children's performance is greatly improved because of the reduced demands on processing resources. In this sense, the result of this experiment was generally consistent with the results of Avrutin & Coopmans' (2000) study, strengthening the hypothesis of processing resources; that is, "the relevant linguistic knowledge is available to young children while their capacity to implement (at least part of) this knowledge is limited" (Avrutin, 1999: 25).

As to the developmental path of children's ability to engage in the bridging process in general, Chinese children from 3 to 4 years old onwards already demonstrate the ability to successfully build a bridge between a definite and an indefinite DP. However, it is unknown whether Chinese children's ability to build such a bridge occurs at an earlier or later age than their Dutch counterparts, who undertook similar tasks in Avrtuin & Coopmans' (2000) study, because a direct comparison between those two studies is not precise (e.g. long time-interval, different statistical techniques). Nevertheless, I can still assume that the corresponding study with Chinese children may reveal better performance because of the different morphosyntactic compositions of definite DPs and word order positions that the two languages have. In Chinese, definite DPs do not have overt lexical markers and they often occur in preverbal position. "Anaphoric bare nouns in the subject position are continuing topics" (Jenks, 2018: 525). A continuing topic may reactivate the antecedent, making it highly activated/accessible. Moreover, the lack of an overt

phonological realization of the determiner also contributes to the establishment of the dependency; that is, according to the S-D-P model (remembering DPRD and UID), the file cards introduced by definite DPs in Chinese are weak (high-information) due to the absence of phonological realization and, as a result, the antecedent of a Chinese definite DP will be relatively strong (and lower information). A strong file card is one that also has a higher activation level, so that fewer processing resources are needed to successfully build a bridge. Thus, Chinese children's ability to engage in bridging may be in place earlier than in their Dutch counterparts.

5.4 Summary of Chapter 5

In this chapter, I have explored the development of syntax-discourse interface knowledge in 3-to-6-year-old Mandarin Chinese children by conducting two separate experiments. In the first experiment, I tested Chinese children's ability to build a dependency between the reflexive *ziji* and its antecedent in logophoric and anaphoric constructions. The results showed that Chinese children start to display knowledge of the logophoric and anaphoric uses of *ziji* from 3 to 4 years old onward (displaying adult-like behavior after 4 to 5 years of age[107]), their performance was equally good in both constructions. I also compared those results with the results for Dutch children in Coopmans' et al. (2004) study and noted one difference (that is, the youngest Dutch children did not show a significant difference between the logophoric and anaphoric conditions). In the second experiment, I tested Chinese children's ability to build a dependency between a definite DP and its antecedent in the specific and nonspecific constructions. They appear to be able to build such dependencies also from 3 to 4 years old onward and become adult-like from 4 to 5 years old. The children also showed sensitivity to the specificity of the antecedent, demonstrating a significant difference between the specific and nonspecific constructions. Although we cannot exactly compare these results with the results found by Avrutin & Coopmans (2000) for Dutch children, we can make a prediction (see section 5.3.2(3)) under the S-D-P model about the difference between the performance of Chinese children and their Dutch counterparts, assuming they would carry out the same task.

[107] Although children who are 3 to 4 years old already begin to display syntax-discourse interface knowledge, their performance was significantly worse than that of children at the age of 4 to 5, 5 to 6, and adults (see details of the statistical results in section 5.2.2 (2)). In other words, Chinese children's syntax-discourse interface knowledge matured (becoming adult-like) at around age 4.5.

I have shown how these results can be captured in the S-D-P model (outlined in the previous chapter). With the background knowledge of the two modules (linguistic and nonlinguistic), the generalizations of the distributional pattern of referential dependencies (DPRD), and uniform information density (UID), I provide a theoretical framework (i.e. the S-D-P model) under which I can interpret children's performance on experiment 1 (reflexives) and experiment 2 (bridging).

To briefly repeat here, the results of experiment 1 have been explained as resulting from different contributions from different linguistic components (i.e. syntax vs. discourse) and the results of experiment 2 have been accounted for by the differential requirements on processing resources. In addition, what is new and intriguing in applying the S-D-P model to the accounts of the experimental data, in fact, lies in the file card system and its operation mechanisms — DPRD and UID. For example, in experiment 1, children's performance on logophoric and anaphoric constructions can be explained as DPRD and UID between the logophoric *ziji* and its antecedent on one hand, and the anaphoric *ziji* and its antecedent on the other hand. Bridging, too, can be illustrated by the mechanism of balanced distributional patterning of the dependent file card (i.e. definite DPs) and its antecedent card (i.e. indefinite specific/nonspecific DPs). In this way, the child acquisition study extends the application of the DPRD and UID as an explanatory mechanism for establishing referential dependencies and provides a coherent account of previously observed and newly obtained experimental results.

Chapter 6

Discussion and Conclusion

The interpretation of a referential dependency established between a pronoun, a reflexive, or a definite DP and its antecedent requires that both the speakers and their addressees be equipped with the relevant linguistic knowledge as well as nonlinguistic processing capacities such as memory. This dissertation has focused on the mechanisms of referential dependencies in English, Dutch and Chinese, where syntax and discourse work together, and on the question of how Chinese children between 3 and 6 years old acquire such knowledge. In this chapter, I will first summarize the main findings of this study, then point out what can be further explored in future research, and, finally, I will briefly describe this study's implications for theories that have been proposed to account for the mechanisms of referential dependencies and for the corresponding child language acquisition data.

6.1 Overview of the Main Findings

6.1.1 The theoretical part: a syntax-discourse processing (S-D-P) model of referential dependencies

One of the focal points of this dissertation is the interpretation of referential dependencies established at the syntax-discourse interface, involving both morphosyntactic and discourse information. Yet, previous theories that focused on the mechanisms of referential dependencies were either from a purely syntactic or a purely discourse theoretical perspective. As I mentioned in Chapter 2, purely syntactic

theories cannot explain the referential dependencies that involve discourse mechanisms (i.e. logophors); purely discourse-oriented theories have not given sufficient attention to the morphosyntactic compositions of the dependent elements, which play a role in the interpretation of the types of referential dependencies investigated here. For this reason, I proposed a syntax-discourse interface model (Chapter 3) to capture the mechanisms of referential dependencies at the syntax-discourse interface level.

This model also explores the processing mechanisms of referential dependencies (Chapter 4). Previous theories (e.g. binding, reflexivity, etc.) have outlined systems of rules and principles responsible for anaphora, which were purely computational in nature and they did not take the processing of referential dependencies (i.e. memory) into consideration. I, instead, regard the establishment of the anaphoric (and logophoric) dependencies not as computational rules and principles but as processes occurring in the human brain, with its relevant processing constraints, when building a model responsible for people's behavior regarding referential dependencies. Therefore, the syntax-discourse interface model is termed as a Syntax-Discourse-Processing (S-D-P) model.

The novelty of the S-D-P model includes two points: (1) The S-D-P model takes morphosyntactic features, discourse components, as well as processing elements such as memory into consideration in the interpretation of referential dependencies. This allows for the proportionality of the syntactic and discourse components involved in the interpretational process to differ from one language to another. For example, how a referential dependency is established in Chinese may be different from that in English and Dutch, as Chinese sees greater contributions from discourse (due to a large repertoire of logophoric uses and lack of overt morphosyntactic markers) while Dutch and English rely more on syntax (e.g. c-command, locality, and overt determiners) (Chapter 3). (2) The S-D-P model suggests that the mechanisms that regulate referential dependencies in English, Dutch and Chinese are essentially universal, and are subject to the same processing constraints regardless of the proportionality of impact of syntactic and discourse constraints. To be more specific, referential dependencies in Chinese, English and Dutch all are regulated by particular processing constraints: the generalizations of the distributional pattern of referential dependency (DPRD) and uniform information density (UID) (Chapter 4).

To be more specific, in Chapter 3, I illustrated the linguistic module of the S-D-P model (i.e. the morphosyntactic and discourse components). I argued that referentially dependent elements and their antecedents are file cards represented in

discourse with a number of morphosyntactic features and the establishment of referential dependencies between them is described as an operation performed on those file cards under discourse rules: (1) bridging; (2) copy-and-paste; (3) cut-and-paste. Each operation has its own constraints. Different languages also see different contributions from those linguistic components. For instance, a reflexive-bridging process in English, in most cases, occurs in the most embedded event file card/the minimal processing unit (i.e. locality). The reflexive-bridging process in Chinese, however, is in many cases also regulated by discourse mechanisms (e.g. the perspective of the speaker). The difference between English and Chinese is therefore a matter of the proportionality of the constraints imposed by syntax and discourse.

The operations of the file cards are also constrained by non-linguistic mechanisms such as memory and attention. As I mentioned in Chapter 4, the basic idea is that file cards with different amounts of morphosyntactic features and salience scales will have different degrees of memory strength because of the depth of processing (Craik & Lockhart, 1972), and the referential dependency established between a dependent file card and its antecedent card follows a specific distributional pattern — the distributional pattern of referential dependency (DPRD): *the weaker a dependent file card, the stronger its antecedent card will be.* The generalization of DPRD has deeper motivations and is related to the uniform information density (UID) hypothesis (Jaeger & Levy, 2007). This hypothesis states that information should be evenly distributed for each linguistic object within an utterance, avoiding information peaks and troughs for the purpose of utterance optimization. In this study I have assumed that a link established between a referentially dependent element and its antecedent functions as a linguistic object whose information is evenly distributed with other linguistic objects occurring in the same sentential environment. In other words, when the information of a dependent file card is high, the information of its antecedent card should be low so that the total amount of information for the linguistic object would not be too high or too low. Such a pattern provides support for DPRD: a weaker dependent card (higher information) is connected to a stronger antecedent card (lower information).

Therefore, the processing of referential dependencies is essentially the processing of information under constraints of informational distribution, which are argued to be universal and are applicable to English, Dutch and Chinese.

6.1.2 The acquisition part: the development of syntax-discourse interface knowledge in 3-to-6-year-old Chinese children

The second main point of this dissertation concerns the development of syntax-discourse interface knowledge in 3-to-6-year-old Chinese children (Chapter 5). By conducting two experimental studies on how Chinese children acquire the two types of referential dependencies (reflexive-bridging and definite DP-bridging), I found that (1) Chinese children showed early awareness of the logophoric use of *ziji* in PP constructions from around age 3 to 4 and performed equally well in both the logophoric and anaphoric conditions and (2) they are able to build a bridge between a definite and an indefinite DP at about the same age (around 3 to 4 years old) with significantly better performance in the specific condition than in the nonspecific condition. Also, the developmental path of their knowledge in these two experiments showed some consistency: although they began to demonstrate syntax-discourse interface knowledge at around age 3, it is only after the age of 4 that they showed fully adult-like behavior.

If we compare these results with parallel studies on Dutch children carried out by Avrutin & Coopmans (2000) and Coopmans, et al. (2004), we observe that Dutch children's performance shows some differences as well as some similarities when compared with the performance of their Chinese counterparts. For example, in the reflexive-bridging experiment, 3-to-4-year-old Dutch children performed significantly worse in the logophoric than in the anaphoric condition, unlike their Chinese counterparts. In the bridging experiment, Dutch children's performance improved significantly in the specific compared to the nonspecific condition, similar to their Chinese peers.

Theoretical explanations for the findings mentioned above can be captured by the S-D-P model. The differences in performance on the logophoric and anaphoric conditions in Chinese and Dutch children can be explained as a matter of the proportionality of the contributions of syntax and discourse. Chinese, having a large repertoire of logophoric uses of *ziji*, relies more on discourse than Dutch, making it possible that Chinese children are more attuned to the discourse components and are able to build a logophoric bridge at a very early age. The result was that Chinese children at age 3 to 4 already knew the use of logophoric *ziji*; thus, they performed well in both experimental conditions. Their Dutch counterparts, on the other hand, relied more on the syntactic component and less on discourse, so their knowledge of

the logophoric use of reflexives lags behind the anaphoric use of reflexives (at least the youngest age group). As a result, their performance was worse in the logophoric condition.

Although languages may differ from each other in the linguistic module (e.g. the proportionality of syntax and discourse), children who speak different languages will undergo the same processing constraints in the nonlinguistic module (DPRD and UID). In the reflexive-bridging experiment, since the dependent file card translated by a logophor is stronger (e.g. lower information) than the dependent file card translated by an anaphor, the antecedent card of a logophor will be weaker than the antecedent card of an anaphor, which also means that the activation of the antecedent of a logophor is lower. With this generalization, children would be predicted to perform worse in the logophoric than in the anaphoric condition. The performance of the Dutch children at age 3 to 4 confirms this prediction. The Chinese children's performance, I suggest, still obeys such processing constraints, though it may be harder to detect. The fact that there is no difference in the two constructions is due to the fact that their performance has already been so good (i.e. ceiling effect) that such a prediction doesn't come to the surface. A masking effect is also seen in older Dutch children (above the age of 4), who did not show significant differences in the two conditions, either. In the bridging experiment, the file card translated by a definite DP in Chinese is very weak (high information) because of the lack of a phonological realization of definite determiners, which indicates that the antecedent card of the definite DP in Chinese is very strong (low information). A strong file card also means high activation, resulting in a relatively high accuracy rate. The empirical results of Chinese children's performance therefore confirm such a prediction, as they are able to build a bridge between a definite DP and its antecedent at around age 3.

A final remark needs to be made about processing resources. The significant differences between the performance of Chinese and Dutch children in the specific and nonspecific conditions can be explained as a matter of the amount of processing resources they have that can be devoted to sentential processing. That is, both Chinese and Dutch children must have knowledge of the semantic connection between the definite DP and its antecedent, otherwise, they would perform poorly in both conditions. The fact that they performed worse in the nonspecific condition than in the specific condition is because the antecedent in the nonspecific condition is less prominent, requiring more processing resources than the specific condition. Children (especially the younger ones) with limited processing resources therefore performed worse in tasks that require more processing resources.

This view of limited processing resources is also supported by the results of the developmental path of syntax-discourse interface knowledge in 3-to-6-year-old Chinese children. In both experiments, the youngest age groups performed worse than the two older age groups even if they already had the corresponding syntax-discourse interface knowledge (performance was significantly above chance-level). It is only after the age of 4 that they entered into a stable stage with adult-like behavior (ceiling effect) which marks, in my view, the age when children's processing capacity becomes sufficient for performing the required tasks.

6.2 Future Research

6.2.1 Model extension

In the outline of the S-D-P model, I discussed how the Chinese reflexive *ziji* establishes a dependency with its antecedent (reflexive-bridging). In addition to *ziji*, Chinese has another reflexive *taziji* (pro-self-N) with its own characteristics. Like *ziji*, *taziji* sometimes obeys the constraints of locality and c-command and sometimes it doesn't:

(1) Locality Constraint

a. 张三$_i$知道李四$_j$喜欢他自己$_{*i/j}$。
Zhangsan$_i$ zhidao Lisi$_j$ xihuan taziji$_{*i/j}$.
Zhangsan know Lisi like pro-self-N
"Zhangsan knows that Lisi likes himself."

b. 张三$_i$说那本书害了他自己$_i$。
Zhangsan$_i$ shuo naben shu hai-le taziji$_i$.
Zhangshan say that book hurt-LE pro-self-N
"Zhangsan$_i$ said that that book hurt him."

In (1a), *taziji* can only refer to the local antecedent *Lisi,* obeying the locality constraint. In (1b), *taziji* refers to the distant antecedent *Zhangsan*, violating the constraint. Notice that the local antecedent *naben shu* (that book) in (1b) is inanimate. In other words, animacy seems to be a factor that will affect whether or not *taziji* can connect to an antecedent:

(2) C-command Constraint

a. 张三$_i$的爸爸$_j$批评了他自己$_{*i/j}$。
Zhangsan$_i$ de baba$_j$ piping-le taziji$_{*i/j}$.
Zhangsan DE dad criticize-LE he-self-N
"Zhangsan's dad criticized himself."

b. 张三$_i$的狗狗$_j$咬了他自己$_{?i/j}$。
Zhangsan$_i$ de gougou$_j$ yao-le taziji$_{?i/j}$.
Zhangsan DE dog bite-LE he-self-N
"Zhangsan's dog bit itself/him."

c. 张三$_i$的骄傲害了他自己$_{*i/j}$。
Zhangsan$_i$ de jiao'ao$_j$ hai-le taziji$_{i/*j}$.
Zhangsan DE pride hurt-LE he-self-N
"Zhangsan's pride hurt him."
(Pan, 1998: 774-776)

In (2a), *taziji* can only refer to the c-commander *Zhangsan de baba* (Zhangsan's father). In (2b), *taziji* can only marginally refer to the non-c-commander *Zhangsan*[108]. In (2c), *taziji* can refer to the non-c-commander *Zhangsan* when the c-commander is inanimate. It can be seen from these three examples that determining the reference of *taziji* is heavily influenced by the animacy feature of the antecedent.

Like *ziji*, *taziji* can also occur in the subject, object, and possessive positions in a sentence, but it differs from *ziji* in that it does not have the properties of being able to enter into long-distance dependencies (when the potential antecedents are all animate), of showing subject-orientation, or sentence contrast uses, among other things. Considering the various uses of *taziji* mentioned above, the representations and operations of *taziji* in the S-D-P can be further explored in future research.

Finally, there are clearly some limitations of the S-D-P model. One of them is that the concept of *information* applied in the model is not based on a precise value obtained by mathematical calculations but on a conceptual mapping between features/salience of the elements and the information of file cards (e.g. less features – higher information). In addition, a more detailed correlation between structural notions of c-command and locality on one hand, and discourse prominence and the

[108] To some native Chinese speakers, *taziji* in (2b) cannot refer to *Zhangsan*.

properties of the file cards on the other hand, can be more deeply explored in future research.

6.2.2 Acquisition studies

The two experimental studies presented in Chapter 5 were designed to be parallel to the studies of Coopmans et al. (2004) (experiment 1) and Avrutin & Coopmans (2000) (experiment 2). One thing to be mentioned is that the two studies shown in Chapter 5 were not exact replicas, because the current experiments were carried out with different stimuli (pictures and stories) and were presented on a computer screen. Therefore, crosslinguistic comparisons between Dutch children's performance with Chinese peers are only in general terms and may not be precise because of the differences in experimental details. A possible solution to this problem is to replicate the two experiments on Chinese children with Dutch children in future research in order to do an exact crosslinguistic comparison.

Also, the test constructions in experiment 1 can further be modified. In that experiment, Chinese children at a very early age (i.e. 3 years old) already began to demonstrate the targeted syntax-discourse knowledge. Such a result may partially have been affected by the complexity of the test constructions. For instance, in the reflexive-bridging experiment, the result that Chinese children at age 3 showed very high accuracy rates in all conditions may indicate that the test constructions were too easy for them. Since testing even younger children with a truth-value judgement task is nearly impossible, it is worthwhile to explore Chinese children's uses of *ziji* in more complex constructions. In addition, their knowledge of the uses of *taziji* in different constructions can also be studied, given that *taziji* has special properties that are different from English *himself/herself* and Chinese *ziji*.

Finally, as I mentioned in the previous sections, the results of the current two experimental studies revealed two things: first, languages vary from each other in proportionality of linguistic components (syntax or discourse); second, the processing constraints in different languages hold universally and are the common constraints across speakers of all languages. How bilingual Chinese-Dutch or Chinese-English children acquire syntax-discourse interface knowledge is worth investigating, given that Chinese is quite different from English and Dutch in ultimately establishing referential dependencies (e.g. the proportionality of contributions of syntax and discourse). Questions such as whether or not, or, to what degree their performance will be different from that of monolingual children, how they manipulate their

attention, whether there are any advantages (or disadvantages) among those children when compared with their monolingual counterparts, all merit further exploration.

6.3 Implications for the Theoretical Framework of UG

During the past decades, child language acquisition studies have been often explored and explained within the framework of UG — a set of principles and parameters. "The principles come to operate in much the same way in every child, with minimal sensitivity to the child's environment, while the parameters take on distinct values as a function of the child's linguistic input" (Snyder & Lillo-Martin, 2011: 670). In other words, principles reflect the invariants of human language while parameters are needed to capture the crosslinguistic variations (Snyder & Lillo-Martin, 2011). Yet, it is still unclear what the nature of those principles are, how those principles are instantiated through the biological properties of our brain, and what kinds of input (e.g. for parameter setting) will influence the child language acquisition processes.

By analogy, in the S-D-P model proposed in this dissertation, the underlying processing mechanisms of a specific language phenomenon (e.g. referential dependencies) are universal in different languages whereas the proportionality of the contributions from different linguistic components (e.g. morphology, syntax, discourse) may differ from one language to another. Namely, the processing resources (e.g. memory, attention) that children of the same age can use are similar regardless of what language they speak. What distinguishes a Dutch child from a Chinese child is the relevance of different components of the linguistic system (syntax and discourse) and their roles in establishing referential dependencies. It is the syntactic structures that contribute more to establishing referential dependencies in languages such as English and Dutch, but it is discourse in Chinese. Children's linguistic apparatus develops in response to encountering examples from their ambient language; thus the relative importance (weight) of syntactic vs. discourse constraints is encoded in their linguistic mechanisms with different degrees of strengths. And this distinction, naturally, comes on top of the universal processing constraints — DPRD and UID.

6.4 Implications for Accessibility Theory and Uniform Information Density

The S-D-P model has certain implications for accessibility theory and uniform information density. By taking both the morphosyntactic features and discourse factors into consideration, the S-D-P model is used to explain how different forms of referentially dependent elements (e.g. SE anaphor, SELF anaphor, pronouns, definite DPs, etc.) connect with their antecedents in intra-sentential as well as inter-sentential environments. As I repeatedly mentioned in the previous chapters, accessibility theory is a discourse theory that focuses on the degree of accessibility of the nominal referents (antecedents), which is marked by different types of accessibility markers (low/intermediate/high), yet it has not discussed the morphosyntactic properties of elements within the set of extremely high accessibility markers, such as reflexives (logophor/anaphors) and SE anaphors. The S-D-P model thus extends that aspect of accessibility theory by taking the morphosyntactic features of various accessibility markers into consideration. As a result, accessibility theory, together with the file card system, can be used to explain the various referential dependencies established in different languages. Moreover, the usefulness of the uniform information density hypothesis for explaining referential dependencies both in adult and child data further supports this hypothesis as a universal processing constraint that humans already possess at a very young age.

6.5 Conclusion

In this dissertation I have explored how referential dependencies (reflexives/ pronouns/definite DPs — antecedents) are established in English, Dutch and Chinese. I have built a Syntax-Discourse Processing (S-D-P) model to describe the mechanisms of referential dependencies in different languages, and then provided some empirical evidence from two child language acquisition studies for such a model. There are still multiple questions to be answered and to be explored in the future. Nevertheless, it contributes to our understanding of referential dependencies both theoretically and empirically. The theoretical aspect provides new insights in existing syntactic and discourse theories on referential dependencies by taking both the morphosyntactic features and discourse factors into consideration, with a processing and computational flavor (e.g. memory and information). The acquisition

aspect provides further support for the newly proposed model but extends the idea of universality as well as language specificity (typical of the UG-based principles and parameters approach) to the domain of information processing.

Bibliography

Aaronson, D., & Ferres, S. (1983). Lexical categories and reading tasks. *Journal of Experimental Psychology: Human Perception and Performance, 9*(5), 675.

Anagnostopoulou, E., & Everaert, M. (1999). Toward a more complete typology of anaphoric expressions. *Linguistic Inquiry, 30*(1), 97-119.

Anderson, J. R. (1983). A spreading activation theory of memory. *Journal of Verbal Learning and Verbal Behavior, 22*(3), 261-295. https://doi.org/10.1016/s0022-5371(83)90201-3

Anderson, J. R., Reder, L. M., & Lebiere, C. (1996). Working memory: activation limitations on retrieval. *Cognitive Psychology, 30*(3), 221-256. https://doi.org/10.1006/cogp.1996.0007

Anderson, M. C., Bjork, R. A., & Bjork, E. L. (1994). Remembering can cause forgetting: retrieval dynamics in long-term memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*(5), 1063-1087. https://doi.org/10.1037//0278-7393.20.5.1063

Anderson, M. C. (2001). Active forgetting. *Journal of Aggression, Maltreatment & Trauma, 4*(2), 185-210. https://doi.org/10.1300/J146v04n02_09

Anderson, M. C. (2003). Rethinking interference theory: Executive control and the mechanisms of forgetting. *Journal of Memory and Language, 49*(4), 415-445.

Anderson, M. C., Bjork, E. L., & Bjork, R. A. (2000). Retrieval-induced forgetting: Evidence for a recall-specific mechanism. *Psychonomic Bulletin & Review, 7*(3), 522-530.

Anderson, J. R. (2009). *Cognitive Psychology and Its Implications*. Worth Publishers.

Ariel, M. (1990). *Accessing Noun-Phrase Antecedents*. Routledge.

Ariel, M. (2000). The development of person agreement markers: From pronouns to higher accessibility markers. *Usage-Based Models of Language, 197*, 260.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: a proposed system and its control processes. In K. Spence., & J. Spence (Eds). *The Psychology of Learning and Motivation (pp.89-195)*. Academic Press.

Avrutin, S. (1997). Events as units of discourse representation in root infinitives. *MIT Occasional Papers in Linguistics, 12*, 65-91.

Avrutin, S. (1999). *Development of the Syntax-Discourse Interface*. Springer Science & Business Media.

Avrutin, S., & Coopmans, P. (2000). Children who build bridges. In S. C. Howell, S. A. Fish, & T. Keith-Lucas (Eds.), *Proceedings of the 24th Annual* BUCLD (pp. 80-91). Cascadilla Press.

Avrutin, S., & Cunningham, J. (1997). Children and reflexivity. In E. Hughes, M. Hughes & A. Greenhill (Eds.), *Proceedings of the 21th Annual BUCLD* (pp. 13-23). Cascadilla Press.

Avrutin, S., & Wexler, K. (1992). Development of principle B in Russian: Coindexation at LF and coreference. *Language Acquisition, 2*(4), 259-306. https://doi.org/10.1207/s15327817la0204_2

Baauw, S., Coopmans, P., & Philip, W. (1998). The acquisition of pronominal coreference in Spanish and the clitic-pronoun distinction. *UiL-OTS Yearbook, 1999*, 1-19.

Baauw, S. (2000). *Grammatical Features and the Acquisition of Reference*: *A Comparative Study of Dutch and Spanish.* LOT.

Baddeley, A. D. (1986). *Working Memory*. Oxford University Press.

Barnett, S. S. (2006). *An Online Poem*. https://www.coursehero.com/file/66828340/CAT-Danedocx/

Bates, D., Maechler, M., Bolker, B., & Walker, S. (2014). lme4: Linear mixed-effects models using Eigen and S4 classes [R package]. Retrieved from http://CRAN.R-Project.org/package=lme4

Battistella, E. (1989). Chinese reflexivization: A movement to INFL approach. *Linguistics, 27*(6), 987-1012.

Bäuml, K. (1997). The list-strength effect: Strength-dependent competition or suppression? *Psychonomic Bulletin & Review, 4*(2), 260-264. https://doi.org/10.3758/bf03209403

Biq, Y. (2004). Construction, reanalysis, and stance:'V yi ge N'and variations in Mandarin Chinese. *Journal of Pragmatics, 36*(9), 1655-1672.

Borer, H., & Wexler, K. (1987). The maturation of syntax. In T. Roeper, & E. Williams (Eds.), *Parameter Setting* (pp. 123-172). Springer.

Brun, D. (2001). Information structure and the status of NP in Russian. In K. Von Heusinger, & K. Schwabe (Eds.), *ZAS Papers in Linguistics*, *23*, 39-57.

Chafe, W. (1994). *Discourse, Consciousness, and Time: The Flow and Displacement of Conscious Experience in Speaking and Writing*. University of Chicago Press.

Chao, Y. R. (1968). *A Grammar of Spoken Chinese*. University of California Press.

Charolles, M. (1999). Associative anaphora and its interpretation. *Journal of Pragmatics, 31*(3), 311-326.

Chen, P. (2004). Identifiability and definiteness in Chinese. *Linguistics, 42*(6), 1129-1184.

Cheng, L. L., & Sybesma, R. (1999). Bare and not-so-bare nouns and the structure of NP. *Linguistic Inquiry, 30*(4), 509-542.

Cheng, L. L. S., & Sybesma, R. (2005). Classifiers in four varieties of Chinese. In G. Cinque & R. S. Kayne (Eds.), The *Oxford Handbook of Comparative Syntax*, pp.259-292). Oxford University Press.

Cheng, L. L., & Sybesma, R. (2012). Classifiers and DP. *Linguistic Inquiry, 43*(4), 634-650.

Cheng, L. L., Heycock, C., & Zamparelli, R. (2017). Two levels for definiteness. In M. Y. Erlewine (Ed.), *Proceedings of GLOW in Asia XI: MIT Working Papers for Linguistics (Vol 84*, 79-93). MIT.

Chien, Y. (1992). Theoretical implications of the principles and parameters model for language acquisition in Chinese. In H. C. Chen, & O. J. L. Tzeng (Eds.), *Advances in Psychology* (pp. 313-345). Elsevier.

Chien, Y., & Lust, B. (2006). Chinese children's knowledge of the binding principles. In P. Li, et al. (Eds.), *The Handbook of East Asian Psycholinguistics* (pp.23-38). Cambridge University Press. https://doi.org/10.1017/CBO9780511550751.004

Chien, Y., & Wexler, K. (1990). Children's knowledge of locality conditions in binding as evidence for the modularity of syntax and pragmatics. *Language Acquisition, 1*(3), 225-295.

Chien, Y., Wexler, K. & Chang, H. (1993). Children's development of long-distance binding in Chinese. *Journal of East Asian Linguistics, 2*(3), 229-259. https://doi.org/10.1007/BF01739134

Chierchia, G. (1998). Plurality of mass nouns and the notion of "semantic parameter". In R. Kluwer (Ed.), *Events and Grammar* (pp. 53-103). Springer.

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

Cinque, G. (1999). *Adverbs and Functional Heads: A Cross-Linguistic Perspective*. Oxford University Press on Demand.

Clark, H. H. (1977). Bridging. In P. N. Johnson-Laird, & P. C. Wason (Eds.), *Thinking: Readings in Cognitive Science* (pp. 411–420). Cambridge University Press.

Clements, G. N. (1975). The logophoric pronoun in Ewe: Its role in discourse. *Journal of West African Languages*, 2, 141-177.

Cole, P., & Sung, L. (1994). Head movement and long-distance reflexives. *Linguistic Inquiry*, 355-406.

Coopmans, P., Krul, M., Planting, E., Vlasveld, I., & van Zoelen, A. (2004). Dissolving a Dutch delay in the acquisition of syntactic and logophoric reflexives. In A. Brugos, L. Micciulla, & C. E. Smith (Eds.), *Proceedings of the 28th Annual BUCLD* (Vol. 1, pp. 108-119). Cascadilla Press.

Cornish, F. (1986). *Anaphoric Relations in English and French: A Discourse Perspective*. Routledge.

Crain, S. (1991). Language acquisition in the absence of experience. *Behavioral and Brain Sciences*, 14(4), 597-612.

Crain, S., & McKee, C. (1985). Acquisition of structural restrictions on anaphora. *North East Linguistics Society*, *16* (1): 94-110. https://doi.org/10.1207/s15327817la0201_2

Crain, S., & Thornton, R. (2000). *Investigations in Universal Grammar: A Guide to Experiments on the Acquisition of Syntax and Semantics*. MIT Press.

Craik, F. I., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior, 11*(6), 671-684.

Craik, F. I., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General, 104*(3), 268.

Cunnings, I., & Felser, C. (2013). The role of working memory in the processing of reflexives. *Language and Cognitive Processes, 28*(1-2), 188-219. https://doi.org/10.1080/01690965.2010.548391

De Brigard, F. (2014). The nature of memory traces. *Philosophy Compass, 9*(6), 402-414.

De Cat, C. (2013). Egocentric definiteness errors and perspective evaluation in preschool children. *Journal of Pragmatics, 56*, 58-69. https://doi.org/https://doi.org/10.1016/j.pragma.2012.08.002

Dillon, B., Chow, W., Wagers, M., Guo, T., Liu, F., & Phillips, C. (2014). The structure-sensitivity of memory access: evidence from Mandarin Chinese. *Frontiers in Psychology, 5*, 1025. https://doi.org/10.3389/fpsyg.2014.01025

Dong, X. F. (2002). Zi and ji in ancient Chinese — the source of the specialty of modern Chinese ziji. *Ancient Chinese Research* (1), 69-75.

Escobar, L., & Gavarró, A. (2001). The acquisition of clitics and strong pronouns in Catalan. *Clitics in Phonology, Morphology and Syntax,* 161-180.

Everaert, M. (1986). *The Syntax of Reflexivization*. Foris Publications.

Garrod, S., & Sanford, A. J. (1981). Bridging inferences and the extended domain of reference. *Attention and Performance IX, 331*, 346.

Gernsbacher, M. A., & Hargreaves, D. J. (1988). Accessing sentence participants: the advantage of first mention. *Journal of Memory and Language, 27* (6), 699-717. https://doi.org/10.1016/0749-596x(88)90016-2

Gordon, P. (1998). The truth-value judgment task. In D. McDaniel, C. McKee, H. Cairns (Eds.), *Methods for Assessing Children's Syntax* (pp. 211-231). Cambridge, Mass: MIT Press.

Grodzinsky, J. & T. Reinhart (1993). The innateness of binding and coreference. *Linguistic Inquiry*, 24, 69-102.

Guéron, J., & Hoekstra, T. (1995). The temporal interpretation of predication. In A. Cardinaletti (Ed.), *Small Clauses* (pp. 77-107). Brill.

Haegeman, L. (1994). *Introduction to Government and Binding Theory*. Wiley-Blackwell.

Hao, Y., Sheng, L., & Gao, L. (2014). Mandarin-speaking children's pronoun interpretation. *Journal of Child Language Acquisition and Development, 2*(6), 1-23.

Hawkins, J. A. (1978). *Definiteness and Indefiniteness: A Study in Reference and Grammaticality Prediction*. Routledge.

He, J. (2009). *Early Child Language Acquisition of the Reflexive Ziji in Mandarin Chinese* [Doctoral Dissertation, Beijing Language and Culture University]. CNKI Theses and Dissertations Database.

Heim, I. (1982). *The Semantics of Definite and Indefinite Noun Phrases* [Doctoral Dissertation, University of Massachusetts]. ProQuest.

Hothorn, T., Bretz, F., & Westfall, P. (2008). Simultaneous inference in general parametric models. *Biometrical Journal: Journal of Mathematical Methods in Biosciences*, 50(3), 346-363.

Hu, J., & Pan, H. (2002). NP prominence and the Chinese reflexive ziji. *Contemporary Linguistics, 1*, 46-60.

Huang, C. J. & Liu, C. S. (2001). Logophoricity, attitudes, and ziji at the interface. In P. Cole, G. Hermon, & C. J. Huang (Eds.), *Syntax and Semantics: Long Distance Reflexives* (pp.150–195). Academic Press.

Huang, C. J., & Tang, C. J. (1991). The local nature of the long-distance reflexive in Chinese. *Long Distance Anaphora, 13*, 263.

Huang, Y. H. (1984) Reflexives in Chinese. *Studies in English Literature and Linguistics, 10*, 163-188.

Hyams, N. (1996). The underspecification of functional categories in early grammar. In H. Clahsen (Ed.), *Generative Perspectives on Language Acquisition* (pp. 91-127). John Benjamins.

Ionin, T. (2006). This is definitely specific: specificity and definiteness in article systems. *Natural Language Semantics, 14*(2), 175.

Jaeger, T. F., & Levy, R. P. (2007). Speakers optimize information density through syntactic reduction. In B. Schlökopf, J. Platt, & T. Hoffman (Eds.), *Advances in Neural Information Processing Systems* (pp. 849-856). MIT press.

Jäger, L. A., Engelmann, F., & Vasishth, S. (2015). Retrieval interference in reflexive processing: experimental evidence from Mandarin, and computational modeling. *Frontiers in Psychology, 6*, 617.

Jenks, P. (2018). Articulated definiteness without articles. *Linguistic Inquiry, 49*(3), 501-536.

Just, M. A., & Carpenter, P. A. (1992). A capacity theory of comprehension: individual differences in working memory. *Psychological Review, 99*(1), 122.

Kamp, H. (1981). A theory of truth and semantic representation. *Formal Semantics-the Essential Readings,* 189-222.

Kamp, H., Van Genabith, J., & Reyle, U. (2011). Discourse representation theory. In D. Gabbay, & F. Guenthner (Eds.), *Handbook of Philosophical Logic* (pp. 125-394). Springer.

Kleiber, G. (1999). Associative anaphora and part-whole relationship: The condition of alienation and the principle of ontological congruence. *Journal of Pragmatics, 31*(3), 339-362.

Lee, T. H. T. (1996). Theoretical issues in language development and Chinese child language. In C. J. Huang, & Y. A. Li (Eds.), *New Horizons in Chinese linguistics* (pp. 293-356). Springer.

Lewis, R. L., & Vasishth, S. (2005). An activation-based model of sentence processing as skilled memory retrieval. *Cognitive Science, 29*(3), 375-419. https://doi.org/10.1207/s15516709cog0000_25

Li, X., & Zhou, X. (2010). Who is ziji? ERP responses to the Chinese reflexive pro-noun during sentence comprehension. *Brain Research, 1331*, 96-104. https://doi.org/10.1016/j.brainres.2010.03.050

Li, R. (2010). *Anaphoric Dependencies: Reflexive Binding and Null Arguments in Child Mandarin* (Unpublished Doctoral Dissertation). City University of Hong Kong.

Lin, T. J. (2015). Tense in Mandarin Chinese sentences. *Syntax, 18*(3), 320-342. https://doi.org/10.1111/synt.12032

Lust, B., Chien, Y. C., Chiang, C. P., & Eisele, J. (1996). Chinese pronominals in universal grammar: A study of linear precedence and command in Chinese and English children's first language acquisition. *Journal of East Asian Linguistics*, *5*(1), 1-47. https://doi.org/10.1007/BF00129804

Lyons, J. (1977). *Semantics*. Cambridge University Press.

Lyons, C. (1999). *Definiteness*. Cambridge University Press.

Marslen, W. W., Levy, E., & Tyler, L. K. (1982). Producing interpretable discourse: The establishment and maintenance of reference. *Speech, Place, and Action,* 339-378.

McClelland, J. L., Rumelhart, D. E., & PDP Research Group. (1986). Parallel distributed processing. *Explorations in the Microstructure of Cognition, 2*, 216-271.

McGeoch, J. A. (1942). *The Psychology of Human Learning: An Introduction.* Longmans.

McKee, C. (1992). A comparison of pronouns and anaphors in Italian and English acquisition. *Language Acquisition, 2*(1), 21-54.

Mensink, G., & Raaijmakers, J. G. W. (1988). A model for interference and for -getting. *Psychological Review, 95*(4), 434-455. https://doi.org/10.1037/0033-295X.95.4.434.

Nakayama, M., Su, Y., & Huang, A. (2017). *Studies in Chinese and Japanese Language Acquisition: In Honor of Stephen Crain.* John Benjamins Publishing Company.

Osgood, C. E. (1948). An investigation into the causes of retroactive interference. *Journal of Experimental Psychology, 38*(2), 132-154. https://doi.org/10.1037/h0055753

Pan. H. (1998). Closeness, prominence, and binding theory. *Natural Language & Linguistic Theory*,*16* (4), 771-815. http://www.jstor.org/stable/4047921

Pan, H. (2001). Why the blocking effect? In P. Cole, G. Hermon, & C. J. Huang (Eds.), *Syntax and Semantics: Long Distance Reflexives* (pp. 279-316). Academic Press.

Passonneau, R. J. (1998). Interaction of discourse structure with explicitness of discourse anaphoric noun phrases. In M. A. Walker, A. K. Joshi, & E. F. Prince (Eds.), *Centering Theory in Discourse* (pp.327-358). Clarendon Press.

Philip, W., & Coopmans, P. (1996). The role of referentiality in the acquisition of pronominal anaphora. In K. Kusumoto (Ed.), Proceedings *of the North East Linguistics Society 26* (pp. 241-256). Harvard University and MIT.

Pollard, C., & Xue, P. (2000). Syntactic and nonsyntactic constraints on long-distance reflexives. In P. Cole, G. Hermon, & C. J. Huang (Eds.), *Syntax and Semantics: Long Distance Reflexives* (pp. 317-342). Academic Press.

Pretorius, E. (2017). *Spelling Out P: A Unified Syntax of Afrikaans Adpositions and V-Particles.* LOT.

Reinhart, T. (1976). *The Syntactic Domain of Anaphora* [Doctoral Dissertation, MIT]. MIT Theses in DSpace. http://hdl.handle.net/1721.1/16400

Reinhart, T. (1983). *Anaphora and Semantic Interpretation*. Croom Helm.

Reinhart, T., & Reuland, E. (1991). Anaphors and logophors: an argument structure perspective. *Long Distance Anaphora,14*, 283.

Reinhart, T., & Reuland, E. (1993). Reflexivity. *Linguistic Inquiry, 24*(4), 657-720.

Reinhart, T., & Siloni, T. (2005). The lexicon-syntax parameter: Reflexivization and other arity operations. *Linguistic Inquiry*, *36*(3), 389-436.

Reuland, E. (2001). Primitives of binding. *Linguistic Inquiry, 32*(3), 439-492.

Reuland, E. (2017). Why is reflexivity so special? Understanding the world of reflexives. *Studia Linguistica*, *71*(1-2), 12-59.

Reuland, E., & Winter, Y. (2009). Binding without identity: Towards a unified semantics for bound and exempt anaphors. In S. L. Devi, A. Branco, & R. Mitkov (Eds.), *Discourse Anaphora and Anaphor Resolution Colloquium* (pp. 69-79). Springer.

Reuland, E., Wong, S. C. H., & Everaert, M. (2020). How the complexity of Mandarin zi-ji simplifies the grammar. *Linguistic Inquiry, 51*(4), 799-814.

Rizzi, L. (2013). Locality. *Lingua, 130*, 169-186. https://doi.org/https://doi.org/10.1016/j.lingua.2012.12.002

Rooryck, J., & vanden Wyngaerd, G. J. (2011). *Dissolving Binding Theory*. Oxford University Press.

Rumelhart, D. E., & McClelland, J. L. (1987). *Psychological and Biological Models*. MIT Press.

Runner, J. T., Sussman, R. S., & Tanenhaus, M. K. (2006). Processing reflexives and pronouns in picture noun phrases. *Cognitive Science, 30*(2), 193. http://gateway.proq-uest.com/openurl?ctx_ver=Z39.88-2003&xri:pqil:res_ver=0.2&res_id=xri:ilcs-us&rft_id=xri:ilcs:rec:abell:R04037437

Schaeffer, J., & Matthewson, L. (2005). Grammar and pragmatics in the acquisition of article systems. *Natural Language & Linguistic Theory, 23*(1), 53-101.

Schumacher, P. B., Piñango, M. M., Ruigendijk, E., & Avrutin, S. (2010). Reference assignment in Dutch: Evidence for the syntax–discourse divide. *Lingua, 120*(7), 1738-1763.

Searle, S. R., Speed, F. M., & Milliken, G. A. (1980). Population marginal means in the linear model: an alternative to least-squares means. *American Statistician, 34* (4). 216–221. <doi:10.1080/00031305.1980.10483031>.

Sells, P. (1987). Aspects of logophoricity. *Linguistic Inquiry, 18*(3), 445-479.

Shannon, C. E. (1948). A mathematical theory of communication. *The Bell System Technical Journal, 27*(3), 379-423.

Sigurjonsdottir, S., & Hyams, N. (1992). Reflexivization and logophoricity: Evidence from the acquisition of Icelandic. *Language Acquisition, 2*(4), 359-413. https://doi.org/10.1207/s15327817la0204_5

Simpson, A. (2005). Classifiers and DP structure in Southeast Asia. In G. Cinque, & R. S. Kayne (Eds.), *Handbook of Comparative Syntax* (pp. 806–838). Oxford University Press.

Sio, J. U. (2006). *Modification and Reference in the Chinese Nominal* [Doctoral dissertation, Universiteit Leiden]. LOT.

Snyder, W., & Lillo-Martin, D. (2011). Principles and parameters theory and language acquisition. *The Cambridge Encyclopedia of Language Sciences,* 670-673.

Song, H., & Fisher, C. (2005). Who's "she"? Discourse prominence influences preschoolers' comprehension of pronouns. *Journal of Memory and Language, 52*(1), 29-57.

Stalnaker, R. (2014). *Context*. OUP Oxford.

Stroik, T. S. (2009). Locality in minimalist syntax. *Linguistic Inquiry Monograph Fifty-One*. MIT Press.

Stokke, A. (2014). Truth and context change. *Journal of Philosophical Logic*, *43*(1), 33-51.

Storm, B., Bjork, E., Bjork, R., & Nestojko, J. (2006). Is retrieval success a necessary condition for retrieval-induced forgetting? *Psychonomic Bulletin & Review, 13*(6), 1023-1027. https://doi.org/10.3758/BF03213919

Sybesma, R. (2007). Whether we tense-agree overtly or not. *Linguistic Inquiry, 38*(3), 580-587.

Sybesma, R., & Sio, J. U. (2008). D is for demonstrative–investigating the position of the demonstrative in Chinese and Zhuang. *The Linguistic Review, 25*(3-4), 453-478.

Sybesma, R. (1999). *The Mandarin VP*. Springer Science & Business Media.

Ullman, M. (2001). The declarative/procedural model of lexicon and grammar. *Journal of Psycholinguistic Research, 30*(1), 37-69. https://doi.org/10.1023/A:1005204207369

Van Hout, A. M. H. A., de Ree, L., & de Ree, M. (2007). Dutch children's interpretation of definites and indefinites in discourse. In A. Gavarró, & M. J. Freitas (Eds.), *Language Acquisition and Development. Proceedings of GALA 2007* (pp. 281- 291). Cambridge Scholars Publishing.

Van Riemsdijk, H. (1990). Functional prepositions. In H. Pinkster, & I. Genee (Eds.), *Unity in Diversity* (pp. 229-241). De Gruyter Mouton.

Van Rij, J., Van Rijn, H., & Hendriks, P. (2013). How WM load influences linguistic processing in adults: a computational model of pronoun interpretation in discourse. *Topics in Cognitive Science, 5*(3), 564-580.

Von Heusinger, K. (2002). Specificity and definiteness in sentence and discourse structure. *Journal of Semantics, 19*(3), 245-274.

Walker, M. A., Joshi, A. K., & Prince, E. F. (1998). Centering in naturally occurring discourse: An overview. In M. A. Walker, A. K. Joshi, & E. F. Prince (Eds.), *Centering Theory in Discourse* (pp.1-28). Clarendon Press.

Wexler, K., & Chien, Y. (1985). The development of lexical anaphors and pronouns. *Papers and Reports on Child Language Development*, 24, 138-149.

Winter, B. (2013). Linear models and linear mixed effects models in R with linguistic applications [arXiv: 13085499]. *Tutorial*, *2*, 1-42.

Xu. L. J. (1995). Definiteness effects on Chinese word order. *Cahiers De Linguistique Asie Orientale, 24*(1), 29-48.

Xu, Y. (2010). *Development of Long-distance Binding of Reflexives in Mandarin Chinese Children* [MA thesis, Hunan University]. CNKI Theses and Dissertations Database.

Yu, W. X. (2000). *Chinese reflexives*. Peeters Publishers.

Yule, G. (1981). New, current and displaced entity reference. *Lingua, 55*(1), 41-52.

Zeng, X. (2013). *The Acquisition of Pronouns by Mandarin-Speaking Children* [MA thesis, Xiangtan University]. CNKI Theses and Dissertations Database.

Appendices

Appendix A: Results of the Two Previous Acquisition Experiments Conducted on Dutch Children

Coopmans et al. (2004)'s study

Table A. 1 Accuracy rates of Dutch children in logophoricity test

	Anaphoric (%)		Logophoric(%)	
	True	False	True	False
group1(3.5-5.7)	94	82	69	69
group2(5.8-7.9)	100	96	90	90
All children	89	97	80	80
Adults	100	96	100	100%

Note: Number of participants: Group1: 49; Group2: 50; Adults: 26

Test sentences in the four conditions(an example):

(1) Anaphoric-True
De vader van Flipje waste zich.
"The father of Flipje washed SE"

(2) Anaphoric-False
De vader van Flipje droogde zich af
"The father of Flipje dried SE"

(3) Logophoric-True
De vader van Rose hield de paraplu boven zich.
"The father of Rose held the umbrella above SE"

(4) Logophoric-False
De vader van Rose verstopt de zeep achter zich
"The father of Rose hid the soap behind SE"

Avrutin & Coopmans (2000)'s study

Table A. 2 Accuracy rates of Dutch and Russian speaking children in the nonspecific condition

	Dutch-speaking children(%)		Russian-speaking children(%)	
	True	False	True	False
group1(3.5-3.11)	93%	46%	87.8%	52%
group2(4.0-4.11)	97%	80.7%	96%	87.9%
group3(5.0-6.6)	93%	87%		

Note: Number of participants: Dutch children in total: 63; Russian: 46

Test sentences (an example):

Less prominent antecedent (nonspecific: postverbal position: nontopics)

(1) Dutch,True

Er vaart een bootje voorbij. De vlag is rood.

"There sails a boat by. The flag is red."

(2) Dutch, False

Er vaart een bootje voorbij. De vlag is blauw.

"There sails a boat by. The flag is blue."

(3) Russian, True

Plyvjot korablik po reke. Flag krasnyj.

"Sails boat on river. Flag red."

(4) Russian, False

Plyvjot korablik po reke. Flag sinij.

"Sails boat on river. Flag blue."

Some more examples in Dutch:

(5) Er zit dus een muis op de grond. De oren zijn blauw (FALSE)

"There is a mouse on the floor. The ears are blue."

(6) Er zit dus een muis op tafel. De staart is lang (TRUE)

"There is a mouse on the table. The tail is long."

Table A. 3 Accuracy rates of Dutch and Russian speaking children in the specific condition

	Dutch-speaking children(%)		Russian-speaking children(%)
	True	False	N.A.
Only one group (2.11-to-3.11)	100%	87.6%	

Note: Number of participants: Group1: 16

More prominent antecedent (specific)

(1) True

Een jongen is aan het eten. De broek is rood.

"A boy is eating. The pants are red."

(2) False

Een jongen is aan het eten. De broek is groen.

"A boy is eating. The pants are green."

Appendix B: Test Stimuli for Experiment 1 & 2

Test Stimuli for Experiment 1

1. 开场指导语（introduction）

XX（小朋友的名字），我们现在来玩一个游戏，好不好？

我们来玩一个猜一猜的游戏，你看，这个布娃娃它的名字叫**胖胖**（布娃娃/手偶和小朋友打招呼）。一会我们会一起看图片，胖胖呢，它坐在我们对面（电脑后面），它看不到图片，胖胖它就会来猜猜我们能看到什么，然后你告诉我胖胖猜得对不对，好不好？如果胖胖猜对了，我们就奖励它一下，摸摸它的头（动作示范）；如果猜错了，我们就轻轻打一下它的小手（动作示范），好不好？

XX (the child's name), Let's play a game together, ok?

Let's play a guessing game. Look, here is a handpuppet. Her name is Pangpang (the handpuppet say hi to the child). We will see some pictures together, but Pangpang cannot see the pictures because she sits in the opposite side of us (behind the laptop). So, she will guess what we can see. Then you tell me whether Pangpang's guessing is right or wrong, ok? If Pangpang's guessing is right, we then give her a reward by touching her head (action demonstration); if Pangpang's guessing were wrong, we then pat her hand gently (action demonstration), ok?

2. 练习 (practice)[109]

练习 1：

实验者：这是小牛，这是小狗。你看，它在跳绳。胖胖，你能猜猜我们能看见什么吗？

手偶：我来猜猜，小狗，小牛...(你们能看见)**小牛在跳绳。**

实验者：胖胖说得对不对呀？

[109] The practice session contains 6 items because this test is divided into two sessions, with 3 practice items for each session. All the test pictures are not presented here for potential copyrights reasons. For those of you who are interested in knowing more about the experiments and those who would like to see the pictures, please contact me via emails: (1) y.xie@uu.nl; (2) idealist2021@126.com.

Experimenter: Look, this is Little Cow. This is Little Dog. See, she is jumping the rope. Pangpang, could you guess what we can see?
Handpuppet: Let me guess. Little Cow, Little Dog…(You can see that) **Little Cow is jumping the rope**.
Experimenter: Was Pangpang's guessing right or wrong?

练习 2:
实验者：这是小牛，这是小老虎。你看，它在唱歌。胖胖，你能猜猜我们能看见什么吗？
手偶：我来猜猜，小老虎，小牛... (你们能看见)**小牛在唱歌**。
实验者：胖胖说得对不对呀？
Experimenter: Look, this is Little Cow. This is Little Tiger. See, she is singing. Pangpang, could you guess what we can see?
Handpuppet: Let me guess. Little Tiger, Little Cow...(You can see that) **Little Cow is singing**.
Experimenter: Was Pangpang's guessing right or wrong?

练习 3:
实验者：这是小猫，这是小老虎。你看，它在画画。胖胖，你能猜猜我们能看见什么吗？
手偶：我来猜猜，小老虎，小猫...（你们能看见）**小猫在画画**。
实验者：胖胖说得对不对呀？
Experimenter: Look, this is Little Cat. This is Little Tiger. See, she is painting. Pangpang, could you guess what we can see?
Handpuppet: Let me guess. Little Tiger, Little Cat...(You can see that) **Little Cat is painting**.
Experimenter: Was Pangpang's guessing right or wrong?

练习 4:
实验者：这是小马，这是小马的姐姐。这是小羊，这是小羊的姐姐。它在看书，它在睡觉。小羊和小羊的姐姐在看电视。胖胖，你能猜猜我们能看见什么吗？
手偶：我来猜猜，小羊, 小羊的姐姐，小马,小马的姐姐...（你们能看见）**小马的姐姐在看书。**
实验者：胖胖说得对不对呀？

Experimenter: Look, this is Little Horse. This is Little Horse's sister. This is Little Sheep. This is Little Sheep's sister. See, She is reading; she is sleeping; Little Sheep and Little Sheep's sister are watching TV. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Little Sheep, Little Sheep's sister; Little Horse, Little Horse's sister...(You can see that) **Little Horse's sister is reading**.

Experimenter: Was Pangpang's guessing right or wrong?

练习 5:

实验者：这是小猪，这是小羊。你看，它在吃苹果。胖胖，你能猜猜我们能看见什么吗？

手偶：我来猜猜，小猪，小羊...（你们能看见）**小羊在吃苹果。**

实验者：胖胖说得对不对呀？

Experimenter: Look, this is Little Pig. This is Little Sheep. See, she is eating an apple. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Little Pig, Little Sheep...(You can see that) **Little Sheep is eating an apple**.

Experimenter: Was Pangpang's guessing right or wrong?

练习 6:

实验者：这是小狗和它的哥哥，这是小猪和它的哥哥。小猪在吃饭，它在踢球。胖胖，你能猜猜我们能看见什么吗？

手偶：我来猜猜，小猪，小猪的哥哥，小狗，小狗的哥哥...（你们能看见）**小猪的哥哥在踢球**。

实验者：胖胖说得对不对呀？

Experimenter: Look, this is Little Dog. This is her brother. See, Little Pig is having supper; He is playing football. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Little Pig, Little Pig's brother, Little Dog, Little Dog's brother…(You can see that) **Little Pig's brother is playing football**.

Experimenter: Was Pangpang's guessing right or wrong?

3. 正式实验 (Test)

(1) Anaphoric Condition

Test Story 1: 指一指的故事 (point at-TRUE)

实验者：这是小羊，这是小羊的阿姨，这是小兔子，这是小兔子的阿姨。有一天，他们在外面玩指一指的游戏（图 1）。小兔子的阿姨偷偷地指了指小兔子，小羊的阿姨呢，也准备来指一指。小羊想：“我的阿姨会指谁呢？这儿？还是这儿呢（图 2）？”我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：我来猜猜: 小动物们正在玩指一指的游戏...**小羊的阿姨偷偷地指了自己。**

Experimenter: This is Little Sheep; this is Little Sheep's aunt; this is Little Rabbit; this is Little Rabbit's aunt. One day, they were playing the game of pointing outside (pic.1). Little Rabbit's aunt pointed at Little Rabbit secretly. Little Sheep's aunt was going to point, too. Little Sheep wondered, "Who will my aunt point at? Here or there?" (pic.2). Let's see what happened (pic.3). Pangpang, could you guess what happened?

Handpuppet: Let me guess. Little animals were playing the game of pointing. **Little Sheep's aunt pointed at ziji secretly.**

Test Story 2: 指一指的故事[110] (point at-FALSE)

实验者：这是小熊，这是小熊的奶奶，这是小象，这是小象的奶奶。有一天，他们在外面玩指一指的游戏（图 1）。小象的奶奶偷偷地指了指小象，小熊的奶奶呢，也准备来指一指。小熊想：“我的奶奶会指谁呢？这儿？还是这儿呢（图 2）？”我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：我来猜猜: 动物们在玩指一指的游戏...**小熊的奶奶偷偷地指了自己**。

Experimenter: This is Little Bear; this is Little Bear's grandma; this is Little Elephant; this is Little Elephant's grandma. One day, they were playing the game of pointing outside (pic.1). Little Elephant's grandma pointed at Little Elephant secretly. Little Bear's grandma was going to point, too. Little Bear wondered, "Who will my grandma

[110] In the truth-value judgement task, each story contains two conditions: True and False. However, in order to avoid the familiarity effect, the scenarios presented in the pictures in each condition are different and the positions of the characters in the pictures are different from each other in each condition. Moreover, the two conditions appear in different sessions.

point at? Here or there?" (pic.2). Let's see what happened (pic.3). Pangpang, could you guess what happened?

Handpuppet: Let me guess. Little animals were playing the game of pointing. **Little Bear's grandma pointed at ziji secretly.**

Test Story 3: 抓痒痒的故事(scratch-FALSE)

实验者：这是小兔，这是小兔的叔叔。这是小象，这是小象的叔叔。一天，他们在果园里摘水果（图 1）。摘着摘着，小动物们的身上就长了一些红点点。好痒呀，于是小象和小象的叔叔拿出了抓痒的小抓子开始轻轻地抓痒。可是小兔和小兔的叔叔只有一个小抓子，小兔的叔叔准备开始抓痒。小兔想："叔叔会抓抓谁呢？抓抓这里？还是抓抓这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：小动物们在抓痒痒...**小兔的叔叔轻轻地抓了自己。**

Experimenter: This is Little Rabbit; this is Little Rabbit's uncle; this is Little Elephant; this is Little Elephant's uncle. One day, they were picking apples in the orchard (pic.1). After a while, some rushes popped out in the arms of the little animals. It was so itching that Little Elephant and Little Elephant's uncle took out a scratcher to scratch. However, Little Rabbit and Little Rabbit's uncle only had one scratcher. The Little Rabbit's uncle was going to scratch. Little Rabbit wondered, "Who will my uncle scratch? Here or there?" (pic.2). Let's see what happened (pic.3). Pangpang, could you guess what happened?

Handpuppet: Let me guess. Little animals were scratching. **Little Rabbit's uncle scratched ziji gently.**

Test Story 4: 抓痒痒的故事(scratch-TRUE)

实验者：这是小熊，这是小熊的姐姐。这是小马，这是小马的姐姐。一天，他们在果园里摘水果（图 1）。摘着摘着，小动物们的身上就长了一些红点点。好痒呀，于是小马和小马的姐姐拿出了抓痒的小抓子开始轻轻地抓痒。可是小熊和小熊的姐姐只有一个小抓子，小熊的姐姐准备开始抓痒。小熊想："姐姐会抓抓谁呢？抓抓这里？还是抓抓这里（图 2）？"我们来看看小熊的姐姐抓了谁（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：我来猜猜: 动物们正在抓痒痒...**小熊的姐姐轻轻地抓了自己。**

Experimenter: This is Little Bear; this is Little Bear's sister; this is Little Horse; this is Little Horse's sister. One day, they were picking apples in the orchard (pic.1). After

a while, some rushes popped out in the arms of the little animals. It was so itching that Little Horse and Little Horse's sister took out a scratcher to scratch. However, Little Bear and Little Bear's sister they only had one scratcher. The Little Bear's sister was going to scratch. Little Bear wondered, "Who will my sister scratch? Here or there?" (pic.2). Let's see what happened (pic.3). Pangpang, could you guess what happened?
Handpuppet: Let me guess. Little animals were scratching. **Little Bear's sister scratched ziji gently.**

Test Story 5: 画一画的故事(draw-FALSE)
实验者：这是小老虎，这是小老虎的妈妈。这是小熊，这是小熊的妈妈。一天，他们在公园里画画（图 1）。你看，小熊的妈妈画了小熊。小老虎的妈妈也准备来画画，小老虎想："妈妈会画谁呢？画这个（指着小老虎），还是画这个呢（指着老虎妈妈）（图 2）？"我们来看看小熊的妈妈画了谁（图 3）。胖胖，你能猜猜发生了什么吗？
手偶：我来猜猜：动物们正在画画...**小老虎的妈妈开心地画了自己**。
Experimenter: This is Little Tiger; this is Little Tiger's mom; this is Little Bear; this is Little Bear's mom. One day, they were drawing in the park (pic.1). You see, Little Bear's mom drew Little Bear. The Little Tiger's mom was going to draw, too. Little Tiger wondered, "Who will my mom draw? this (pointing at Little Tiger) or that (pointing at his mom)?" (pic.2). Let's see what happened (pic.3). Pangpang, could you guess what happened?
Handpuppet: Let me guess. Little animals were drawing. **Little Tiger's mom drew ziji happily.**

Test Story 6: 画一画的故事(draw-TRUE)
实验者：这是小猫，这是小猫的哥哥。这是小猪，这是小猪的哥哥。一天，他们在沙滩上画画（图 1）。你看，小猪的哥哥画了小猪。小猫的哥哥也准备来画画，小猫想："哥哥会画谁呢？画这个（指着小猫），还是画这个（指着猫哥哥）呢（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？
手偶：我来猜猜: 动物们正在画画...**小猫的哥哥开心地画了自己。**
Experimenter: This is Little Cat; this is Little Cat's brother; this is Little Pig; this is Little Pig's brother. One day, they were drawing on the beach (pic.1). You see, Little Pig's brother drew Little Pig. The Little Cat's brother was going to draw, too. Little

Cat wondered, “Who will my brother draw? This (pointing at Little Cat) or that (pointing at his brother)?” (pic.2). Let’s see what happened (pic.3). Pangpang, could you guess what happened?

Handpuppet: Let me guess. Little animals were drawing. **Little Cat’s brother drew ziji happily.**

Test Story 7: 拍一拍的故事(pat-FALSE)

实验者：这是小狗，这是小狗的爸爸，这是小猫，这是小猫的爸爸。有一天，他们在爬楼梯（图 1），爬着爬着，他们的腿就开始疼起来。于是小猫和小猫的爸爸拿出小拍子开始轻轻地拍拍腿。可是小狗和小狗的爸爸只有一个小拍子。小狗的爸爸拿着拍子准备拍拍腿，小狗想：“爸爸会拍谁呢？这里？还是那里（图 2）？”我们来看看发生了什么（图 3）。

手偶：我来猜猜: 动物们正在拍拍腿...**小狗的爸爸轻轻地拍了自己.**

Experimenter: This is Little Dog; this is Little Dog’s dad; this is Little Cat; this is Little Cat’s dad. One day, they were climbing the stairs (pic.1). After a while, they felt pain on their legs, so Little Cat and Little Cat’s dad took out two patters to pat legs. However, Little Dog and Little Dog’s dad only had one patter, The Little Dog’s dad was going to pat. Little Dog wondered, “Who will my dad pat? Here or there?” (pic.2). Let’s see what happened (pic.3). Pangpang, could you guess what happened?

Handpuppet: Let me guess. Little animals were patting. **Little Dog’s dad patted ziji gently.**

Test Story 8: 拍一拍的故事(pat-TRUE)

实验者：这是小马，这是小马的爷爷，这是小猪，这是小猪的爷爷。有一天，他们在爬楼梯（图 1），爬着爬着，他们的腿就开始疼起来。于是小猪和小猪的爷爷拿出小拍子开始轻轻地拍拍腿。可是小马和小马的爷爷只有一个小拍子。小马的爷爷手里拿着拍子，小马想：“爷爷会拍谁呢？这里？还是那里（图 2）？”我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：我来猜猜：动物们在拍拍腿...**小马的爷爷轻轻地拍了自己**。

Experimenter: This is Little Horse; this is Little Horse’s grandpa; this is Little Pig; this is Little Pig’s grandpa. One day, they were climbing the stairs (pic.1). After a while, they felt pain on their legs, so Little Pig and Little Pig’s grandpa took out two patters to pat legs. However, Little Horse and Little Horse’s grandpa only had one patter. The Little Horse’s grandpa was going to pat. Little Horse wondered, “Who will

my grandpa pat? Here or there?" (pic.2). Let's see what happened (pic.3). Pangpang, could you guess what happened?

Handpuppet: Let me guess. Little animals were patting. **Little Horse's grandpa patted ziji gently.**

(2) Logophoric Condition

Test Story 9: 藏棒棒糖的故事(hide…behind-FALSE)

实验者：这是小兔，这是小兔的阿姨。这是小羊，这是小羊的阿姨。这是一个盒子，盒子里是棒棒糖。一天，他们在家里玩把棒棒糖藏起来的游戏（图 1）。你看，小羊的阿姨把棒棒糖藏在了小羊后面。小兔的阿姨也从盒子里拿出一个棒棒糖准备藏起来。小兔想：“阿姨会把棒棒糖藏在谁后面呢？这里？还是这里（图 2）？”我们来看看发生了什么（图 3）。

手偶：我来猜猜: 动物们在玩藏棒棒糖的游戏...**小兔的阿姨把棒棒糖藏在了自己后面。**

Experimenter: This is Little Rabbit; this is Little Rabbit's aunt; this is Little Sheep; this is Little Sheep's aunt. Here is a box with lollipops in it. One day, they were playing the game "hiding the lollipop" at home (pic.1). See, Little Sheep's aunt hid the lollipop behind Little Sheep. Little Rabbit's aunt also took a lollipop out of the box and planned to hide it somewhere. Little Rabbit wondered, "Behind whom will my aunt hide the lollipop? Here or there? (pic.2)" Let's see what happened (pic.3).

Handpuppet: Let me guess. Little animals were playing the game "hiding the lollipop", **Little Rabbit's aunt hid the lollipop behind ziji.**

"

Test Story 10: 藏棒棒糖的故事(hide…behind -TRUE)

实验者：这是小熊，这是小熊的妈妈。这是小老虎，这是小老虎的妈妈。这是一个盒子，盒子里是棒棒糖。一天，他们在家里玩把棒棒糖藏起来的游戏（图 1）。你看，小老虎的妈妈把棒棒糖藏在了小老虎后面。小熊的妈妈也从盒子里拿出一个棒棒糖准备藏起来。小熊想：“妈妈会把棒棒糖藏在谁后面呢？这里？还是这里（图 2）？”我们来看看发生了什么（图 3）。

手偶：我来猜猜: 动物们在玩藏棒棒糖的游戏...**小熊的妈妈把棒棒糖藏在了自己后面。**

Experimenter: This is Little Bear; this is Little Bear's mom; this is Little Tiger; this is Little Tiger's mom. Here is a box with lollipops in it. One day, they were playing the game "hiding the lollipop" at home (pic.1). See, Little Tiger's mom hid the lollipop behind Little Tiger. Little Bear's mom also took a lollipop out of the box and planned to hide it somewhere. Little Bear wondered, "Behind whom will my mom hide the lollipop? Here or there? (pic.2)" Let's see what happened (pic.3).
Handpuppet: Let me guess. Little animals are playing the game "hiding the lollipop", **Little Bear's mom hid the lollipop behind ziji.**

Test Story 11:打伞的故事(hold…above -FALSE)
实验者：这是小猪，这是小猪的爷爷。这是小马，这是小马的爷爷。有一天，他们在公园里玩耍（图 1）。突然，下雨了。于是小马和小马的爷爷打起了伞。可是小猪和小猪的爷爷只有一把伞，小猪的爷爷准备打伞，小猪想："爷爷会把伞打在谁头上呢？这里？还是这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？
手偶：我来猜猜: 动物们正在打伞...**小猪的爷爷把伞打在了自己头上。**
Experimenter: This is Little Pig; this is Little Pig's grandpa; this is Little Horse; this is Little Horse's grandpa (pic.1). Suddenly, it is raining, so Little Horse and Little Horse's grandpa opened the umbrella and held them above their heads. However, Little Pig and Little Pig's grandpa only had one umbrella. Little Pig's grandpa was going to open the umbrella. Little Pig wondered, "Above whom will my grandpa hold the umbrella? Here or there (pic.2)? Let's see what happened (pic.3).
Handpuppet: Let me guess. Little animals were holding the umbrella. **Little Pig's grandpa held the umbrella above ziji.**

Test Story 12: 打伞的故事(hold…above -TRUE)
实验者：这是小猫，这是小猫的爸爸。这是小狗，这是小狗的爸爸。有一天，他们在公园里玩耍（图 1）。突然，下雨了。于是小狗和小狗的爸爸打起了伞。可是小猫和小猫的爸爸只有一把伞，小猫的爸爸准备打伞，小猫想："爸爸会把伞打在谁头上呢？这里？还是这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？
手偶：我来猜猜: 动物们打起了伞...**小猫的爸爸把把伞打在了自己头上**。

Experimenter: This is Little Cat; this is Little Cat's dad; this is Little Dog; this is Little Dog's dad (pic.1). Suddenly, it is raining, so Little Dog and Little Dog's dad opened the umbrella and held them above their heads. However, Little Cat and Little Cat's dad only had one umbrella. Little Cat's dad was going to open the umbrella. Little Cat wondered, "Above whom will my dad hold the umbrella? Here or there? (pic.2) Let's see what happened (pic.3).

Handpuppet: Let me guess. Little animals were holding the umbrella. **Little Cat's dad held the umbrella above ziji.**

Test Story 13: 摆椅子的故事(put…behind-TRUE)

实验者：这是小兔，这是小兔的叔叔。这是小象，这是小象的叔叔。一天，他们在广场上跳舞（图 1）。跳着跳着，他们就跳累了，于是小兔和小兔的叔叔搬来了椅子，并放了下来。小象的叔叔也搬来了一把椅子准备放下。小象想："叔叔会把椅子放在谁后面呢？这里？还是这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：我来猜猜: 动物们正在把椅子放下来...**小象的叔叔把椅子放在了自己后面.**

Experimenter: This is Little Rabbit; this is Little Rabbit's uncle; this is Little Elephant; this is Little Elephant's uncle. One day, they were dancing on the square (pic.1). After a while, they felt a bit tired, so Little Rabbit and Little Rabbit's uncle carried two chairs with them and put them down. Little Elephant's uncle also carried a chair and is going to put it down. Little Elephant wondered, "Behind whom will my uncle put the chair? Here or there? (pic.2)" Let's see what happened (pic.3).

Handpuppet: Let me guess. Little animals were putting down the chairs. **Little Elephant's uncle put the chair behind ziji.**

Test Story 14: 摆椅子的故事(put…behind-FALSE)

实验者：这是小熊，这是小熊的姐姐。这是小马，这是小马的姐姐。一天，他们在广场上跳舞（图 1）。跳着跳着，他们就跳累了，于是小熊和小熊的姐姐搬来了椅子，并放了下来。小马的姐姐也搬来了一把椅子准备放下。小马想："姐姐会把椅子放在谁后面呢？这里？还是这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？

手偶：我来猜猜：动物们正在把椅子放下来...**小马的姐姐把椅子放在了自己后面。**

Experimenter: This is Little Bear; this is Little Bear's sister; this is Little Horse; this is Little Horse's sister. One day, they were dancing on the square (pic.1). After a while, they felt a bit tired, so Little Bear and Little Bear's sister carried two chairs with them and put them down. Little Horse's sister also carried a chair and was going to put it down. Little Horse wondered, "Behind whom will my sister put the chair? Here or there? (pic.2)" Let's see what happened (pic.3).
Handpuppet: Let me guess. Little animals were putting down the chairs. **Little Horse's sister put the chair behind ziji.**

Test Story 15: 摆筷子的故事(place…in front of-FALSE)
实验者：这是小猪，这是小猪的哥哥。这是小猫，这是小猫的哥哥。一天，他们准备吃早餐，却发现桌上没有筷子（图 1）。于是小猫和小猫的哥哥拿来了筷子摆在了面前。小猪的哥哥也去拿了一双筷子准备把筷子摆一摆。小猪想："哥哥会把筷子摆在谁面前呢？这里？还是这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？
手偶：我来猜猜: 动物们正在摆筷子...**小猪的哥哥把筷子摆在了自己面前。**

Experimenter: This is Little Pig; this is Little Pig's brother; this is Little Cat; this is Little Cat's brother. One day, they were going to have breakfast, but there were no chopsticks on the table (pic.1). So Little Cat and Little Cat's brother took two pairs of chopsticks and placed them in front of them. Little Pig's brother also took a pair of chopsticks and was going to place it on the table. Little Pig wondered, "In front of whom will my brother place the chopsticks? Here or there? (pic.2)" Let's see what happened (pic.3).
Handpuppet: Let me guess. Little animals were placing chopsticks. **Little Pig's brother placed the chopsticks in front of ziji.**

Test Story 16: 摆筷子的故事(place…in front of-TRUE)
实验者：这是小象，这是小象的奶奶。这是小熊，这是小熊的奶奶。一天，他们准备吃早餐，却发现桌上没有筷子（图 1）。于是小熊和小熊的奶奶拿来了筷子摆在了面前。小象的奶奶也去拿了一双筷子准备把筷子摆一摆。小象想："奶奶会把筷子摆在谁面前呢？这里？还是这里（图 2）？"我们来看看发生了什么（图 3）。胖胖，你能猜猜发生了什么吗？
手偶：我来猜猜：动物们正在摆筷子...**小象的奶奶把筷子摆在了自己面前**。

Experimenter: This is Little Elephant; this is Little Elephant's grandma; this is Little Bear; this is Little Bear's grandma. One day, they were going to have breakfast, but there were no chopsticks on the table (pic.1). So Little Bear and Little Bear's grandma took two pairs of chopsticks and placed them in front of them. Little Elephant's grandma also took a pair of chopsticks and is going to place it on the table. Little Elephant wondered, "In front of whom will my grandma place the chopsticks? Here or there? (pic.2)" Let's see what happened (pic.3).

Handpuppet: Let me guess. Little animals were placing chopsticks. **Little Elephant's grandma placed the chopsticks in front of ziji.**

Test Stimuli for Experiment 2

1. 开场指导语，同实验一（Introduction, the same as experiment 1）

2. 练习部分 (Practice)

练习 1:

实验者：你看，这是小马，这是小熊，你看，它在喝水。胖胖，你能猜猜我们能看见什么吗？

手偶：我来猜猜，小马，小熊...（你们能看见）**小马在喝水**。

实验者：胖胖说得对不对呀？

Experimenter: Look, this is Little Horse. This is Little Bear. See, she is drinking water. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Little Horse, Little Bear...(You can see that) Little Horse is drinking water.

Experimenter: Was Pangpang's guessing right or wrong?

练习 2:

实验者：你看，这是小猫，这是小猫的叔叔。他们在吃冰淇淋。这是小兔子，这是小兔子的叔叔，它在洗澡。胖胖，你能猜猜我们能看见什么吗？

手偶：我来猜猜，小猫，小猫的叔叔，小兔子，小兔子的叔叔...**小兔子的叔叔在洗澡。**

实验者：胖胖说得对不对呀？

Experimenter: Look, this is Little Cat. This is Little Cat's uncle. They are eating ice creams. This is Little Rabbit. This is Little Rabbit's uncle. He is taking a shower. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Little Cat, Little Cat's uncle, Little Rabbit, Little Rabbit's uncle… (You can see that) Little Rabbit's uncle is taking a shower.

Experimenter: Was Pangpang's guessing right or wrong?

练习 3:

实验者：你看，这是一只小牛，这是一只小兔子，你看，它在睡觉呢。胖胖，你能猜猜我们能看见什么吗？

手偶：我来猜猜，小牛，小兔子...（你们能看见）**小兔子在睡觉。**

实验者：胖胖说得对不对呀？

Experimenter: Look, this is a cow. This is a rabbit. See, she is sleeping. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Little Cow, Little Rabbit...(You can see that) Little Rabbit is sleeping.

Experimenter: Was Pangpang's guessing right or wrong?

3. 正式实验部分 (Test)：

(1) Nonspecific

Picture 1: bike-tires (True)

实验者：这是操场。操场上有卡车，还有自行车。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 自行车, 卡车...**有辆自行车在操场上，轮胎是绿色的。**

Experimenter: Look, this is a playground. On the playground are a truck and a bike. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Bike, truck… **There is a bike on the playground. The tires are green.**

Picture 2: bus-door (False)

实验者：你看，这是马路，马路上有房子，路灯，车子。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 汽车, 房子...**有辆汽车在马路上，门是黄色的。**

Experimenter: Look, this is a road. On the road are a house, a streetlight, and a bus. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Bus, house… **There is a bus on the road. The door is yellow.**

Picture 3: boat-flag (True)

实验者：这是大海，海上有船，海边有城堡。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 船, 城堡...**有条船在海面上， 旗子是绿色的。**

Experimenter: Look, this is the sea. On the sea is a ship and on the coastal is a castle. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. ship, castle… **There is a ship on the sea. The flag is green.**

Picture 4: girl-scarf (False)

实验者：你看，这是一间教室，讲台上有男孩，还有女孩。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 女孩, 男孩...**有个女孩在教室里，围巾是黄色的。**

Experimenter: Look, this is a classroom. On the stage are a boy and a girl. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Girl, boy…**There is a girl in the classroom. The scarf is yellow.**

Picture 5: bucket-lid (True)

实验者：你看，这是地面，地上有锅子，还有桶子。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 桶子, 锅子...**有个桶子在地面上，盖子是蓝色的。**

Experimenter: Look, this is the floor. On the floor there are a pot and a bucket. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Bucket, pot…**There is a bucket on the floor. The lid is blue.**

Picture 6: plane-windows (False)

实验者：这是马路。马路上有汽车。天空里有飞机，白云。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 飞机, 汽车...**有架飞机在天空中，窗子是绿色的。**

Experimenter: Look, this is the road. On the road is a bus. In the sky are a plane and some clouds. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Plane, bus… **There is a plane in the sky. The windows are green.**

Picture 7: boy-pants (True)

实验者：下雪了。雪地里站着男孩和女孩。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 男孩, 女孩...**有个男孩在雪地里， 裤子是黄色的。**

Experimenter: It is snowing. In the snowfield stand a boy and a girl. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Boy, girl…**There is a boy in the snowfield. The pants are yellow.**

Picture 8: T-shirt-pockets (False)

实验者：这是一个沙发，沙发上有裤子，还有衣服。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 衣服，裤子...**有件衣服在沙发上， 口袋是绿色的。**

Experimenter: This is a sofa. On the sofa are a T-shirt and a pair of pants. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. T-shirt, pants… **There is a T-shirt on the sofa. The pockets are green.**

(2) Specific Condition[111]

Picture 9: plane-windows (True)

实验者:这是马路。马路上有汽车。天空里有飞机，白云。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 飞机, 汽车...**有这样一架飞机在天空中， 窗子是绿色的。**

Experimenter: Look, this is a road. On the road is a bus. In the sky are a plane and some clouds. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Plane, bus… **There is this plane in the sky. The windows are green.**

Picture 10: boy-pants (False)

实验者：下雪了。雪地里站着男孩和女孩。胖胖，你能猜猜我们能看见什么吗?

手偶：男孩, 女孩...**有这样一个男孩在雪地里， 裤子是黄色的。**

Experimenter: It is snowing. In the snowfield stand a boy and a girl. Pangpang, Could you guess what we can see?

Handpuppet: Let me guess. Boy, girl… **There is this boy in the snowfield. The pants are yellow.**

Picture 11: car-door (True)

实验者：你看，这是一条马路，马路上有房子，路灯，车子。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 汽车, 房子...**有这样一辆汽车在马路上，门是黄色的。**

Experimenter: Look, this is the road. On the road are a house, a streetlight, and a bus. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Bus, house… **There is this car on the road. The door is yellow.**

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[111] In the specific condition, the test items are the same as those in the nonspecific condition, because what I would like to explore is whether or not making the antecedent more prominent by adding the lexical marker "this" will result in different performances done by children. All the other factors are controlled, including the test items. Also, in order to avoid familiarity effect, the pictures used in the specific condition are re-designed and are different from those used in the nonspecific condition, with the positions, the shapes, and the colors of the test items slightly changed. I also swap the true and false condition in which the test items will occur to further avoid the familiarity effect.

Picture 12: ship-flag (False)

实验者：看，这是大海，海面上有船，海边有城堡。胖胖，你能猜猜我们能看见什么吗?

手偶：我来猜猜: 船, 城堡...**有这样一条船在海面上， 旗子是蓝色的。**

Experimenter: Look, this is the sea. On the sea is a ship; on the coastal is a castle. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. ship, castle… **There is this ship on the sea. The flag is blue.**

Picture 13: bike-tires (False)

实验者：这是草地。草地上有卡车，还有自行车。

手偶：我来猜猜: 自行车, 卡车...**有这样一辆自行车在草地上，轮胎是蓝色的。**

Experimenter: Look, this is the grassland. On the grassland are a truck and a bike. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Bike, truck… **There is this bike on the grassland. The tires are blue.**

Picture 14: T-shirt—pockets (True)

实验者：这是一个沙发，沙发上有裤子，还有衣服。

手偶：我来猜猜: 衣服 裤子...**有这样一件衣服在沙发上， 口袋是绿色的。**

Experimenter: This is a sofa. On the sofa are a T-shirt and a pair of pants. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. T-shirt, pants… **There is this T-shirt on the sofa. The pockets are green.**

Picture 15: bucket—lid (False)

实验者：你看，这是地面，地上有锅子，还有桶子。

手偶：我来猜猜: 桶子 锅子...**有这样一个桶子在地面上， 盖子是绿色的。**

Experimenter: Look, this is the floor. On the floor there are a pot and a bucket. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Bucket, pot… **There is this bucket on the floor. The lid is green.**

Picture 16: girl-scarf (True)

实验者：这是一间教室，讲台上有男孩，还有女孩。

手偶：我来猜猜: 女孩, 男孩...**有这样一个女孩在教室里， 围巾是黄色的。**

Experimenter: Look, this is a classroom. On the stage are a boy and a girl. Pangpang, could you guess what we can see?

Handpuppet: Let me guess. Girl, boy… **There is this girl in the classroom. The scarf is yellow.**

Fillers[112]:

Additional Filler 1: False

实验者：你看，这是一个小动物，它在水里游泳。胖胖，你能猜猜这是什么小动物吗？

手偶：我来猜猜: 在水里游泳...**我猜是小青蛙**。

实验者：胖胖说得对不对呀？

Experimenter: See, this is a little animal. She is swimming in the water. Pangpang, could you guess what kind of animal it is?

Handpuppet: Let me guess, swimming in the water…**I guess it is a frog.**

Experimenter: Was Pangpang's guessing right or wrong?

Additional Filler 2: False

实验者：你看，这是一个小动物，它有圆圆的脸，喜欢爬树。胖胖，你能猜猜这是什么小动物吗？

手偶：我来猜猜: 圆圆的脸，爬树...**我猜是小熊猫**。

实验者：胖胖说得对不对呀？

Experimenter: See, this is a little animal. He has a round face and he likes climbing trees. Pangpang, could you guess what kind of animal it is?

Handpuppet: Let me guess, a round face, climbing trees…**I guess it is a panda**.

Experimenter: Was Pangpang's guessing right or wrong?

[112] In addition to these fillers, the experimental items in experiment 1 & 2 are regarded as fillers to each other; that is, instead of doing experiment 1 & 2 separately, I mixed all the items together in the two experiments and did the two experiments simultaneously.

Additional Filler 3: False

实验者：你看，这是一个小动物，它有长长的耳朵...胖胖，你能猜猜这是什么小动物吗？

手偶：我来猜猜: 有长长的耳朵...我猜是小马。

实验者：胖胖说得对不对呀？

Experimenter: See, this is a little animal. She has very long ears. Pangpang, could you guess what kind of animal it is?

Handpuppet: Let me guess, long ears…**I guess it is a horse**.

Experimenter: Was Pangpang's guessing right or wrong?

Additional Filler 4: False

实验者：你看，这是一个小动物，它有圆滚滚的身体...胖胖，你能猜猜这是什么小动物吗？

手偶：我来猜猜: 圆滚滚的身体...**我猜是小猪**。

实验者：胖胖说得对不对呀？

Experimenter: See, this is a little animal. He has a round body. Pangpang, could you guess what kind of animal it is?

Handpuppet: Let me guess, a round body…**I guess it is a pig**.

Experimenter: Was Pangpang's guessing right or wrong?

Additional Filler 5: True

实验者：你看，这是一个小动物，它有长长的脖子...胖胖，你能猜猜这是什么小动物吗？

手偶：我来猜猜: 长长的脖子...**我猜是长颈鹿**。

实验者：胖胖说得对不对呀？

Experimenter: See, this is a little animal. She has a long neck. Pangpang, could you guess what kind of animal it is?

Handpuppet: Let me guess, a long neck…**I guess it is a giraffe**.

Experimenter: Was Pangpang's guessing right or wrong?

Summary

In this dissertation, I explored how Mandarin Chinese children from 3 to 6 years old acquire knowledge of referential dependencies at the syntax-discourse interface. Such dependencies require a form of bridge building between the element *ziji* (self-)) and an antecedent like *Zhangsan*, or between a definite noun phrase like *zuozhe* (the author) and an earlier mentioned noun phrase like *(yi)-ben shu* (a book).

The aim of dissertation is to understand the development of syntax-discourse interface knowledge in 3-to-6-year-old Mandarin Chinese children. In order to achieve this goal, I first built a Syntax-Discourse-Processing (S-D-P) model to describe the mechanisms of referential dependencies in Mandarin Chinese, and then conducted two language comprehension experiments to explore how they acquire the knowledge of the two types of referential dependencies at the syntax-discourse interface.

The findings show that Mandarin children begin to demonstrate the syntax-discourse interface knowledge at a very early age. Specifically, they know how to build a bridge between *ziji* and its antecedent, as well as a bridge between a definite noun phrase and its antecedent both at around age 3-to-4, and after the age of 4 they show fully adult-like behavior.

In all, this dissertation has six chapters. The followings are the short summaries for each chapter:

In Chapter 1, I first introduce the concept of referential dependency and its instantiations, and then I clarify what knowledge children have of these referential dependencies at the syntax-discourse interface. Furthermore, I illustrate the reasons for building the Syntax-Discourse-Processing model and present an overview of contents of each subsequent chapter.

In Chapter 2, I discuss the existing syntactic and discourse theories on the two types of referential dependencies that are established at the syntax-discourse interface. The

first type of dependency is built between a reflexive and its antecedent; the second is built between a full-form definite DP and its antecedent. By doing this, I aim to point out the merits and drawbacks in previous theories and provide possible solutions for the problems that have arisen for these theories, and which constitute the motivation for building the S-D-P model.

In Chapter 3, I illustrate in detail the Syntax-Discourse-Processing (S-D-P) model of referential dependencies in detail with English, Dutch, and Chinese data. This model is an extension of Heim's (1982) file change semantics and Avrutin's (1999) and Schumacher et al.'s (2010) syntax-discourse interface model. Briefly speaking, the S-D-P model includes: (1) various forms of basic components called file cards (which are further composed of a set of morphosyntactic features); (2) a set of operational rules on how these file cards interact with each other in discourse, including bridging, cut-and-paste, and copy-and-paste. It is important to note that the S-D-P model includes two aspects: linguistic and non-linguistic. Chapter 3 only focused on the linguistic part of the model.

In Chapter 4, I discuss the nonlinguistic aspect of the S-D-P model – the processing mechanisms of referential dependencies established between a pronoun/ reflexive/definite noun phrase and its antecedent. Since memory plays an important role in the interpretation of referential dependencies, I first present some basic facts of memory and then show how the operational rules mentioned in Chapter 3 are implemented by processing mechanisms.

In Chapter 5, I demonstrate how Mandarin Chinese children from 3 to 6 years old acquire the knowledge of the two types of referential dependencies by two language comprehension experiments. 91 Mandarin Chinese children aged between 3 to 6 took part in each experiment respectively (the participants are the same in both experiments). The results show that they know how to build a bridge between *ziji* and its antecedent, as well as a bridge between a definite noun phrase and its antecedent, both at around age 3-to-4.

In Chapter 6, I present the conclusion and discussion, including what new information is obtained in this study, what the implications are for some existing theories, and what should be further explored in future research.

Samenvatting

In deze dissertatie heb ik onderzocht hoe Mandarijn Chinese kinderen van 3 tot 6 jaar kennis verwerven van referentiële afhankelijkheden. Zulke afhankelijkheden vereisen een vorm van bruggenbouw tussen het element *ziji* (-zelf) en een antecedent als *Zhangsan*, of tussen een definiete nominale frase zoals *zouzhe* (de schrijver) en een eerder uitgedrukte nominale frase als *(yi)-ben shu* (een boek).

Het doel van dit proefschrift is inzicht te krijgen in de ontwikkeling van de syntaxis-discourse interface kennis bij 3- tot-6-jarige Mandarijn Chinese kinderen. Om dit doel te bereiken, heb ik eerst een Syntax-Discourse-Processing (S-D-P) model gebouwd om de mechanismen van referentiële afhankelijkheden in het Mandarijn Chinees te beschrijven, en vervolgens heb ik twee taalbegripsexperimenten uitgevoerd om te onderzoeken hoe deze kinderen kennis verwerven van de twee soorten referentiële afhankelijkheden op de syntaxis-discourse-interface.

De bevindingen laten zien dat Mandarijnse kinderen al op zeer jonge leeftijd beschikken over kennis van de syntaxis-discourse interface. Meer in het bijzonder weten ze hoe ze een brug moeten bouwen tussen *ziji* en zijn antecedent, alsook een brug tussen een bepaalde zelfstandig naamwoord zin en zijn antecedent. Beide vertoonden zij rond de leeftijd van 3 tot 4 jaar, en na de leeftijd van 4 vertoonden ze volledig volwassen gedrag.

In totaal heeft dit proefschrift zes hoofdstukken. Hieronder volgen korte samenvattingen van elk hoofdstuk.

In Hoofdstuk 1 introduceer ik eerst het concept referentiële afhankelijkheid en zijn concretiseringen, en vervolgens maak ik duidelijk welke kennis kinderen hebben van deze referentiële afhankelijkheden op de syntaxis-discourse interface. Verder verduidelijk ik de redenen voor het bouwen van het Syntax-Discourse-Processing-model en presenteer ik een overzicht van de inhoud van elk volgend hoofdstuk.

In Hoofdstuk 2 bespreek ik bestaande syntactische- en discourse-theorieën over de twee soorten referentiële afhankelijkheden die tot stand komen op de syntaxis-discourse-interface. Het eerste type afhankelijkheid betreft een relatie tussen een reflexief en zijn antecedent; het tweede betreft een relatie tussen een definitieve DP en zijn antecedent. Hiermee wil ik de voor- en nadelen van eerdere theorieën uitlichten en mogelijke oplossingen aandragen voor de problemen die voortkomen uit deze theorieën, en die de motivatie vormen voor het bouwen van het S-D-P-model.

In Hoofdstuk 3 illustreer ik in detail het Syntax-Discourse-Processing (S-D-P)-model van referentiële afhankelijkheden geïllustreerd met Engelse, Nederlandse en Chinese data. Dit model is een uitbreiding van Heims' (1982) *file change semantics* en Avrutins (1999) en Schumacher et al.'s (2010) syntaxis-discourse interfacemodel. Kortweg omvat het S-D-P-model: (1) verschillende vormen van basiscomponenten genaamd bestandskaarten (die verder zijn samengesteld uit een reeks morfosyntactische kenmerken); en (2) een reeks operationele regels over het samenspel tussen deze bestandskaarten in de discourse, inclusief het bouwen van bruggen, knippen en plakken, en kopiëren en plakken. Belangrijk is op te merken dat het S-D-P-model twee aspecten omvat: taalkundig en niet-taalkundig. Hoofdstuk 3 richt zich enkel op het linguïstische aspect van het model.

In Hoofdstuk 4 besprek ik het niet-taalkundige aspect van het S-D-P-model – de verwerkingsmechanismen van referentiële afhankelijkheden die zijn vastgesteld tussen een voornaamwoord/reflexief/definitieve DP en zijn antecedent. Aangezien het geheugen een belangrijke rol speelt in de interpretatie van referentiële afhankelijkheden, presenteerik eerst enkele basisfeiten van het geheugen en laat ik vervolgens zien hoe de operationele regels die in Hoofdstuk 3 worden genoemd, worden tot uitvoer gebracht in verwerkingsmechanismen.

In Hoofdstuk 5 laat ik zien hoe Mandarijn-Chinese kinderen van 3 tot 6 jaar de kennis van de twee soorten referentiële afhankelijkheden verwerven door middel van twee taalbegripsexperimenten. Aan elk experiment namen respectievelijk 91 Mandarijn-Chinese kinderen van 3 tot 6 jaar deel (de deelnemers zijn in beide experimenten hetzelfde). De resultaten laten zien dat ze een brug weten te bouwen tussen ziji en zijn antecedent, evenals een brug tussen een definiete nominale frase en zijn antecedent, beide rond de leeftijd van 3 tot 4 jaar.

In Hoofdstuk 6 presenteer ik de conclusie en discussie, inclusief de nieuwe informatie die in met deze studie is verkregen, wat de implicaties zijn voor enkele bestaande theorieën, en wat in de toekomst verder onderzocht zou moeten worden.

Curriculum Vitae

Yuan Xie was born on April 26th, 1990 in Chenzhou, Hunan, China. She attended Hunan First Normal University from 2009 to 2013 and obtained her bachelor degree in English. During this period, she acquired the general knowledge of English language, literature, and culture. From 2013 to 2016, she went to Beijing International Studies University and obtained her master degree in English language, literature and culture (theoretical linguistics and applied linguistics). During these three years, she received a systematic academic training in theoretical linguistics and applied linguistics and developed her research interests in aphasics and child language acquisition studies. She determined to deepen her knowledge in linguistics, so she began her PhD programme in Utrecht Institute of Linguistics in Utrecht University in 2016, with a research topic on the development of syntax-discourse interface knowledge in 3 to 6 years old Mandarin Chinese children. This dissertation is the result of the research.