

## Referential Dependencies in Chinese: A Syntax-Discourse Processing Model

Yuan Xie<sup>1</sup>

Utrecht Institute of Linguistics OTS, Utrecht University, Trans 10, The Netherlands  
y.xie@uu.nl

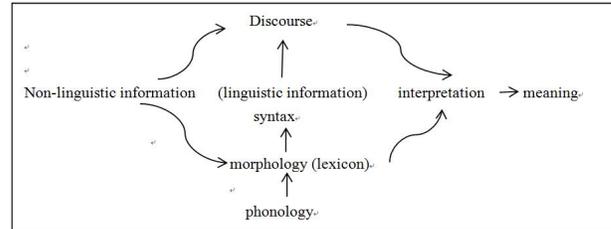
**Abstract:** In this paper, I am proposing a syntax-discourse processing model for the representation and interpretation of referential dependencies in Chinese. Chinese referentially dependent expressions (e.g. pronouns, reflexives, certain full noun phrases) are different from those in many indo-European languages and rely more on discourse (e.g. using bare noun phrases to express definiteness--lacking overt article *the*; sentence-free reflexive *ziji* (*self-N*)--referring to the speaker), for this reason, this model, taking both the morphosyntactic and discourse features of the referentially dependent expressions into consideration, reflects the view that referentially dependent nominal expressions and their antecedents are information units that are stored in our working memory system and the referential dependencies are established through the interactions of those information units in our working memory system.

**Keywords:** referential dependencies; syntax-discourse processing model; working memory; information units

### 1. Introduction

One of the key problems, the modeling of language processing, is how we can match structured representations of language with properties of the brain that allows human to process information generally. In other words: how is language represented and processed in our brain? First, we generally assume that language is a hierarchical system composed of different levels (e.g. phonology, morphology, syntax, etc). The interpretation of language parts, however, happens on the level of discourse--a level where both linguistic knowledge (e.g. phonological, morphological, syntactic information, etc) as well as non-linguistic knowledge (e.g. world knowledge, vision information, etc) converge:

1. Here I would like to give my sincere thanks to my two supervisors, Prof.dr. Sergey Avrutin and Prof. dr. Peter Coopmans. Thanks for their guidance, comments and corrections in the whole process of writing and revising this paper.



(Avrutin, 1999: 45, modified)

**Fig.1** Representations of language in general

In Figure 1, two knowledge modules (e.g. linguistic and non-linguistic) converge on interpretation: non-linguistic information such as world knowledge, vision information, etc; linguistic information that comes from lexical properties, syntactic structures, etc.

Under this framework, I will show the representation of referential dependencies in Chinese, which also involves those two knowledge modules. Firstly, in terms of the linguistic information--the morphosyntactic and discourse distributions of the referentially dependent expressions in Chinese--is different from those in many other languages. For example, English has an article system which allows for a *bridging* relationship to be established between an indefinite DP and a definite DP (e.g. *John bought a book. The author is famous. "the author" is bridged into "a book"*). Chinese, in contrast, does not have such overt articles. The question is how Chinese encodes such bridging relations between DPs in the absence of overt articles. Another referential dependency is the one established between a reflexive element and its antecedent. This is also a *bridging* relation in many languages, whereby the reflexivizing morpheme -SELF typically has semantic relations historically with forms of inalienable possession (e.g. a body part, nose, rib, soul, etc), which shows a hidden connection with its antecedent. Moreover, Chinese, with two types of reflexives (e.g. *ziji* (self-N) and *taziji* (pro-self-N)), differ from many other languages in the number of morphosyntactic features encoded in the reflexives. For example, Chinese *ziji* (self-N) does not have person, gender, and number features, which English reflexive *himself/herself* has). The question then is how Chinese, a language with two reflexive expressions with different combinations of morphosyntactic features and distinctive discourse features, encodes bridging connections with their antecedents. Secondly, in terms of the non-linguistic information (e.g. memory, vision, etc), here in this paper I mainly focus on distinctive linguistic part (e.g. morphosyntactic/discourse feature) and the cognitive part will be explored in my future work.

Basing myself on Heim's (1982) file change semantics, Avrutin's (1999) and Schumacher, Pinango and Avrutin's (2010) syntax-discourse model, I am proposing a model here that reflects the hypothesis that referential dependencies are established through a series of linguistic operations (e.g. morphosyntactic/discourse features), which finally is relating with non-linguistic module (e.g. memory activation level). I will show what this model can account for and which language-related domains it can be applied to.

### 1.1 What can this model account for?

Previous linguistic proposals concerning referential dependencies have been proposed from either purely syntactic theoretical perspectives (e.g. Chomsky 1981; Huang & Tang, 1991; Reinhart & Reuland, 1993 ) or purely discourse-theoretical perspective (e.g. Ariel, 1990; Walker, Joshi & Prince, 1998; Kamp, Van Genabith, & Reyle, 2011). With the model I intend to propose, I am taking both morphosyntactic and discourse features into consideration and aim to account for the representation and processing of referential dependencies in Chinese. First, I will outline the representation part --how nominal elements like reflexives, pronouns and (in)definite NPs are represented in terms of memory cards (information units). Secondly, I will outline the processing part --what discourse operations Chinese referential dependencies have, what possible error patterns may occur during language processing and what possible explanations there could be from the perspective of processing resources (e.g. memory).

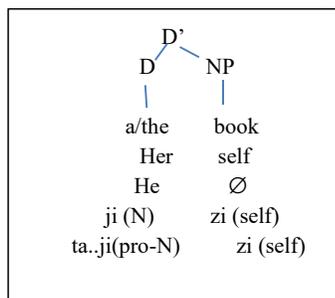
### 1.2 Which language domains can this model be applied to?

This model can be applied to such language-related domains as language processing, language acquisition, language pathology. For example, for language acquisition, using the rules established within this model, we can test children's knowledge of the referential dependencies and explain when and why children will obey or violate those rules, shedding light on what they already know and how they apply this knowledge. Similarly, we can also test the corresponding knowledge of aphasics and their (dis)ability to use this knowledge since these two populations show similarities.

## 2. The Representation of DPs: from syntax to discourse

### 2.1 Syntactic structure of DPs

The representation of nominal phrases in natural language, DPs, involves a translation process: from the syntactic structure into discourse for interpretation. The latter, in turn, is affected by memory activation level. The typical syntactic structure of DP is:

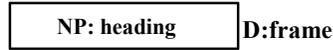


**Fig.2** syntactic structure of DP

The distribution pattern of the full noun phrase DP *a/the book*, the pronoun *he* and the reflexive herself *ziji (self) taziji (pro-self-N)* is similar, with D occupied by *a/the he, her*, and NP occupied by *book, self, ,zi(self)*.

## 2.2 Translation from syntax to discourse

The structure of DP is composed of two parts: D and NP, as was shown in Figure 2. The structure of each information unit (e.g. memory card) is also composed of two parts: a frame (a memory place holder), introduced by the functional category D; a heading (an identifier), introduced by the lexical category NP:



The translation from a syntactic DP onto a discourse memory card is as follows:

a. DP: [D° [NP]]	e.g. [her[self]]
b. D°----frame	e.g. D: her
c. NP---heading	e.g. NP: self

(Schumacher, Pinango, Avrutin, 2010:1743)

With Schumacher, Pinango and Avrutin (2010), I assume that the D, head of the DP, is the functional category specifying its categorial nature as the head of a nominal phrase [+N], and further consisting of a set of phi-features such as person, gender and number. Further specifications may include case, [+/- definiteness] and [+/-specificity]. These are translated into the frame of the memory card. NP is the lexical category with specific lexical features like dog [+animacy, -human, + hairy], boy [-adult, +human] etc, which can be translated into the heading part of the memory card. We define the frame and heading as follows:

### Definition 1: Frames and Headings

A **frame** is a translation of features of the functional category (e.g. person, number, gender, +N). A **heading** is a translation of features of the lexical category.

Those features (either functional or lexical), are not always all present. For example, in the Dutch simplex expression *zich*, the frame *zich* only has the third person feature. The English pronouns *he* and *she* have all the three phi features (person, gender, number) and categorial feature [+N]. Likewise, we can determine that neither the English reflexive *himself/herself* nor the Chinese reflexives *ziji(self-N)* and *taziji (pro-self-N)* have an independent lexical feature (*self* is a variable). Given the determination of their presence or absence, we can formulate featural make-up in terms of sufficiency or insufficiency. This is defined as follows:

**Definition 2: The Features of D and NP**

- a. For all the Ds in pronouns/reflexives, D has Sufficient Functional Features (SFF) if it has at least the following three features [+person] [+gender] [+number]; Otherwise, D is called Insufficient (IFF).
- b. For all the NPs in pronouns/reflexives, NP has Sufficient Lexical Features (SLF) if it can be interpreted independently; If not, it is called Insufficient (ILF).
- c. For all the Ds in full noun phrases, D has SFF if it has the [+definiteness] feature; if not, it is called ILF.
- d. All the DPs that do not have an overt Ds or overt NP, they are labelled as containing Null Functional Feature (NFF) and Null Lexical Feature (NLF) respectively.

Since features (functional and lexical) can either be sufficient or insufficient, the corresponding memory cards (with frames and headings) also have two associated conditions. These are labelled as weak and strong.

**Definition 3 The Strength of Frames and Prominence of Headings**

- a. A Strong Frame (SF) is a translation of sufficient functional features; A Weak Frame (WF) is a translation of insufficient functional features; An Empty Frame (EF) is a translation of null functional features.
- b. A Strong Heading (SH) is a translation of sufficient lexical features; A Weak Heading (WH) is a translation of insufficient lexical features; An Empty Heading (EH) is a translation of null lexical features.

Given the above definitions (2 and 3), we can determine 9 (3\*3) combinations of frames and headings. In (1-9) I have listed the possible mapping mechanisms and corresponding examples (drawing on Chinese, Dutch and English):

- |                       |                   |                |  |   |     |
|-----------------------|-------------------|----------------|--|---|-----|
| (1) $D_{SFF}NP_{SLF}$ | $\longrightarrow$ | $F_{SF}H_{SH}$ | (e.g. a dog)                                   |  | [1] |
| (2) $D_{NFF}NP_{ILF}$ | $\longrightarrow$ | $F_{EF}H_{WH}$ | (e.g. classical Chinese reflexive 'zi' (self)) |  |     |
| (3) $D_{NFF}NP_{SLF}$ | $\longrightarrow$ | $F_{EF}H_{SH}$ | (e.g. Chinese bare NP : gou (dog))             |  |     |
| (4) $D_{IFF}NP_{NLF}$ | $\longrightarrow$ | $F_{WF}H_{EH}$ | (e.g. zich, ancient Chinese 'ji' (N))          |  |     |
| (5) $D_{IFF}NP_{ILF}$ | $\longrightarrow$ | $F_{WF}H_{WH}$ | (e.g. zichzelf, ziji (self-N))                 |  |     |
| (6) $D_{IFF}NP_{SLF}$ | $\longrightarrow$ | $F_{WF}H_{SH}$ | (e.g. the dog, the bride)                      |  |     |
| (7) $D_{SFF}NP_{NLF}$ | $\longrightarrow$ | $F_{SF}H_{EH}$ | (e.g. him, her, it)                            |  |     |
| (8) $D_{SFF}NP_{ILF}$ | $\longrightarrow$ | $F_{SF}H_{WH}$ | (e.g. himself, herself)                        |  |     |
| (9) $D_{NFF}NP_{NLF}$ | $\longrightarrow$ | $F_{EF}H_{EH}$ | (e.g. null topic sentence in Chinese)          | $\emptyset$   |     |

Among all the nine conditions, we can see that only the card in condition (1) is complete, with a complete (strong) frame and a complete (strong) heading. This

[1] In all the nine conditions, we use nine graphs to show the mapping between a DP and a card: a box with full lines representing a strong frame; a box with dotted lines representing a weak frame; two full lines within the box representing a strong heading; two dotted lines within the box represent a weak heading; and an empty box/lines representing an empty frame/heading.

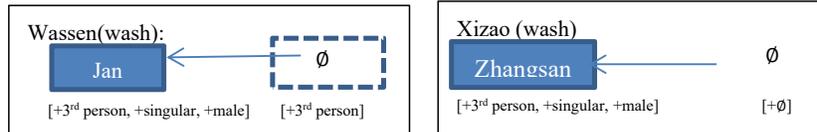
complete card is independent because it does not rely on other cards to be interpreted; all the other cards are incomplete, with either incomplete (weak/empty) frame or incomplete (weak/empty) heading. Those incomplete cards are dependent cards because they rely on other cards to be interpreted. In my model, there are three typical discourse operations between the dependent cards and independent cards: copy-and-paste, cut-and-paste and bridging. These will be illustrated in the next section.

### 3. The processing of DPs: three types of operations

#### 3.1 Cut-and-Paste

Referential dependencies between the simplex expressions and their antecedents can be established through a cut-and-paste process on the level of discourse, for example:

- (10) a. Jan<sub>i</sub> wāshē zìch<sub>i</sub>.  
 Jan washed zich  
 “John washed himself”  
 b. Zhāngsān xízāo le.  
 Zhāngsān wash LE<sup>[2]</sup>.  
 “Zhangsan washes himself”



In (10a) the morphological feature of *zich* is third person, so it matches with the singular antecedent *Jan*; Also, *zich* cannot be stressed, fronted or have a new guise in (10a). Here *guise* is to be interpreted as similar with *sense*, which is in contrast with *reference*. For example, *morning star* and *evening star* have the same *reference* but they are with different *guises*. In other words, *guises* are the representations of the referents in discourse. Here in (10a), *zich* does not have the above discourse features (e.g. fronted, stressed or new guise), and that is why it does not exist independently in discourse. In other words, the memory card triggered by *zich* does not exist in discourse, therefore – in order for *zich* to get an interpretation, its card should be cut and pasted onto another card. In addition, the predicate *wash* provides a context for *zich* to be cut (giving rise to a so called inherently reflexive interpretation, where only one participant is acceptable). In (10b), although Chinese does not have an overt form like Dutch *zich*, the empty position introduced by the empty card does not exist in discourse either. We can now formulate the following rule

[2] About the markers in this paper: *LE* is an aspect marker, representing finishing; *DE* represents a modifier auxiliary, it usually occurs between a adjective and a noun, or a possessive relation between two nouns. *AP* represents aspect marker (present)

**Cut-and-Paste Rule:**

Information can be cut-and-pasted iff

- the referentially dependent card has a weak (or empty) frame and an empty heading;
- the morphosyntactic features of the frames do not give rise to a conflict between the referentially dependent card and the referentially independent card;
- the discourse features of the heading cannot introduce an independent card in discourse and the predicate provides a context for it.

**3.2 Copy-and-paste: Pronouns**

Referential dependencies between strong pronouns (e.g. pronouns that have fully specified phi-features and different from clitics and simplex expressions such as Dutch *zich*, see Cardinaletti and Starke, 1999) and their antecedents are established through a copy-and-paste process on the level of discourse, for example:

- (11) Zhangsan<sub>i</sub> zai changge. Ta<sub>i</sub> feichang kaixin.  
 Zhangsan AP sing. He very happy.  
 “Zhangsan is singing. He is very happy”



Because the card triggered by *ta* has an empty heading, it needs to copy information from other cards to establish the completeness of the information. In (11), *ta* copies information from *Zhangsan* under the instructions of the frame features (e.g. third person, singular, male). However, copy-and-paste is forbidden in the following cases:

- (12) a. \*Zhangsan<sub>i</sub> hen lei le. Tamen<sub>i</sub> shuizhao-le.  
 Zhangsan very tired LE. They fall asleep LE.  
 “Zhangsan was very tired. They fell asleep”  
 b. \*Zhangsan<sub>i</sub> xihuan ta<sub>i</sub>.  
 Zhangsan like him  
 “Zhangsan likes him”  
 c. Zhangsan<sub>i</sub> xihuan ta<sub>i</sub>-de didi.  
 Zhangsan like he-DE brother  
 “Zhangsan likes his brother”  
 d. Zhangsan<sub>i</sub> zai ta<sub>i</sub> pangbian fang-le yi-ben shu

- Zhangsan Prep him next to put- LE one-CL book  
 “Zhangsan put a book next to him”  
 f. \*Ta<sub>i</sub> pashu de shihou, Zhangsan<sub>i</sub> shouli nazhe yige pingguo.  
 He climb DE time, Zhangsan hand-in hold one-CL apple  
 “When he climbs the trees, Zhangsan hold an apple in his hand”

In (12a), the morphological features of *tamen(they)* are inconsistent with those of *Zhangsan*, therefore, *tamen (they)* cannot copy information from *Zhangsan*. In (12b), information transfer via copy-and-paste is disallowed because *Zhangsan* and *ta (him)* are in the same information chunk. By information chunk we mean the smallest information unit triggered by the same event on the same level. For example, in (12c) and (12d), *ta* can copy and paste information from *Zhangsan* because *ta* is not in the same information chunk with the potential antecedent *Zhangsan* (*ta* is embedded in the possessive phrase and the prepositional phrase respectively), so copy-and-paste is possible in (12d) and (12c). The reason for impossibility of information transfer between *ta* and *Zhangsan* in (12b) is that the result of copy-and-paste would involve two identical guises (e.g. Zhangsan<sub>i</sub> likes Zhangsan<sub>i</sub>), which is ungrammatical<sup>[3]</sup>. In (12f) transfer via copy-and-paste is not acceptable, either. The reason is that copy-and-paste is uni-directional, that is, information will copy from a more prominent card and paste it onto a less prominent card. In this paper, I propose a value system to roughly measure the prominence scale of cards:

**Value System: prominence of cards:**

Prominence value system is measured by values[+1]. The sources of prominence include:

- (1) lexicon meanings (e.g. mental involvement verbs);
- (2) syntactic positions (e.g. subject/object);
- (3) discourse factors (e.g. context, topic, focus, discourse distance, perspectives, etc).

According to the value system, *ta* gets two values because it occurs in the subject position and carries the topic/focus<sup>[4]</sup> information in (12f) (value [+2]), therefore it is more prominent than *Zhangsan* (object, unfocused). In line with the observations spelled out here, we can formulate the copy-and-paste rule(s) as follows:

**Copy-and-Paste Rule(s): Pronouns**

Information can be copied-and-pasted iff

- a. the referentially dependent card has a strong frame and an empty heading;
- b. the morphosyntactic features of the frames are matched between the referentially dependent card and the referentially independent card.
- c. the referentially dependent card and the referentially independent card that provides information for the former are not in the same information chunk.
- d. the referentially dependent card is at least equal in prominence with the referentially independent card.

[3] In the example *Zhangsan likes Zhangsan*, the two *Zhangsan* may end up with one reference (e.g. two people whose names are *Zhangsan* or two situations that one *Zhangsan* involves in), but two identical guises are forbidden.

[4] For details of focus information on Chinese pronoun *ta*, see Lust, Chien, Chiang & Eisele (1996: 30).

### 3.3 Bridging

There are two types of bridging in this model. One is the bridging process between an indefinite DP and a definite DP. We label this as a form of *loose bridging*, to draw a contrast with another type of bridging, called *tight bridging*. In the latter case the referentially dependent card contains a heading (e.g. the reflexiving element SELF) denoting an inalienable possession relation with its antecedent (e.g. a body part). The following examples illustrate this.

#### Tight Bridging

In Chinese, illustrations of tight bridging can be divided into the following types:

- (13) a. Zhangsan<sub>i</sub> renwei Lisi<sub>j</sub> ti-le ziji<sub>i/j</sub>.  
Zhangsan think Lisi kick-LE self-N  
“Zhangsan thought that Lisi kicked him/himself”
- b. Zhangsan<sub>i</sub> gaosu-le Lisi<sub>j</sub> ziji<sub>i/\*j</sub>-de fenshu.  
Zhangsan tell-LE Lisi self-N-DE scores  
“Zhangsan told Lisi about his own scores”
- c. Wangwu<sub>i</sub> renwei wo<sub>j</sub> nao-le ziji<sub>\*i/j</sub>.  
Wangwu think I scratch-LE self-N  
“Wangwu thought that I scratched myself”
- d. Zhangsan<sub>i</sub> renwei Lisi<sub>j</sub> kanjian-le taziji<sub>\*i/j</sub>  
Zhangsan think Lisi see LE pro-self-N  
“Zhangsan thought that Lisi saw himself”
- f. Zhangsan<sub>i</sub> gaosu-le Lisi<sub>j</sub> taziji<sub>i/j</sub>-de fenshu.  
Zhangsan tell-LE Lisi pro-self-N-DE scores  
“Zhangsan told Lisi about his scores”

In (13a), *ziji* (*self-N*) can be bridged either to *Zhangsan* or to *Lisi*. We formulate it as a continuing rule because the two cards *Zhangsan* and *Lisi* have equal prominence. According to the value system above, *Zhangsan* gets one value [+1] from the lexical meaning of the mental verb *thought* while *Lisi* gets one value [+1] from the discourse distance (closer to the reflexive). Therefore, they are of equal prominence; in (13b), *ziji* (*self-N*) can only bridge to the distant *Zhangsan* because *Zhangsan* is more prominent than *Lisi*. *Zhangsan* is more prominent than *Lisi* because of the matrix verb *told* [+1] and the subject position of *Zhangsan*[+1], although *Lisi* also gets one value from distance [+1].

In (13c) and (13d), *ziji* (*self-N*) can only bridge into local *wo* (*I*). This is not because *wo* (*I*) is more prominent than *Zhangsan* but because of the hidden frame and heading feature-matching: Chinese *ziji* (*self-N*) contains hidden discourse information (e.g. the speaker) and hidden semantic information (e.g. *zi* means nose), and once *ziji* encounters the first person pronoun *wo*(*I*), the hidden discourse feature (e.g. the speaker) should be realized as early as possible. This is the same in (13d), in which *taziji* (*pro-self-N*) can only bridge to *Lisi* because of the combination features of *ta* and *ziji* should be realized as early as possible. Thus, we formulate the following rules:

**Bridging Rule I: Continuing, Jumping and Principle of Earlier Realization**

Information can be tightly bridged iff (i) the referentially dependent card has a strong (or weak) frame and a weak heading; (ii) the morphological features of the referentially dependent card and the referentially independent card are not in conflict, and:

- a. bridging will continue if the referentially independent cards have equal prominence.
- b. bridging will jump over the less prominent cards if the referentially independent cards have unequal prominence.
- c. bridging should be realized as early as possible once the morphosyntactic features of the frames and the lexical features of the headings are matched.

As to the complex reflexive *taziji* (*pro-self-N*), another property that needs to be mentioned is that when *taziji* and its antecedent card are in the same information chunk (e.g. *Lisi* and *taziji* in (13d)), it behaves like English reflexive *himself/herself*. When it is outside of this specific information chunk (e.g. in (13f)), it functions like a stressed pronoun, with the structure: [the pronoun *ta* + emphatic use].

**Loose Bridging**

Chinese does not have the determiner article *the*. Instead, the definiteness of a DP is usually encoded by other devices, such as syntactic position (e.g. preverbal position Chao, 1968; Xu, 1995; Cheng & Sybesma, 1999), lexical devices such as demonstratives, classifiers (e.g. Sybesma & Sio, 2008), aspects of world knowledge and visual information such as pointing (e.g. Avrutin, 1999). Here are some examples:

- (14)
- a. Zhangsan mai-le (yi)-ben shu. Zuoze hen youming.  
Zhangsan buy-LE (one)-CL book. Author very famous  
“Zhangsan bought a book. The author is very famous”
  - b. Zhangsan<sub>i</sub> mai-le-ben shu. Ta<sub>i</sub> hen xihuan na-wei zuozhe.  
Zhangsan buy-LE-CL book. He very like that-CL author.  
“Zhangsan bought a book. He likes that author very much”
  - c. Taiyang hen da.  
Sun very big  
“The sun is very big”
  - d. Che feichang xuanku. (pointing)  
Car very fancy  
“The car is very fancy”

In (14a), the definiteness of *zuoze* (*author*) is encoded by its preverbal position; in (14b), although *zuoze* occurs in postverbal position, the demonstrative *na-ge* (*that*) turns *zuoze* into a definite DP; in (14c), the definiteness of the DP *taiyang* (*sun*) is encoded through the common world knowledge shared by human beings; in (14d), the definiteness of the DP *che* (*car*) is encoded through pointing (visual information). On the other hand, indefiniteness in Chinese is usually encoded by the construction

“(numerals) + classifiers + NP”, such as *yi-tiao-yu* (one-CL<sup>shape</sup>-fish: a fish). For further details and discussion see Cheng & Sybesma (1999).

**Bridging Rule II: Source of Definiteness**

Information can be loosely bridged iff

- a. the referentially dependent card has a weak frame and a weak heading;
- b. the morphosyntactic feature of the referentially dependent card is [+definite] and that of the referentially independent card is [-definite]. The source of definiteness in Chinese is encoded through lexicon devices (e.g. *na-ge* (that-CL)), syntactic position (preverbal); visual information (e.g. pointing), and world knowledge (e.g. presupposition), etc.

Until now, I have illustrated how different kinds of DPs are represented and how different types of referential dependencies are interpreted in Chinese. The next step is to explain why such referential dependencies are in fact established. In this paper, I suggest that the morphosyntactic features and discourse features together help us establishing the dependencies between cards. For example, in terms of discourse prominence, according to Ariel (1990), the prominence of antecedents is related with the degree of memory activation. The activation level of memory can be correlated with the levels of processing (e.g. Craik & Lockhart, 1972; Anderson, 2005; Baddeley & Hitch, 2017). According to Craik & Lockhart (1972), there are two levels of processing in the memory system--deep and shallow. Deep or shallow processing will result in different memory traces, which can be mapped to the prominence scale of the cards. In other words, the prominence of the cards may reflect the level of memory activation. Since this model is an initial trial for the interpretation of referential dependencies in Chinese, especially for the memory activation part, a more detailed framework is needed in the future model modification process.

#### 4. Conclusion and Future Work

In this paper I have introduced a syntax-discourse interface processing model for the representation and interpretation of referential dependencies in Chinese. Under the hypothesis that referential dependencies are highly related with the level of memory activation, this model suggests that referential dependencies can be established through interactions among memory cards by means of such rules as copy-and-paste, cut-and-paste and bridging. These memory cards (information units) themselves are composed of frames (e.g. projected by D, with functional categorical features) of different strengths, and headings (e.g. projected by NP, with lexical categorical features) of different degrees of prominence.

There are three points that need extra attention. The first one is about the modules of language processing. The model I am proposing in this paper involves two knowledge modules: linguistic and non-linguistic. In this paper, I mainly illustrate the linguistic

module. As to the non-linguistic module (e.g. the memory/cognitive part), the present model is an embryonic outline of the role of memory and it lacks survey on the previous cognitive models. All these need further specification in the future work. The second point is about the adequacy of the data, although I have illustrated the working of the model by just a few examples, they are enough to deduce the basic rules above, for I have selected the most prototypical examples from different constructions in Chinese. Due to the limitation of the length of the paper, I have not been able to explain different constructions in greater detail. The final point is about the application of the model. This model is expected to be applied to language acquisition and language pathology, for example, it will be tested against obtained empirical data from experiments testing Chinese children's knowledge of referential dependencies at different ages and the corresponding knowledge of Chinese different types of aphasics in the future work.

### References

- [1] Anderson, J. R. *Cognitive psychology and its implications*. Macmillan (2005).
- [2] Ariel, M. *Accessing noun-phrase antecedents*. Routledge (1990).
- [3] Avrutin, S. *Development of the syntax-discourse interface*. Springer Science & Business Media (1999).
- [4] Baddeley, A. D., & Hitch, G. J. Is the levels of processing effect language limited? *Journal of Memory and Language*, 92, 1-13 (2017).
- [5] Cardinaletti, A., & Starke, M. The typology of structural deficiency: A case study of the three classes of pronouns. *Clitics in the languages of Europe*, Mouton de Gruyter, Berlin, 145-233 (1999).
- [6] Chao, Y. J. *A grammar of spoken Chinese*. University of California. Press (1968).
- [7] Cheng, L. S., & Sybesma, R. Bare and not-so-bare nouns and the structure of NP. *Linguistic Inquiry*, 30(4), 509-542 (1999).
- [8] Chomsky, N., *Lectures on government and binding*, Foris Publications, Dordrecht, (1981).
- [9] Craik, F. I., & Lockhart, R. S. Levels of processing: A framework for memory research. *Journal of verbal learning and verbal behavior*, 11(6), 671-684 (1972).
- [10] Heim, I. *The semantics of definite and indefinite NPs*. University of Massachusetts at Amherst dissertation (1982).
- [11] Kamp, H., Van Genabith, J., & Reyle, U. *Discourse representation theory*. In *Handbook of philosophical logic* (pp. 125-394). Springer, Dordrecht (2011).
- [12] Lust, B., Chien, Y. C., Chiang, C. P., & Eisele, J. 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 (1996).
- [13] Reinhart, T., & Reuland, E. Reflexivity. *Linguistic Inquiry*, 24(4), 657-720 (1993).
- [14] Schumacher, P. B., Piñango, M. M., Ruigendijk, E., & Avrutin, S. Reference assignment in dutch: evidence for the syntax-discourse divide. *Lingua*, 120(7), 1738-1763 (2010).
- [15] Sybesma, R., & Sio, J. U. S., D is for demonstrative—investigating the position of the demonstrative in Chinese and Zhuang. *The Linguistic Review*, 25(3-4), 453-478 (2008).
- [16] Walker, M. A., Joshi, A. K., & Prince, E. F. (Eds.). *Centering theory in discourse*. Oxford University Press (1998).
- [17] Xu, L. Definiteness effects on Chinese word order. *Cahiers de linguistique-Asie orientale*, 24(1), 29-48 (1995).