Available online at www.worldscientificnews.com

World Scientific News

An International Scientific Journal

WSN 124(2) (2019) 279-291 EISSN 2392-2192

Biologically Localized Merge of Topics in Mandarin Chinese

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ABSTRACT

The present article is devoted to the study of the biological localization of merging topics in Mandarin Chinese. The canonical topic structures in Chinese can be classified into 2 types: scrambling topic structures and left dislocated topic structures. In the first type, the topic is moved from its original position of an object or an adjunct to the spec CP position of the sentence; while in the second type, the topic is base generated in the spec CP position. The displaced topic is internally merged with its comment and the base generated topic is externally merged with its comment. Both logical possibilities of merge are localized laterally in BA 44.

***Keywords*:** biology, linguistics, localization, merge, topic, Brodmann Area 44

1. INTRODUCTION

Unlike the subject prominent languages such as English, Chinese is a typical topic prominent language [1, 2]. As a topic prominent language, the topic comment structure in Chinese is very popular in the language. Canonical topics in Chinese are positioned at the sentence initial position, optionally marked by modal particles as topic markers. In some sentences as in (1-4), the topics are raised from their original position to the spec Topic Phrase position.

(Received 01 March 2019; Accepted 17 March 2019; Date of Publication 18 March 2019)

(1) Zhe ben shu, wo xihuan du.
This Cl. book I like read
"This book, I like to read."

(2) Du zhe ben shu, wo xihuan.
Read this Cl. book I like
"To read this book, I like."

(3) Zai zhe ben shu li, wo kandao le xiwang.
In this Cl. book in, I see Part. Hope
"In this book, I saw hope."

(4) Zuotian wanshang, wo du guo zhe ben shu.
Yesterday evening I read Part. this Cl. book
"Yesterday evening, I read this book."

The scrambled topics in the examples of (1-4) are moved respectively from their original object position as in (1), predicate position as in (2), IP adjunct position as in (3) and VP adjunct position as in (4). The moved topics as shown in the above examples can be a noun as in (1), a verb phrase as in (2), a prepositional phrase as in (3) and an adverbial phrase as in (4).

However, in some other sentences, especially in some left dislocation structures such as in (5-8), topics might be base generated in the sentence initial position instead of movement from the main clauses.

(5) Shu, wo xihuan zhe ben.
Book I like this Cl.
"Books, I like this one."

(6) Zhe ben shu, wo xihuan du ta.
This Cl. book I like read it
"This book, I like to read it."

(7) Du shu, wo xihuan (du) zhe ben.
Read book I like read this Cl.
"To read books, I like (to read) this one."

(8) Zuotian wanshang, wo du le yi wanshang zhe ben shu.
Yesterday evening I read Part. an evening this Cl. Book
"Yesterday evening, I read this book for a whole evening."

In this article the merging process of the topics in the above examples will be dealt with in the following paragraphs.

2. LITERATURE REVIEW

The distribution and the syntactic behavior of the topics have been well discussed in the literature [3-6], although none of them deals with the biological localization of merge. There is still a controversial dispute on whether the topic is base generated or moved. In this article,

however, the author argues that in scrambled topic structures as in (1-4), the topics are moved, while in the left dislocation structures as in (5-8) the topics are base generated.

One of the articles on the biological localization of merge in topic structures in Mandarin Chinese holds that the sentence final topics in Shandong Dialect as illustrated in (9-12) [7] are internal merged from the object position or the adjunct position of the sentence to check the [+ABOUT] and the [+DEFINITE] features of the head Topic, and internal merge is biologically localized in Brodmann Area 44 [7].

(9) bie chi le, zhezhongcai! (object)
Not eat Part. such a vegetable
"Don't eat such a vegetable anymore!"

(10) shei qu a, na difang! (object)
Who go Part. that place
"Who goes to such a place!"

(11) taiyang hao a, jintian! (adjunct)
Sun nice Part. today
"The sun is nice today!"

(12) wo gai bu liao, xianzai. (adjunct)
I change not Part. now
"I can't change it now!"

Based on this observation, the author of this article follows the stipulation that internal merge of the topics are triggered by the requirement to check the strong [+ABOUT] and the [+DEFINITE] features of the head [7], and that internal merge and external merge are both biologically localized in BA 44 [7]. However, in this article, we'll mainly deal with the canonical topic structures in Mandarin Chinese as shown in (1-8), and leave the sentence final topic structures aside for open discussion.

3. THEORETICAL BACKGROUND

Merge is a biological species-specific object; a unique recycled cognitive procedure that constitutes the finite but unbounded systems of language which generate a limitless number of representations in various fields such as linguistics, art, music, mathematics. Merge, as the central neuronal computational process, is a recursive operation that is motivated by biological considerations [8]. Traditionally, merger is defined as in below: it takes two constituents as input and combines them to form a novel constituent labeled by one of the inputs: $\{\alpha\} + \{\beta\} \rightarrow \{\alpha, \{\alpha, \beta\}\}$ [9]. Chomsky [10-12] further suggests that merge refers to the basic combining operation that is unbounded, and Boeckx [8] follows it: merge (simplicitor) = def $\{\alpha, \beta\}$, in which labeling is considered as the result of a Minimal Search algorithm [13-15].

Berwick and Chomsky [13] define merge: "as a dyadic operation taking two syntactic objects as arguments, for example, two word-like atomic elements from the lexicon, such as read and books, returning the combination of the two as a single new syntactic object, leaving the original syntactic objects untouched. Merge is just set formation. Merge can then apply to this new hierarchically structured syntactic object, yielding, for example, the guy read books.

In this way, Merge recursively builds an infinite array of hierarchically structured representations." Merge, as the basic property of language, may also be defined as in the following [14, 15]: "Merge is a (dyadic) operation that takes two syntactic objects, call them X and Y, and constructs from them a single new syntactic object, call it Z. X, Y can be building blocks that are drawn from the lexicon or previously constructed objects. To put it simply, Merge (X, Y) just forms the set containing X and Y. neither X nor Y is modified in the course of the operation Merge"

Berwick and Chomsky [13] further posit: "there are two logical possibilities for Merge when it applies to two syntactic objects X and Y. either X and Y are disjoint, or else one of X or Y is a part of the other. The first case is External Merge (EM), and the second is Internal Merge (IM)."

The above mentioned two possible logical possibilities of merging X and Y are defined as in the following: "Either X and Y are distinct, and neither one is a term of the other, or else one of the two elements X or Y is a term of the other, where Z is term of W if it is a subset of the other or the subset of a term of the other." [14] The just mentioned syntactic operation is called external merge, in which two distinct objects are combined [15].

"When the syntactic object X is a term of the other Y or the syntactic object Y is a term of X, X and Y are internally merged. Internal merge is a ubiquitous property of language, sometimes called displacement. Phrases are heard in one place but they are interpreted both there and somewhere else" [14].

This understanding of the basic syntactic property of language will be applied to the analysis of the canonical topic sentences in Mandarin Chinese exemplified in (1-8) in the following section.

4. MAIN PART

This section mainly dwells on the derivation of the topic structures and the merging operation of the topics. Firstly, we'll deal with the derivation of the topic sentences in Mandarin Chinese. The scrambled topic structures of (1-4) are actually derived from the following sentences written as in (13-16).

(13) wo xihuan du zhe ben shu.
I like read this Cl. book
"I like to read this book."

(14) wo xihuan du zhe ben shu.
I like read this Cl. book
"I like to read this book."

(15) wo zai zhe ben shu li kandao le xiwang.
I in this Cl. book in see Part. hope
"I saw hope in this book."

(16) wo zuotian wanshang du guo zhe ben shu.
I yesterday evening read Part. this Cl. book
"I read this book last night."

As Chinese is a topic prominent language, the head topic position in CP carries strong [+TOPIC] feature [7], which requires the object or the adjunct in the sentence to be raised to fill in the empty spec CP position in order for the strong head [+TOPIC] feature to be checked. In (13) the noun phrase "zhe ben shu" is moved from the object position of the sentence to the spec CP position to check the strong [+TOPIC] feature of the head, and thus the sentence is interpreted as a topic sentence as illustrated in (17). In (14) the verbal phrase "du zhe ben shu" is raised to the spec CP position to check the strong [+TOPIC] feature of the head, and thus the sentence is interpreted as a topic sentence as illustrated in (18). In (15) the prepositional phrase "zai zhe ben shu li" is raised to the spec CP position to check the strong [+TOPIC] feature of the head, and thus the sentence is interpreted as a topic sentence as illustrated in (19). In (16) the adverbial phrase "zuotian wanshang" is raised to the spec CP position to check the strong [+TOPIC] feature of the head, and thus the sentence is interpreted as a topic sentence as illustrated in (20).

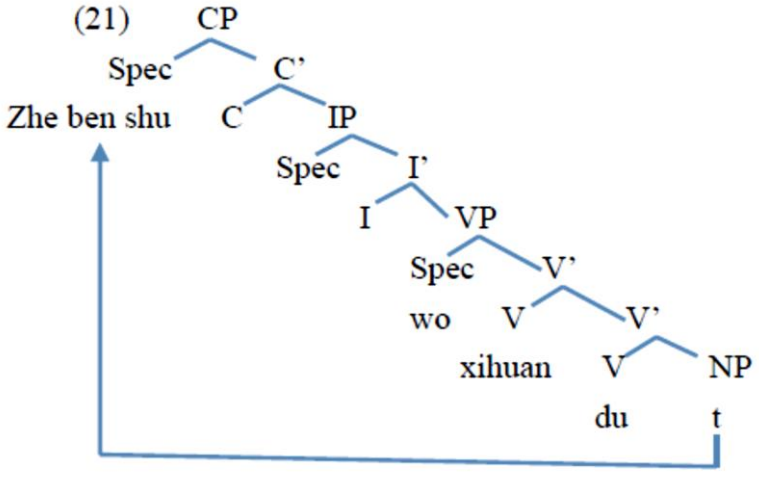
(17) [Zhe ben shu]$_i$, wo xihuan du t_i.
This Cl. book I like read
"This book, I like to read."

(18) [Du zhe ben shu]$_i$, wo xihuan t_i.
Read this Cl. book I like
"To read this book, I like."

(19) [Zai zhe ben shu li]$_i$, wo t_i kandao le xiwang.
In this Cl. book in, I see Part. Hope
"In this book, I saw hope."

(20) [Zuotian wanshang]$_i$, wo t_i du guo zhe ben shu.
Yesterday evening I read Part. this Cl. book
"Yesterday evening, I read this book."

The derivation process of (17), for example, can be illustrated by the tree diagram as demonstrated in (21).



However in the Minimalist Program, such a derivation process may also be accounted for in light of the copy theory. The raised topic to the spec CP position leaves behind in its original place another copy, and this copy is silent in the externalization of the sentence. The unpronounced copy in the sentence is indicated by a line in the center. This derivational process of the sentences in (1-4) can be illustrated as in (22-25) respectively below.

(22) Zhe ben shu, wo xihuan du ~~zhe ben shu~~.
This Cl. book I like read this Cl. book
"This book, I like to read ~~this book~~."

(23) Du zhe ben shu, wo xihuan ~~du zhe ben shu~~.
Read this Cl. book I like read this Cl. book
"To read this book, I like ~~to read this book~~."

(24) Zai zhe ben shu li, wo ~~zai zhe ben shu li~~ kandao le xiwang.
In this Cl. book in, I in this Cl. book in see Part. Hope
"In this book, I saw hope ~~in this book~~."

(25) Zuotian wanshang, wo ~~zuotian wanshang~~ du guo zhe ben shu.
Yesterday evening I yesterday evening read Part. this Cl. book
"Yesterday evening, I read this book ~~yesterday evening~~."

Now let's turn to the merge operation of the topic sentences in (1-4). Displacement of the topics in the above examples is called internal merge. In sentence (1), for example, the noun phrase "zhe ben shu" (for convenience the merge operation of this noun phrase is omitted) is external merged with the verb "du" into a V' "du zhe ben shu", the V' "du zhe ben shu" is external merged with the verb "xihuan" into the verbal phrase "xihuan du zhe ben shu", and the VP "xihuan du zhe ben shu" is external merged with the pronoun "wo" into the IP "wo xihuan du zhe ben shu". Finally the IP "wo xihuan du zhe ben shu" is internal merged with the topic phrase "zhe ben shu" into the CP "zhe ben shu, wo xihuan du zhe ben shu." As the first copy of the noun phrase "zhe ben shu" is the most prominent copy, it is externalized and pronounced, while the last copy of the noun phrase "zhe ben shu" is not prominent, it is deleted and silent in the externalization of the sentence. This process of merge is illustrated in below.

(26) Merge (du, zhe ben shu) => {du, zhe ben shu}

(27) Merge (xihuan, du zhe ben shu) => {xihuan, du zhe ben shu}

(28) Merge (wo, xihuan du zhe ben shu) => {wo, xihuan du zhe ben shu}

(29) Merge (zhe ben shu, wo xihuan du zhe ben shu) => {zhe ben shu, wo xihuan du zhe ben shu}

As it is indicated in (29) there are two copies of the noun phrase "zhe ben shu" in the internal merge of X and Y, only the structurally most prominent copy remains in the externalization of the sentence. Since Chinese is a topic prominent language, the first copy of the topic is the structurally most prominent one and stays externalized, while the second copy of the noun phrase is deleted. The externalized noun phrase is pronounced in the sensorimotor level while the deleted noun phrase is silent in PF. And finally after the series of merging operations, the sentence is derived as in (30).

(30) zhe ben shu, wo xihuan du.

The merging process of (2-4) is similar to the above example of that of (1). For saving space, the merging operation of the sentences in (2-4) is omitted. Readers interested in it may refer to the process illustrated in (26-30).

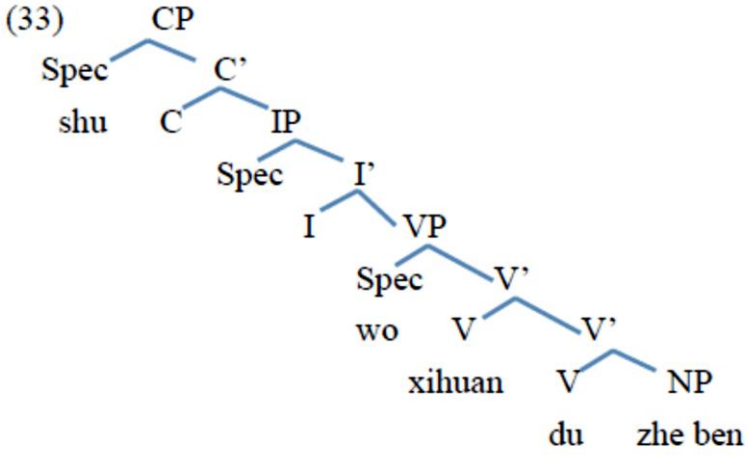
Now let's turn to the derivation of the second type of topic structures. Suppose the derivation operation of (5-8) is similar to that of that of (1-4). The left dislocated topics in (5-7) are derived from the corresponding sentences in (31) and (8) is derived from the sentence in (32).

(31) wo xihuan du zhe ben shu.
I like read this Cl. book
"I like to read this book."

(32) wo zuotian wanshang du le zhe ben shu.
I yesterday evening read Part. this Cl. book
"I read this book last night."

In (31) it is not acceptable to move the noun "shu" out of the whole NP "zhe ben shu". As in (5) the DP "zhe ben" is an abbreviated form of "zhe ben shu", the topic "shu" might not be raised out of the NP "zhe ben shu". Instead it is most probably base generated in the spec CP position to check the strong [+TOPIC] feature of the head as shown in the tree diagram of (33).

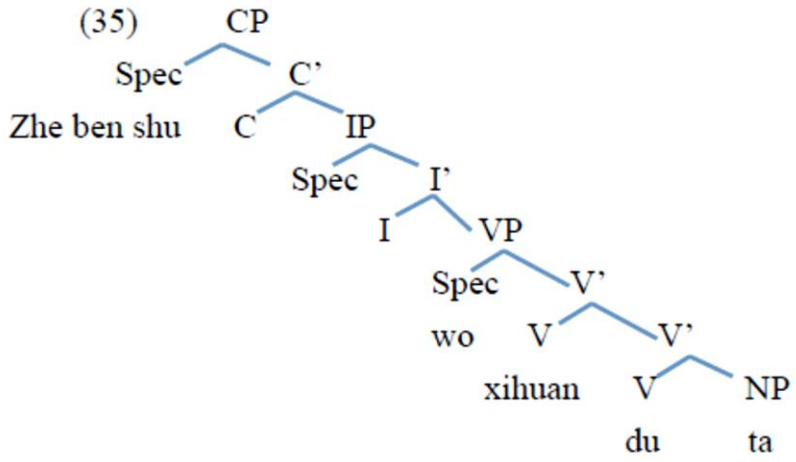
(33)



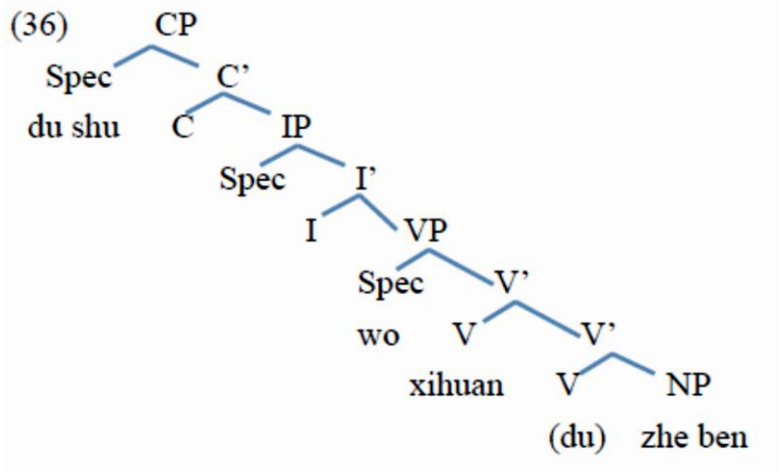
Similarly in (31) although it is possible to move "zhe ben shu" out of the object position, it is not accessible to explain the grammaticality of the resumptive pronoun in the object position. It may be supposed that after the topic is moved out of the object position, a resumptive pronoun "ta" is inserted in the empty object position. But according to the copy theory, after there are 2 copies of "zhe ben shu" in the sentence, and as the topic is the structurally most prominent copy it is pronounced in the externalization, while the second copy in the object position is deleted as shown in (22) repeated here in (34).

(34) Zhe ben shu, wo xihuan du ~~zhe ben shu~~.
This Cl. book I like read this Cl. book
"This book, I like to read ~~this book~~."

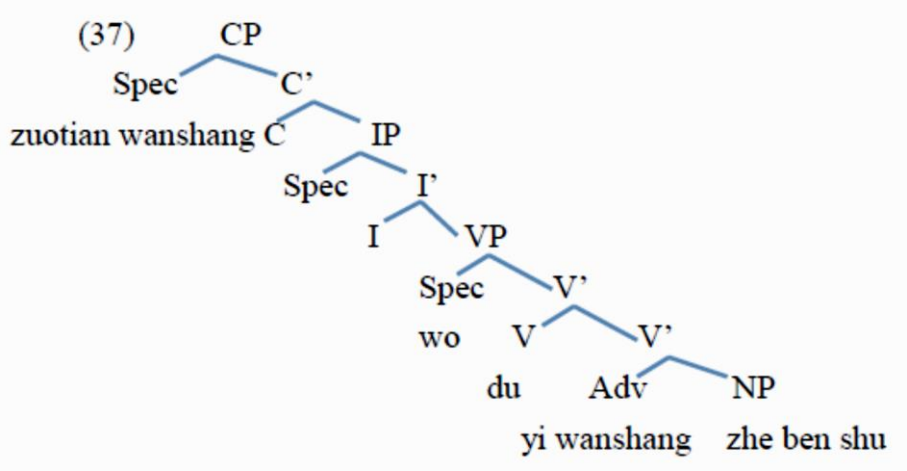
It might be possible to assert that after the deletion of the second copy, the resumptive pronoun "ta" is inserted in the object position for the purpose of filling the gap. But it is still a problem as to why in such a structure, insertion of a resumptive pronoun is necessary. For convenience and ease of explanation, it is much better to suppose that the topic "zhe ben shu" is base generated in the spec CP position for the purpose to check the strong [+TOPIC] feature of the head. The derivation process of (6) may b illustrated in the tree diagram of (35).



Moreover in (31) if the VP "du shu" is extracted out of the VP "du zhe ben shu", it is not plausible to explain why only the VP "du shu" is extracted while the remaining elements in the middle of the phrase "zhe ben" is stranded. It might be more plausible to assume that the VP "du shu" is base generated in the spec CP position for the purpose to check the strong [+TOPIC] feature of the head. If this is on the right track, the derivation of (7) may be demonstrated in the tree diagram of (36) below.



Is it possible to derive (8) out of the sentence of (32)? Let's then suppose that the topic "zuotian wanshang" is moved out of the adjunct in the sentence. After it is raised to the spec CP position, the noun phrase "yi wanshang" is inserted in the original adjunct position of the moved topic, but why is this operation necessary requires further explanation. For ease of theory and convenience of operation, it may be assumed that the topic "zuotian wanshang" is base generated in the spec CP position for the purpose to check the strong [+TOPIC] feature of the head. The derivation of sentence (8) is illustrated in the tree diagram in (37).



Different from the merge operation of topics in examples of (1-4), the merge operation of the topics in (5-8) is called external merge, in which there is no displacement of any constituent. First merge the verb "du" with the NP "zhe ben" and forms the VP "du zhe ben", then merge the VP "du zhe ben" with the verb "xihuan" and forms the VP "xihuan du zhe ben", and merge the pronoun subject "wo" with the VP "xihuan du zhe ben" into the IP "wo xihuan du zhe ben", and finally merge the topic "shu" with the IP "wo xihuan du zhe ben" into the CP "shu, wo xihuan du zhe ben". The merging operation of the sentence in (5) may be shown as in below.

(38) Merge (du, zhe ben) => {du, zhe ben}

(39) Merge (xihuan, du zhe ben) => {xihuan, du zhe ben}

(40) Merge (wo, xihuan du zhe ben) => {wo, xihuan du zhe ben}

(41) Merge (shu, wo xihuan du zhe ben) => {shu, wo xihuan du zhe ben}

The merging operations in (6-8) are similar to that of the process of (5) as shown in (38-40). For lack of space, the exact process is thus omitted.

Readers might be not satisfied with the above analysis of the derivation and merger of topics, as it is known that there is also another type of topics unmentioned here, usually called dangling topics in the academia.

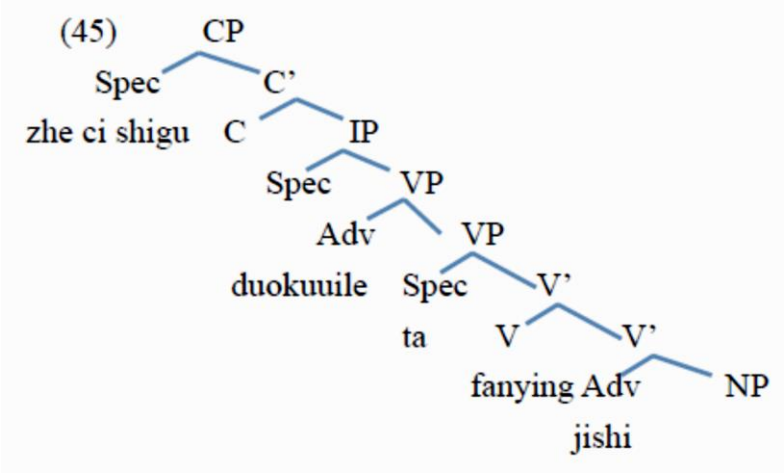
Dangling topics are actually another case of left dislocation, in which the only difference lies in that in left dislocated structures the definite topics are coreferential with another element in the comment but in dangling topics the definite topics are not coreferential with another element in the comment as shown in the following examples.

(42) zhe ci shigu, duokui le ta fanying jishi.
This Cl. accident fortunately Part. he act promptly
"(As to) This accident, it is fortunate that he acts promptly."

(43) jiaju, ta zhi you yi zhang chuang.
Furniture he only has a Cl. bed
"(As to) Furniture, he only has a bed."

(44) kecheng, wo ai shang jufa ke.
Course I love attend syntax course
"(As to) Courses, I love to attend syntax lectures."

In dangling topic structures the topics have an aboutness relation with the comments, and thus they are base generated in the spec CP position, which make it reasonable to fall into the type of left dislocation topic structures. Dangling topics are not moved from anywhere but base generated in the spec CP position. The derivation of the dangling topic in (42) is illustrated in (45).



In (42) the verb merges with the adverb into a V' "fanying jishi", the subject pronoun "ta" merges with the V' "fanying jishi" into the VP "ta fanying jishi", the adverb "duokuile" merges with the VP "ta fanying jishi"into the IP "duokuile ta fanying jishi", and then the topic "zhe ci shigu" merges with the IP "duokuile ta fanying jishi" into the topic structure "zhe ci shigu, duokuile ta fanying jishi". The merging process can be illustrated as in the following.

(46) Merge (fanying, jishi) => {fanying, jishi}

(47) Merge (ta, fanying jishi) => {ta, fanying jishi}

(48) Merge (duokuile, ta fanying jishi) => {duokuile, ta fanying jishi}

(49) Merge (zhe ci shigu, duokuile ta fanying jishi) => {zhe ci shigu, duokuile ta fanying jishi}

As shown in (45), the dangling topic structures in Chinese are derived in the same way with the derivation of the left dislocated structures of the sentences in (5-8) as in shown in (33)

and (35-37). The merging operation of the dangling topic structures of (42-44) is similar to that of the left dislocated topic structures of (5-8). For the above mentioned reasons, dangling topics are considered in the present article as a type of left dislocation in which topics are not moved but instead base generated in the spec CP position.

5. DISCUSSION

The French surgeon Paul Broca proposed in 1864 that the position of the language is located in the front of the left hemisphere of the brain called the Broca's area (or the center of language speaking). When Broca dissected the patient, he discovered that if the left hemisphere of the brain was damaged, the patient would be suffering from the pain of language disorders. Ten years later, the German neurologist Carl Wernicke found another variety of aphasia with lesions in the more posterior portions of the left hemisphere in the brain, now known as Wernicke's area. This shows that language is laterally located in the left hemisphere of the human brain.

The different language disorders illustrated by Broca aphasia and Wernicke aphasia reveal different areas of the human brain have different functions, and prove further the modularity of language. The neurolinguists discover that damage to different areas of the human brain will lead to different language disorders. What Broca aphasia causes are syntactic disorders, and what Wernicke aphasia causes are semantic disorders. This supports that the psychological grammar, like the human brain, is not a nondistinctive system, but a system consisted of modules with different functions.

The linguistic behavior of word substitution by the Wernicke aphasic patients shows that the lexicon in our human brain is not a simple list of words but an organized connective network. The substituted word is usually similar in pronunciation to the word that substitutes it. For example, sable is used to substitute for table. Sometimes they are similar in meaning, for example, table is used to substitute for chair. This shows that there is neurological link between these words [16].

Similar findings also exist in reading. Many aphasic patients become dyslexic after their brain damage. Such a phenomenon is called acquired dyslexia, because these patients are normal readers before their brain is damaged. For example, some patients pronounce the word south into west when they read it. Dyslexic patients often omit functional words. This shows that such types of words are different from the lexical words such as nouns and verbs in psychological lexicon. The above mentioned patients have difficulty in reading functional words such as which and would, but have no difficulty in reading their homophones witch and wood. This shows that in our mental lexicon, the processing of lexical words and functional words are not carried out in the same area in our brains, which proves that these two types of words are constrained by different neurological mechanisms in different areas of the brain and further supports the argument that our brain and language have complicated module structures.

On many occasions, when we attempt to speak we find that we cannot find the appropriate words to express our ideas. Aphasic patients often find no appropriate words to speak when they talk with others. Such phenomenon as someone wants to say something but cannot find the suitable words to speak is called anomia. The language obstacles that the aphasic patients meet with are not caused by the dysfunction of neuromuscular of the language organ or general damage to the cognitive ability.

These patients can produce and hear sounds, and their dysfunction is related in part with language mechanism or language organ. The aphasic patients' selective damage to language provides important information on different cognitive abilities especially the organizational structure of grammar and lexicon. These patients also prove that language is an independent cognitive function, and that within language damage to different areas of the brain affects different language components or language modules. For example, Broca aphasia affects the syntactic module while Wernicke aphasia affects the semantic module [16].

As it has been argued, merge, as a basic property of language, is ubiquitously localized in the ventral anterior portion of the Brodmann Area 44 [17, 18]. BA 44 is an area in the Broca's area responsible for the syntactic merge of language, art, or mathematics. It is a part of the frontal cortex also known as pars opercularis of the inferior frontal gyrus, located at anterior to premotor cortex and on the lateral surface inferior to BA 9 [18]. The dorsal and ventral pathways linked the syntactic operation in the Broca's area with the semantic information processing in the Wernicke's area, and the cyclic ring formed by the dorsal and ventral fiber tracts provides a foundational basis for the syntactic operation of merge.

As Berwick and Chomsky [19 p. 159] posit that "the word-like elements, or at least their features as used by Merge, are somehow stored in the middle temporal cortex." The information from the lexicon to the dorsal areas where merge takes place is carried by the dorsal or ventral fiber tracts, as Perani et al. [20] observe "these dorsal and ventral fiber tracts together form a complete 'ring' that moves information from the lexicon to the areas on the dorsal side where it is used by Merge." The syntactic operation of merge depends on the "ring" formed by the fiber tracts, as Berwick and Chomsky [19 p. 161] further point out, "this fiber-tract 'ring' must be in place in order that syntactic processing work."

The localization of merge in BA 44, either internal merge or external merge, is syntactically and semantically processed while the linking ring of the dorsal and ventral fiber tracts works in the left hemisphere of the brain [20].

6. CONCLUSION

This article focuses on the merge operation of the 2 types of canonical topic structures in Mandarin Chinese, namely, the scrambled topic structure and the left dislocated topic structure. The topics raised in the first type of topic structures are internal merged with their comments while the topics base generated in the second type of topic structures are external merged with their comments on the right side of the sentence. Both logical possibilities of merge are localized in the BA 44 on the left hemisphere of the brain in the Broca's area.

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