

# Mandarin Chinese And the Lexical Mapping Theory —a study of the interaction of morphology and argument changing

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Recent developments in syntactic theories, such as the Lexical Mapping Theory in LFG (Bresnan and Kanerva 1989, and L. Levin 1987) and studies on lexical semantic structures in GB (Hale and Keyser 1986, and B. Levin 1987), have focused on the relations between conceptual structures and lexical thematic structures. In this paper, I will adopt the Lexical Mapping Theory of LFG (Lexical-Functional Grammar) in order to formulate a theory for the lexical assignment of predicate-argument structures of Mandarin Chinese verbs.

The study of the lexical mapping of Mandarin predicate-argument structures will also underline the role of morpholexical processes in the language. Contrary to the commonly held assumption that Mandarin has scarcely any morphology, I will show that many lexical rules in Mandarin entail both overt representations and syntactic consequences. Alsina's (in preparation) proposed distinction of (unmarked) lexical options from morphologically marked lexical rules, such as the applicative constructions in Bantu languages, will be adopted. It will be shown that argument changing facts in Mandarin are accounted for by lexical options as well as by overtly marked morpholexical rules, instantiated by either affixation or pre-verbal argument-marking. This position will be supported by accounts of the *V-gei* construction and the 'easy to' construction in Mandarin Chinese.

## I. Definition of Grammatical Functions in Mandarin Chinese

First, it is necessary to clarify what grammatical functions (GFs) refer to in this article. LFG gives grammatical functions an autonomous status. This position is comparable to that of grammatical relations in Relational Grammar (RG, Perlmutter 1978 and

Perlmutter and Rosen 1984). The definitions of GFs (e.g. subjects and objects) have been sources of debate among Chinese syntacticians because GFs lack morphological marks in this language. Taking a strictly modular and surface-based approach, I will adopt a fairly straightforward structural definition of Grammatical Functions in Mandarin Chinese.<sup>1</sup>

This position is not unrelated to the topic of this paper, as I am taking GFs as classifications of the surface representations of arguments. In a case-marked language like Japanese or Latin, salient surface markings determine the GFs of arguments. In a language without clear morphological case markings, like Mandarin Chinese, it is only natural to infer that syntactic configurations, including word order, determine the GFs of arguments.<sup>2</sup> Taking this position allows the lexical encoding of predicate-argument structures in terms of GFs in LFG to predict the surface form of sentences with a non-transformational syntax. In addition, this position makes the lexical linking of a predicate with its different predicate-argument structures one of the most interesting parts of the theory.

As a first step, I will present GFs as defined by syntactically unambiguous surface positions. A SUBJ(ect) is defined as the argument position immediately before a predicative phrase, such as underlined in (1a).<sup>3</sup> An OBJ(ect) occurs in the argument

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- 1 Our position is similar to the vigorously formalized definition in lexibase grammar proposed in Starosta (1985). Li (1989) has recently argued for the same approach. See Hou (1979) for a summary of earlier definitions of GFs in Mandarin.
  - 2 A reviewer of BIHP points out that GF-marking particles in Japanese could be argued to be postpositions rather than morphological cases (e.g. Ishikawa 1985). However, the contrast I am underlining here is not between whether morphological cases mark grammatical functions in a language or not. I am underlining the contrast between whether GFs are marked by markers or structures. Except for oblique functions, typical GFs in Mandarin are marked by their structural positions only, while typical Japanese GFs are marked by the particles -ga, -o, -no etc. However, even this position is not uncontroversial. Starosta (1985) argues that the case LOCATION can be marked by two case inflections -li and -shang in Mandarin Chinese.
  - 3 This is similar to Starosta's (1985:218) definition of 'the grammatical subject in a Chinese sentence as the last unmarked NP before the verb.' Both definitions account for the occurrences of temporal adjuncts between a subject and a predicate. Starosta (1985) relies on the notion of markedness, in contrast to our reliance on the concept of argument position.

position of a sister of a transitive predicate, such as underlined in (1b).<sup>4</sup> With ditransitive verbs, an additional 'object' can be found. In Mandarin, it could be argued that, of the two objects, it is the linearly preceding one which is semantically restricted.<sup>5</sup> In subclassifying objective functions, the argument position adjacent to a ditransitive predicate will be considered the restricted object and represented as OBJth (Object-theta), such as underlined in (1c). Finally, an OBLth (Oblique-theta) is a grammatically marked argument position, with its thematic role usually set off by a preposition, such as underlined in (1d).

- (1) a. *Zhege wenti bu rongyi*  
       this problem NEG easy  
       'This problem is not easy.'
- b. *Zhangsan kanjian-le Wang Xiaowu*  
       Zhangsan see-PERF Wang Xiaowu  
       'Zhangsan saw Wang Xiaowu.'
- c. *Zhangsan gei-le Lisi yi-feng xin*  
       Zhangsan give-PERF Lisi one-CLASS letter  
       'Zhangsan gave Lisi a letter.'
- d. *Zhangsan dui Lisi hen-hao*  
       Zhangsan towards Lisi very-nice  
       'Zhangsan was very nice to Lisi.'

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4 Starosta (1985:218) defines a 'direct object' in Mandarin as 'the unmarked Noun Phrase which immediately follows the verb.' Note the symmetry in his definition of subject and direct object.

5 This position is supported by the fact that the nonadjacent objects behave like objects of typical transitive verbs in *ba* and *bei* sentences, as observed in Huang (1990a) and Huang (1992b). It also offers an explanation as to why most ditransitive verbs do restrict the thematic role of the adjacent object to GOAL. Classification based on semantic restrictedness, however, can go either way. The roles of the two objective functions, such as GOAL-THEME, are determined by the ditransitive predicates. Classifying either of the pair as an OBJ has the consequence of semantically restricting the other role to the subset compatible with ditransitive predicates.

Based on the above definitions of grammatical functions, I will explore the mapping from lexical thematic roles to predicate-argument structures of verbs, which are defined in terms of grammatical functions in LFG.

## II. Classification of Grammatical Functions and Thematic Roles

The theory of LFG, with the recent addition of the Lexical Mapping Theory, supplies a framework postulating mapping relations from conceptual structures to linguistic instantiations. In this framework, the components between thematic structures and f-structures are linguistic. However, whether the mapping from conceptual structures to thematic structures are extra-linguistic or not remains an open issue. In other words, a linguistic theory does not predict how human beings conceptualize, and it may or may not predict how conceptual structures are translated into thematic structures (e.g. Jackendoff 1987). Nevertheless, it will have to predict how these thematic structures are translated into lexical predicate-argument structures and, of course, how these predicate-argument structures receive linguistic representations.<sup>6</sup>

(2) [ CONCEPTUAL STRUCTURE ]



[ THEMATIC STRUCTURE ]



← [ The Lexical Mapping Theory ]

[ THE LEXICON: Predicate-Argument Structures ]



← ( mediation of annotated c-structures )

[ F-STRUCTURES ]

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6 A null hypothesis supposes that there is no need for mapping and that the thematic structures are the predicate-argument structures. The Lexicase theory of Starosta (1988) shows that the null hypothesis is plausible. However, a detailed contrast between our mapping theory and the null hypothesis is beyond the scope of this paper.



The Lexical Mapping Theory differs from the transformation-based theories of semantic relations, in that it does not represent semantic relations in terms of tree structures, e.g. where patients are traditionally represented as a post-verbal argument in an abstract deep-structure.<sup>7</sup> Instead, the theory takes thematic roles as primitive notions definable in terms of features. The theory classifies both thematic roles and grammatical functions with two features which will be discussed in more details below.<sup>8</sup> The compatibility of the features then determines the possible GF representations of the thematic roles abstracted from the conceptual structures. Since a formalized account of how situations are conceptualized in languages is not yet available, the theory predicts the linguistic representations of each language in terms of thematic roles. The linguistic representations are, of course, characterized in terms of grammatical functions.

In LFG, grammatical functions are classified into four groups. SUBJ and OBJ are two groups that have only one member, while OBJ<sub>th</sub> and OBL<sub>th</sub> both contain more than one member. OBL<sub>th</sub> is the group of explicitly and exceptionally marked functions which are thematically restricted, i.e. they can only represent certain thematic roles, and are distinguished from each other by their thematic role.<sup>9</sup> Similarly, OBJ<sub>th</sub> is the group of thematically restricted OBJ functions differing from each other only in their thematic

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7 Different versions of generative-transformational grammars differ radically with each other with regard to the role of the abstract level of deep-structure in semantic interpretation. On one hand, generative semanticists try to define all semantic relations in terms of tree structures. On the other hand, taking an approach with more emphasis on lexicon, the current GB version of transformational grammar lexically encodes thematic roles while structurally assigning them. For instance, a patient typically receives its thematic role in a post-verbal position at deep-structure level because of the principles governing the assignments of theta-roles. Both contrast with the Lexical Mapping Theory where no abstract structures are involved in either assigning or interpreting thematic roles.

8 A few more features are clearly necessary to exhaustively classify all grammatical functions. For instance, an additional feature can be motivated to differentiate a COMP (sentential complement) from an OBJ.

9 For example, *to John* in the English sentence *Mary sent a letter to John* represents the grammatical function OBL<sub>goal</sub> and *for Mary* in *John won the match for Mary* represents the grammatical function OBL<sub>ben</sub>.

roles.<sup>10</sup>

The four-way classification of grammatical functions is achieved with two features,  $\pm r$  and  $\pm o$ . The feature  $\pm r$  marks whether a function is thematically restricted or not. The two functions SUBJ and OBJ are thematically unrestricted, meaning that these two functions can in principle encode any thematic roles. The other functions bearing subscriptions are restricted to encoding only the thematic role indicated. For example,  $OBL_{goal}$  (a typical English example would be instantiated by a PP marked by *to*) can only represent the thematic role GOAL, but not others.<sup>11</sup> Another division is whether a function is objective or not, i.e. an objective function can be an argument of transitive predicates, e.g. transitive verbs and prepositions, but cannot be an argument of intransitive predicates, e.g. intransitive verbs and nouns. SUBJ's and OBL's are not objective, while other functions are. This is marked by  $\pm o$ .<sup>12</sup>

### (3) *Classifications of Syntactic Functions*

o: objective	r: restricted
-r (unrestricted)	: SUBJ, OBJ
+r (restricted)	: $OBJ_{th}$ , $OBL_{th}$
-o (non-objective)	: SUBJ, $OBL_{th}$
+o (objective)	: OBJ, $OBJ_{th}$

With the above classification, grammatical functions are definable in terms of two features, as follows:

10 Note that they are referred to as second objects (OBJ2) in earlier versions of LFG (e.g. Bresnan 1982), and mistakenly assumed to be semantically unrestricted.

11 The fact that some prepositions do mark more than one thematic role does not necessarily contradict my position. I am treating grammatical functions as representations of arguments subcategorized by predicates. Hence any OBL function would have unambiguous prepositional marking. In other words, it would be wrong to say that all *to*-PPs are  $OBL_{goal}$ 's, but the grammar should predict that  $OBL_{goal}$ 's can be instantiated as *to*-PPs.

12 In both Mandarin Chinese and English, we can take a function's occurrence at a post-predicate position as an indication of the +o feature of that function.

- (4) a. SUBJ : -r, -o  
 b. OBJ : -r, +o  
 c. OBJ<sub>th</sub> : +r, +o  
 d. OBL<sub>th</sub> : +r, -o

The above classification also suggests a theory of syntactic markedness for grammatical functions. Both Alsina and Mchombo (1988) and Bresnan (1989) have recently proposed that only unmarked functions, i.e. those with '-' features, can be suppressed by a lexical rule. Based on this theory of markedness, a hierarchy of grammatical functions is given in Bresnan (1989), quoted here as (5).<sup>13</sup>

- (5) SUBJ > OBJ/OBL<sub>th</sub> > OBJ<sub>th</sub>

In addition to the hierarchy of GFs, hierarchies of thematic roles have been proposed to account for how they function in the grammar. One of the central facts motivating a thematic hierarchy is that some roles seem to show closer affinity to the predicate and are usually combined earlier with the predicate than other roles. In other words, these hierarchies reflect how thematic roles are syntactically encoded. The Lexical Mapping Theory utilizes such a hierarchy to determine feature assignments to thematic roles. A standard hierarchy given in Bresnan and Kanerva (1989) is quoted here as the basis for discussion in the next section.<sup>14</sup> The relationship between GFs and thematic roles will be discussed in

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13 Zaenen (to appear) further suggests using matching hierarchies of thematic roles and grammatical functions to determine the mapping. Her hierarchy, however, is not strictly based on markedness.

14 Despite the claimed universality of each thematic hierarchy (e.g. Gruber 1976 and Jackendoff 1987), they do differ from each other in details. For instance, the relevance of the hierarchical order between LOCATIVE and THEME is discussed in detail in Bresnan and Mchombo (forthcoming). Since each hierarchy drew upon a different set of languages as supporting data, the discrepancy will be taken as suggestion that certain parochial variations are allowed over a universal thematic hierarchy. In particular, I will argue with supporting evidence that the position of GOAL in the thematic hierarchy for Mandarin Chinese differs from (6). Note that the slashes '/' in this hierarchy connect thematic roles which are hierarchically equivalent.

the following section.

(6) *Hierarchy of Thematic Roles* (Bresnan and Kanerva 1989)

agent > ben/mal > goal/exp > instr > th/pat > loc

### III. Lexical Mapping Theory for Mandarin Chinese

#### III.1 *The Lexical Mapping Theory*

The Lexical Mapping Theory of LFG has evolved from recent works such as Levin (1987), Bresnan and Kanerva (1989), and Alsina (1989). Admittedly, there are certain details of the theory which not every researcher agrees upon. Hence, when introducing the theory in this section, I will try to adhere to the parts commonly accepted by most researchers, and adopt specific proposals only when they are needed to provide the best account of the Mandarin data presented here.

The nucleus of the Lexical Mapping Theory is the lexical mapping principles from thematic roles to grammatical functions. The principles assign features to a thematic role depending on both its inherent nature and the thematic structures it occurs in. Next, based on these features, the principles predict the grammatical function assignment of each role in predicate-argument structures. As is well-known, thematic roles do not have one-to-one correspondences with their grammatical function representations. Thus the prediction of which thematic role is assigned to which grammatical function under what circumstance is non-trivial. The position adopted here is that we can predict the range of possible syntactic representations in terms of grammatical functions based solely on the thematic structure involved and the postulated lexical mapping principles.

A general constraint on the lexical mapping principles is that they must be monotonic. In other words, the principles are ordered and later assignments of features must not conflict with previous assignments. The theory proposes two stages of feature assignments that interact with morpholexical rules. The assignments are carried out by either Intrinsic or Default Classifications. The Intrinsic Classification applies first to each

thematic role according to its inherent properties. The Default Classification assigns features according to the relative position of a role in each thematic structure.

First, in Intrinsic Classification, thematic roles are roughly divided into two groups. Alsina (in preparation) proposes without explication the semantic feature of dependency to differentiate the two groups. It is claimed that the prototypical dependent roles are THEME and PATIENT and that the prototypical independent roles are AGENT and CAUSER. In Chichewa, a Bantu language, independent roles are assigned the feature  $-o$ . Moreover, dependent roles are assigned  $-r$ , unless they are lower than GOAL in the thematic hierarchy. A similar proposal by Zaenen (to appear) suggests that the intrinsic assignment of features to thematic roles be determined by whether they are agentlike or patientlike. She proposes that in Dutch agentlike roles are assigned the feature value  $-o$ , and patientlike roles are assigned the feature value  $-r$ . As to how to determine whether a role is agentlike or patientlike, Zaenen (to appear) adopts the criteria given in Dowty (1991). Dowty (1991) lists the properties of Agent Proto-Role and Patient Proto-Role and suggests that argument selection is determined by whether the meaning of the predicate entails more Agent Proto-Role properties or more Patient Proto-Role properties for a particular argument.<sup>15</sup> Since both proposals involve prototypical semantic properties and both involve the same set of features, I suggest merging the two proposals. The term dependency will be adopted and Proto-Role properties will be taken as determining, though not defining, elements of the semantic features.

It is worth mentioning that intrinsic assignments are language-specific and each language may differ in the feature values assigned to each individual thematic role.<sup>16</sup> However, the notion of dependency is a proposed universal and hence, any variations that might occur would be the result of how the dependent roles are semantically defined rather

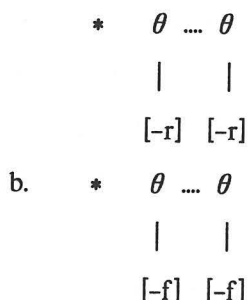
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15 The counting of properties and the selection in cases where identical number of either property occurs obviously calls for further research but is beyond the scope of this paper.

16 There should be universal constraints on possible feature values for agentlike and patientlike roles. It seems reasonable to hypothesize that agentlike roles will never be intrinsically assigned the value  $+r$  and patientlike roles will never be intrinsically assigned the value  $-o$ .

than in the notion of dependency itself. I will adopt an interpretation, suggested in Lin (1990), that an independent role is one whose intrinsic assignment is unique and a dependent role is one whose intrinsic assignment has more than one possible value and thus is dependent on co-occurring thematic roles to determine the feature value assigned. The universal constraint (7a) stipulates that, regardless of how many thematic roles are introduced in a thematic structure, one role at most can be intrinsically assigned the feature value  $-r$ . Furthermore, as concerns intrinsic assignment proposed in Alsina and Mchombo (1988) and which follows from the universal constraint (7a), I suggest that neither of the unmarked features, i.e.  $-r$  or  $-o$ , can be assigned to more than one role, as in (7b).

(7) a. Alsina and Mchombo (1988)



The feature-value set of the thematic roles is incomplete after Intrinsic Classification. The feature assignment is completed by Default Classification. In Default Classification, the notion of a top thematic role (marked by  $\wedge$ ) is crucial. The top thematic role in a thematic structure is defined as the thematic role highest on the thematic hierarchy. Default Classification assigns a feature value to the top thematic role and other feature values to the other roles in order to complement the features these thematic roles received through the applications of Intrinsic Classification. Note that this assignment, as well as all the intrinsic assignments, is subject to the general constraint of monotonicity and cannot conflict with the existing feature values. Later assignments will fail to apply if they conflict with an earlier assignment. The following Default Classification is given in

Bresnan and Kanerva (1989).

(8) Default Classification

$\hat{\theta}$	elsewhere,	$\theta$
[-r],		[+r]

The significance of the top thematic role adopted in the default assignment, as observed in Bresnan (1989), is that this is the definition of 'logical subject' in the Lexical Mapping Theory. Explanation of why 'logical subjects' are often, though not always, instantiated by the grammatical function SUBJ follows from this theory.

The concept of a top thematic role will also complement Zaenen's (to appear) observation that the -r feature is comparable to the definition of 'internal argument' roles in GB, and the -o feature is comparable to the GB definition of 'external argument'. Thus generalizations captured in terms of abstract notions in GB are shown to be related to a well-motivated set of features in the Lexical Mapping Theory.<sup>17</sup>

A thematic structure is subject to optional applications of morpholexical rules. Morpholexical rules are so-called because they change the lexical thematic structures of lexical items, usually with accompanying morphological effects. They correspond to lexical rules in an earlier version of LFG. In other words, morpholexical rules are responsible for accounting for alternative syntactic instantiations of a predicate such as the active-passive correspondence. Possible manipulations of predicate-argument structures include: 1) introducing a new role, e.g. applicative, 2) suppressing an existing role, e.g. passive, and 3) establishing a binding relation between roles, such as with compound verbs.<sup>18</sup>

17 For an explication of the theoretical comparisons, please see Bresnan (1989), Zaenen (to appear), and Alsina (in preparation).

18 It is important to note that the intrinsic assignment applies to initial thematic structures regardless of whether the structure is an output of an application of a morpholexical rule. This is linguistically well-motivated since each application of a morpholexical rule creates a new thematic structure and, correspondingly, a new lexical item.

Within the Lexical Mapping Theory, especially the version outlined in Alsina and Mchombo (1988) and in Alsina (in preparation), lexical rules can be further classified according to whether they have morphological effects or not. Specifically, Alsina (in preparation) treats lexical rules with morphology as a lexical entry whose semantics crucially involve manipulation of thematic structures. In other words, a lexical rule is a change of grammatical relations encoded on a lexical item. In addition to the morphology and category, the semantics of such an item would specify how the thematic structure of a predicate is affected by its attachment. In addition, the only possible lexical operations without morphology are assumed to involve suppression of unmarked thematic roles. Thus, the two types of lexical rules are GF-changing morpholexical rules which are always morphologically marked, and lexical options whose function is suppression of unmarked roles without overt morphology. This theory has very interesting implications with regard to the interaction of morphology and lexical rules in Mandarin, since the language has been long assumed to be lacking in overt morphology. Our discussion in the next section will focus on the first two functions and the theory will be elucidated with exemplary rules from Mandarin Chinese.

Last in the Lexical Mapping Theory are the Well-formedness Conditions. A thematic structure can be mapped to any predicate-argument structure of grammatical functions as long as the annotated feature values on each thematic role are compatible with the classification of grammatical functions. However, some illegal predicate-argument structures may result from the mappings. These illegal structures are ruled out by the wellformedness conditions. The first is the Subject Constraint and the second is Function-argument Bi-uniqueness. The Subject constraint requires that each predicate-argument structure contain a subject and rules out the mappings that result in no subjects.<sup>19</sup> The

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19 It is well-known that there are sentences without surface subjects in Mandarin Chinese. I will retain the null hypothesis of the Subject Constraint and assume for the moment that the absence of surface subjects is governed by discorsal factors. In other words, 'zero anaphora' and its referents will be accounted for with discourse principles, such as the ones proposed in Tai (1978) and Chen (1987).



Function-argument Bi-uniqueness Condition, first articulated in Bresnan (1982b), requires that each argument be assigned exactly one function and each function be assigned exactly one argument. Thus the two conditions will guarantee the one-to-one mapping between thematic roles and grammatical functions and the existence of only one SUBJ.

To sum up the discussion presented in this section, I will list the components of the Lexical Mapping Theory below.

(9) The Lexical Mapping Theory

- a) Intrinsic Classification
- b) Default Classification
- c) Morpholexical Rules
- d) Well-formedness Conditions
  - i. Subject constraint
  - ii. Function-argument Bi-uniqueness

III.2 *Illustrative Example: English send and cook*

Before proposing the lexical mapping principle for Mandarin Chinese, the classifications and conditions involved in the predicate-argument structures of two English double object verbs are given below to illustrate the application of the Lexical Mapping Theory. This account is a revision, integrating Alsina's (in preparation) recent proposals, of the analysis given in Alsina and Mchombo (1988).

- (10) a. John sent Mary a book.  
b. Mary was sent a book.  
c. \*A book was sent Mary.

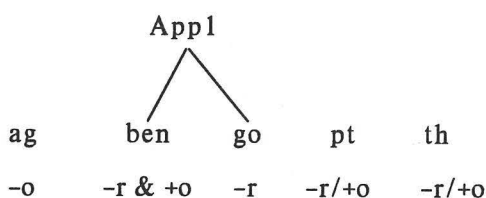
(11) a. John cooked Mary a meal.

b. \*Mary was cooked a meal.

c. \*A meal was cooked Mary.

The verbs *send* and *cook* differ from each other, as given in (10) and (11), in the English dialect described in Alsina and Mchombo (1988). At first sight, the contrast between the two double objects seems to be arbitrary. However, the authors show that the contrast can be predicted in terms of the predicate-argument structures allowed by the Lexical Mapping Theory. In this theory, the relevant Intrinsic Classification of thematic roles in English is defined as below. Rule (12) stipulates that dependent roles (PATIENT and THEME) are assigned the feature value  $-r$ . In addition, since both roles are lower than GOAL in the thematic hierarchy (6), they also have the alternative value  $+o$ . As for the applicative roles added on via the morpholexical rules, an applicative GOAL is assigned the feature  $-r$  because it is a dependent role. And an applicative BENEFICIARY is assigned both the feature values  $-r$  and  $+o$  simultaneously.<sup>20</sup>

(12) Intrinsic Classifications for English



With the postulation of (12), the contrast between (10) and (11) can be predicted. The basic assumption is that the verb *send* encodes the thematic structure of  $\langle \text{agent, goal}_{\text{appl}}, \text{theme} \rangle$  while the verb *cook* encodes the thematic structure  $\langle \text{agent, ben}_{\text{appl}}, \text{theme} \rangle$ . The

20 I will assume without explication that the co-occurrence of the two feature values for the BENEFICIARY role is a parochial characteristic of the standard dialect. Alsina and Mchombo (1988) demonstrate that contrasts among dialects of English can be derived from the differences in their intrinsic assignments. Also note that the feature  $+r$  cannot be assigned to the role  $\text{GOAL}_{\text{appl}}$  because the Monotonicity Constraint does not allow an assigned feature value,  $-r$  in this case, to be contradicted.

two applicative roles in either verb are optional. And the assignment of the role GOAL to the indirect object of *send* and the role BENEFICIARY to *cook* is based on the semantic meaning of the predicates. (13) and (14) summarize the lexical mapping processes from thematic structures to predicate-argument structures. These processes will be discussed in detail below.

(13) a.

Send	<agent	goal <sub>appl</sub>	theme>
Intrinsic	-o	-r	+o
Default	-r		+r
Well-formed cond.	SUBJ	OBJ	OBJ <sub>th</sub>
Ex.	John sent Mary a book.		

b.

Send	<agent	goal <sub>appl</sub>	theme>
Intrinsic	-o	-r	+o
Passive	∅		
Default			+r
Well-formed cond.		SUBJ	OBJ <sub>th</sub>
Ex.	Mary was sent a book.		

(14) a.

Send	<agent	ben <sub>appl</sub>	theme>
Intrinsic	-o	-r & +o	+o
Default	-r		+r
Well-formed cond.	SUBJ	OBJ	OBJ <sub>th</sub>
Ex.	John cooked Mary a meal.		

b.

Send	<agent	ben <sub>appl</sub>	theme>
Intrinsic	-o	-r & +o	+o
Passive	∅		
Default			+r
Well-formed cond.		*OBJ	OBJ <sub>th</sub>
Ex.	*Mary was cooked a meal.		

For both verbs, the assignment of feature values by Intrinsic Classification is straightforward. According to (12), the independent role AGENT is intrinsically assigned the feature  $-o$ . Although the classifications allow a THEME to be assigned either  $-r$  or  $+o$ , the assignment of  $-r$  violates the constraint on the unique assignment of the unmarked feature value given as (7b). This is because either  $GOAL_{appl}$  or  $BENEFICIARY_{appl}$  are obligatorily assigned  $-r$  and assigning  $-r$  to THEME simultaneously would lead to ill-formed mapping. Thus the only possible assignment for the THEME role when accompanied with either applicative role is  $+o$ . Next, the Default Classification assigns  $-r$  to the top thematic role, which is AGENT in either case. It also assigns  $+r$  to all the remaining thematic roles. The assignment takes place only with the THEME role because assigning the feature to either applicative role will violate the general monotonic constraint, since they both have already been assigned the feature value  $-r$ . After the completion of the classifications, the theory checks the compatibility of the feature values with those of the possible grammatical function representations. According to the postulated classification of grammatical functions, a SUBJ is  $-r$ , and  $-o$ . Hence the AGENT of both verbs is mapped to SUBJ. Similarly, both THEME roles are mapped to  $OBJ_{th}$  because they are assigned the features  $+o$  and  $+r$ . Although the GOAL role of *send* is only assigned the feature  $-r$  and so is free to be mapped to either SUBJ or OBJ, the mapping to SUBJ is ruled out by the Bi-Uniqueness Condition on argument-function assignments. Thus both (13a) and (14a) are grammatical with identical predicate-argument structures. (13b) and (14b) involve the passive morpholexical rule which suppresses AGENT roles with the well-known effects of passive morphology. As stated above, Default Classification applies after morpholexical rules. (13b) and (14b) show identical Intrinsic Classification with (13a) and (14a) respectively. However, after the suppression of the AGENT role with passivization, the Default Classification applies differently. In both cases, the assignment of  $-r$  to the top thematic role is vacuous and thus trivial. This is because the top thematic role, GOAL and BENEFICIARY respectively, has been already assigned that feature value. The resulting assignment of features predicts that a passive sentence with a GOAL as SUBJ is possible

while it is impossible to have a BENEFICIARY as SUBJ. In terms of the Lexical Mapping Theory, the BENEFICIARY role is necessarily mapped to OBJ because of the obligatory assignment of both  $-r$  and  $+o$  to it. Because of the fact that the AGENT role is suppressed and the THEME role has the feature values  $+o$  and  $+r$ , the thematic structure must be mapped to a predicate-argument structure with one OBJ and one OBJ<sub>th</sub> but no SUBJ, as seen in (14b). Thus it violates the Subject Constraint and has to be ruled out. The fact that neither verb allows their THEME role to appear as a SUBJ in passive sentences, exemplified by (10c) and (11c), can be explained in the same way.<sup>21</sup> Thus we have shown with two English double object verbs how the Lexical Mapping Theory predicts syntactic behaviors from thematic structures with the mediation of predicate-argument structures.

### III.3 *The Lexical Mapping Theory for Mandarin Chinese*

Adopting the general framework of the Lexical Mapping Theory of LFG, I propose that Lexical Mapping for Mandarin Chinese be determined by the hierarchy (15), the Intrinsic Classification of (19) and the Default Classification of (20). Below, I will discuss each proposal in turn.

The thematic hierarchy differs in two respects from the one proposed by Bresnan and Kanerva (1989). First, the role DOMAIN (dom) is added to capture the position of the last NP argument in sentences such as *Ta ti-le wo yi xia* (s/he kick-PERF me one time) 'S/He kicked me once.' Second, the position of the role GOAL is moved to the position between THEME and LOCATION.

#### (15) Thematic Hierarchy for Mandarin Chinese

agent > ben/mal > instr > th/pat > exp/goal > loc/dom

21 It is not mentioned in this analysis as to how the grammatical *A meal was cooked for Mary* and *A book was sent to Mary* would be accounted for. A possible analysis is to treat the post-verbal PPs as adjuncts. Hence the THEME is the only remaining role after passive suppression and will be assigned  $-r$  as the top role, and is thus mapped to SUBJ. The co-occurrence conditions between the verbs and PPs, i.e. *to*-PPs are only allowed after *send* while *for*-PPs are allowed after both, can be accounted for in terms of semantic selectional restrictions between predicates and adjuncts.

I will not offer arguments for the addition of the role DOMAIN, since it is well-motivated for Mandarin in studies such as Teng (1975). The fact that the thematic role GOAL has a Mandarin-specific position below THEME in the thematic hierarchy is supported by three sets of data: lexicalized compounds, idiom chunks, and ditransitive verbs.<sup>22</sup>

Mo (1990) observes that many Mandarin lexicalized compounds incorporate their GOAL roles while allowing the THEME roles to be expressed as SUBJs. In other words, GOAL seems to show a closer affinity to the predicate than THEME.

- (16) a. Lisi *cheng-ming*            le  
      Lisi become/attain-fame PERF  
      'Lisi became famous.'
- b. Lisi biding *cheng-da-qi*  
      Lisi surely become/attain-big-vessel  
      'Lisi will surely become someone of great status.'

The verb *cheng* 'to become' (or its more commonly used modern Mandarin equivalent *biancheng*) takes a THEME and a GOAL as its arguments.<sup>23</sup> For the compound *cheng-ming*, however, the GOAL role is incorporated and the THEME role is grammaticalized as a SUBJ, as in (16a). The independent status of the thematic role GOAL in the grammar,

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22 Both observations concerning the first two sets of data, as well as the original proposal for the language-specific revision are due to Mo (1990). The third set of data was discussed in both Huang (1990a) and Huang (1992b).

23 The use of *cheng* suggests a more literary style and hence is somewhat marked in comparison to the more colloquial bisyllabic *biancheng*. The monosyllabic *cheng*, however, is still commonly used in certain constructions with GOAL OBJ.

- i) a. Zhangsan *cheng-le*            ming-ren  
      Zhangsan become-PERF fame-person  
      'Zhangsan has become a celebrity.'
- b. Ta de xin lilun *cheng-le*    ge        da-xiaohua  
      s/he DE new theory become-PERF CLASS big-joke  
      'Her/his new theory became such a joke.'

despite the fact that it is only a lexicalized component of the compound, is supported by the fact that internal modification of the incorporated GOAL is possible, as in (16b). Other compounds with similar thematic structures are *chu-gui* 'leave-rail, to derail,' *chu-guo* 'leave-country, to go abroad,' *ru-liu* 'enter-rank, to be recognized/established,' *ru-shui* 'enter-sleep, to fall asleep,' *he-shen* 'fit-body, to fit well,' and *chong-gong* 'fill-official, to be confiscated.'<sup>24</sup> Take note that typical movement verbs such as *chu* 'to go out, to leave,' *ru* 'to enter,' *dao* 'to arrive,' etc. are very productive in compounding and the incorporation of their GOAL argument seems to be the unmarked case. Thus, the contrast between the incorporated GOAL/SOURCE and the un-incorporated THEME SUBJ shows that, in Mandarin, GOAL is closer than THEME to the predicate with the argument-structure of <THEME, GOAL>.

Similarly, with idiom chunks, or *chengyu*, it can be shown that very often a GOAL rather than a THEME becomes part of the frozen form.<sup>25, 26</sup>

- (17) Ta de hua shizai bu-kan-ru-er  
 s/he DE words really NEG-able-enter-ear  
 'His/her words are really offensive.'

24 Strictly speaking, the second argument of the verb *chu* 'to leave' is a SOURCE. The roles SOURCE and GOAL are treated as a pair, often referred to only as GOAL, with opposite semantics but with identical positions in almost all proposed thematic hierarchies. Also take note that treating the second argument of *he* 'to fit' as a GOAL may be controversial.

25 *Chengyu* is not the exact equivalent of idiom chunks. A *chengyu* is a frozen expression with an idiomatic interpretation. Barring rare exceptions, a *chengyu* is composed of four syllables (i.e. of four characters in written form). Since *chengyu* is the most commonly used form of idiom chunks in Mandarin, the discussion will be limited to it.

26 A BIHP reviewer raised the point that diachronic evidence should not be used directly in synchronic studies. That is, assuming that the incorporation process is complete and no longer part of the grammar, then it bears no direct evidence to the thematic hierarchy of the language. However, it can be used as supporting evidence if synchronic V-N compounding can be shown to reflect the same hierarchical order, as illustrated above with (16). Furthermore, it can be shown that, even though *chengyu* are supposed to be frozen forms, limited variations are allowed. For instance, *bu-kan-ru-yan* (NEG-able-enter-eye) 'be visually offensive,' *bu-kan-ru-mu* (NEG-able-enter-eye) 'be visually offensive,' *bu-kan-ru-kou* (NEG-able-enter-mouth) 'be non-appetizing' are all related variations of the frozen form. It shows that such incorporation does not violate the synchronic grammar.

Lastly, it is theoretically interesting to answer why Mandarin ditransitive verbs allow passive sentences with THEME as SUBJ, but not with GOAL as SUBJ, as given in (18). An account of the contrast should shed light on the theory of grammars because the two languages have exactly parallel linear order for the arguments of their transitive predicates.

- (18) a. wo song-le Lisi yi-ben shu  
           I give-PERF Lisi one-CLASS book  
           'I gave Lisi a book.'
- b. \*Lisi (bei wo) song-le yi-ben shu  
           Lisi BEI I give-PERF one-CLASS book  
           comp. 'Lisi was given the book by me.'
- c. nei-ben shu (bei wo) song-le Lisi  
           that-CLASS book BEI I give-PERF Lisi  
           comp. '\*That book was given Lisi by me.'

Recall that a passive construction, by well-established definition, involves the suppression of the top thematic role, which entails the mapping of the highest remaining role to SUBJ. The fact that a THEME instead of a GOAL assumes the SUBJ function in a passive construction with a ditransitive verb suggests that in Mandarin the thematic role THEME is higher than the role GOAL in the hierarchy. Hence the contrast between English and Chinese is naturally explained by the variation in the hierarchical order of the two roles. A more detailed account of the predicate-argument structures of Mandarin ditransitive verbs will follow in the next section. Thus the three sets of data discussed all support the proposal that THEME should be placed above GOAL in the thematic hierarchy for Mandarin Chinese.<sup>27</sup>

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27 Please note that hierarchical arguments based on compounding require that the roles involved co-occur in the compounds. In other words, incorporation of GOAL shows that GOAL is closer to the verb than THEME only when a co-occurring THEME is not incorporated. When there is no co-occurring THEME, we can only show that GOAL is the lowest role in that particular thematic structure, but not that GOAL is lower than THEME. A group of seeming counter-examples pointed out by another BIHP reviewer will be accounted for based on the above observation in the concluding remarks.



Next, for Intrinsic Classification, I will integrate the positions of Zaenen (to appear) and Alsina (in preparation). First, the assignment is based on the semantic notion of dependency, which in turn is based on the dichotomy of agentlike and patientlike properties.<sup>28</sup> I am assuming, like Zaenen, that whether a role is agentlike or patientlike will be determined by the number of its *Proto-Agent Properties* and *Proto-Patient Properties*, as defined in Dowty (1991).<sup>29</sup> In addition, my hypothesis is that in default cases, agentlike and patientlike roles exhaustively divide the thematic hierarchy into two. Specifically, I am assuming that independent, i.e. agentlike, thematic roles are the two highest roles, namely AGENT and BENEFICIARY.<sup>30</sup> Dependent, i.e. patientlike, thematic roles are all the others, including INSTRUMENT, THEME/PATIENT, GOAL/

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- 28 As mentioned above, another way to interpret the semantic feature dependency is to define it in terms of the autonomous status of intrinsic assignments. Lin (1990) suggests that dependent roles are so called because their alternative intrinsic assignment values are dependent upon accompanying thematic roles in the same thematic structure. Similarly, independent roles are so called because their intrinsic assignment values are unique and independent of accompanying roles.
- 29 The properties contributing to the Proto-Agent role, as proposed in Dowty (1991), are 1) volition, 2) sentience (and/or) perception, 3) causes event, 4) movement, and 5) referent exists independent of action of verb. The properties contributing to the Proto-Patient role are 1) change of state, 2) incremental theme, 3) causally affected by event, 4) stationary (relative to the movement of Proto-Agent), and 5) referent may not exist independent of action of verb, or may not exist at all.
- 30 Other related roles, such as CAUSER, will be grouped together with AGENT. And roles such as MALEFICIARY will be grouped together with BENEFICIARY. It is also worth pointing out that a BENEFICIARY role seems to be more patientlike both intuitively and according to Dowty's Proto-properties. A BENEFICIARY role in most cases has the Proto-Patient property of being stationary relative to the movement of Proto-Agent. The EXPERIENCER role, on the other hand, shows agentlike properties of being sentient and referring to something which exists independent of the action of the verb. Thus, it seems that the thematic hierarchy is neither solely, nor directly determined by the dichotomy of patientlike and agentlike properties. Since the alternative theory of Alsina's (in preparation) concept of dependency is yet to be fully developed, I will assume in this paper the overly simplified position that agent- and patientlike roles form two disjoint groups in the thematic hierarchy.

(19) *Intrinsic Classification:*

agentlike: -o

patientlike: -r

or (if lower than THEME): +o

Finally, for the Default Classification of Mandarin thematic roles, a modification will have to be added to accommodate the locative inversion construction (Chang 1990).

The modification is that a LOCATION role will take precedence and be assigned the -r feature in the environment of presentative focus (f). It is natural to assume that the modification applies to all environments with presentative focus. The Default Classification will still assign the -r feature value to the top thematic role when there is either no presentative focus or no locative role. This proposal will be supported by my analysis of verbs with locative inversion in the next section.

(20) *Default Classification:*

if <[f], ...loc> then loc: -r,

otherwise,  $\theta$ : -r

elsewhere: +r

#### IV. Verb Classification according to the Lexical Mapping Theory

The theory of lexical mapping proposed in the last section can be shown to make correct predictions of some seemingly idiosyncratic syntactic representations of Chinese predicates. In addition to demonstrating the feasibility of this theory, the discussion of Chinese data below also shows that many grammatical variations which seem to be semantically

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31 This position remains to be verified by future research. At this moment, I can only show that this hypothesis makes the correct prediction of the lexical structures of most classes of Mandarin Chinese verbs.

dependent can be lexically encoded in a precise formal theory.

#### IV.1 *Ditransitive Verbs*

Ditransitive verbs in Mandarin are like their English counterparts in that they require the 'indirect object,' i.e. GOAL, to occur immediately after the verb and before the 'direct object,' i.e. THEME.<sup>32</sup> Like English ditransitive verbs, the GOAL can also be represented by an oblique function after the THEME. This oblique GOAL is marked by the preposition *to* in English, and by the preposition *gei* in Chinese. However, as referred to in the previous discussion on thematic hierarchies and exemplified by (18), repeated here, the two languages contrast with each other regarding passives.

- (18) a. *wo song-le Lisi yi-ben shu*  
           I give-PERF Lisi one-CLASS book  
           'I gave Lisi a book.'
- b. \**Lisi (bei wo) song-le yi-ben shu*  
           Lisi BEI I give-PERF one-CLASS book  
           comp. 'Lisi was given the book by me.'
- c. *nei-ben shu (bei wo) song-le Lisi*  
           that-CLASS book BEI I give-PERF Lisi  
           comp. '\*That book was given Lisi by me.'

In English, the GOAL role can be the SUBJ of a passive construction while the THEME can be a passive SUBJ only when the GOAL is grammatically marked as an oblique function. In Mandarin, however, the THEME can be the SUBJ while the GOAL cannot. We will show here how the postulated difference in the thematic hierarchy together with the Lexical Mapping Theory correctly predict the similarities and the differences between the two languages.

32 The study here is based on the descriptive account of ditransitive verbs in Cheng and Huang (1988), which draws upon several previous studies, especially those in Tang (1979).

- (21) a. song 'to give'      <agent      theme      goal>  
           Intrinsic              -o              -r              +o  
           Default                -r                              +r  
           Well-formed cond.      SUBJ      OBJ      OBJ<sub>th</sub>  
           Ex.    wo song-le Lisi yi-ben shu                              [(18a)]
- b. song 'to give'      <agent      theme      goal>  
           Intrinsic              -o              -r              +o  
           Passive                 $\emptyset$   
           Default    +r  
           Well-formed cond.                      SUBJ      OBJ<sub>th</sub>  
           Ex.    nei-ben shu (bei wo) song-le Lisi                              [(18c)]

Recall our proposal that dependent roles be assigned the feature -r and dependent roles lower than THEME be assigned the feature +o. (21) shows that, with the predicate *song* 'to give,' we correctly predict the grammatical representation when all three thematic roles are present and when the top role is suppressed via passivization.<sup>33</sup> The fact that a GOAL cannot be the SUBJ in a passive construction with a ditransitive verb is predicted by the fact that the thematically higher THEME role is present and that it is intrinsically marked +o, a feature value incompatible with the SUBJ function.

In the last section, a morpholexical rule was defined as a lexical operation marked with morphology, and a lexical option was defined as a lexical rule without morphological consequences, following Alsina (in preparation). The definition leads to the very important issue of the position of morpholexical rules in Mandarin Chinese grammar. Even though Starosta (1985) convincingly proposes a 'pseudocompounding' analysis of the at-

33 Recall that grammatical functions are determined in terms of surface marking in LFG and that I assume that grammatical functions are defined in terms of surface configurations in Mandarin. Specifically, I assume that co-occurring OBJ and OBJ<sub>th</sub> are distinguished by OBJ<sub>th</sub> always preceding OBJ. It is this strictly surface-based definition of grammatical functions which enables us to directly predict the surface representations with lexical mapping to grammatical functions.

tachment of localizers in Mandarin, the commonly held belief is that Chinese has an impoverished morphology which is composed mainly of compounding. I will argue for Starosta's (1985) position that lexical rules with overt marks do occur in the language with data involving several groups of predicates, including ditransitive verbs.

Cheng and Huang (1988) discuss the classifications of double object constructions in Mandarin Chinese. One of the classificatory criterion, adopted from Tang (1979a), is the obligatoriness of the occurrence of the morpheme *gei* before the indirect object in the position immediately following the verb. It is observed that the prototypical double object verb *gei* 'to give' does not allow the occurrence of another *gei* after it. In contrast, the post-verbal *gei* is obligatory after verbs such as *ji* 'to send.' It has also been observed that certain Mandarin verbs without inherent ditransitive thematic structure can take double objects when marked with *gei*. Thus, double object constructions can be classified according to whether the occurrence of *gei* is obligatory, optional, or not allowed.

- (22) a. Zhangsan ti-*gei*-(le)            Lisi yi-ge            qiu  
          Zhangsan kick-GET-PERF Lisi one-CLASS ball  
          'Zhangsan kicked a ball to Lisi.'
- b. \*Zhangsan ti-(le)            Lisi yi-ge            qiu  
          Zhangsan kick-PERF Lisi one-CLASS ball
- c. nei-ge            qiu (bei Zhangsan) ti-\*(*gei*)-le            Lisi  
          that-CLASS ball BEI Zhangsan kick-GET-PERF Lisi  
          'That ball was kicked to Lisi (by Zhangsan).'

*Gei* in (22a) has often been treated as a preposition marking GOAL (e.g. Teng 1975). This position is neither supported by distributional evidence nor by other syntactic tests. First, attested PPs in Chinese either occur after an OBJ in the VP-final position, as the locative PP in *ta fang-le yi-ben shu zai zhuoshang* 'S/He put a book on the desk,' or pre-verbally after the SUBJ, as the GOAL PP in *ta dui Zhangsan shuohua* 'S/He talked to Zhangsan.' No independent evidence suggests that an oblique PP can occur in a position immediately

preceding an OBJ.<sup>34</sup> Second, the fact that the perfective aspect marker *-le* is attached after rather than before *gei* suggests that *gei* and the preceding verb form a verbal compound. The morpholexical analysis is further supported by the fact that no constituent can be inserted between the verb and *gei*.

Given the linguistic facts suggesting that verb-*gei* is a complex verb, the function of *gei* should be transparent. In (22), the verb *ti* 'to kick' is a transitive verb which does not subcategorize for a third GOAL argument (e.g. 22b). The complex verb *ti-gei*, on the other hand, behaves like a typical ditransitive verb (e.g. 22a). The account of *ti* as a transitive verb and *ti-gei* as a ditransitive verb is also supported by the contrast in the passive sentences (22c). In terms of the Lexical Mapping Theory, I will postulate-*gei* as the locus of the morpholexical rule introducing an applicative GOAL.<sup>35, 36</sup> In other words, the

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34 A BIHP reviewer, citing Tang (1979a), observes that *gei* can occur after either *gongji* 'to supply' and *jiao* 'to teach' and suggests that these are cases of *gei* as preposition. PP analysis of these verbs faces the problems discussed in this article.

i) a. ta gongji-gei wo xuduo shu [Tang 1979a.204(33)]

s/he supply-GEI I many book

'S/He supplied me with many books.'

b. ta gongji-gei-le wo xuduo shu

s/he supply-GEI-PERF I many book

'S/He supplied me with many books.'

c. \*ta gongji-le-gei wo xuduoshu

s/he supply-PERF-GEI I many book

'S/He supplied me with many books.'

ii) a. wo jiao-gei-le ta yixie mijue [Tang 1979a.202(23b)]

I teach-GEI-PERF s/he some knack

'I taught him/her some knacks.'

b. ?\*wo jiao-le-gei ta yixie mijue

I teach-PERF-GEI s/he some knack

The ungrammatical ic) and iib), in contrast with the grammatical ib) and iia), support the affixation account but not the preposition account.

35 The term applicative is taken from Bantu syntax to refer to the roles which are added to predicates when they are marked by affixes (called the applicative affixes). See Alsina and Mchombo (1988), Bresnan (1989), Bresnan and Kanerva (1989) etc. for references on Bantu applicatives.

36 A BIHP reviewer suggests that *ti* might have an inherent GOAL argument, such as in *ti-dao*

function-changing process is accounted for as lexically encoded on the affix instead of as an abstract rule simultaneously introducing a morphological marker.<sup>37</sup>

(23) *gei* morpholexical rule

Phonology	Morphology	Semantics
[ <i>gei</i> ]	suffix	$\langle \theta \dots \theta_i \theta_j \dots \rangle \Rightarrow \langle \theta \dots \theta_{iGOAL} \theta_j \dots \rangle$

In addition to capturing the above generalizations that a PP hypothesis fails to capture, the applicative morpholexical rule account has several implications. First, the fact that *-gei* cannot be attached to the verb *gei* 'to give' will be straightforwardly accounted for with a haplology rule in the phonological component of (23).<sup>38</sup> The same account does not follow automatically if *gei* is treated as a preposition because haplology is not known to cause ellipsis of a major lexical category.<sup>39</sup> Second, the account also offers an explanation for the three way classification of double object constructions. The non-occurrence of the complex verb *gei-gei* has been shown to be a consequence of haplology working on the phonological part of the morpholexical rule. The optional occurrence of *-gei* can be treated as the result of two alternative sources of the GOAL role. The verbs allow an

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*men-wai* 'kick to outside the door' and *ti-jin qiumen* 'kick into the goal.' Both examples involve complex verbs, *ti-jin* 'kick-in' and *ti-dao* 'kick-to.' The observation only confirms our position that *ti* is a verb subcategorizing for <AGENT, THEME> and that the addition of a GOAL role has to be introduced by a lexical rule and be morphologically marked.

- 37 Here the term 'suffix' reflects the fact that *gei* is attached after rather than before a verbal root. Starosta (1985:251-2) specifically argued against mischaracterizing similar verbs as compounds.
- 38 Chao (1968) introduces the term haplology to explain the absence of sentence-final *le-le* 'PERF + CHANG-OF-STATE.' He also suggests that this be a phonological rule of Mandarin. Both Tang (1979a) and Teng (1985) use haplology to explain the non-occurrence of the *gei-gei* series.
- 39 Even though haplology is attested for affixed elements such as suffixes and clitics (particles), e.g. *-le-le* becomes *le*, it has not been shown to affect any major category lexical item. Furthermore, assuming that [V<sup>PP</sup>] is a possible haplology configuration has the undesirable consequence of predicting that it also applies to similar configurations, e.g. [P<sup>NP</sup>], etc. The prediction is incorrect, as exemplified by sentences such as *ta dui duicuo haobuzaiyi* 's/he DUI right-wrong do-not-care-at-all, S/he does not care whether it is right or wrong at all.'

optional combination with *-gei* because they can either subcategorize for the GOAL role in their thematic structures, or allow the role to be introduced by the applicative morpholexical rule. A verb subcategorized for GOAL is not marked while a verb with GOAL introduced by a morpholexical rule is marked by *-gei*.<sup>40</sup> Lastly, the verbs that have an obligatory *-gei* when GOAL is present do not have the GOAL role in their thematic structures but are semantically compatible with the applicative GOAL role. Thus, the GOAL role can only be introduced through the morpholexical rule marked by *-gei*.<sup>41</sup>

To sum up, it is shown that the post-verbal *-gei* in Mandarin double object construction involves a morpholexical rule. It is a verbal suffix introducing an additional GOAL role instead of a preposition. This analysis and the revised lower position of the GOAL role in the thematic hierarchy for Mandarin straightforwardly account for both the classification of ditransitive verbs and the contrast between Mandarin and English with regard to the passive construction.

#### IV.2 *Unaccusative Verbs*

The term unaccusative verb is first proposed by Perlmutter (1978) in Relational Grammar to subclassify intransitive verbs. Specifically, it refers to the verbs whose subjects seem to have patientlike properties.<sup>42</sup> The corresponding term, unergative verbs, refers to the other subclass of intransitive verbs whose subjects have agentlike properties. The contrast can be illustrated in Mandarin Chinese with the unaccusative *kai* 'to open,' as opposed to the unergative *chi* 'to eat'.

(24) a. *men kai-le*

door open-PERF

'The door opened.'

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40 The possibility that a GOAL is introduced by a morpholexical rule on top of the subcategorized one is ruled out by the Bi-uniqueness Condition. And the post OBJ *gei*-PP will be accounted for by mapping to OBL<sub>goal</sub>.

41 For more detailed discussion of the accounts outlined here, please refer to Huang (1990b).

42 Perlmutter's (1978) original unaccusative hypothesis was given in Relational Grammar terms: Certain intransitive clauses have an initial 2 but no initial 1.



b. Wangwu kai-le        men.

Wangwu open-PERF door

'Wangwu opened the door.'

(25) a. Wangwu chi-le

Wangwu eat-PERF

'Wangwu ate.'

b. Wangwu chi-le        fan.

Wangwu eat-PERF meal

'Wangwu ate (his meal).'

Thus, the unaccusative hypothesis is actually a theory for the classification of intransitive verbs. In terms of the Lexical Mapping Theory, I will follow Zaenen's (to appear) definition of unaccusativity:<sup>43</sup>

(26) An unaccusative participant is a participant that is intrinsically marked -r.

An unaccusative verb is a nonpassive [intransitive] verb which has an unaccusative participant as its subject.

According to the above definition, unaccusative verbs in Mandarin are those nonpassive verbs whose only arguments have the thematic roles of either THEME/PATIENT or any of the lower roles. The unaccusative verbs have the following mapping onto their predicate-argument structure.

(27) <i>Unaccusative verbs</i>	<THEME>
Intrinsic Classification	-r
Possible Mapping	SUBJ/OBJ
Well-formedness Cond.	SUBJ

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43 The word 'intransitive' is added by the author to Zaenen's definition to underline Perlmutter's original proposal that unaccusative verbs are a subclass of intransitive verbs.

- (28) a. Na-ren            si/bing-le  
          that-person die/sick-PERF  
          'That person died/is sick.'
- b. qianbao diu-le  
          purse throw-PERF  
          'The purse is missing/lost.'
- c. Na-ren            lai-le  
          that-person come-PERF  
          'That person has come/arrived.'
- d. deng liang-le  
          lamp light-PERF  
          'The lamp has been turned on.'

The mapping in (27) correctly predicts the unaccusative sentences in (28).<sup>44</sup> With morpholexical rules, I will show that other idiosyncratic sentences involving unaccusative verbs can be accounted for straightforwardly.

It is well-known that a few unaccusative verbs have a corresponding transitive form with a subject which seems to be semantically incompatible with the notion of agency and is often described as an inalienable possessor, such as in (29).

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44 A reviewer of BIHP observes that the verb *lai* 'to come/arrive' does not seem to be an unaccusative verb in RG terms, since the intransitive *lai* can occur in an imperative sentence, its only argument should be considered an initial 1 in RG. Recall that unaccusative verbs and unergative verbs exhaustively classify intransitive verbs. The issue underlined by the difference between RG and our classification is then whether to account for the differences between *lai* and other proto-typical unaccusative verbs in terms of the unaccusative/unergative dichotomy, or in terms of further subclassifications within unaccusative verbs. I will show that our classification offers a uniform account of several Mandarin constructions.

- (29) a. Lisi si-le fuqin  
 Lisi die-PERF father  
 'Lisi's father died on him.' i.e. 'Lisi's father died.'  
 [comp. fuqin si-le 'Father died.']
- b. shibing duan-le tui  
 soldier broken-PERF leg  
 'The soldier's leg broke on him.'  
 i.e. 'The soldier's leg is broken.'  
 [comp. tui duan-le 'The leg is broken.']

I assume that the subjects in the sentences in (29) actually have the thematic roles of MALEFICIARY. In other words, they are the victims of the event described by the VPs. In terms of lexical mapping, the verbs are derived from the basic unaccusative verb by the addition of an applicative MALEFICIARY role through a morpholexical rule.<sup>45</sup> I will further assume that the application of this morpholexical rule is limited to predicates which are both telic and effective.<sup>46</sup> The lexical mapping of the predicates after the addi-

45 MALEFICIARY, as opposed to the often-mentioned POSSESSOR, is an apt choice as the role name. A priori, a possessor is a relation between an argument and another argument, not between an argument and its predicate, and therefore plays no part in the thematic hierarchy. Even more crucial is the fact that the possessor-possessee relationship is very often affected by the action. In the following sentence, the concept of the subject as the 'possessor' depends on the fact that he physically possesses the money since he does not legally possess it.

i) Lisi diu-le ta baoguan de yi-wan kuai qian  
 Lisi throw-PERF s/he keep DE one-ten-thousand MEASURE money  
 'Lisi lost the ten thousand dollars that he was entrusted with.'  
 [comp. yi-wan kuai qian diu-le 'Ten thousand dollars was lost.']

Lisi in i) does not play the role of an AGENT because losing things does not entail any action on his part, nor does the event involve any volition of his. In addition, the sentence describes a situation where Lisi has neither legal nor physical possession of the money. Thus the postulation that the pre-verbal argument is a POSSESSOR is problematic.

46 Without further elaboration, I will take a telic predicate as one which is bounded, and an effective predicate as one which makes an argument come into (or out of) existence.

tion of an applicative MALEFICIARY role is given below in (30).<sup>47</sup>

(30) *Unaccusative verbs with mal<sub>appl</sub> <mal<sub>appl</sub> theme>*

Intrinsic Classification	-o	-r
Default Classification	-r	
Well-formedness cond.	SUBJ	OBJ

As mentioned above, the role MALEFICIARY is classified as independent and assigned the feature -o.<sup>48</sup> In addition, since the role is higher than THEME in the thematic hierarchy, it receives the Default Classification of -r. The result is that there is only one possible mapping, with the MALEFICIARY role as the SUBJ and the THEME role as the OBJ, as exemplified by the sentences in (29).

A similar set of data with non-canonical subjects is called the locative inversion construction. It differs from the so-called 'inalienable possessor' construction in having LOCATION as subjects. Chang (1990) gives a detailed account for this construction, including evidence for the subjecthood. Only a sketch of the phenomena will be given here. The predicates in question are a subset of those with unaccusative uses.

- (31) a. qianmian lai-le yi-ge ren  
front come-PERF one-CLASS person  
'There is a person coming in front (of us etc.).'
- b. zhuoshang liang-le yi-zhan deng  
desk-top light-PERF one-CLASS lamp  
'There is a lamp lit on the desk.'

47 Other unaccusative predicates belonging to this class include *xia* 'be blind,' *yishi* 'be lost' etc. The condition on the feature of effectiveness may be further restricted to negative effectiveness.

48 The role is not agentlike according to Dowty's principles. Here we are assuming that it is the interaction between the fact that it is an applied role and the fact that it is an independent role which determine the assignment. Further justification of the current assignment needs to be given in future studies.

- c. jiali            huai-le            san-ge            chuangzi  
     home-inside broken-PERF three-CLASS window  
     'There are three windows broken in the house.'
- d. cunzili            si-le            yi-tou            niu  
     village-inside die-PERF one-CLASS cow  
     'There is a cow dead in the village.'

The data motivate a morpholexical rule adding an applicative LOCATION. The rule applies to telic unaccusative predicates.<sup>49</sup>

(32) *Unaccusative verbs with loc* appl <theme[f] loc>

Intrinsic Classification	-r	-o
Default Classification		-r
Well-formedness cond.	OBJ	SUBJ

The Intrinsic Classification is predicted by (19), with the classification of LOCATION as an agentlike role.<sup>50</sup> The role THEME is assigned the feature -r, while the dependent role LOCATION is assigned -o. The Default Classifications are assigned according to our pro-

49 As observed by a BIHP reviewer, verbs such as *pao* 'to run' and *fei* 'to fly' also occur in locative inversion. They are not likely to be classified as unaccusative verbs in RG terms because their SUBJs are volitional. However, they are unaccusative intransitive verbs in Zaenen's definition adopted in this paper. In other words, our classification based on the -r intrinsic classification has the advantage of predicting that only unaccusative verbs are involved in locative inversion. Van Valin's (1990) definition of unaccusative verbs as intransitive activity or state verbs with an UNDERGOER argument would also classify the two above verbs as unaccusative verbs, while the RG definition of unaccusativity would entail accounting for locative inversion as involving predicates of more than one class.

50 The -o intrinsic assignment of the LOCATION role is argued for in both Bresnan (1989) for English and Chichewa, and in Chang (1990) for Mandarin. Please note that in the ACTOR-UNDERGOER hierarchy of Role and Reference Grammar (RRG, Van Valin 1990), the locative is also a role which can be instantiated as either macrorole (roughly equivalent to Dowty's agentlike and patientlike proto-roles). Please also note that I am following the convention of using LOCATION to refer to any point belonging to the temporal-spatial continuum.

posed revision in (20).<sup>51</sup> The discursual functions of presentative focus will not be discussed here. It will only be observed that when the LOCATION role is expressed by the SUBJ function, it always represents the given background information. In contrast, the other role receives presentative focus and is introduced as new information. This postulation will also easily account for the locative inversion facts in (33).

- (33) a. shu fang (zai) zhuzi-shang  
           book put at desk-top  
           'The book is (put) on the desk.'
- b. zhuzi-shang fang-le shu  
           desk-top put-PERF book  
           'There are books (put) on the desk.'
- c. Zhangsan tang (zai) shafa-shang  
           Zhangsan lie at sofa-top  
           'Zhangsan lies on the sofa.'
- d. shafa-shang tang-zhe Zhangsan  
           sofa-top loc-DURATIVE Zhangsan  
           'There lies Zhangsan on the sofa.'

The only difference between (33a & c) and (33b & d) respectively is that the predicates are assigned different feature values by Default Classification, as shown in (34).<sup>52</sup>

51 There are logically two possible ways to account for the fact that the role LOCATION is represented by a higher GF. Instead of revising the Default Classification, one could stipulate that LOCATION is higher in the thematic hierarchy than PATIENT/THEME. However, this is in contradiction with most known thematic hierarchies and unsupported by facts. Thus, we note that the behavior of the LOCATION role shows its affinity with the verb. In (33a & c) the subcategorized LOCATION roles are encoded as OBL<sub>loc</sub> while the THEME roles are encoded as SUBJ. This fact suggests that LOCATION is lower in the thematic hierarchy than THEME and should receive the default classification of +r.

52 A BIHP reviewer argues that *tang* cannot be unaccusative since it is volitional. However, as pointed out in a previous footnote (fn. 49), our definition of unaccusativity does not involve volition. We can note again that even though Van Valin (1990) argues for semantic parame-

(34a) gives the mapping for the unmarked predicate subcategorizing for a LOCATION, while (34b) gives the predicate with presentative focus.

(34) a. <i>Predicates ( e.g. zai, tang )</i>	<theme loc>	
<i>subcategorize for LOCATION</i>		
Intrinsic Classification	-r	+o
Default Classification		+r
Well-formedness Cond.	SUBJ	OBJ <sub>th</sub>
b. <i>Corresponding predicates</i>	<theme[f] loc>	
<i>with locative inversion</i>		
Intrinsic Classification	-r	-o
Default Classification		-r
Well-formedness Cond.	OBJ	SUBJ

The assignment of either -o or +o to the LOCATION role in the Intrinsic Classification of (34) calls for an explanation. Recall that the proposal assigns the agentlike roles the feature value -o and the rest either -r or +o. Assigning +o to the LOCATION role follows without any problem since it is a patientlike role lower than THEME. On the other hand, recall Zaenen's (to appear) theory that feature assignments be determined by the number of agentlike and patientlike properties each role possesses.<sup>53</sup> She also postulates that participants of predicates with an equal number of patientlike and agentlike properties could be assigned either value. It can be observed that the locative participant involved in the pred-

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ters in the definition of unaccusative verbs, his position is exactly that different languages will use different semantic principles to classify intransitive verbs. Many use Aktionsart and a few use volitionality. Somewhat similar to our approach, his account utilizes the more abstract concepts of both Dowty's (1979) classification of activity vs. achievement verbs and the RRG ACTOR-UNDERGOER hierarchy to state generalizations of the unaccusative hypothesis.

53 Zaenen's (in preparation) principle is as follows:

If a participant has more patient properties than agent properties, it is marked -r.

If a participant has more agent properties than patient properties, it is marked -o.

icates discussed has one agentlike property: referent exists independent of action of verb, and one patientlike property: is stationary (relative to movement of Proto-Agent), as given by Dowty (1991). Thus, assigning the locative participant either the agentlike value  $-o$  or the patientlike value  $+o$  is motivated. Assignment of the other patientlike value  $-r$ , of course, is ruled out by the condition of the unique assignment of  $-r$  (Alsina and Mchombo 1988). The alternative assignments nicely account for the optionality of the prepositions in (34a) and (34c).<sup>54</sup>

Lastly, Mandarin Chinese allows DOMAIN and RANGE roles to occur as an NP immediately following either the verb or the object NP, as in (35).

- (35) a. ta ti-le wo yi-jiao  
s/he kick-PERF me one-foot  
'S/He kicked me once.'
- b. deng liang-le san-zhan  
lamp light-PERF three-CLASS  
'Three of the lamps lighted.'

From the above fact, a lexical option adding a DOMAIN/RANGE role should be postulated.<sup>55</sup> The roles DOMAIN/RANGE are patientlike and are at the bottom of the thematic

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54 Two additional remarks: First, the characterization of the locative participant as an OBJ<sub>th</sub> is well-supported by the fact that its syntactic position does not allow any participant without locative marking, as in i).

i) a. shu fang zhuzi-shang  
book put desk-top  
'The book is put on the desk.'

b. \*shu fang zhuzi  
book put desk

Second, it is assumed that backgrounding enhances the agentlike properties. With the plausible assumption that backgrounding information is encoded in the conceptual structure and therefore available for mapping at the thematic structure level, it can be predicted that the locative participant is assigned the agentlike feature  $-o$  in (27b).

55 I will not formulate the lexical option. But I am assuming that, like all lexical rules, it specifies its effect as well as application domain.



hierarchy.<sup>56</sup> Since they are dependent roles lower than THEME, they are predicted to have the +o intrinsic assignment. A DOMAIN role has to be intrinsically assigned either -r or +o as a dependent role. However, because the higher role THEME is assigned -r and because Alsina and Mchombo's (1988) constraint prevents the assignment of more than one -r, the DOMAIN role is assigned the value +o by default. The mapping of unaccusative predicates with the addition of a DOMAIN, such as (35b) is given as (36).

(36) *Unaccusative verbs with DOMAIN* <theme dom>

Intrinsic Classification	-r	+o
Default Classification		+r
Well-formedness cond.	SUBJ	OBJ <sub>th</sub>

The lexical mapping process is straightforward. It predicts that, with an unaccusative predicate, the DOMAIN/RANGE role occurs as a restricted OBJ.

In this subsection, Mandarin unaccusative verbs are defined in terms of the Lexical Mapping Theory following Zaenen (in preparation). Unaccusative verbs are intransitive verbs whose only argument receives the Intrinsic Classification of the feature value -r. It is shown that this definition leads to straightforward generalizations concerning the addition of either a MALEFICIARY role or a DOMAIN/RANGE role, and concerning locative inversion. It is argued that both MALEFICIARY application and locative inversion involve a subset of unaccusative predicates. Thus it suggests that explanatory verb classifications are achieved through the Lexical Mapping Theory.

### IV.3 *Some Transitive Verbs*

It goes without saying that the proposed Lexical Mapping Theory for Mandarin also correctly predicts the functional argument structure of transitive predicates in Mandarin

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56 The only applicable Proto-Role property is that the referent of a DOMAIN/RANGE roles either do not exist or may not exist independent of the action. This is a patientlike property. They are lower than THEME in the hierarchy because they stay closer to the predicates. DOMAIN/RANGE roles are always realized as postverbal arguments within VP, while THEME can have pre-verbal OBL positions (e.g. with ba construction).

Chinese.

(37) *Typical transitive predicates* <agent theme/patient>

Intrinsic Classification	-o	-r
Default Classification	-r	
Well-formedness cond.	SUBJ	OBJ

The theory predicts that in unmarked cases, AGENT roles are encoded as SUBJ, and PATIENT roles as OBJ.

A non-trivial case involves the addition of DOMAIN roles to transitive predicates.

(38) *Transitive predicates with DOMAIN* <agent patient dom>

Intrinsic Classification	-o	-r	+o
Default Classification	-r		+r
Well-formedness cond.	SUBJ	OBJ	OBJ <sub>th</sub>

Applying the same Intrinsic Classification, the prediction concerning transitive predicates with the DOMAIN role is made. The theory predicts that the PATIENT will be encoded as OBJ, while the DOMAIN will be encoded as OBJ<sub>th</sub>.<sup>57</sup> According to the definition of grammatical functions given in section I, this would wrongly predict that the DOMAIN role precedes the PATIENT in their surface representations. A straightforward way out of this dilemma is to stipulate that the linear order between the objective functions, unrestricted or restricted, is determined not only by the classifications of their grammatical functions

57 There are details to be worked out concerning the rule of adding a DOMAIN participant. For instance, the head classifier of the grammatical representation of the DOMAIN participant is selected by the predicate and by the THEME role. For instance we can say *ta ti-le wo yi-jiao* (s/he kick-PERF me one-foot) 'S/He kicked me once' but not *\*ta ti-le wo yi-quan* (s/he kick-PERF me one-fist), and we can say *deng liang-le san-zhan* (lamp light-PERF three-CLASS) but not *\*deng liang-le san-ben* 'Three of the lamps lighted.' Such selections seem to me to be better encoded in terms of the compatibility of syntactic features, similar to the treatment of agreements in unification-based grammars.

but also by their thematic roles.<sup>58</sup> Since this proposal entails a major revision of the definition of grammatical functions in Mandarin, it should be studied in greater detail in the future.

Other morpholexical rules involving transitive predicates include a *ba*-rule to suppress the THEME role and to introduce a *ba*-phrase, and a *bei*-rule to both suppress the AGENT role and to optionally introduce a *bei*-phrase. A discussion of either rule, however, calls for another paper. It suffices to observe that with the morpholexical rule proposal and with the account of Mandarin unaccusative predicates, the fact that transitive verbs with corresponding unaccusative uses have no *bei* counterparts follows without further stipulation. The morpholexical rules apply to the -o AGENT role, while no such role exists in the thematic structures of transitive predicates with unaccusative uses.

#### IV.4 Another Morpholexical Rule: The Case of *nan-/hao-*

It has been shown with the verb-*gei* compound that argument changing rules can be marked by morphology in Mandarin Chinese. The presence of -*gei* marks the addition of an applicative GOAL to the argument structure. Another morpholexical rule will be introduced in this section. The following sentences are often considered as the equivalents of English 'tough movement' constructions with predicates *be easy to* and *be difficult to*.

- (39) a.   zhe-ben     shu   hen nan du  
          this-CLASS book very hard read  
          'This book is difficult to read.'
- d.   \*zhe-ben     shu   hen nan dui/bei wo du  
          this-CLASS book very hard DUI/BEI I read  
          comp. 'This book is difficult for me to read.'

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58 The data discussed in this article would lead to the following Linear Precedence (LP) statement:

i)  $OBJ_{goal} < OBJ < OBJ_{dom}$

- (40) a. zhe-ben shu hen nan du  
this-CLASS book very easy read  
'This book is easy to read.'
- d. \*zhe-ben shu hen nan dui/bei wo du  
this-CLASS book very easy DUI/BEI I read  
comp. 'This book is easy for me to read.'

Although the parallel syntax and semantics of the sentence pairs in (39a) and (40a) are striking, so are the contrasts of (39b) and (40b). The ungrammatical Mandarin (39b) and (40b) serve to demonstrate the fact that no constituents can intervene between the alleged matrix verb *nan/hao* and the supposedly embedded predicate. As a matter of fact, we show in (41) that adjuncts do occur between a matrix verb and the predicate it governs, but not between *hao/nan* and the ensuing verbs.

- (41) a. wo yao/xiang tian-tian du shu  
I want day-day read book  
'I want to study everyday.'
- b. \*shu hen hao tian-tian du  
book very good day-day read

The fact that *nan/hao* does not allow any adjunct to follow could be easily explained if it is recognized as part of a complex verb.

The example sentences in (42) and (43) illustrate that, unlike English tough movement verbs, *nan/hao* cannot be matrix verbs which license embedded predicates with a missing object. They show that *nan/hao* never allow the following 'verb' to have any arguments.

(42) \*zhe-ge        difang hen nan du shu  
      this-CLASS place very hard read book  
comp. 'It is very difficult to read books here.'

(43) \*Zhangsan    hen    nan    song    liwu    (gei    ta)  
      Zhangsan    very hard give present GEI him  
      'John is very difficult to give a present to.'

One of the most important motivations for analyzing English to *be easy to* as missing an embedded object is simply the fact that the predicates allow such an object to occur when the matrix subject is filled (e.g. English 42). Since there are no expletive subject NPs in Mandarin, it is shown that no post-verbal argument is allowed for the transitive verb *du* 'to read' even when the matrix subject position is filled with locative inversion. The contrasting Mandarin-English pair in (43) further supports this point. The English sentence shows that the matrix subject controls a gap in the embedded clause, in spite of the extra post-verbal argument. The Mandarin sentence, on the other hand, allows no post-verbal components.

Based on the above facts, I will posit that *nan-/hao-* and related morphemes are not matrix verbs but are verbal prefixes. In particular, they will be represented with the following morpholexical rule. Note that I am postulating an additional syntactic component in the morpholexical rule to indicate that both the top thematic role and the THEME role are suppressed. It goes without saying that whether an argument is represented or not pertains to syntactic information. In addition, the fact that a morpholexical rule in Alsina's (in preparation) proposal contains phonological, morphological, and semantic information but no syntactic information seems anomalous. The lexicon should be the most appropriate place for the collection of grammatical information from different linguistic components.

(44) *nan-/hao-* morpholexical rule

phonology	morphology	syntax	semantics
[nan/hao]	prefix	for all $\theta \neq \text{theme}$	$\langle \dots \text{theme} \dots \rangle \Rightarrow$
		$\theta \rightarrow \emptyset$	$\langle \text{difficult/easy} \langle \dots \text{theme} \dots \rangle \rangle$

The morphological and phonological components of (44) are straightforward. The syntax information specifies that all thematic roles except the THEME are suppressed. Semantically, the predicate represented by the second half of the complex predicate becomes the only argument of the predicate represented by the prefix. The fact that the role THEME must be specified can be demonstrated with double object verbs, as in (45).

- (45) a.   liwu     hen   nan song  
           present very hard give  
           'It is very difficult to give presents.'
- b.   \*Zhangsan hen   nan song  
           Zhangsan very hard give

The morpholexical rule analysis also correctly predicts two characteristics typical of lexical relations. Contrary to the prediction of a syntactic 'tough movement' account, there are idiosyncratic gaps in the combination of *nan-/hao-* with other verbal stems. For instance, there is *hao-xiao* 'easy to laugh at, funny' but there is no *nan-xiao* 'hard-laugh' nor *hao-ku* 'easy-cry' in the language. In addition, suppletive semantic shifts are predicted by the morpholexical rule account, but not predicted by a syntactic account. Compounds such as *hao-chi* good-eat 'to be delicious' and *nan-kan* hard-watch 'embarrassing' illustrate the last argument.

## V. Conclusion

In the sections above, the Lexical Mapping Theory of LFG has been introduced and a

revised version of the theory for Mandarin Chinese has been proposed, as summarized in (46).

(46) Lexical Mapping for Mandarin Chinese (summary)

*A. Thematic Hierarchy :*

agent > ben/mal > instr > th/pat > exp/goal > loc/dom

*B. Intrinsic Classification :*

agentlike : -o

patientlike : -r

or (if lower than THEME) : +o

*C. Default Classification*

if <..<sub>f</sub>.., ...loc> then loc : -r

otherwise  $\theta$  : -r

elsewhere : +r

*D. Morpholexical Rules* (See Section IV for examples)

We have shown, based on the above theory, that syntactic representations and verb classifications of Mandarin Chinese can be predicted with an unambiguous formalism from thematic structures. The prediction is based on the lexical theory that the conceptual structures of verbs are expressed in terms of thematic roles. Moreover, each thematic role in the lexical thematic structure is then assigned the feature values of  $\pm o$  (object-like) or  $\pm r$  (restricted) according to Intrinsic and Default Classifications. Assignment of grammatical functions to this thematic structure is then governed by the matching features and by Well-formedness Conditions on lexical predicate-argument structures.

In particular, we also have demonstrated with an *argument-adding* morpholexical rule (-*gei*) and an *argument-suppression* morpholexical rule (*nan-/hao-*) that argument changing processes can be morphologically marked in Mandarin. The fact that a morpholexical approach systematically accounts for generalizations in Mandarin suggests

that future studies focus on the interaction of syntax and morphology in Mandarin.

The above results are largely compatible with previous works done within the general frameworks of Case Grammar and Relational Grammar. This is expected because this study shares the Case Grammar emphasis on thematic roles (or case) and the Relational Grammar emphasis on grammatical relations. Our current approach, however, differs substantially from either theory because we have no need to postulate abstract deep-structures and syntactic derivations. Hou's (1979) RG study posits initial (i.e. deep) and final (i.e. surface) grammatical relations and proposes accounts in terms of the derivation from a deep abstract level to a surface level. Similarly, deep case relations are mapped to surface representations by syntactic transformations in Case Grammar. For instance, our account of *nan-/hao-* as verbal prefixes deviates considerably from the Case Grammar-based transformational account of predicate-lowering as formulated in Teng (1975). In contrast to these two theories (as well as others with abstract deep structure), the LFG theory admits only the surface GFs and mediates the surface representation with conceptual structures through the thematically based Lexical Mapping Theory.

Our strictly surface-based approach leads us to both the observation that argument changing in Mandarin is often accompanied by verbal derivations and the hypothesis that these derivations involve morphological affixes carrying the argument-changing information. Starosta's (1985) Lexicase approach is a precursor of the direction this current work has taken. Both his 'pseudocompounding' account of localizers and my proposed accounts of three suffixes support the position that morpholexical rules determine Chinese surface syntax and that the morphology of Mandarin Chinese is not as depleted as many linguists have previously thought. Our two works, hence, call for in-depth studies concerning the classification of Mandarin morphological processes.

In proposing a lexical mapping theory for Mandarin, I have also discussed the thematic hierarchy for Mandarin Chinese. Since a complete and comprehensive study of hierarchical relations of thematic roles has not been done for Mandarin Chinese, I have



taken the proposed universal hierarchy and proved that the order of GOAL versus THEME seems to be reverse in Mandarin. My arguments crucially involve predicates containing both GOAL and THEME arguments. I have shown that verb compounding with these predicates invariably incorporates the GOAL role while retaining the THEME role as a syntactic argument. This clearly shows that the GOAL role is closer to the predicates and thus lower in the thematic hierarchy.

This position is substantiated by the fact that we have not found any compounds that incorporate the THEME role while retaining the GOAL role as a syntactic argument. Compounds such as *song-li* 'send-present, to give a present (to someone),' and *song-ke* 'send-guest, to see a guest off' that have an incorporated THEME do not conflict with the proposed hierarchy. An incorporated THEME co-occurring with an AGENT only shows that THEME is lower than AGENT in the hierarchy, as we have proposed in (46A). Our hierarchy also correctly predicts that the GOAL roles cannot be a required argument of these compounds. The hierarchy predicts that the lower GOAL role would have to occur closer to the predicate than the higher THEME role. Since the THEME role is already incorporated, there is no closer representation possible for the GOAL role.

As for why a potentially ambiguous incorporated argument is interpreted as a THEME rather than a GOAL, it can be explained by lexical preference (L. Levin 1987). A well-known example is *song-ke* 'send-guest, to see a guest off', where the guest is semantically compatible as either a GOAL (i.e. the recipient of something being sent) or a THEME. Since a predicate with several argument structures is often biased towards one of the interpretations, we can observe that the THEME reading in this case is simply the semantically preferred one. In other words, the thematic hierarchy determines the syntactic position of cooccurring roles, but it does not necessarily determine whether a role is represented or not.

Results of this paper also suggest that verb classifications can be derived from the in-

interaction of the Lexical Mapping Theory and a finite set of semantic features.<sup>59</sup> The suggestion applies to Mandarin in particular and to natural languages in general. There are, of course, quite a few loose ends to be tied up. For instance, predicates with propositional arguments represented by sentential grammatical functions, i.e. COMP and XCOMP, are not discussed. The purpose of this paper, however, is to establish a framework under which the lexical mapping of Mandarin Chinese can be systematically studied. Thus, instead of trying to be exhaustive and definitive at the same time, a broad coverage of grammatical facts is presented with limited argumentation. Further detailed studies on the Lexical Mapping Theory and on how thematic roles are structured and organized are eagerly anticipated.

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59 It can be observed that the Lexical Mapping approach is very similar to the RRG (Van Valin 1990) approach of predicting surface representations in terms of semantic properties. The RRG verb classification depends on properties such as inherent verbal aspect (Aktionsart) and an ACTOR-UNDERGOER hierarchy composed of thematic roles. Studies in LFG and RRG have reached largely compatible results. For instance, both Zaenen (to appear) and Van Valin (1990) argue that semantic parameters define unaccusative verbs. However, they take different approaches concerning the relationship among thematic roles, which are decomposed into different primitives in each theory. How semantic properties interact with thematic roles will be one of the major issues in future theoretical studies.

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