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Information Compatibility and Resultative Verb Compounds in Mandarin*

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1. Introduction

A resultative verb compound (henceforth RVC) in Mandarin is composed of two free verbal morphemes with the second verb indicating a logical result caused by the action or process represented by the first verb. Examples of RVCs are given in (1).

- (1) a. Zhangsan pao-lei le.
Zhangsan run-tired LE
'Zhangsan was tired as a result of his running.'
- b. Zhangsan chi-bao fan le.
Zhangsan eat-full rice LE
'Zhangsan felt full as a result of his eating rice.'
- c. Zhangsan chi-wan fan le.¹
Zhangsan eat-finish rice LE
'The rice was gone as a result of Zhangsan's eating.'
- d. Zhangsan qi-lei-le ma le.
Zhangsan ride-tired-LE horse LE
'Zhangsan was tired as a result of his riding the horse.'
- or
'The horse was tired as a result of Zhangsan's riding it.'
- e. Zhangsan xia-ying-le na-pan qi.
Zhangsan play-win-LE that-CL chess
'Zhangsan won the chess game as a result of his playing.'

The RVCs shown in (1a) through (1e) can be: a one-place predicate and a one-place predicate together form a one-place compound (e.g. *pao-lei* 'run-tired' in (1a)), a two-place predicate and a one-place predicate together form a two-place compound (e.g. *chi-bao* 'eat-full' in (1b), *chi-wan* 'eat-finish' in (1c), and *qi-lei* 'ride-tired' in (1d)), or two two-place predicates form a two-place compound (e.g. *xia-ying* 'play-win' in (1e)), as is summarized in (2).

- (2) 1a: V<1> V<1> => RVC<1>
1b,c,d: V<2> V<1> => RVC<2>
1e: V<2> V<2> => RVC<2>

(The number in the brackets indicates the number of arguments the verb can take.)

Apparently, the number of the arguments that the compound can take is not the total of the number of the arguments that its constituents can take. Therefore, to find a way to predict the derivation of the argument structure of the RVC is the first purpose of this study.

Also, the RVCs in (1) do not behave consonantly in the *ba* construction, in which the object is preposed to the preverbal position, as shown in (1').

- (1') b. *Zhangsan ba fan chi-bao le.
Zhangsan BA rice eat-full LE
- c. Zhangsan ba fan chi-wan le.
Zhangsan BA rice eat-finish LE
'The rice was gone as a result of Zhangsan's eating.'

- d. Zhangsan ba ma qi-lei le.
Zhangsan BA horse ride-tired LE
'The horse was tired as a result of Zhangsan's riding it.'
*'Zhangsan was tired as a result of his riding the horse.'
- e. *Zhangsan ba na-pan qi xia-ying le.
Zhangsan BA that-CL chess play-win LE

As shown in (1'b) and (1'e), *chi-bao* and *xia-ying* cannot appear in the *ba* construction, but *chi-wan* and *qi-lei* can, as shown in (1'c) and (1'd). But, in the *ba* construction, *qi-lei* can only have the reading that the horse was tired as a result of Zhangsan's riding it. Therefore, to find a way to explain the *ba* construction phenomenon is the second purpose of this study.

Besides, in the sentences in (1), we can see that the second constituent verb of the RVC sometimes pairs up with the subject and sometimes with the object of the sentence in interpretation. For example, in (1b), the second constituent of the RVC *chi-bao* pairs up with the subject *Zhangsan*. Therefore, (1b) indicates that the result of the eating action was Zhangsan's being full. Whereas, in (1c), the second constituent of the RVC *chi-wan* pairs up with the object *fan* 'rice'. Therefore, (1c) indicates that the result of the eating action was the rice being gone. But in (1d), the second constituent of the RVC *qi-lei* can either pair up with the subject to form the first reading that Zhangsan's being tired was the result of his riding the horse, or pair up with the object to form the second reading that the horse's being tired was the result of Zhangsan's riding it. However, in the *ba* construction, the second verb of the RVC in (1d) must pair up with the object and not with the subject in interpretation, as shown in (1'd). Hence, to find a way to predict the interpretations of the RVCs is the third purpose of this study.

2. An information-based analysis

The resultative verb compound in Mandarin has been widely studied. It has been analyzed as derived by transformational rules in Hashimoto (1965) and Lu (1977), by structural reanalysis in Huang (1984), and derived by a lexical rule in Thompson (1973). Li (1990) is the one that solely focuses on the derivation of the argument structure. These analyses, however, are all inadequate to explain the argument structure derivation and the *ba* construction phenomenon of the RVCs (see Li 1993 for details). In this section, we are going to propose a more plausible analysis for the RVCs based on Shieber's (1986) information unification theory and on the LFG system proposed by Kaplan & Bresnan (1982). In section 2.1, the rule of information merging is introduced to deal with the derivation of the semantic structure of the RVC. In 2.2, the rule of information mapping is presented, by way of which the arguments of the RVC are mapped correctly to their syntactic positions in the active sentence structure and in the *ba* construction. In 2.3, we show that by way of the rules of information merging and information mapping, the RVCs can be properly interpreted.

2.1 Information merging

Before presenting the analysis, let's examine the properties of the constituent verbs of the RVCs first. We can see that the first constituents of the RVCs such as those introduced in (1a)-(1e) and those listed in (3) are activity verbs according to Vendler's (1967) classification, the second constituents are achievement verbs, and the compounds themselves are accomplishment verbs.²

- | | | |
|-----|----------------------|----------------------|
| (3) | da-pao 'hit-break' | si-pao 'tear-break' |
| | tuei-kai 'push-open' | wei-bao 'feed-full' |
| | du-ni 'read-bored' | ma-lei 'scold-tired' |

We suggest that the compounding of the RVC is a morphological process³ in which an activity verb takes an achievement verb to form a resultative verb:⁴

(4) The Compounding Rule of RVCs

$$V_{act} : V_{ach} \rightarrow V_{result}$$

Accompanying the compounding rule is the rule of information merging, which is proposed to deal with the semantic feature structures of the two constituent verbs in order to derive the correct semantic feature structure of the compound.

The semantic structure considered here consists of three features: the argument structure (ARG), the selectional restriction (SR), and the aspect (ASP). The argument structure refers to the thematic roles that a verb can assign. The only feature of the selectional restriction considered here is animacy. As for the aspect, Vendler's definition and classification are adopted. Examples of the semantic feature structure are given in (5). In (5a), *chi* 'eat' is shown to take two arguments, the Agent and the Theme. The Agent is animate and the Theme is inanimate. *Bao* 'full', as shown in (5b), only takes one argument, the Experiencer, which is animate. And *wan* 'finish' in (5c) is shown to take one argument, the Theme, which is inanimate. Besides, the aspect of *chi* is activity and that of *bao* and *wan* is achievement.

- (5) a. *chi* 'eat':
SEM: <ARG: Agent, Theme>
<SR: [+animate], [-animate]>
<ASP: activity>
- b. *bao* 'full':
SEM: <ARG: Experiencer>
<SR: [+animate]>
<ASP: achievement>
- c. *wan* 'finish':
SEM: <ARG: Theme>
<SR: [-animate]>
<ASP: achievement>

The rule of information merging is a modification of Shieber's (1986) information unification theory.⁵ It is used to deal with the semantic feature structures of the verbs to derive the correct semantic feature structure of the RVC. The rule consists of two parts, one for the merging of the arguments and the other for the merging of the aspects. The rule is given in (6).

(6) Information Merging

- i) If the arguments and the selectional restrictions are compatible:
- if V_{ach} and V_{act} both have two arguments, merge the first argument of V_{ach} with the first argument of V_{act} and the second argument of V_{ach} with the second argument of V_{act} ;
 - if V_{ach} has one argument and V_{act} has two, merge the argument of V_{ach} to either argument of V_{act} ;
 - if both V_{ach} and V_{act} have one argument, merge them; otherwise, create a second position for the argument of V_{ach} ; otherwise, the process fails.
- ii) Merge the value of ASP of V_{ach} with that of V_{act} if they are compatible with each other.

Compatibility of arguments and selectional restrictions means that there is no contradictory feature between two arguments and the selectional restrictions. For example, an Experiencer may be compatible with an Agent or a Theme if the Theme is [+animate], but an Agent may not be compatible with a Patient. As for the compatibility of aspects, we assume, in terms of Vendler's system, an activity together with an achievement constitutes an accomplishment, which is exactly the phenomenon of the RVCs in Mandarin. Hence, activities are compatible with achievements and this is the only case of aspects concerned in this study. Examples of the application of the information merging rule are given in (7).

In (7a), the compound is composed of *xia* 'play' and *ying* 'win'. Both of the verbs are two-place predicates. By rule (6ia), the first argument of *xia* (i.e. the Agent) merges with the first argument of *ying* (i.e. the Experiencer) and the second argument of *xia* (i.e. the Theme) merges with the second argument of *ying* (i.e. the Theme). Thus, the compound *xia-ying* has two arguments: the Agent-Experiencer and the Theme.

- (7) a. *xia-ying* 'play-win':
xia 'play':
SEM: <ARG: Agent_[+ani], Theme_[-ani]>
<ASP: activity>
ying 'win':
SEM: <ARG: Experiencer_[+ani], Theme_[-ani]>
<ASP: achievement>
xia-ying 'play-win':
SEM: <ARG: Agent-Experiencer_[+ani], Theme_[-ani]>
<ASP: activity-achievement>

The compound in (7b) is composed of *chi* 'eat' and *bao* 'full', whose semantic feature structures were given in (5). With the compounding rule, the rule of information merging applies and the semantic feature structures merge with each other. The Experiencer of *bao* merges with the Agent of *chi* and not with the Theme by rule (6ib), because the Experiencer is [+animate] and the Theme of *chi* is [-animate]. Thus, the compound *chi-bao* has two arguments: the Agent-Experiencer and the Theme. In (7c), the two constituents of the compound are *chi* 'eat' and *wan* 'finish', whose semantic feature structures were also given in (5). By rule (6ib), the Theme of *wan* merges with the Theme of *chi* and not with the Agent because both of the Themes are [-animate]. After information merging, the compound *chi-wan* has two arguments: the Agent and the Theme.

- (7) b. *chi-bao* 'eat-full':
SEM: <ARG: Agent-Experiencer_[+ani], Theme_[-ani]>
<ASP: activity-achievement>
c. *chi-wan* 'eat-finish':
SEM: <ARG: Agent_[+ani], Theme_[-ani]>
<ASP: activity-achievement>

In (7d), both *pao* 'run' and *lei* 'tired' have one argument and they are compatible with each other; therefore, by rule (6ic), the arguments of the two verbs merge with each other to form Agent-Experiencer, which is the only argument of the compound *pao-lei*.

- (7) d. *pao-lei* 'run-tired':
pao 'run':
 SEM: <ARG: Agent>
 <SR: [+animate]>
 <ASP: activity>
lei 'tired':
 SEM: <ARG: Experiencer>
 <SR: [+animate]>
 <ASP: achievement>
pao-lei 'run-tired':
 SEM: <ARG: Agent-Experiencer_[+ani]>
 <ASP: activity-achievement>

Cases in which the arguments of the two constituent verbs of the compound are incompatible with each other are rare. But, this is not a problem in our present system. For example, in (8a) *chi* 'eat' and *huai* 'bad' are both one-place predicate (the Theme of *chi* is optional) but the compound has two arguments. As we can see, the arguments of *chi* and *huai* are not compatible with each other because one is [+animate] and the other [-animate]. This is a special case of information merging and a last resort is needed, i.e. the second part of rule (6ic). With the last resort in (6ic), a new argument position of the compound is created and the argument structure of *chi-huai* is correctly derived as <Agent, Theme>, as shown in (8b). And the compound can also appear in the *ba* construction as shown in (8c), which is discussed in 2.2.

- (8) a. Ta chi-huai duzi le
 he eat-bad tummy LE
 'He got some problem with his tummy as a result of his eating.
 b. *chi* 'eat':
 SEM: <ARG: Agent>
 <SR: [+animate]>
 <ASP: activity>
huai 'bad':
 SEM: <ARG: Theme>
 <SR: [-animate]>
 <ASP: achievement>
chi-huai 'eat-bad':
 SEM: <ARG: Agent_[+ani], Theme_[-ani]>
 <ASP: activity-achievement>
 c. Ta ba duzi chi-huai le.
 he BA tummy eat-bad LE

As for the aspect, the only case in question here is the merging of activity and achievement, which, as discussed above, are compatible with each other in Vendler's system and can be merged with each other to form an accomplishment verb.

With the present system, only the correct semantic structure of the RVC is derived. Besides, the mechanism used is inherent to the arguments, i.e. the properties of the arguments and compatibility between arguments. Hence, our system here has a constrained, economical and principled way to derive the semantic structure of the RVC.

2.2 Information mapping

In the framework of LFG developed by Kaplan & Bresnan (1982), the argument structure of a lexical item plays a crucial role in the grammatical description of that lexical item. Each argument in this system is associated with a grammatical function (e.g. subject, object, etc.) by a lexical rule. In this way, a word with a particular lexical form will be able to associate with a particular sentence structure. This system has been adopted by Selkirk (1982) to deal with the formation and interpretation of verbal compounds in English, for example, and is adopted here in this study to deal with the *ba* construction phenomenon.

Based on the LFG system and the semantic structure developed in 2.1, we now can construct the syntactic structure which the resultative verb compound in Mandarin may be associated with. The rule involved is called information mapping, which deals with the mapping between the argument structure and the grammatical functions (GFs) of the RVC. The grammatical functions concerned here are those in the active sentence and in the *ba* construction in Mandarin. The active sentence is of SVO order and the *ba* construction is of S *ba*+O V order. In the mapping,⁶ the first argument is mapped to the subject of the active sentence and the second argument, if there is one, is mapped to the object. In the *ba* construction, the first argument is mapped to the subject and the second argument to the *ba*-object only when the following two conditions are satisfied: first, the aspect of the verb must be accomplishment (i.e. activity-achievement here) (Liu 1992); second, the first argument must be of full agency.⁷ Full agency means that it must be Agent and does not combine with other thematic roles such as Experiencer, Theme, etc. (i.e., Agent-Experiencer and Agent-Theme are not instances of full Agent). The rule of information mapping is given in (9).

(9) Information Mapping:

Active:

ARG:	Arg1	Arg2
GF:	SUBJ	OBJ

Ba construction:

- Condition: i) ASP: accomplishment (i.e. activity-achievement)
 ii) ARG1: Full Agency (e.g. *Agent-Experiencer)

ARG:	Arg1	Arg2
GF:	SUBJ	<i>Ba</i> OBJ

With the rule of information mapping, we can explain why some RVCs can appear in the *ba* construction and some cannot. As shown in (10a) through (10d), the first arguments of *chi-bao* 'eat-full', *chi-wan* 'eat-finish', *chi-huai* 'eat-bad', and *xia-ying* 'play-win' (whose semantic structures were given in (7) and (8)) all map to the subject and the second arguments to the object in the active structure. However, in the *ba* construction, only *chi-wan* and *chi-huai* are allowed and *chi-bao* and *xia-ying* are not because the first arguments of *chi-wan* and *chi-huai* are Agent, which satisfies the second condition of the *ba* construction, but the first arguments of *chi-bao* and *xia-ying* are Agent-Experiencer, i.e. not of full agency, which does not satisfy the second condition of the *ba* construction. This explains why sentences such as (1c) and (8c) are grammatical and (1b) and (1e) are not.

- (10) a. *chi-bao* 'eat-full':
 Active:
 ARG: Agent-Experiencer Theme
 | |
 GF: SUBJ OBJ
Ba construction:
 Condition i) accomplishment: satisfied
 ii) full agency: not satisfied
- b. *chi-wan* 'eat-finish':
 Active:
 ARG: Agent Theme
 | |
 GF: SUBJ OBJ
Ba construction:
 Condition i) accomplishment: satisfied
 ii) full agency: satisfied
 ARG: Agent Theme
 | |
 GF: SUBJ *Ba* OBJ
- c. *chi-huai* 'eat-bad':
 Active:
 ARG: Agent Theme
 | |
 GF: SUBJ OBJ
Ba construction:
 Condition i) accomplishment: satisfied
 ii) full agency: satisfied
 ARG: Agent Theme
 | |
 GF: SUBJ *Ba* OBJ
- d. *xia-ying* 'play-win':
 Active:
 ARG: Agent-Experiencer Theme
 | |
 GF: SUBJ OBJ
Ba construction:
 Condition i) accomplishment: satisfied
 ii) full agency: not satisfied

Thus, with the present system, the phenomenon of the *ba* construction is explained and predicted.

2.3 The interpretation of the RVC

With the mechanism of information merging and information mapping, we can also give the RVCs appropriate interpretations. For example, in sentence (1b), the argument of the second constituent of the RVC *chi-bao* 'eat-full' is paired up with the subject of the sentence in interpretation, which is predicted by the rules of information merging and information mapping. First, the rule of information merging merges the argument of the second verb *bao* to the first argument of the first verb *chi* in terms of information compatibility to form the first argument of the compound, as previously shown in (7b). Then, the rule of information mapping

maps the first argument of the compound to the subject in the active sentence; as previously shown in (10a). This explains why (1b) has the interpretation that the result of the eating action was Zhangsan's being full instead of the rice's being full.

- (1) b. Zhangsan chi-bao fan le.

Zhangsan eat-full rice LE

'Zhangsan felt full as a result of his eating rice.'

Whereas, in sentence (1c), the argument of the second verb *wan* 'finish' is paired up with the object of the sentence in interpretation. This is because the rule of information merging merges the argument of *wan* to the second argument of the first verb *chi* to form the second argument of the compound, as previously shown in (7c), and then the rule of information mapping maps this argument of the compound to the object in the active sentence, as previously shown in (10b). Therefore, (1c) has the interpretation that that the rice was gone was the result of Zhangsan's eating and does not have the interpretation that that Zhangsan was gone was the result of his eating the rice.

- (1) c. Zhangsan chi-wan fan le.

Zhangsan eat-finish rice LE

'The rice was gone as a result of Zhangsan's eating.'

With the present system, we can also explain why sentences like (1d) have two readings while in the *ba* construction it only has one reading.

- (1) d. Zhangsan qi-lei-le ma le.

Zhangsan ride-tired-LE horse LE

'Zhangsan was tired as a result of his riding the horse.'

or

'The horse was tired as a result of Zhangsan's riding it.'

- (1') d. Zhangsan ba ma qi-lei le.

Zhangsan BA horse ride-tired LE

'The horse was tired as a result of Zhangsan's riding it.'

*'Zhangsan was tired as a result of his riding the horse.'

As shown in (11a), the first constituent of the compound, i.e. *qi* 'ride', has two arguments: the Agent and the Theme. The Agent is animate and the Theme can be either animate or inanimate. The second constituent of the compound, i.e. *lei* 'tired', has only one argument: the Experiencer, which must be animate.

- (11) a. *qi-lei* 'ride-tired':

qi 'ride':

SEM: <ARG: Agent_[+ani], Theme_[±ani]>

<ASP: activity>

lei 'tired':

SEM: <ARG: Experiencer_[+ani]>

<ASP: achievement>

By the rule of information merging, the argument of *lei* can merge with either the first argument or the second argument of *qi*. If it merges with the first argument of *qi* to form the first argument of the compound *qi-lei*, the argument structure of the compound is like that in (11b). Then the rule of information mapping maps the first argument of the compound to the subject in the active sentence; thus, the Experiencer of the tiredness is the subject *Zhangsan*. In this case, the first argument is Agent-Experiencer, which does not satisfy the second condition of the *ba* construction; therefore, (1'd) does not have this reading.

(11) b. *qi-lei* 'ride-tired':

SEM₁: <ARG: Agent-Experiencer_[+ani], Theme_[±ani]>
 <ASP: activity-achievement>

Active:

ARG:	Agent-Experiencer	Theme
GF:	SUBJ	OBJ

Ba construction:

Condition i) accomplishment: satisfied
 ii) full agency: not satisfied

If the argument of *lei* merges with the second argument of *qi* to form the second argument of the compound, the argument structure of the compound is like that in (11c). Then, the rule of information mapping maps the second argument of the compound to the object in the active sentence; thus, the Experiencer of the tiredness is the object, i.e. the horse. And as both conditions of the *ba* construction are satisfied, the compound can appear in the *ba* sentence with this reading, which is the only reading of (1'd).

(11) c. *qi-lei* 'ride-tired':

SEM₂: <ARG: Agent_[+ani], Theme-Experiencer_[+ani]>
 <ASP: activity-achievement>

Active:

ARG:	Agent	Theme-Experiencer
GF:	SUBJ	OBJ

Ba construction:

Condition i) accomplishment: satisfied
 ii) full agency: satisfied

ARG:	Agent	Theme-Experiencer
GF:	SUBJ	<i>Ba</i> OBJ

In summary, the rules of information merging and information mapping not only can correctly derive the argument structure of the RVC from those of its constituents and map the arguments to the right structural positions, they can also correctly predict the interpretations of the RVCs.

3. Conclusion

In this paper, we have suggested that by the rules of information merging and information mapping, the issues of resultative verb compounds in Mandarin—the argument structure of the compound, the grammaticality of the compound in the *ba* construction, and the interpretation of the compound—can be derived, explained and predicted. But, the compatibility of arguments, selectional restrictions, and aspects of the verbs in the rule of information merging is only sufficiently defined for the cases studied in this paper. Refinement may be needed for other cases. Also, the system presented in this paper is sufficient to explain the phenomena of the resultative verb compounds in Mandarin. Whether it is also applicable to other V-V compounds in Mandarin or in other languages is a topic for future research.

NOTES

*I would like to thank Susan Steele and Richard Oehrle for giving me helpful comments. Of course, all the errors are mine.

¹ *Chi-wan* 'eat-finish' is ambiguous in two ways. It can be said to be composed of an action verb and a verb indicating the result of that action, or composed of an action verb and an aspectual marker of completion (i.e. the eating was completed, but the rice was not necessarily gone), because *wan* can be a verb or an aspectual marker (Lu 1975). Only the first interpretation is of concern here.

² According to Vendler (1967), verbs or verb phrases can be classified into four categories according to the time schemata:

- a. Activities: Continuous tenses with no set terminal point.
- b. Achievements: Lacking continuous tenses, predicated only for single instants of time.
- c. Accomplishments: Continuous tenses with set terminal point.
- d. States: Lacking continuous tenses, predicated for a shorter or longer period of time.

Sometimes, the distinction is subtle. For example, *bao* 'full' in Mandarin can be a state, as in (i), or an achievement, as in (ii).

i) *Wo hen bao.*

I very full

'I am very full.' (I am in the state of being full.)

ii) *Wo bao le.*

I full LE

'I became full.' (I turned into the state of being full.)

³ See Li (1993) for the argument against the suggestion that the compounding of the RVC is a syntactic process.

⁴ The rule here follows the categorial grammar tradition. The purpose is to give the compound a structure and a way to interpret it (Bach 1983). But instead of having more categorial types for the verbs, we follow Steele (1990) and put it in the way shown in (4). Also, that the activity verb is the functor in the rule does not mean that it is the head of the compound. We would leave it an open question as to whether there is a head in the resultative verb compounds.

⁵ By information unification, the information of two elements must be identical or the information of one element must subsume that of the other; otherwise, they cannot be unified. In the case of RVCs, normally the arguments of the two constituent verbs are not identical; therefore, the unification theory is not applicable without modification.

⁶ The mapping concerned here is that of the RVCs. If it is not an RVC, the mapping may be different, which will not be discussed in this study.

⁷ The *ba* construction is traditionally called the disposal form, which states how an object is manipulated, handled and dealt with (Wang 1947). Therefore, the requirement of full agency of the subject in the *ba* construction can be inferred (also see the footnote in Liu (1992)). Aside from these two conditions, other requirements of the *ba* construction, e.g. the presuppositionality of the object, are irrelevant to the morphological issue in question.

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