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Participant Sharing in Chinese Resultatives

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1 Introduction

Chinese resultatives take the form of verbal compounds V_1 - V_2 , V_1 describing an activity e_1 and V_2 its resultant state s_2 . In (1), V_1 is *kan* ‘hack’ and V_2 *diao* ‘fall-off’. The sentence means Zhangsan hacked the leaves and the leaves fell off as a result.

- (1) *Zhangsan kan-diao le shuye.*
Zhangsan hack-fall PRF leaves
‘Zhangsan hacked the leaves and the leaves fell off.’

Following the literature, we call these compounds Resultative Verb Compounds (RVCs) and use S(subject) + V_1 - V_2 + O(bject) to talk about simple sentences containing RVCs. In (1), S is *Zhangsan* while O is *shuye* ‘the leaves’.

This paper mainly discusses semantic relations between O and V_1 , V_2 respectively. It claims that O is *thematically* related to both V_1 and V_2 . Specifically:

- O receives a theta role from V_2 by being its argument;¹
- O receives a theta role from V_1 , not by being its argument, but to satisfy a requirement of RVC formation, which we call *Participant Sharing*.

We motivate *Participant Sharing* (cf. Rothstein 2004) by showing previous analyses (Li 1990, 1995, Lin 2004, Williams 2005, 2014, to appear) are inadequate in capturing the relation of O to V_1 .

Then, we implement the idea by adding into the semantic rule of resultative formation a conjunct $[[O] \in \theta(e_1)]$, which requires the argument of V_2 also receive a thematic role from V_1 .

Finally, we show the *argument* facts discussed here are compatible with the *modifier* facts reported in Liu (2014). Both suggest that V_1 and V_2 head their own verbal projections in syntax, with the resulting RVC being $[_{VP} V_1 [_{VP} V_2 P]]$. This is similar to Sybesma (1999) but contra Li (1990) and Williams (2005, 2014, to appear), where V_1 - V_2 is treated as a single complex head.

2 Problem with Argument Sharing

As is illustrated in (1), simple RVC sentences consist of S, V_1 - V_2 , and O. Since there are two verbs but only two argument positions S and O, assuming both verbs have their own theta roles to assign/discharge,² it is natural to ask: where does the additional theta role go if V_1 is transitive?

Li (1990) is the first to raise the question and he answers it with *Argument Sharing*, following Higginbotham’s (1985) *Theta Identification*.

- (2) *Argument Sharing*
Identify the argument of V_2 with an argument of V_1 .

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¹The name *argument* mentioned in this paper can either be regarded as a slot in a verb’s Argument Structure (Grimshaw 1990) or a lambda-bound variable in the Fregean denotation of a verb (see Heim and Kratzer 1998 page 54). As far as I can see, these two interpretations of *argument* make no difference in the setting of this paper.

²This is a common assumption for theories that want to compositionally derive RVC from its two individual verbs. Such a theory is not only conceptually desirable, but also empirically motivated in view of (i), RVC formation is fully productive; (ii), the two verbs V_1 and V_2 are *free*, i.e., they can themselves serve as the sole verb in a simple clause.

In other words, for (1), *the leaves* is both an argument of V_2 *fall-off* and an argument of V_1 *hack*, and thus it receives both a theme role from V_2 and a patient role from V_1 .

However, Argument Sharing cannot be right. Consider (3).

- (3) *Zhangsan ku-shi le shoupa* unergative V_1
 Zhangsan cry-wet PRF handkerchief
 ‘Zhangsan was crying and his handkerchief got wet as a result.’

Sentence (3) is an example of an unergative verb *cry* being V_1 . Crucially, in this case the O simply cannot be an argument of the V_1 (as *the handkerchief* cannot be an argument of *cry*), so Argument Sharing cannot be satisfied.

Weakening (2) into (4) would presumably solve the problem.

- (4) *Argument Sharing* (the weakened version)
 Identify the argument of V_2 with an argument of V_1 , if it is possible.³

But (4) will not work either, because there are transitive V_1 but without Argument Sharing; following Lin (2004), I call these cases unselective transitive V_1 (in the sense that V_1 does not select O as its argument). See (5).

- (5) *Zhangsan kan-dun le fuzi* unselective transitive V_1
 Zhangsan hack-blunt PRF axe
 ‘Zhangsan hacked something and the axe got blunt.’

Although (1) and (5) share the same V_1 *hack*, (1) involves Argument Sharing while (5) does not. A comparison between (1) and (5) shows that we would never know when Argument Sharing is to be applied. Thus, a theory based on Argument Sharing alone does not seem right.

3 Problem with Pragmatic Association

Based on examples like (3) and (5), Sybesma (1999) and Williams (2005, 2014, to appear) propose *Pragmatic Association*.

In this theory, a thematic relation between V_2 and O is always present,⁴ but there is no thematic relation between V_1 and O (and correspondingly no syntactic relation between the two). Any understood relation of O to V_1 is pragmatically inferred.

Take (5) as an example. In Williams’ analysis, it means ‘Zhangsan hacked something, and the axe got blunt as a result’ and pragmatics tells us that *the axe* is the instrument of *hacking*.

Similarly, (1) means ‘Zhangsan hacked something, and the leaves fell off as a result’ and we infer from world knowledge that *the leaves* is the patient of *hacking*.

As a result, Pragmatic Association avoids the problem faced by Argument Sharing by denying O to ever be an argument of V_1 and thus provides a unified analysis for (1), (3) and (5).

However, this analysis over-generates. Consider (1) again: Lin (2004) notices a mere Pragmatic Association predicts it can either have (6a) or (6b) as its interpretation.

- (6) *Zhangsan kan-diao le shuye*
 Zhangsan hack-fall PRF leaves
 a. ‘Zhangsan hacked the leaves, and the leaves fell off.’
 b. **Impossible:** ‘Zhangsan hacked the tree and the leaves fell off.’

³What is ‘possible’ can be further specified. For example, in view of (3), we can state (the weakened) Argument Sharing as the following: Identify the argument of V_2 with an argument of V_1 , if V_1 is unergative.

⁴Sybesma (1999) and Williams (2005, 2014 and to appear) differ in how they derive this thematic relation. For Sybesma, O receives a thematic role from V_2 because it is an argument of V_2 ; while for Williams, O is never an argument of V_2 and its thematic relation with V_2 comes from a stipulation (Williams attributes it to Parsons 1990) which roughly says: if O is the patient of the entire RVC (which describes a change-of-state event), it is also a theme of the V_2 (which describes its resultant state) in the RVC.

But (6b) is impossible, as is further illustrated by the contradiction in (7).

- (7) # *Zhangsan kan-diao le shuye, dan ta mei kan shuye*
 Zhangsan hack-fall PRF leaves, but he not hack leaves
 a. #‘Z hacked the leaves and the leaves fell off, but Z did not hack the leaves’.
 b. **Impossible:** ‘Z hacked something and the leaves fell off, but Z did not hack the leaves.’

In other words, the O in (1)/(6) has to be interpreted as the patient of hacking, which Pragmatic Association cannot guarantee.

Direct Causation?

The over-generation problem cannot be solved by Kratzer’s (2005) (following Bittner 1999) *Direct Causation* either.

First, Direct Causation has the effect that the causal relation between V_1 and V_2 within a RVC has to be *direct*. This further could be used to block the ‘indirect’ reading of (1)/(6) — Zhangsan hacked the tree and the leaves fell off. This is a welcome result.

However, the combination of Pragmatic Association and Direct Causation still fails to account for the Chinese data in its full range, because Chinese has RVCs that do not involve causation, e.g., *xie-cuo* ‘write-wrong’, *shui-xing* ‘sleep-awake’. Direct Causation fails to apply to them.

Further, it has been noticed (Lin 2004) that there are aspectual restrictions on V_1 and V_2 : V_1 s are always activity verbs, while V_2 s are stative/achievement verbs. Under a causal analysis of the two eventualities, the aspectual restriction is not easy to explain: why is an event only able to cause a state, but not another event? Why is **shuo-tiao* ‘tell-jump’ not attested? Instead, it seems that the relation between the two eventualities is better to be analyzed as temporal (Rothstein 2004). Thus, for our purposes, Pragmatic Association + Direct Causation cannot be used to solve the over-generation problem.

4 Participant Sharing

The above discussion shows that neither Argument Sharing nor Pragmatic Association can be used to model the relation between V_1 and O in a simple RVC sentence. In view of their problems, we propose *Participant Sharing* as in (8).

- (8) *Participant Sharing*
 To combine two verbs V_1 , V_2 into an RVC V_1 - V_2 , the event introduced by V_1 and the state introduced by V_2 have to share at least one participant.
 Where, an individual is a participant of an event if the NP denoting the individual receives a theta role from the verb that describes the event.⁵

Participant Sharing treads a middle ground between the two earlier proposals: it enforces a grammatical relation between V_1 and O (unlike the Pragmatic Association approach); but it denies an Verb-Argument relation between V_1 and O (contra Argument Sharing) and by doing this it leaves open what the precise relation will be.

Constraint (8), together with the *antipassive* assumption (9) usually assumed in the resultative literature (Kratzer 2005, Williams 2005, 2014, to appear), captures (1), (3) and (5).

- (9) *Antipassive Assumption*
 O is never an argument of V_1 .

⁵In other words, NPs receiving an Agent role, a Theme role, an Instrument role, a Locative role, an Experiencer role, a Goal Role, etc. from a verb are all regarded as denoting participants of the event described by the verb. However, the paper cannot decide how many theta roles (and thus participants) a certain verb (and its corresponding event) could have, which is an empirical question for theta theory and lexical semantics.

Notice (9) is at least motivated by (3) and (5), where the O *the handkerchief/the axe* is obviously not an argument of V_1 *cry/hack*.

Below, we show how Participant Sharing + Antipassive explains the pattern shown by (1), (3) and (5), repeated here as (10), (11) and (12).

- (10) *Zhangsan kan-diao le shuye* selective transitive V_1
 Zhangsan hack-fall PRF leaves
 a. ‘Zhangsan hacked the leaves, and the leaves fell.’
 b. **Impossible:** ‘Zhangsan hacked the tree and the leaves fell.’
- (11) *Zhangsan ku-shi le shoupa* unergative V_1
 Zhangsan cry-wet PRF handkerchief
 ‘Zhangsan was crying and his handkerchief got wet as a result.’
- (12) *Zhangsan kan-dun le fuzi* unselective transitive V_1
 Zhangsan hack-blunt PRF axe
 ‘Zhangsan hacked something and the axe got blunt.’

First, the Antipassive Assumption solves the problem faced by Argument Sharing by directly denying the principle (in other words, there is never any Argument Sharing). But crucially, the effect of Argument Sharing is preserved by Participant Sharing.

Specifically, in (10), although the O *the leaves* is interpreted as the patient of *hack*, it is not an argument of it; the patient relation between *the leaves* and *hack* is instead enforced by Participant Sharing.

Likewise, in (11), Participant Sharing is satisfied by letting *the handkerchief* receive a locative role from *cry*; in (12) it is met by allowing the *the axe* to receive an instrument role from *hack*.

Second, Participant Sharing solves the over-generation problem faced by Pragmatic Association, by excluding any sentence/interpretation whose O does not receive a theta role from V_1 of the RVC.

Specifically, in (10b), *the tree* receives the patient role from the *hack*, putting *the leaves* in a situation where it can receive no imaginable thematic role, violating the Participant Sharing constraint. As a result, (10b) is blocked.

Below, we implement our analysis in a Davidsonian event semantics (Davidson 1967).

5 Implementation

Following Kratzer’s (1996) *event identification*, we formalize the above idea using an RVC-formation rule (13).

- (13) RVC FORMATION
- a. Transitive V_1 : $\lambda x \lambda y \lambda e_1 [P(x)(y)(e_1)] + \lambda x \lambda s_2 [Q(x)(s_2)]$
 $= \lambda x \lambda y \lambda e_1 \exists z \exists s_2 [R(e_1)(s_2) \wedge P(z)(y)(e_1) \wedge Q(x)(s_2) \wedge x \in \theta(e_1)]$
- b. Intransitive V_1 : $\lambda x \lambda e_1 [P(x)(e_1)] + \lambda x \lambda s_2 [Q(x)(s_2)]$
 $= \lambda x \lambda y \lambda e_1 \exists s_2 [R(e_1)(s_2) \wedge P(y)(e_1) \wedge Q(x)(s_2) \wedge x \in \theta(e_1)]$

Three things need to be mentioned. First, existentially binding of the internal argument of V_1 represents the idea that O is never an argument of V_1 . Second, Participant Sharing is modeled by $\llbracket O \rrbracket \in \theta(e_1)$, where $\llbracket \theta \rrbracket = \lambda e \lambda x (x \text{ bears a theta role to } e)$. Third, R represents the relation between e_1 and s_2 ; I leave it open whether R is Causal (Kratzer 2005) or Temporal (Rothstein 2004). The results of applying (13) to (10)–(12) are shown in (14)–(16).

- (14) $\llbracket (10) \rrbracket = \exists z \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \mathbf{hack}(\mathbf{Zhangsan})(z)(e_1) \wedge \mathbf{fallen}(\mathbf{the\ leaves})(s_2) \wedge \mathbf{the\ leaves} \in \theta(e_1)]$
 Pragmatics tells us *the leaves* can only be interpreted as the patient of *hack*; $\llbracket (10) \rrbracket$ simplified to:
 $\llbracket (10) \rrbracket = \exists z \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \mathbf{hack}(\mathbf{Zhangsan})(z)(e_1) \wedge \mathbf{fallen}(\mathbf{the\ leaves})(s_2) \wedge \mathbf{the\ leaves}$

= PATIENT(e_1)]

Since z is the internal argument of V_1 , $z = \text{PATIENT}(e_1)$; the above formula becomes:

$\llbracket(10)\rrbracket = \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \text{hack}(\text{Zhangsan})(\text{the leaves})(e_1) \wedge \text{fallen}(\text{the leaves})(s_2)]$

Thus, we get the right interpretation for (10) and predict it cannot have the ‘indirect’ reading.

- (15) $\llbracket(11)\rrbracket = \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \text{cry}(\text{Zhangsan})(e_1) \wedge \text{wet}(\text{the handkerchief})(s_2) \wedge \text{the handkerchief} \in \theta(e_1)]$

Pragmatics tells us that *the handkerchief* can be interpreted as the location of *cry*, and the formula can be simplified to:

$\llbracket(11)\rrbracket = \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \text{cry}(\text{Zhangsan})(e_1) \wedge \text{wet}(\text{the handkerchief})(s_2) \wedge \text{the handkerchief} = \text{LOCATION}(e_1)]$

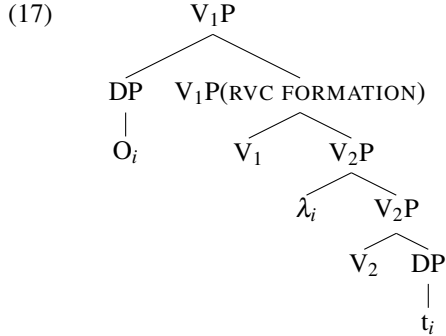
- (16) $\llbracket(12)\rrbracket = \exists z \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \text{hack}(\text{Zhangsan})(z)(e_1) \wedge \text{blunt}(\text{the axe})(s_2) \wedge \text{the axe} \in \theta(e_1)]$

Pragmatics tells us that *the axe* can be interpreted as the instrument of *hack* (in the context of being blunt), and the formula can be simplified to:

$\llbracket(12)\rrbracket = \exists z \exists e_1 \exists s_2 [R(e_1)(s_2) \wedge \text{hack}(\text{Zhangsan})(z)(e_1) \wedge \text{blunt}(\text{the axe})(s_2) \wedge \text{the axe} = \text{INSTRUMENT}(e_1)]$

6 A Transparent Syntax-Semantics Interface

The above semantics is compatible with a VP-complementation syntax as in (17). In (17), V_1 takes V_2P as its complement; O starts out as the complement of V_2 and adjoins to V_1P .



Our semantics (RVC FORMATION) is compatible with (17) in the following sense: first, O is always an argument of V_2 , because it is merged there, and thus O always receives a theta role from V_2 . Second, movement of O to an adjunct position within V_1P syntactically ensures that O gets a thematic role from V_1 , if we assume that an NP receives a theta role from a verb if the NP appears within the verb’s maximal projection. But O is not an argument of V_1 , because V_1 takes a VP as its complement, not O (assuming function-argument application requires syntactic sisterhood). Finally, subsequent movements of V_1 - v and V_2 - v derive the correct surface order $S+V_1$ - V_2 +O (Collins 2002, for its application to Chinese RVC, see Liu 2014).

Notice that Participant Sharing is not so compatible with a *complex head* syntax (Thompson 1973, Huang 1988 and 1992, Li 1990 and 1995, Williams 2005, 2014, to appear), as in (18).

- (18) *Complex head* [S [O [v_c V_1 V_2]]]

This is because: Participant Sharing requires V_1 to assign a theta role to O; if we further assume that for an NP to receive a theta role from a verb, the NP has to appear within the verb’s maximal projection, then O cannot receive a theta role from V_1 in (18) because O is not within V_1P (O is only within V_cP).

The VP complementation syntax in (17) is further supported by behaviors of event *modifiers*, as noticed by Liu (2014).

- (19) S V₁-V₂ O DurP
Zhangsan zuotian da-kai le men san xiaoshi
 Zhangsan yesterday hit-open PRF door three hours
 ‘Yesterday, Zhangsan opened the door, and the door remained open for 3 hours.’
- (20) S DurP V₁-V₂ O
Zhangsan zuotian san xiaoshi cai da-kai le men
 Zhangsan yesterday three hour then hit-open PRF door
 ‘Yesterday, Zhangsan tried to open the door for three hours, and then, the door got open.’

Sentences (19)–(20) show *independent modification*:⁶ V₁ and V₂ can be independently modified. Specifically, in (19), the post-RVC temporal modifier (*for*) *three hours* modifies V₂ *open* while in (20), the pre-RVC temporal modifier (*for*) *three hours* modifies V₁ *hit*. This supports a VP complementation syntax for RVC, because different modifiers can attach to different verbal phrases.

Finally, simple verbs allow V + Durative Phrase + Object order while RVC does not (21)–(22).

- (21) V + DurP + Object
wo (yijing) kai ershi nian jichengche le
 I (already) drive twenty years taxi PRF
 ‘I have (already) driven taxi for twenty years.’ (Lin 2008)
- (22) *RVC + DurP + Object
 **Zhangsan da-kai le san fenzhong men*
 Zhangsan hit-open PRF three minutes door
 ‘Zhangsan has opened the door and the door opened for three minutes.’

This fact is explained by the movement of O in (17), which will always strand the Durative Phrase V₂P-finally. For details, see Liu 2014.

7 Conclusion

We have shown that the object of an RVC has to receive thematic roles from both V₁ and V₂; we call this requirement Participant Sharing and encoded it in the RVC formation rule; we further showed that Participant Sharing is compatible with the fact that both V₁ and V₂ can be independently modified; we finally concluded that these semantic facts ask for a VP complementation syntax for Mandarin RVCs.

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⁶Some speakers might find (19) not very natural; I think it’s because it violates a well-know (perhaps phonological) ‘Postverbal Constraint’ which prefers only one constituent following the verb in Mandarin Chinese. Thus, moving the object preverbally as in (i) makes (19) perfect, and crucially, the DurP still modifies the V₂ after the object moves, thus not affecting the argument made here.

(i) Zhangsan yesterday BA door hit-open PRF three hours.

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