# A Study on Causative meaning of Verb-Resultative Construction in Mandarin Chinese Based on the Generative Lexicon Theory

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**Abstract.** Based on the Generative Lexicon Theory, this paper analyses the co-compositon and the qualia projections of the predicate verb denoting an action and the complement verb describing the result in the Verb-Resultative Construction. The paper reveals that the co-compostion of the qualia structures results in a derived causative sense of the VP, where the AGENTIVE role of the action verb matches that of the complement verb, and the FORMAL role of the action verb matches that of the complement verb. In consequence, under the qualia unification $(QS\ \alpha\ (\beta) = QS\ \alpha \cap QS\ \beta )$ , the FORMAL role of the complement verb is shared with that of the VP, and the AGENTIVE role of the action verb is shared with that of the VP, resulting in a derived causative and aspectually telic interpretation.

**Keywords:** Verb-Resultative construction· Causative· Generative lexicon theory

## 1    Introduction

Verb-Resultative Construction in Mandarin Chinese is a representative expression, which expresses the meaning of the causation, and its syntactic representation and semantic structure are very complicated. The study on it not only involves the study on lexical-semantic features, but also involves the study on the interface between semantics and syntax. Based on the GLT, the paper attempts to explore why the VRC can generate causative meaning. Through the analysis of the co-composition, the qualia unification, and the qualia projections of a predicate verb denoting an action and a complement verb describing the result, we explore the argument structures, the event structures, and the qualia structures of two verbs in the VRC, and we also explore the interaction among these structures. In addition, we explore the syntactic encoding of the causative event schema, and thus providing a novel theoretical

perspective and study methods on the studies of the interface between semantics and syntax of Mandarin Chinese.

## 2     The VRC represents a left-headed binary event

The Verb-Resultative Construction expressing the causative meaning is the product of the syntactic encoding of the causative event schema. By the co-composition of a predicate verb denoting an action and a complement verb describing result, the VRC projects the information of the verbs to the syntactic level. According to the Extended Event Structure, the VRC represents a TRANSITION EVENT, focusing the action bringing about a state. As a kind of causative expression, the VRC is a binary event structure constituted of 2 subevents, a causing event $e_1$ and a caused event $e_2$, and the initial event e1 is headed. There are 2 kinds of sequential relations between subevents, that is " $e_1 <^{\propto} e_2$ " and " $e_1 <o^{\propto} e_2$ ". The causing event can completely precede or precede and overlap the resulting event.

$$e_1 <^{\propto} e_2 \tag{1}$$

A complex event constituted of two subevents, the causing event $e_1$ and the caused event $e_2$, where $e_1$ and $e_2$ are temporally ordered such that the first completely precedes the second, can be lexicalized with a relation we will call "exhaustive ordered part of ", $<^{\propto}$ . For example:

   1. 我打碎了杯子。(*I broke the cup.*)

$$e_1 <o^{\propto} e_2 \tag{2}$$

A complex event constituted of two basically simultaneous subevents, the causing event $e_1$ and the caused event $e_2$, where the causing event starts before the caused event, can be lexicalized with a relation we will call "exhaustive ordered overlap", $<o^{\propto}$ . It involves a precede and overlap relation between the process and the resulting state. For example:

   2. 水泡湿了鞭炮。(*The water wet the firecracker.*)

The event schema of the VRC expressing Causative meaning is described as follows:

$$
\begin{aligned}
\text{EVENT} = E1 &= e_1\text{: process}\\
E2 &= e_2\text{: state}\\
\text{RESTR} &= e_1 <\propto e_2 \ \text{ or } \ e_1 <o^{\propto} e_2\\
\text{HEAD} &= e_1\\
\text{QUALIA} = \text{FORMAL} &= \alpha\_\_\text{Result}\,(e_2,\ y)\\
\text{AGENTIVE} &= \alpha\_\_\text{act}\,(e_1,\ x,\ y)
\end{aligned}
\tag{3}
$$

## 3     The co-composition and the qualia projections of the predicate verb and the complement verb in the VRC

The co-composition operation is the function application $(QS\alpha(\beta) = QS\alpha \cap QS\beta)$ caused by the qualia unification. The causative meaning of the VRC is closely related

to the qualia structures of the 2 verbs in the VP. The operation of the qualia unification generates the causative meaning of the VRC. When the operation of co-compostion in the VRC occurs, the function application binds the FORMAL role of the complement verb into the qualia structure of the action verb as its FORMAL role, and binds the AGENTIVE role of the action verb into the qualia structure of the complement verb as its AGENTIVE role. A type of feature unification occurs, licensed by the identity of qualia values for AGENTIVE and FORMAL respectively in two verbs. The complement verb co-specifies the action verb. The operation of co-compositon results in a qualia structure for the VP that reflects aspects of both constituents. The co-compostion of the qualia structures results in a derived causative sense of the VP, where the AGENTIVE role of the action verb matches that of the complement verb, and the FORMAL role of the action verb matches that of the complement verb. In consequence, the AGENTIVE role of the action verb acts as the AGENTIVE role of the entire VP, and the FORMAL role of the complement verb acts as the FORMAL role of the entire VP.

According to the traditional linguistics, verbs are divided into 2 subcategories, that is the transitive verbs and the intransitive verbs. It is somehow a vague taxonomy. In this paper, we adopt the classifying criteria of the Modern Linguistics, and divide Chinese verb into 3 subcategories, that is the accusative verbs, the unaccusative verbs and the unergative verbs. We analyse the co-compostion and syntactic projection of these verbs. The dual combination of three kinds of verbs should generate 9 kinds of combination form, but we only find 7 in the VRC.

## 3.1 The collocation of an accusative verb and an unergative verb

The first verb is an accusative verb, and the second verb is an unergative verb in the VRC.

3.张三赶跑了李四。(*Zhang San chased Li Si away*.)

According to the argument coherence, the events must cohere in some way, such that the lexical item is predicated of the same individual over at least two consecutive events. The relation expressed by the causing event and that expressed by the resulting event must make reference to at least one parameter in common. This reference can be direct or indirect. The causing event $e_1$ and the resulting event $e_2$ have a common argument "李四" (*Li Si*).

$$
\begin{bmatrix}
\text{赶} \quad (chase) \\
\text{EVENTSTR} = \begin{bmatrix} E_1 = e_1:\text{process} \\ E_2 = e_2:\text{state} \\ \text{RESTR} = e_1 <_\propto e_2 \\ \text{HEAD} = e_1 \end{bmatrix} \\
\text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \boxed{1}\begin{bmatrix} \text{animate\_ind} \\ \text{FORMAL} = \text{physobj} \end{bmatrix} \\ \text{ARG2} = \boxed{2}\begin{bmatrix} \text{animate\_ind} \\ \text{FORMAL} = \text{physobj} \end{bmatrix} \end{bmatrix} \\
\text{QUALIA} = \begin{bmatrix} \text{FORMAL} = \text{leave or move}(e_1, \boxed{2}) \\ \text{AGENT} = \text{utterence or action\_act}(e_1, \boxed{1}, \boxed{2}) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 1.** The lexical representation for the verb "赶" *(chase)*

The accusative verb "赶"(*chase*) represents a binary event, and its subevents are the action of " 赶 "(*chase*), and the result of " 赶 "(*chase*). It has 2 TRURE ARGUMENTS, that is an agent argument and a patient argument,both of which are the animate individual. "The utterence" or "push" acts as its AGENT role and the "leave" or "move" acts as its FORMAL role and TELIC role.

$$
\begin{bmatrix}
跑 \quad (\,r\,u\,n\,) \\
\mathrm{EVENTSTR} = [\,E_1 = e_1 : \mathrm{process}\,] \\
\mathrm{ARGSTR} = \begin{bmatrix} \mathrm{ARG1} = \boxed{1} \begin{bmatrix} \mathrm{ind} \\ \mathrm{FORMAL} = \mathrm{physobj} \end{bmatrix} \end{bmatrix} \\
\mathrm{QUALIA} = \begin{bmatrix} \mathrm{FORMAL} = \mathrm{move}(e_1, \boxed{1}\,) \\ \mathrm{AGENT} = \mathrm{run\_act}(e_1, \boxed{1}\,) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 2.** The lexical representation for the verb "跑" *(run)*

The unergative verb " 跑 "(*run*) represents a simple event, and it has a TRUE ARGUMENT. The argument is an agent argument, and it might be an animate individual, or it might be a motor vehicle such as "train" or "car". "Making sth/sb move or leave" acts as the TELIC role of the verb "赶"(*chase*), and "move" acts as the FORMAL role of the verb "跑"(*run*). A type of feature unification occurs, and thus the TELIC role of "赶"(*chase*) and the FORMAL role of "跑"(*run*) matches. "李四"(*Li Si*) is an animate individual, so it satisfies the requirement of the object of the verb "赶"(*chase*) and "跑" (*run*).

$$
\begin{bmatrix}
李 \quad 四 \quad (\quad L\,i \quad S\,i\,) \\
\mathrm{ARGSTR} = [\, \mathrm{ARG1} = x : \mathrm{human}\,] \\
\mathrm{QUALIA} = [\, \mathrm{FORMAL} = \mathrm{animate\_ind}\,]
\end{bmatrix}
$$

**Fig. 3.** The lexical representation for the noun "李四"(*Li Si*)

Given these three expressions, the qualia structure resulting from co-compostion within the VP[VP 赶跑李四](*chase Li Si away*) can be expressed as follows:

$$
\begin{bmatrix}
赶 \; 跑 \; 李 \; 四 \quad (\,chase\ Li\ Si\ away\,) \\
\mathrm{EVENTSTR} = \begin{bmatrix} E_1 = e_1 : \mathrm{process} \\ E_2 = e_2 : \mathrm{state} \\ \mathrm{RESTR} = \angle_\alpha \\ \mathrm{HEAD} = e_1 \end{bmatrix} \\
\mathrm{ARGSTR} = \begin{bmatrix} \mathrm{ARG1} = \boxed{1} \\ \mathrm{ARG2} = \boxed{2} \; \begin{bmatrix} 李 \; 四 \; (\,Li\ Si\,) \\ \mathrm{QUALIA} = \begin{bmatrix} \mathrm{physobj\text{-}lcp} \\ \mathrm{FORMAL} = \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\mathrm{QUALIA} = \begin{bmatrix} \mathrm{cause\text{-}lcp} \\ \mathrm{FORMAL} = P(e_2, \square[\,\boxed{3}\,]) \\ \mathrm{AGENT} = 赶 \; (\,Chase\,)\_act(e_1, \boxed{1}, \boxed{2}\,) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 4.** The lexical representation for the VP [VP 赶跑李四](*chase Li Si away*)

" 赶 跑 "(*chase away*) make " 李 四 "(*Li Si*) leave the original position, and 口 represents the change of the location or state of "李四" (*Li Si*).
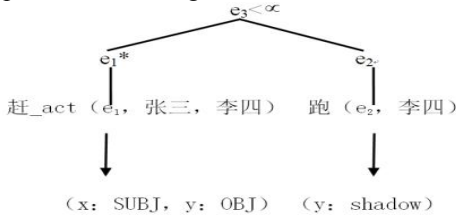


**Fig. 5.** The qualia projection of "张三赶跑了李四" *(Zhang San chased Li Si away)*

This can also be represented by the mapping given below:

a. Qi: R ($e_1$*, "张三" (*Zhan San),* "李四"(*Li Si*)) $\rightarrow$ x: SUBJ, y: OBJ        (4)

b. Qj: P ($e_2$, "李四" *(Li Si)*) $\rightarrow$ shadowed

According to the HEADEDNESS theory, only arguments associated with the headed event are obligatorily expressed at surface structure. The headless events, along with their arguments are shadowed, resulting in an interpretation with quantification closure over these arguments. "张三赶跑了李四" (*Zhang San chased Li Si away*) is a left-headed event structure, so it foregrounds the AGENTIVE predicate, and projects all arguments "张三" (*Zhang San*) and "李四" (*Li Si* ) therein. And the resulting event is the headless event, consequently shadowing the arguments "李四" (*Li Si* ).

## 3.2    The collocation of an unergative verb and an accusative verb

The first verb is an unergative verb, and the second verb is an accusative verb in the VRC.

4.我跑忘了一件事。(*I forgot to do something because of running.*)

The lexical representation for the unergative verb "跑"(*run*) is illustrated above, and the lexical representation for the accusative verb "忘" (*forget*) is illustrated as follows:
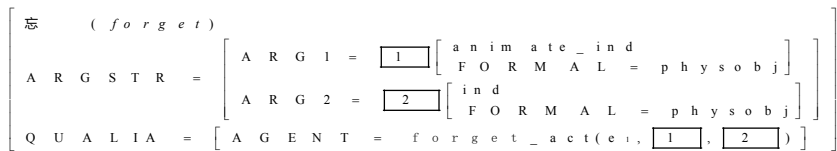


**Fig. 6.** The lexical representation for the accusative verb "忘" *(forget)*

The accusative verb "忘" (*forget*) has two TRUE ARGUMENTS. The ARG1 is an agent argument, and the ARG2 is a patient argument. The ARG1 must be an animate individual.
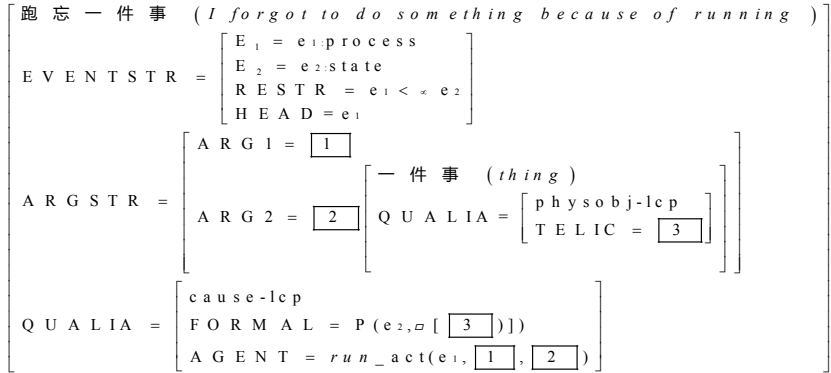
$$
\begin{bmatrix}
\text{跑 忘 一 件 事} \quad (I\ forgot\ to\ do\ something\ because\ of\ running\ ) \\[4pt]
\text{EVENTSTR} = \begin{bmatrix} E_1 = e_1 : \text{process} \\ E_2 = e_2 : \text{state} \\ \text{RESTR} = e_1 <_\propto e_2 \\ \text{HEAD} = e_1 \end{bmatrix} \\[10pt]
\text{ARGSTR} = \begin{bmatrix} \text{ARG 1} = \boxed{1} \\[4pt] \text{ARG 2} = \boxed{2}\ \text{QUALIA} = \begin{bmatrix} \text{一 件 事} \quad (thing) \\ \text{physobj-lcp} \\ \text{TELIC} = \boxed{3} \end{bmatrix} \end{bmatrix} \\[10pt]
\text{QUALIA} = \begin{bmatrix} \text{cause-lcp} \\ \text{FORMAL} = P(e_2, _\square [\ \boxed{3}\ ]\ ]) \\ \text{AGENT} = run\_act(e_1, \boxed{1}, \boxed{2}) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 7.** The lexical representation for the VP "跑忘一件事" *(I forgot to do something because of running )*

In the VP "我跑忘了一件事"(*I forgot to do something because of running*), the AGENTIVE role of the action verb "跑"(*run*) matches that of the complement verb "忘"(*forget*), and the FORMAL role of the complement verb "忘"(*forget*) matches that of the action verb "跑" (*run*). In consequence, the AGENTIVE role for "跑"(*run*) acts as the AGENTIVE role of the entire VP, and the FORMAL role of "忘"(*forget*) acts as the FORMAL role of the entire VP.

The qualia projection of "我跑忘了一件事"(*I forgot to do something because of running*) is illustrated as follows:

a. Qi: R($e_1$*, "我"*(I)*) $\rightarrow$ x: SUBJ                           (5)

b. Qj: P($e_2$, "我" *(I)*, 一件事*(thing)*) $\rightarrow$ x: shadowed, y: OBJ

### 3.3    The collocation of an unergative verb and an unaccusative verb

The first verb is an unergative verb, and the second verb is an unaccusative verb in the VRC.
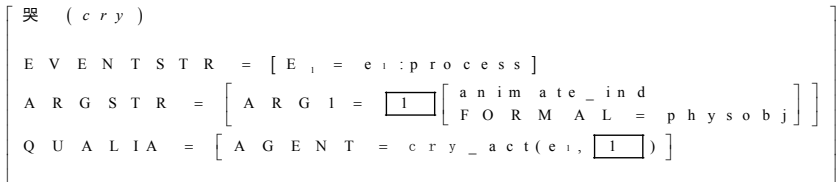
5.我哭肿了眼睛。(*My eyes are swollen for crying.*)

$$
\begin{bmatrix}
\text{哭} \quad (cry) \\[4pt]
\text{EVENTSTR} = [ E_1 = e_1 : \text{process} ] \\
\text{ARGSTR} = \begin{bmatrix} \text{ARG 1} = \boxed{1} \begin{bmatrix} \text{animate\_ind} \\ \text{FORMAL} = \text{physobj} \end{bmatrix} \end{bmatrix} \\
\text{QUALIA} = \begin{bmatrix} \text{AGENT} = cry\_act(e_1, \boxed{1}) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 8.**  The lexical representation for the verb "哭"*(cry)*

The unergative verb "哭"(*cry*) represents a TRANSITION event, and has a TRUE ARGUMENT. The ARG1 is an animate individual.
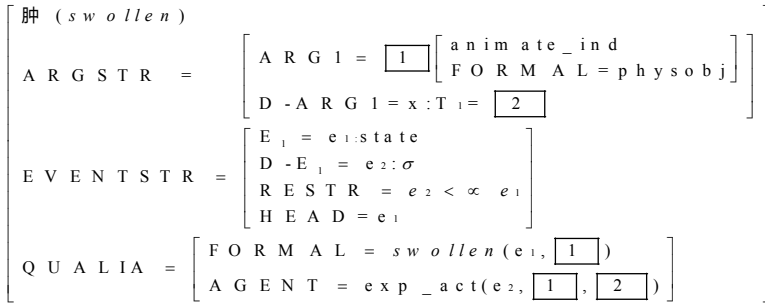
$$
\begin{bmatrix}
\text{肿 } (swollen) \\
\text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \boxed{1}\begin{bmatrix} animate\_ind \\ FORMAL = physobj \end{bmatrix} \\ \text{D-ARG1} = x:T_1 = \boxed{2} \end{bmatrix} \\
\text{EVENTSTR} = \begin{bmatrix} E_1 = e_1:state \\ D\text{-}E_1 = e_2:\sigma \\ RESTR = e_2 <_\propto e_1 \\ HEAD = e_1 \end{bmatrix} \\
\text{QUALIA} = \begin{bmatrix} FORMAL = swollen(e_1, \boxed{1}) \\ AGENT = exp\_act(e_2, \boxed{1}, \boxed{2}) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 9.** The lexical representation for the verb "肿"*(swollen)*

The unaccusative verb "肿"(*swollen*) represents a right-headed binary event, and it has a TRUE ARGUMENT, a DEFAULT ARGUMENT and a Default PROCESS. The Default PROCESS $e_2$ acts as the AGENT role that brings about the state.
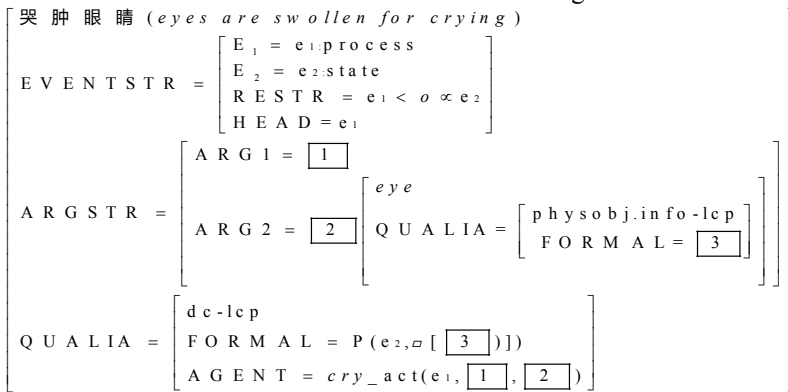
$$
\begin{bmatrix}
\text{哭 肿 眼 睛 } (eyes\ are\ swollen\ for\ crying) \\
\text{EVENTSTR} = \begin{bmatrix} E_1 = e_1:process \\ E_2 = e_2:state \\ RESTR = e_1 <_{o\propto} e_2 \\ HEAD = e_1 \end{bmatrix} \\
\text{ARGSTR} = \begin{bmatrix} \text{ARG1} = \boxed{1} \\ \text{ARG2} = \boxed{2}\ \text{QUALIA} = \begin{bmatrix} eye \\ \begin{bmatrix} physobj.info\text{-}lcp \\ FORMAL = \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\text{QUALIA} = \begin{bmatrix} dc\text{-}lcp \\ FORMAL = P(e_2, \square[\boxed{3}])]) \\ AGENT = cry\_act(e_1, \boxed{1}, \boxed{2}) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 10.** The lexical representation for the VP "哭肿眼睛"*(eyes are swollen for crying)*.

The AGENTIVE role of the qualia structure of the complement verb "肿"(*swollen*) implies a stage-level predicate. This stage-level predicate represents a Default Causative Paradigm. In the VRC, the co-composition activates the stage-level predicate. And therefore the stage-level predicate facilitates or licenses reference to that which brings about that state, but only in specific constructions under co-compostional operation.

In the VP "我哭肿了眼睛"(*My eyes are swollen for crying*), the AGENTIVE role of the action verb "哭"(*cry*) matches that of the complement verb "肿"(*swollen*), and the FORMAL role of the complement verb "肿"(*swollen*) matches that of the action verb "哭"(*cry*). In consequence, the AGENTIVE role of the verb "哭"(*cry*) acts as the AGENTIVE role of the entire VP, and the FORMAL role of the verb "肿"(*swollen*) acts as the FORMAL role of the entire VP. "我的眼睛"(*my eyes*) undergoes the change of the state, and the state of "不肿" (*being not swollen*) converts to the state of "肿" (*being swollen*).

The qualia projection of "我哭肿了眼睛" (*My eyes are swollen for crying*) is illustrated as follows:

$$\text{a. Qi: R } (e_1^*, \text{"我"}(I)) \rightarrow x:\text{SUBJ} \tag{6}$$

$$\text{b. Qj: P } (e_2, \text{"眼睛"}(eyes)) \rightarrow y:\text{OBJ}$$

"我哭肿了眼睛" (*My eyes are swollen for crying*) represents a left-headed binary event. The event $e_1$ "我哭" (*I cry*) results in the event $e_2$ "我的眼睛肿" (*My eyes are swollen*). The word "眼睛" (*eyes*) and "我" (*I*) is the whole and part.

### 3.4     The collocation of an unergative verb and an unergative verb

The first verb is an unergative verb, and the second verb is also an unergative verb in the VRC.

6.他气哭了我。(*I was angered to tears by him.*)

The experiencer predicates predicate a certain state of the person performing a certain act, and it exhibits the experienced causation. The underlying semantics of experiencer predicates is a causative structure where the surface subject is the logical object of an experiencing event. A complex event constituted of two basically simultaneous subevents, the causing event $e_1$ and the caused event $e_2$, where the causing event starts before the caused event, can be lexicalized with a relation we will call "exhaustive ordered overlap", $<o^\propto$. The temporal restriction involves a precede and overlap relation between the experiencing process and resulting experienced state. The sequential relation between the subevents of the experiencer predicate is illustrated as "$e_1<o^\propto e_2$". That is, if doing something angers me, then I need not complete the activity before I become angry. Taking the sentence "一句话气哭了那个老头" (*The old man was angered to tears by hearing the sentence*) as an example, the sentence means that the old man cry because of being angry, and when he is crying he does not stop being angry. However, "赶跑"(*chase away*) is different from "气哭" (*angered to tears*). In the sentence "张三赶跑了李四" (*Zhang San chased Li Si away*), the causing event $e_1$ completely precedes the caused event $e_2$, and the temporal restriction is illustrated as "$e_1<^\propto e_2$".

$$
\begin{bmatrix}
\text{气 哭 } (angered\ to\ tears) \\[4pt]
\text{EVENTSTR} = \begin{bmatrix} E_1 = e_1 : process \\ E_2 = e_2 : state \\ RESTR = <o^\propto \\ HEAD = e_1 \end{bmatrix} \\[20pt]
\text{ARGSTR} = \begin{bmatrix} D\text{-}ARG1 = \boxed{1}\ [\ <\ \boxed{2}\ ,\ <e,t>\ >\ ] \\ ARG2 = \boxed{2}\ \begin{bmatrix} animate\_ind \\ FORMAL = physobj \end{bmatrix} \end{bmatrix} \\[20pt]
\text{QUALIA} = \begin{bmatrix} experiencer\ causative\_lcp \\ FORMAL = cry(e_2, \boxed{2}) \\ AGENTIVE = exp\_act(e_1, \boxed{2}) \end{bmatrix}
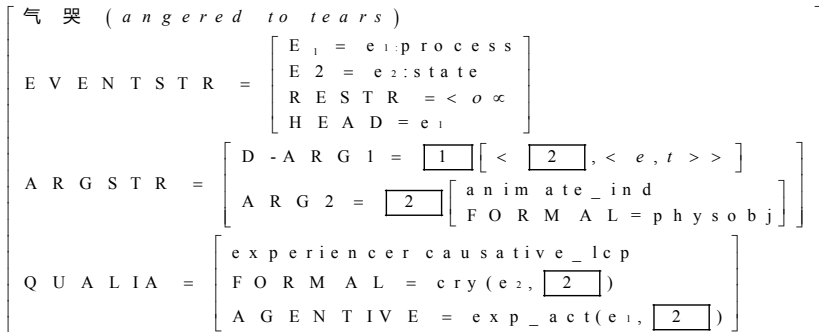\end{bmatrix}
$$

**Fig. 11.** The lexical representation for the VP "气哭" (*angered to tears*).

Experiencer predicates select for an event function in subject position. According to the type theory of the formal semantics, e represents a individual, <e, t> is a one-element predicate function, <e, <e, t>> means e is substituted into <e, t>, then we can get t after rearranging. The ARG2 is e, and e is substituted into <e, t>, then we can get t. So the causer of the VRC "气哭" (*angered to tears*) is an event which represents a proposition, and it is the event that the ARG2 experienced. "他气我" (*He make me angry*) results in the change of the state.

$$
\begin{bmatrix}
气 \quad 哭 \quad 我 \quad (angered\ to\ tears) \\
\text{EVENTSTR} = \begin{bmatrix} E_1 = e_1{:}process \\ E2 = e_2{:}state \\ RESTR = \angle o_\times \\ HEAD = e_1 \end{bmatrix} \\
\text{ARGSTR} = \begin{bmatrix} ARG1 = \boxed{1}\begin{bmatrix} < \boxed{2}, <e,t>> \end{bmatrix} \\ ARG2 = \boxed{2} \begin{bmatrix} 我 \ (I) \\ QUALIA = \begin{bmatrix} animate\_ind \\ TELIC = \boxed{3} \end{bmatrix} \end{bmatrix} \end{bmatrix} \\
\text{QUALIA} = \begin{bmatrix} experiencer\ causative\_lcp \\ FORMAL = P(e_2, _\square[\ \boxed{3}\ )]) \\ AGENTIVE = exp\_act(e_1, \boxed{1}, \boxed{2}) \end{bmatrix}
\end{bmatrix}
$$
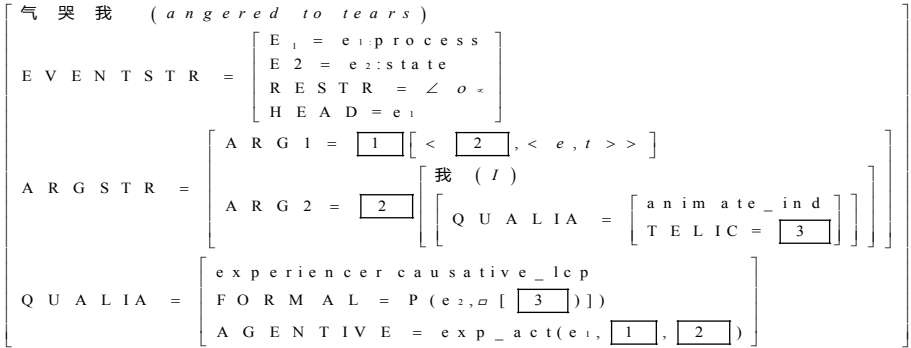
**Fig. 12.** The lexical representation for the VP "气哭我" *(I was angered to tears)*

The ARG2 is a TRUE ARGUMENT, while the ARG1 is a DEFAULT ARGUMENT (D-ARG1), such as "我气哭了" (*I was angered to tears*) must implies that there is an event that makes me cry.

The qualia projection of "他气哭了我" (*I was angered to tears by him*) is illustrated below:

a. Qi: R (e$_1$*, "他"(*he*), "我"*(I)*) $\rightarrow$ x: SUBJ, y: OBJ                    (7)

b. Qj: P (e$_2$, "我"*(I)*) $\rightarrow$ y: shadow

## 3.5    The collocation of an unaccusative verb and an unaccusative verb

The first verb is an unaccusative verb, and the second verb is also an unaccusative verb in the VRC.

7. 我 累 倒 了 他 。     (*Helping me made him so tired that he finally fell ill.*)

$$
\begin{bmatrix}
累 \quad (\ t\ i\ r\ e\ d\ ) \\[2pt]
ARGSTR = \begin{bmatrix} ARG1 = \boxed{1}\begin{bmatrix} animate\_ind \\ FORMAL = physobj \end{bmatrix} \\[6pt] D\text{-}ARG1 = x:T_1 = \boxed{2} \end{bmatrix} \\[12pt]
EVENTSTR = \begin{bmatrix} E_1 = e_1{:}state \\ D\text{-}E_1 = e_2{:}\sigma \\ RESTR = e_2 < \propto e_1 \\ HEAD = e_1 \end{bmatrix} \\[12pt]
QUALIA = \begin{bmatrix} FORMAL = tired\ (e_1, \boxed{1}\ ) \\ AGENT = exp\_act(e_2, \boxed{1}\ , \boxed{2}\ ) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 13.**    The lexical representation for the verb "累"(tired)

$$
\begin{bmatrix}
倒 \quad (\ fell\ ill\ ) \\[2pt]
ARGSTR = \begin{bmatrix} ARG1 = \boxed{1}\begin{bmatrix} animate\_ind \\ FORMAL = physobj \end{bmatrix} \\[6pt] D\text{-}ARG1 = x:T_1 = \boxed{2} \end{bmatrix} \\[12pt]
EVENTSTR = \begin{bmatrix} E_1 = e_1{:}state \\ D\text{-}E_1 = e_2{:}\sigma \\ RESTR = e_2 < \propto e_1 \\ HEAD = e_1 \end{bmatrix} \\[12pt]
QUALIA = \begin{bmatrix} FORMAL = 倒\ (fell\ ill)(e_1, \boxed{1}\ ) \\ AGENT = R(推\ (push),打\ (hit),绊\ (stumble),摔\ (fall),病\ (sick),累\ (tired)ect.\ )\_act(e_2, \boxed{1}, \boxed{2}\ ) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 14.**    The lexical representation for the verb "倒" *(fell ill)*

In the VRC, the complement verb "倒" (*fell ill*) denotes the resulting state, and the AGENTIVE role of the qualia structure of the complement verb implies a stage-level predicate which represents a DEFAULT CAUSATIVE PARADIGM, and it is a derived interpretation and is not lexicalized into one lexical item. The unaccusative verbs can denote only a state and not a transition, as with the adjective. Stage-level predicates, therefore, facilitate or license reference to that which brings about that state, but only in specific constructions such as the VRC under co-compositional operations.

Here we are assuming that R is a predicate that is sortally structured to subsume "推"(*push*), "打"(*hit*), "绊"(*stumble*), "摔"(*fall*), "病"(*sick*), "累"(*tired*) and related predicates. The stage-level predicate acts as a function over the VP "累倒" (he was so tired that he fell ill), and under the qualia unification, the FORMAL role of "倒" (*fell ill*) unifies with that of the VP "累倒" (*he was so tired that he fell ill*), resulting in a derived causative and an aspectually telic interpretation.

The qualia projection of VP "我累倒了他" (*Helping me make him so tired that he finally fell ill*) is illustrated as follows:

a. Qi: R (e_1*, "我" *(I)*, "他"*(He)*) $\rightarrow$ x: SUBJ, y: OBJ     (8)

b. Qj: P (e_2, "他" *(He)*) $\rightarrow$ shadowed

### 3.6    The collocation of an unaccusative verb and an unergative verb

The first verb is an unaccusative verb, and the second verb is an unergative verb in the VRC.

　8.宝宝累跑了保姆。(*Taking care of the baby was so tired that the babysitter left.*)

　The lexical representation for the unaccusative verb "累" (*tired*) and the lexical representation for the unergative verb "跑" (*run*) are illustrated above. In the VP "宝宝累跑了保姆" (*Taking care of the baby was so tired that the babysitter left*), the AGENTIVE role of the action verb "累" (*tired*) matches that of the complement verb "跑"(*run*), and the FORMAL role of the complement verb "跑"(*run*) matches that of the action verb "累"(*tired*). In consequence, the AGENTIVE role for "累" (*tired*) acts as the AGENTIVE role of the entire VP, and the FORMAL role of "跑" (*run*) acts as the FORMAL role of the entire VP. "保姆"(*babysitter*) undergoes the change of the location and the state.

　The qualia projection of "宝宝累跑了保姆" (*Taking care of the baby was so tired that the babysitter left* )is illustrated as follows:

$$\text{a. Qi: R } (e_1\text{*, 宝宝}(\textit{baby})\text{, 保姆}(\textit{babysitter})) \rightarrow x\text{: SUBJ, } y\text{: OBJ} \qquad (9)$$

$$\text{b. Qj: P } (e_2\text{, 保姆}(\textit{babysitter})) \rightarrow \text{shadowed}$$

### 3.7    The collocation of an accusative verb and an unaccusative verb

#### "打碎" (*broke*), "杀死" (*kill*), and "擦干净" (*wipe clean*)

　9. 玛丽擦干净了桌子。 (*Mary wipes the table clean.*)

$$
\left[
\begin{array}{l}
\text{干　净　(clean)} \\[4pt]
\text{EVENTSTR} = \left[\begin{array}{l}
E_1 = e_1:\text{state} \\
D\text{-}E_1 = e_2:\text{process} \\
\text{RESTR} = e_2 <_\alpha e_1 \\
\text{HEAD} = e_1
\end{array}\right] \\[18pt]
\text{ARGSTR} = \left[\begin{array}{l}
\text{ARG1} = \boxed{1}\left[\begin{array}{l}\text{physobj}\\\text{FORMAL} = \text{entity}\end{array}\right] \\
\text{D-ARG1} = \boxed{2}
\end{array}\right] \\[18pt]
\text{QUALIA} = \left[\begin{array}{l}
\text{FORMAL} = \text{clean}(e_1, \boxed{1}) \\
\text{AGENTIVE} = R(e_2, \boxed{1}, \boxed{2})
\end{array}\right]
\end{array}
\right]
$$

**Fig. 15.**  The lexical representation for the unaccusative verb "干净"*(clean)*

In the VRC, the complement verb "干净"(*clean*) denotes the resulting state, and the AGENTIVE role of the qualia structure of the complement verb implies a stage-level predicate which represents a DEFAULT CAUSATIVE PARADIGM, and it is a derived interpretation and is not lexicalized into one lexical item.

　Here we are assuming that R is a predicate that is sortally structured to subsume "擦" (*wipe*), "洗" (*wash*) and related predicates. The stage-level predicate acts as a function over the VP "擦桌子" (*wipe the table*), and under the qualia unification, the FORMAL role of "干净" (*clean*) unifies with that of the VP "擦桌子" (*wipe the*

*table*), resulting in a derived causative and an aspectually telic interpretation. The accusative verb can denote only a state and not a transition, as with the adjectives. Stage-level predicates, therefore, facilitate or license reference to that which brings about that state, but only in specific constructions such as VRC under co-compositional operations.
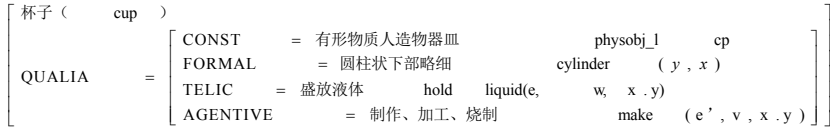
10.我摔碎了杯子。 (*I break the cup.*)

$$
\begin{bmatrix}
杯子（\qquad cup \qquad） \\
QUALIA \quad = \begin{bmatrix}
CONST & = 有形物质人造物器皿 & physobj\_l & cp \\
FORMAL & = 圆柱状下部略细 & cylinder & (y,x) \\
TELIC & = 盛放液体 & hold \quad liquid(e, & w, \quad x.y) \\
AGENTIVE & = 制作、加工、烧制 & make & (e',v,x.y)
\end{bmatrix}
\end{bmatrix}
$$

**Fig. 16.**    The qualia structure of the noun "杯子"*(cup)*

$$
\begin{bmatrix}
摔\ 碎\ 杯\ 子\ (\ break\ the\ cup\ ) \\
EVENTSTR \ = \begin{bmatrix}
E_1 = e_1 : process \\
E_2 = e_2 : state \\
RESTR \ = < \propto \\
HEAD = e_1
\end{bmatrix} \\
ARGSTR \ = \begin{bmatrix}
ARG1 = \boxed{1} \\
ARG2 = \boxed{2} \quad \begin{bmatrix}
杯\ 子\ (\ cup\ ) \\
QUALIA = \begin{bmatrix} physobj.info\text{-}lcp \\ TELIC = \boxed{3} = \varnothing \end{bmatrix}
\end{bmatrix}
\end{bmatrix} \\
QUALIA \ = \begin{bmatrix}
dc\text{-}lcp \\
FORMAL = P(e_2, \neg\ \square\ [\ \boxed{3}\ ]) ] \\
AGENT = 摔\ (\ break\ )\_act(e_1, \boxed{1}, \boxed{2})
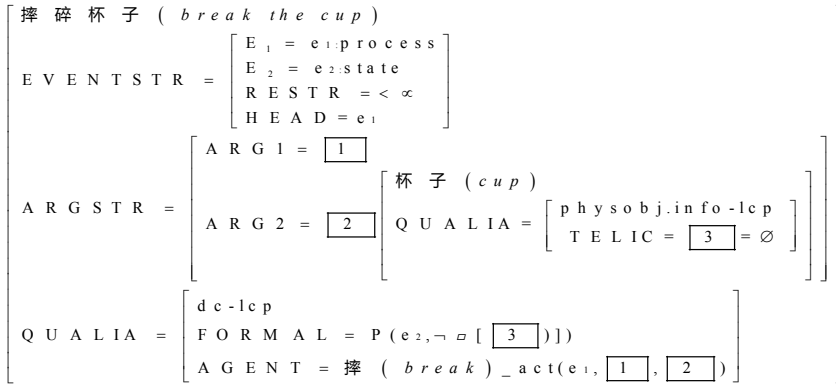\end{bmatrix}
\end{bmatrix}
$$

**Fig. 17.**    The qualia structure of the VP[$_{VP}$ 摔碎杯子] (*break the cup*)

$\neg\square$ represents the conversion of the opposite state. "摔碎杯子" (*break the cup*) represents a TRANSITION event. The resulting state of a transitional event of "摔碎杯子" (*break the cup*) refers to the inability to use the object i.e., "杯子" (*cup*) for that which it is intended; i.e., its TELIC role "盛放液体" (*hold or contain liquid*). Because the cup is broken, the change of the state causes the cup can no longer play the original function. The co-composition of the verb "摔" (*break*) and "碎" (*smash*) has contextual influence on the object "杯子" (*cup*), resulting in a derived causative and an aspectually telic interpretation.

## 喝醉 (*get drunk*)

11.我喝醉了酒。 (*I drink wine and get drunk.*)

$$
\begin{bmatrix}
喝 \quad (\ d r i n k\ ) \\[2pt]
E V E N T S T R = \begin{bmatrix} E_1 = e_1 : p r o c e s s \\ E_2 = e_2 : s t a t e \end{bmatrix} \\[8pt]
A R G S T R = \begin{bmatrix} A R G_1 = a n i m a t e\_i n d i v i d u a l \\ A R G_2 = 流\ 食\ 、\ 液\ 体\ (\ l i q u i d\ ) \end{bmatrix} \\[8pt]
Q U A L I A = \begin{bmatrix} F O R M A L = 醉\ (\ d r u n k\ )\ o r\ 饱\ (\ f u l l\ ) \\ A G E N T = 喝\ (\ d r i n k\ )\_a c t ( e_1 , x ) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 18.** The lexical representation for the accusative verb "喝" *(drink)*

$$
\begin{bmatrix}
醉\ (\ d r u n k\ ) \\[2pt]
A R G S T R = \begin{bmatrix} A R G 1 = \boxed{1} \begin{bmatrix} a n i m a t e\_i n d \\ F O R M A L = p h y s o b j \end{bmatrix} \\ D - A R G 1 = x : T_1 = \boxed{2} \end{bmatrix} \\[14pt]
E V E N T S T R = \begin{bmatrix} E_1 = e_1 : s t a t e \\ D - E_1 = e_2 : \sigma \\ R E S T R = e_2 < \propto e_1 \\ H E A D = e_1 \end{bmatrix} \\[16pt]
Q U A L I A = \begin{bmatrix} F O R M A L = 醉\ (\ d r u n k\ ) ( e_1 , \boxed{1}\ ) \\ A G E N T = R\ 喝\ (\ d r i n k\ )\_a c t ( e_2 , \boxed{1} , \boxed{2}\ ) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 19.** The lexical representation for the unaccusative verb "醉" *(drunk)*

$$
\begin{bmatrix}
我\ 喝\ 醉\ 了\ 酒\ (\ I\ d r i n k\ w i n e\ a n d\ g e t\ d r u n k\ ) \\[2pt]
E V E N T S T R = \begin{bmatrix} E_1 = e_1 : p r o c e s s \\ E_2 = e_2 : s t a t e \\ R E S T R = e_1 < \propto e_2 \\ H E A D = e_1 \end{bmatrix} \\[16pt]
A R G S T R = \begin{bmatrix} A R G_1 = \boxed{1} \begin{bmatrix} 我\ (\ I\ ) \\ Q U A L I A = \begin{bmatrix} a n i m a t e - l c p \\ F O R M A L = \boxed{3} \end{bmatrix} \end{bmatrix} \\[14pt] A R G 2 = \boxed{2} \begin{bmatrix} 酒\ (\ w i n e\ ) \\ Q U A L I A = \begin{bmatrix} p h y s o b j . i n f o - l c p \\ T E L I C = 醉\ (\ g e t\ d r u n k\ ) \end{bmatrix} \end{bmatrix} \end{bmatrix} \\[20pt]
Q U A L I A = \begin{bmatrix} C a u s e - l c p \\ F O R M A L = P ( e_2 , \square [\ \boxed{3}\ ) ] ) \\ A G E N T = 喝\ (\ d r i n k\ )\_a c t ( e_1 , \boxed{1} , \boxed{2}\ ) \end{bmatrix}
\end{bmatrix}
$$

**Fig. 20.** The lexical representation for the VP "我喝醉了酒" *(I drink wine and get drunk)*

$e_1$"我喝酒"(*I drink wine*) causes $e_2$"我醉"(*I get drunk*), the AGENTIVE role of the qualia structure of the verb "醉" (*get drunk*) is a stage-level predicate R, and the embodiment of R is "喝" (*drink*). One of the FORMAL role of the qualia structure of "喝"(*drink*) is "醉"(*get drunk*), and thus the qualia unification occurs, licensed by the identity of qualia values for AGENTIVE and FORMATIVE respectively in two verbs. The co-compostion of the qualia structures results in a derived causative sense of the VP, where the AGENTIVE roles of the action verb"喝"(*drink*) matches that of the complement verb" 醉 "(*get drunk*), and the FORMAL role of the complement

verb"醉"(*get drunk*) matches that of the action verb "喝"(*drink*). In consequence, the AGENTIVE role of the action verb"喝"(*drink*) acts as the AGENTIVE role for the entire VP, and the FORMAL role of the complement verb"醉"(*get drunk*) acts as the FORMAL role of the entire VP. Eventually the co-composition causes the change of my state, that is the state of "not being drunk" converts to the state of "being drunk".

The qualia projection of "我喝醉了酒"(*I drink wine and get drunk*) is illustrated as follows:

a. Qi: R (e$_1$*, "我" *(I),* "酒" *(wine))* $\rightarrow$ x:SUBJ, y:OBJ                (10)

b. Qj: P (e$_2$, "我" *(I))* $\rightarrow$ shadowed

## 4    Conclusion

This paper analyses the co-compostion of the action verb and the complement verb in the VRC. The dual combination of three kinds of verbs should generate nine kinds of collocations, but we only find seven kinds of collocations in the VRC as follows:

A. The collocation of an accusative verb and an unergative verb, e.g., "张三赶跑了李四" *(Zhang San chased Li Si away)*;

B. The collocation of an unergative verb and an accusative verb, e.g., "我跑忘了一件事" *(I forgot to do something because of running )*;

C. The collocation of an unergative verb and an unaccusative verb, e.g., "我哭肿了眼睛" *(My eyes are swollen for crying)*, and "我哭湿了手帕" *(I cry and make my handkerchief wet)*;

D. The collocation of an unergative verb and an unergative verb, e.g., "他气哭了我" *(I was angered to tears by him)*;

E. The collocation of an unaccusative verb and an unaccusative verb, e.g., "我累倒了他" *(Helping me make him so tired that he finally fell ill)*;

F. The collocation of an unaccusative verb and an unergative verb, e.g., "宝宝累跑了保姆" *(Taking care of the baby is so tired that the babysitter leave)*;

G. The collocation of an accusative verb and an unaccusative verb, e.g., "我摔碎了杯子"*(I break the cup)*, and "我喝醉了酒"*(I drink and get drunk)*.

However, we did not find the following two kinds of collocations:

I. The collocation of an unaccusative verb and an accusative verb;

II. The collocation of an accusative verb and an accusative verb.

As discussed above, some interesting phenomena are found:

First of all, we find that the unaccusative verb as the component of the resultative complement of the VRC has an absolute dominance, and its combine with other kinds of verbs more freely, and its combinations with other verbs are the richest. Why? The reason is that the complement of the VRC emphasizes the state of the participant, and thus the unaccusative verb which mainly represents the state is more suitable for the composition of the resultative complement than others.

What`s more, we calculate the collocations of the verbs in *the collocations of the verb and resultative complement dictionary in Mandarin Chinese*, and we find that there are 266 collocations of an unergative verb and an unaccusative verb, which account for 22% of the collocations of the verbs in the whole dictionary. And there are 157 collocations of an unaccusative verb and an unaccusative verb, which account for 13% of the collocations of the verbs in the whole dictionary. And there are 787 collocations of an accusative verb and an unaccusative verb, which account for 65% of the collocations of the verbs in the whole dictionary.

Among all of the collocations of an unaccusative verb and the other verbs, the collocations of an accusative verb and an unaccusative verb have an absolute dominance, when the unaccusative verb acts as the complement in the VRC. While the proportion of the collocations of an unaccusative verb and an unaccusative verb is the lowest. Why? The reason is that an accusative verb denotes an action, while an unaccusative verb denotes a state. In the VRC the first verb describes an action, therefore the accusative verb as the first verb of the VRC has an absolute dominance. The second verb of the VRC describes the result, and thus the collocations of an accusative verb and an unaccusative verb have an absolute dominance, and the subtypes of this kind of collocations are the richest.

Last but not the least, the collocation of an accusative verb and an accusative verb can not be found in the VRC. Why? The reason is that this kind of collocation can not satisfy the requirement of the VRC. The accusative verb denotes the action, so the collocation of an accusative verb and an accusative verb can not denote the state of the verb, while the complement of the VRC requires a component that denotes the state of the verb.

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