

Lexical Representation and Classification of Eventive Verbs

— Polarity and Interaction between Process and State

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Abstract

Event classification is one of the most crucial tasks in lexical semantic representation. Traditionally, researchers regarded process and state as two top level events and discriminated them by semantic and syntactic characteristics. In this paper, we add cause-result relativity as an auxiliary criterion to discriminate between process and state by structuring about 40,000 Chinese verbs to the two correspondent event hierarchies in E-HowNet. All verbs are classified according to their semantic similarity with the corresponding conceptual types of the ontology. As a consequence, we discover deficiencies of the dichotomy approach and point out that any discrete event classification system is insufficient to make a clear cut classification for synonyms with slightly different semantic focuses. We then propose a solution to remedy the deficiencies of the dichotomy approach. For the process or state type mismatched verbs, their inherited semantic properties will be adjusted according to their POS and semantic expressions to preserve their true semantic and syntactic information. Furthermore, cause-result relations will be linked between corresponding processes and states to bridge the gaps of the dichotomy approach.

1 Introduction

Clarifying the nature of verb classes is a crucial issue in lexical semantic research, being of great interest to both theoretical and computational linguistics. Many classification and representation theories have already been presented including the widely cited theories proposed by Vendler (1967), Dowty (1979), Bach (1986), Parsons (1990), Levin (1993), Pustejovsky (1995) and Rosen (2003). Additionally, several online

verb classification systems, such as WordNet (Fellbaum 1998), VerbNet (Kipper-Schuler 2006), FrameNet (Fillmore et al. 2003) and Levin's verb classification are also available. Each approach views events from a different perspective, and each approach clarifies a different part of the overall problem of understanding the linguistic representation of events. Overall, they can be divided into two main schools, one is semantic classification, such as Vendler's approach; and the other is syntactic classification, such as Levin's approach.

Since different event classifications pinpoint the basic features of events that need to be represented, we need to clarify the goal we want to achieve before adopting or proposing an event classification. In this paper, we aim to achieve a better lexical semantic representation framework for E-HowNet (Chen et al. 2003), and we adopt the typologies of process and state as the two top level event types. However, since verbs may express different aspects or viewpoints of conceptual events, is difficult in some cases to make a clear-cut difference between process and state verbs. Verb-result compounds, such as 購妥 *gou-tuo* 'to complete procurement', are obvious examples which are either pure process or state. Furthermore their semantic interactions also need to be clarified. Consider, for example, the synonym words (strictly speaking near synonyms and hyponyms) of 記得 *ji-de* 'remember' in Mandarin Chinese: (a) 想起 *xiang-qi* 'call to mind', 記取 *ji-qu* 'keep in mind', 背起來 *bei-qi-lai* 'memorize', (b) 念念不忘 *nian-nian-bu-wang* 'memorable', 刻骨銘心 *ke-gu-ming-xin* 'be remembered with deep gratitude'; although these words are near synonyms, their senses shift slightly according to different semantic focuses and often resulting in different grammatical behavior. If we classify group (a) as a process type, and group (b)

as a state type by their fine-grained semantic focuses, we may lose the important information of they are actually near synonyms and denote the same event type. Therefore, in order to design a better semantic and syntactic representational framework for verbs, we try to clarify the polarity and interaction between process and state.

The remainder of this article is organized as follows. In the next section, we begin with a review of past research. Section 3 clarifies the polarity between process and state, and then difficulties of the dichotomy approach will be addressed. In Section 4 we describe the interaction between process and state, and propose solutions to overcome the difficulties mentioned in the previous section. Finally, we conclude our findings and possible future research in Section 5.

2 Backgrounds

Over 2300 years ago, Aristotle (1984) proposed the first event-based classification of verbs. His main insight was the distinction between states and events (called ‘processes’ in this paper). From the late 1960’s, a large number of event classifications, variously based on temporal criteria (such as tense, aspect, time point, time interval), syntactic behavior (such as transitivity, object case, event structure), or event arguments (such as thematic role mapping, agent type, verb valence) have been suggested and have aroused many heated discussions. These representations can be roughly divided into the two main schools of semantic classification and syntactic classification. In the following discussion, we take Vendler and Levin as representatives for the two respective schools, and we will find that both schools treat process and state as two obviously different event types.

2.1 Vendler’s Classification

Vendler’s classification (1967) is the most influential and representative system in terms of the semantic classification approach. He classified verbs into four categories “to describe the most common time schemata implied by the use of English verbs” (pp. 98-99). The four categories are given in (1):

- (1) a. *States*: non-actions that hold for some period of time but lack continuous tenses.
- b. *Activities*: events that go on for a time, but do not necessarily terminate at any given point.
- c. *Accomplishments*: events that proceed toward a logically necessary terminus.

d. *Achievements*: events that occur at a single moment, and therefore lack continuous tenses (e.g., the progressive).

Distinctly, states denote a non-action condition and are irrelevant to temporal properties, while the other three denote an event process or a time point in an event process. Vendler’s successors, such as Verkuyl (1993), Carlson (1981), Moens (1987), Hoeksema (1983), extended this discussion without changing Vendler’s basic framework. According to Rosen (2003), the successors all pointed out that state and process are two major event types. Ter Meulen (1983, 1995) thus suggested a redefinition of the Vendler classes. She defined states have no internal structure or change, while events, i.e., the processes dealt with in our paper and consisting in Vendler’s other three event types, are defined on the basis of their parts.

2.2 Levin’s Classification

Levin (1993) believes that identifying verbs with similar syntactic behavior provides an effective means of distinguishing semantically coherent verb classes. She proposed a coarse-grained classification for verbs based on two observations: the first is many result verbs lexicalize results that are conventionally associated with particular manners, and vice versa, many manner verbs lexicalize manners that are conventionally associated with particular results. The examples she gave are listed in (2):

(2) The pervasiveness of the dichotomy (Levin 2011)

	Manner verbs	vs.	Result verbs
Verbs of damaging:	<i>hit</i>	vs.	<i>break</i>
Verbs of putting-2-dim	<i>smear</i>	vs.	<i>cover</i>
Verbs of putting-3-dim	<i>pour</i>	vs.	<i>fill</i>
Verbs of removal	<i>shovel</i>	vs.	<i>empty</i>
Verbs of combining	<i>shake</i>	vs.	<i>combine</i>
Verbs of killing	<i>stab</i>	vs.	<i>kill</i>

Levin argued the origins of the dichotomy arises from a lexicalization constraint that restricts manner and result meaning components to fit in a complementary distribution: a verb lexicalizes only one type; and those components of a verb’s meaning are specified and entailed in all uses of the verb, regardless of context. Further, not only do manner and result verbs differ systematically in meaning, but they differ in their argument realization options (Rappaport and Levin 1998, 2005). For example, result verbs show a causative alternation, but manner verbs

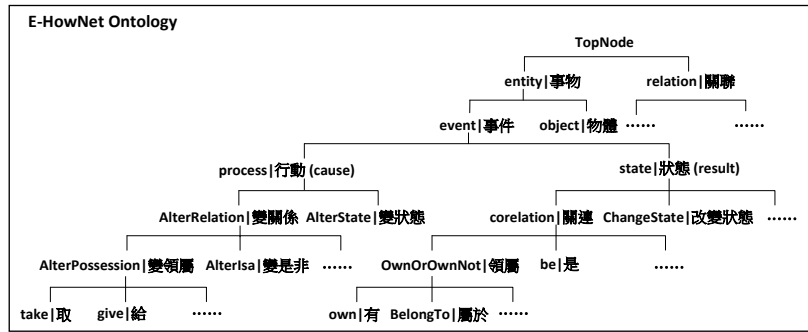


Figure 1. The Architecture of E-HowNet

do not, as shown in example (3); and, manner verbs show considerably more and different argument realization options than result verbs (Rappaport and Levin 1998), such as those described in (4).

- (3) a. Kim broke the window./The window broke.
b. Kim wiped the window./*The window wiped.

- (4) a. Terry wiped. (activity)
b. Terry wiped the table. (activity)
c. Terry wiped the crumbs off the table. (removing)
d. Terry wiped the crumbs into the sink. (putting)
e. Terry wiped the slate clean. (change of state)
f. Terry wiped the crumbs into a pile. (creation)

Levin's manner verb and result verb dichotomy characterizes semantic and syntactic interactions between verbs. Specifically, this syntactic dichotomy is caused by the semantic characteristics of the language. We consider a similar semantic relation of cause-result between process verbs and state verbs to show the dichotomy and interactions between them. In fact, Levin's result verbs are verb-result compounds in Chinese and our result verbs refer to pure states. The above cited verbs pairs, such as *stab* and *kill* in (2), are both process verbs. By our notion of process and state dichotomy *wounded* and *die* are result states of *stab* and *kill*, respectively.

2.3 E-HowNet's Classification

E-HowNet (Chen et al. 2005) is a frame-based entity-relation model that constructs events, objects and relations in a hierarchically-structured ontology. By following the conventional event classification theories, verbs are partitioned into process and state first, which is a higher priority dichotomous classification criterion than the syntactic classification in E-HowNet, since E-HowNet is a primarily semantic classification system. Furthermore, semantic classification is more intuitive, and more in line with the general

view of the real world. Based on this criterion, the top-level E-HowNet ontology is established as depicted in Figure 1.

3 The Polarity and Interaction between Process and State

Process and state have long been treated as two top classes of events. Semantically, their distinctions are evident and intuitive, such as the obvious difference between the process verb 取悅 *qu-yue* 'please' and the state verb 喜悅 *xi-yue* 'joyful'. With respect to syntax, process and state verbs also have their own individual characteristics; for example, 取悅 *qu-yue* 'please' must have a patient object but 喜悅 *xi-yue* 'joyful' does not. Differentiating them is considered obvious in theoretic and practical linguistic research areas. However, from the perspective of a fine-grained lexical analysis, researchers have also found that it is difficult to make clear cut differences between process and state. Take the following as examples. The state verb 生氣 *sheng-qi* 'angry' may accept an object goal in Mandarin and can be hardly differentiated from the process verb 發脾氣 *fa-pi-qi* 'get angry' in semantics. In this paper, we do not aim to strictly partition 生氣 *sheng-qi* 'angry' and 發脾氣 *fa-pi-qi* 'get angry' into state and process type. Instead, our objective is to discriminate processes from states with an emphasis on why we encounter difficulties of discriminating them, and what are better representations that may preserve as much semantic and syntactic information as possible. For example, the verb 遇害 *yu-hai* 'be murdered' can be either classified as a process of *kill* or a state of *die*, with neither classification being absolute. A better solution might be that even if the verb is misclassified into either type, we can still recognize that the experiencer of 遇害 *yu-hai* 'be murdered' is killed and dead. In this section, we emphasize the general distinction between pro-

cess and state, and then in the next section, we introduce several approaches we adopted while encountering difficulties of process-state dichotomy.

The differentiating characteristics between process and state verbs, other than semantic differences, are not obvious. Summarizing the previously mentioned theories in Section 2, the polarities between process and state can be generalized as below:

(5) The polarities and interactions between process and state

Processes: cause of states, dynamism (i.e., relevant to temporal properties), object domination

States: result of processes, stasis (i.e., irrelevant to temporal properties), object modification

The polarity of dynamism and stasis is a semantic-based distinction, whereas the domination of objects or their modification is a syntax-based distinction. They are both common but coarse-grained event classification criteria and most verbs can be distinguished by these coarse-grained classification criteria. However some verbs like 發脾氣 *fa-pi-qi* ‘get angry’ and 遇害 *yu-hai* ‘be murdered’ are not easily classified. In our study, we propose an interaction between cause and result as an auxiliary criterion, which asserts that *processes* are the cause of states and they denote an event process or a time point on an event process. On the other hand, *states* are the result of processes and they denote a non-action condition and are thus irrelevant to temporal properties, i.e., they have no internal structure or change. Although it would appear that cause-result is a natural differentiation criterion between processes and states, it may not be a one-to-one relation and some of verb types may not have obvious cause-result counterparts. For instance, the concept of causative process {earn|賺} may achieve several resultant states such as {obtain|得到} and {rich|富}, though the process of {swim|游} does not have an obvious result state. Nonetheless if we can use the characteristics of (5) to differentiate all verbs into process and state types, which may help us achieve the first step towards a lexical semantic classification for verbs. We then use semantic expressions, part-of-speech (POS) features, and relational links such as cause-result relationship between process types and state types to make a better lexical semantic representation. Regarding the verb type classification, the following questions may be raised. Is the process-state dichotomy

approach feasible? How are the verbs denoting complex event structures, such as verb-result compounds, classified? Is it true that all states have causing processes and all processes have result states? The following observations will provide the answers to these questions.

3.1 Observations and Difficulties of the Process-State Dichotomy in E-HowNet

In order to develop the lexical semantic representation system E-HowNet, we classified all Chinese verbs into a process and state type-hierarchy, as illustrated in Figure 1. We use the characteristics (5) of dynamism and stasis as a semantic-based distinction; the domination and modification of objects as a syntax-based supporting criterion; as well as the cause-result relation as a complementary criterion to distinguish process from state. It is interesting that with the exception of general acts, almost all top-level Chinese verb types; whether of process or state types, necessarily have their cause-result counterpart. However for the fine-grained lower level types or lexical level verbs, there are three different cases of lexical realizations of cause-result dichotomy, which are listed in the following.

Case 1: Process types have result states and vice versa. An example of cause-result mapping between process and state is given in (6).

(6) Causative process type {brighten|使亮}: e.g., 磨光 *mo-guang* ‘burnish’, 擦亮 *ca-liang* ‘polish’ etc. $\leftarrow \rightarrow$

Resultant state type {bright|明}: e.g., 水亮 *shui-liang* ‘bright as water’, 光燦 *guang-can* ‘shining’ etc.

For this case, the process and state are two different types and can be differentiated by the fundamental differences between dynamic and static types or by the cause-result relation. However, lexemes may shift their senses due to different compounding, resulting in a classification dilemma of semantic similarity first or dichotomy of process and state first. As was mentioned in the above example, the causative process type {kill|殺害}, e.g., 吊死 *diao-si* ‘hang by the neck’, has a resultant state type {die|死}, e.g., 往生 *wang-sheng* ‘pass away’. Then, how about the result-state verb 遇害 *yu-hai* ‘be murdered’? Should we classify 遇害 *yu-hai* ‘be murdered’ as a process type {kill|殺害}? Or, as a state type {die|死}? The verb 遇害 *yu-hai* ‘be murdered’ seems to be the resultant state {die|死} in terms

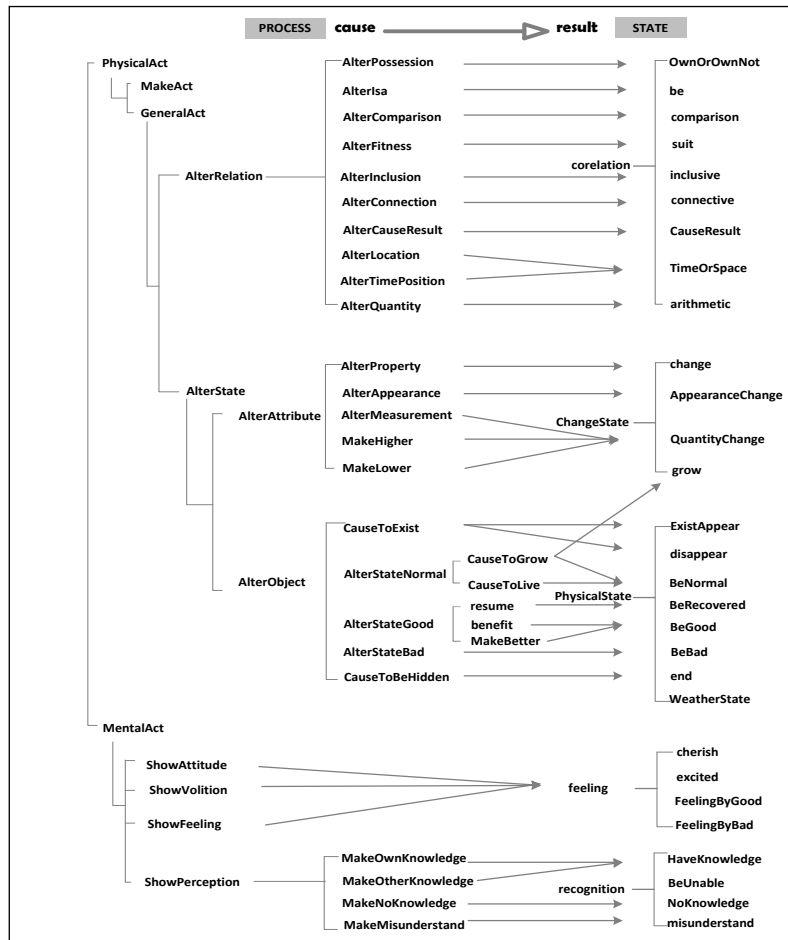


Figure 2. The Matching between Processes and Result States in E-HowNet

of stativity, but from the perspective of a semantic focus, it is more akin to a causative process {kill|殺害}. This classification difficulty always occurs when we analyze verbs denoting different aspect situations, such as passive or achieved situations. As a result, near synonyms of same event type could be separated apart for denoting different aspectual situations.

In terms of the E-HowNet ontology, the cause-result matching between processes and states almost reaches 100% respecting hypernymy concepts as shown in Figure 2. However, at the hyponym or lexical level, we found that the correspondent rate was not as high as in top-level concepts. This results in Case 2 below.

Case 2: Process types neither have nodes of result states nor do state types have nodes of causing processes in the E-HowNet ontology, which means the result states or causal processes are either vague or they are not lexicalized common concepts. (7), (8) are typical examples.

(7) The causative process type {punish|處罰}, such as 行刑 xing-xing ‘execute’ or 處決 chu-jue

‘put to death’, have the corresponding aspectual resultant states, such as 受刑 shou-xing ‘be put to torture’ and 伏法 fu-fa ‘be executed’, but no lexicalized concept in common to denote *being punished* or *being tortured* in Chinese. Therefore, there is no proper node of state type to which the above two stative verbs belong in E-HowNet.

(8) There is no lexicalized concept in common to denote causative processes, such as 板起(臉) ban-qu-lian ‘put on a stern expression’ and 正色 zheng-se ‘with a stern countenance’ in Chinese, and which are the cause of the resultant state type {austere|冷峻}, e.g., 凝重 ning-zhong ‘serious’, 不苟言笑 bu-gou-yan-xiao ‘serious in speech and manner’. That is, there is no proper node of the process type to which the above two process verbs 板起臉 ban-qu-lian ‘put on a stern expression’ and 正色 zheng-se ‘with a stern countenance’ belong.

For lexemes of Case 2, the characteristics of process and state of (5) can still differentiate the lexemes on the process and state types, but there are no actual corresponding conceptual nodes in

the ontology. This means that some stative verbs must be attached to the process type node and some of process verbs should be attached to stative type node in the ontology for the sake of keeping reasonable semantic consistency.

Case 3: Some processes and respective states co-exist concurrently and are not in the cause-result temporal sequence. We call such concurrent process and state a dual process-state. There are 26 dual process-state type primitives in the E-HowNet ontology, with example (9) describing one of them.

(9) the dual process-state {living|生活} includes: (a) 求生 qiu-sheng ‘seek to survive’, 度日 du-ri ‘subsist’, and (b) 生存 sheng-cun ‘exist’, 在世 zai-shi ‘be living’, 一息尚存 yi-xi-shang-cun ‘be still alive’. The semantic focus of group (a) indicates a process of *making a living* or *to live*, while group (b) indicates the state of *being alive* or *be living*. The two types of process and state coexist and they are not cause-result relation.

For the dual process-state type, we encounter the similar dilemma of the previous two cases. If we choose the bipartite process and state approach, near synonyms will belong to two nodes far apart in the ontology. If we adopt the approach of a unified conceptual node for each dual process-state type, the result will be the same problem as in Case 2, i.e., stative verbs and process verbs are of the same type.

Furthermore, in Mandarin Chinese we have many verb-result compounds (VR), such as 累病 lei-bing ‘sick from overwork’, 驚退 jing-tui ‘frighten off’ and 購妥 gou-tuo ‘to complete procurement’. Since causative process and resultant state are contained in the same verb, how should we classify them?

4 Knowledge Representation for Process and State Verbs

The difficulties of the dichotomous approach are caused by the semantic interaction between state and process. We thus propose the classification criterion (5) and a representational scheme according to the above observations, and try to solve the corresponding difficulties without changing the framework of the dichotomy structure. The idea is that all verbs are classified according to their semantic similarity with the conceptual types of the ontology. The process or state type mismatched verbs will have their types

adjusted by their POS or semantic expressions. Such an approach is functional insofar as, for example, using the feature of ‘*don’t fly*’ to adjust the flying property for penguins as bird type and still maintaining the inherent properties. Furthermore, cause-result relations will be linked between corresponding processes and states to bridge the gaps of the dichotomy approach. This proposal is put forward to interpret the semantic and syntactic consistency and differences of verbs with respect to lexical representation.

4.1 Lexical Semantic Representation for Verbs that are Attached to Process or State Primitives

For the Case 1 verbs, every process has the corresponding result state, and every state has the corresponding causal processes. For synonym verbs with a process and state dichotomy, each verb is placed under its corresponding conceptual nodes. In addition, cause-result relation links will be established between corresponding process types and state types, as exemplified in the Figures 2 and 4. In real implementation, there are 310 corresponding cause-result pairs established. However from a practical point of view, all semantic representation systems are discrete systems. Given that they use a limited number of primitive concepts to express complex concepts, the result is that some words are forced to be classified to the most similar concept node but with a mismatched major type, such as 遇害 yu-hai ‘be murdered’ possibly being classified as the process type {kill|殺害} instead of the state type {die|死}. We will resolve such kind of problem by the following method for Case 2.

As shown in the observation of Case 2, some of the cause-result corresponding concepts are vague and some are not lexicalized, neither of which occur as conceptual type nodes in the ontology. As a result, for verbs whose potential hypernyms are missing, we will classify these verbs to their cause-result counterpart conceptual nodes instead. After this, we use the part-of-speech to distinguish the state or process, as illustrated in (10).

(10) causative process: {FondOf|喜歡} ↔ there is no corresponding resultant state lexicons: 看中 kan-zhong ‘take fancy to’, 喜愛 xi-ai ‘love’, 酷愛 ku-ai ‘ardently love’, 熱衷 re-zhong ‘be addicted to’. Since these verbs in E-HowNet are tagged with active POS, they are classified to {FondOf|喜歡}.

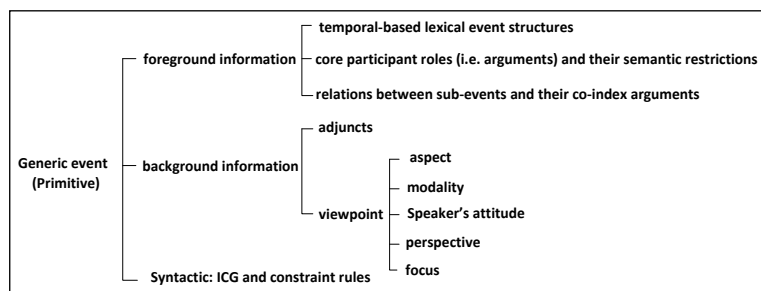


Figure 3. The Content and Formation of LESRE

The verbs of 癡情 *chi-qing* ‘be infatuated’, 興致盎然 *xing-zhi-ang-ran* ‘full of interest’ in E-HowNet are tagged with stative POS, but there is no lexicalized state primitive to place these verbs, and as such, they are classified to the corresponding existing hypernym process node, i.e., {FondOf|喜歡}.

With part-of-speech tags, we have no problem discriminating state verbs that are attached to a process primitive. In fact, we can define state verbs in {result(process)} format; or process verbs in {cause(state)} format in order to make both semantic distinctions and link relations. Example (11) lists the expressions of verbs in (10).

(11) 看中 *kan-zhong* ‘take fancy to’, 喜愛 *xi-ai* ‘love’, 酷愛 *ku-ai* ‘ardently love’, 熱衷 *re-zhong* ‘be addicted to’ are defined as {FondOf|喜歡}; 癡情 *chi-qing* ‘be infatuated’, 興致盎然 *xing-zhi-ang-ran* ‘full of interest’ are defined as {result({FondOf|喜歡})}.

Moreover, fine-grained part-of-speech tags also provide syntactic constraint information for each verb; this solves the difficulty in Case 2 and effectively makes a semantic and syntactic distinction for synonyms.

4.2 Lexical Representation for Verbs that are Attached to Dual Process-State Primitives

For Case 3 dual process-state verbs, the bipartite nodes for state and process are not needed for two reasons. Firstly, it is hard to make distinction between process and state for the dual types, and secondly, state and process are just two different viewpoints of same events. A single dual process-state conceptual type may contain both process and stative verbs of same event type of different viewpoints. We use part-of-speech tags to tell the difference between semantic focus and the syntactic behavior of each verb. In addition,

the dual process-state type also indicates that the process and state coexist at the same time.

4.3 Lexical Semantic Representation for Verb-Result Compounds

In addition to the verbs belonging to Cases 1-3, we also wanted to address the solution for classification difficulty of VR compounds. Take as examples the verbs with VR structure in example (12); no matter which event type we classified them to, no difference was caused with respect to lexical representation.

(12) 累病 *lei-bing* ‘sick from overwork’ def: {ill|病態: cause={tired|疲乏}}
 驚退 *jing-tui* ‘frighten off’ def: {frighten|嚇唬: patient={x}, result={leave|離開: theme={x}}}
 購妥 *gou-tuo* ‘to complete procurement’ def: {buy|買: aspect={Vachieve|達成}}

The semantic expressions provide information to clarify the accurate word meaning and relation between V1 and V2, as well as to constrain the syntactic behaviors in the Verb-Result structure. Although it is controversial to recognize the semantic focus of these verbs, i.e., to determine whether they are more state-like or more process-like, it is not an important issue in making a semantic and syntactic distinction in lexical representation. We built explicit links of cause-result relations between sub-events in the LESRE framework of E-HowNet (Chen et al. 2013), such as {ill|病態} and {tired|疲乏} of the verb 累病 *lei-bing* ‘sick from overwork’. We also encoded the co-indexed arguments for all related event pairs, e.g., the patient of {frighten|嚇唬} is the agent of {leave|離開} in (12).

5 Discussion and Conclusion

Levin (2010) had pointed out that different studies support positing verb classes of varying grain-sizes, including (a) coarse-grained classification discriminating *manner verb*, *result verb*;



Figure 4. Three Grain-sizes of Event Classification in E-HowNet Construction

(b) medium-grained classification discriminating *motion verbs*, *speaking verbs* etc., with Fillmore’s verb classification being regarded as a representative of medium-grained classification; and (c) fine-grained classification discriminating *run*, which lexicalizes a manner of motion that causes directed displacement towards a goal. Nevertheless, while these classifications are different in grain-size, they are not contradictory for the classification criteria.

In E-HowNet, we carry this viewpoint through the whole construction by firstly classifying events into causative processes and their corresponding resultant states, i.e., the top two levels of events we mainly discussed in this paper; we then further subdivided more than 1200 generic events (i.e., primitives) into a semantic hierarchy framework as a medium-grained event classification. Finally, the near synonyms were attached to each primitive and discriminated by fine-grained features that were integrated in the lexical event structure representation of E-HowNet (abbreviated as LESRE; see Chen et al. 2013). The content and formation of LESRE is shown in Figure 3.

We believe the varying grain-sizes classifications provide different semantic and syntactic realization options, such as the coarse-grained classification in which process verbs show considerably more and different argument options than state verbs; further, the idiosyncrasy of each grain-size classification, as well as their interaction, will provide us with advanced knowledge in lexical representation. We will, therefore, continue to complete the LESRE theory in the near future, with the ultimate objective being to establish a completed event classification system which can be applied to both theoretical and computational linguistics. The sketch of different

grain-sized event classification in the E-HowNet construction is detailed in Figure 4.

Event classification is one of the most crucial tasks in lexical semantic representation. Traditionally, researchers have regarded process and state as two top level events and defined them by counter temporal features and syntactic rules. In this paper, we added cause-result relativity as an auxiliary criterion to discriminate between process and state, and structured about 40,000 Chinese verbs to the two correspondent event classes. All verbs were classified according to their semantic similarity with the conceptual types of the ontology. The process or state type mismatched verbs would have their types be adjusted by their POS or semantic expressions. Furthermore cause-result relations would be linked between corresponding processes and states to bridge the gaps of the dichotomy approach.

We not only aimed to claim the deficiency of dichotomy approach, but also to point out that any discrete event classification system is insufficient to make a clear cut classification for all verbs, such as synonyms with slightly different semantic focuses. Although misclassification maybe unavoidable, under our framework of event classification, we proposed the remedy of using fine-grained feature expressions to recover erroneous information inherited from the mismatched classification and differentiated the fine-grained semantic differences for near synonyms. The E-HowNet feature expression system is an incremental system, i.e., fine-grain features can be added gradually without side effects. Currently we have resolved the medium-grained classification among 1200 generic event types for about 40,000 Chinese verbs. In the future, we will improve their fine-grained feature expressions to achieve better lexical semantic and syntactic representations.

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