

On the Sentence Category Transfer of Action-effect Sentences in Chinese-English Machine Translation

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Abstract

Of the 57 basic sentence categories (SC) defined in the HNC theory, action-effect SC is an important one with distinctive features. In the light of the HNC conceptual network, action-effect sentences in the Chinese language arise directly from causative verbs and compelling verbs, and indirectly from general acting verbs, i.e. via the use of the “de(得)” construction. In Chinese-English machine translation, action-effect sentences follow different SC and SF (sentence format) transfer rules. Therefore, different transfer frames should be adopted so as to ensure the generation of TL sentences with proper syntactico-semantic structures. Experiments show that the rules underlying the SC-SF transfer of action-effect sentences from Chinese to English can cover 90.3% of all the sentences in question.

1 Introduction

The HNC (short for Hierarchical Network of Concepts) theory (Huang, 1998) put forward the idea of action-effect chain (AEC), which is composed of the following six links: action (X), process (P), transfer (T), effect (Y), relation (R) and state (S). It advocates that AEC can be used to reflect the maximum commonness of the world and to depict the fundamental laws underlying the existence and development of everything in the universe (Huang, 1998:29). Besides AEC, HNC expounds human thinking via the concept of judgment (D). As judgment is a kind of response made by the rational subjective world to the objective world and the emotional subjective world, judgment and AEC combine to describe the relationship between subjectivity and objectivity, between rationality and emotionality (Zhang Keliang, 2002). AEC+judgment can be called “the generalized action-effect chain” (GAEC), which serves as the basis both for the classification of principal primitive concepts (which constitute one of the eight HNC semantic networks) and for the semantic categorization of sentences.

The semantic category of sentences is referred to in the HNC theory as sentence category (SC). The HNC SC system includes 57 basic SCs and, in theory, 3192 composite SCs and over 10 millions of compound SCs (Huang, 2001). Basic SCs are those that have no more than one eigen chunk (EK) which depicts just one of the seven links of GAEC*. Composite SCs have only one EK, but their EK originates from the semantic blending of the EKs of basic SCs and depicts two or more of the links of GAEC. As to compound SCs, they come from the compounding of basic SCs and/or composite SCs, with two or more EKs that contain information related to corresponding links of GAEC.

The 57 basic SCs fall into 7 main types: action, effect, process, transfer, relation, state and judgment. This paper focuses on a special subtype of action SC, i.e. action-effect SC, and investigates the rules underlying the SC transfer of sentences of this sort from Chinese to English. By this study we expect to gain some insights into the relationship between the syntactico-semantic structure of a Chinese

* It should be pointed out that some basic SCs may not have any EK as far as a specific language is concerned. To Chinese, for example, there are four EK-free SCs (referential comparison-jugment jD021J/jD022J, restrictive comparison-judgment jD011J/jD011J/jD012J, concise tendency jD2J, concise state S04J) and a quasi EK-free SC (concise judgment jD0J).

sentence and that of its English translation and to facilitate the structural transfer of the HNC-based Chinese-English MT engine under construction.

2 Action-effect Sentences

Action-effect sentences are sentences that belong to the semantic subtype of action SC. They are represented as follows:

$$XYJ=A+XY+B+YC, YC=!31ErJ$$

In the representation above, XYJ is the SC code for action-effect sentences, while A stands for agent chunk, XY for action-effect EK, B for object chunk, and YC for content chunk of effect. Moreover, YC is derived from the extension of a chunk (hence extended chunk or EC) and is essentially a sentence (called EC sentence and represented as ErJ) in the sentence format (SF) of !31. !31 is a code for elliptical SF that covers sentences omitting the first generalized object chunk (JK1)⁼. The omitted JK1 is in fact the previously adjoining B. In other words, B+YC is a semantically (and also syntactically to Chinese at least) complete sentence. Moreover, the EK of the EC sentence is also the ErK of the action-effect sentence. For example,

(1c) 周末的大风||迫使||他||[#改变||计划#]。

(1e) Weekend gales|| forced|| him|| [#to change|| his plans#].

Note: (i) sentence (*e) hereafter is the reference English translation of the Chinese sentence (*c); (ii) for readers' convenience, all the examples given in this paper are tagged with the following symbols: “||” (for chunks in independent sentences and EC sentences), “^” (for logical chunk markers), and “[#...#]” (for EC sentences); (iii) attached in the parentheses, if any, is the SC-SF expression of the sentence in question.

In sentence (1c), there exists the following mapping: “周末的大风(weekend gales)”—A, “迫使(forced)”—XY(Ep), “他(him)”—B, “改变计划(to change his plans)”—YC. And B+YC, i.e. “他改变计划(him to change his plans)” is an action-effect composite sentence XY0*22J(SC-SF expression: XY0*22J=A+XY0+B), whose EK “改变(change)” plays the role of the Er in the action-effect sentence.

2.1 Features of action-effect sentences

Action-effect SC is closely related to basic action SC whose representation is

$$XJ=A+X+B, B=XB+YB+YC.$$

When the B chunk in XJ is extended into a sentence (EC sentence), XJ becomes XYJ. Here are some of the distinctive features of action-effect sentences:

(1) XYJ usually has two EKs: the former is called premise EK (or Ep), i.e. XY, while the latter is called result EK (or Er) which is in fact the EK of the embedded EC sentence ErJ. Since Ep and Er depict respectively the action link and the generalized effect link of AEC, XYJ is in nature a compound SC. Nevertheless, considering that XYJ covers a large part of any natural language, it is purposely defined as a basic SC.

(2) The relationship between the two EKs in XYJ is not a global-local relationship (Eg~El relationship), but a cause-effect or sequential relationship (Ep~Er relationship). In inflectional languages like English, Ep functions as a finite verb or verbal cluster while Er functions as an infinite verb or verbal cluster. In sentence (1e), for instance, its Ep is the finite verb “force” while its Er is the infinite verb “to change”.

(3) As one of the HNC-defined SCs with an embedded EC sentence, XYJ uses the coupled Ep and Er for the complete depiction of the action link and the effect link of AEC. In other words, XYJ's YC is indispensable to the syntactico-semantic integrality of the sentence. For example, sentence (2c) and its translation sentence (2e) would neither stand on its own without their YC “沸腾了” and “go mad” respectively.

(2c) 申奥成功的消息||使||整个北京城||[#沸腾了#]。

⁼ Refer to Zhang Keliang (2001) for details about HNC sentence formats.

⁼ For a more detailed explanation of these and other symbols used in HNC tagging, please refer to Huang (2002a).

(2e) The news that Beijing succeeded in bidding for the 2008 Olympiad|| made|| the whole city||
[#go mad#].

(4) XYJ's YC must be an EC sentence in !31 SF. And the absent JK1 must be the previously adjoining B, which also serves as the object of XY. Take sentence (3c) for example.

(3c) 匪徒||强迫||人质||[#交出||手机、BP机等通讯工具#]。

(3e) The mobsters|| forced|| the hostages|| [#to hand over|| their cell phones, pagers and any other communications devices#].

In this XYJ-type sentence, the YC “交出手机、BP机等通讯工具 (to hand over their cell phones, pagers and any other communications devices)” is itself an embedded sentence with T21J (physical transfer) as its SC and !31 as its SF. “人质 (the hostages)” functions both as the absent TA in the EC sentence T21J and as B, the object of XY “强迫 (forced)”, in the SC sentence XYJ.

(5) Despite the fact that XYJ is closely related to XJ, they differ from each other in terms of the A chunk: the focus of the A in XJ cannot take content chunk C whereas the A in XYJ can. The A containing C as its focus in XYJ often takes the form of sentence ecdysis (SE), which is a chunk in function but a degraded or transformed sentence in nature. Take the following sentences for example.

(4c) 舒适的环境||让||人||[#产生||惰性#]。

(4e) Comfortable conditions|| make|| one|| [#get|| lazy#].

(5c) 年轻人的性自由||使得||爱滋病||[#泛滥成灾#]。

(5e) The liberal attitude of the young|| caused|| AIDS|| [#to spread rampantly#].

(6c) 地方政府和企业参与办学，||也会促使||高校||[#进一步改革||管理制度#]。

(6e) Local governments and enterprises take part in education, which|| can also drive|| colleges and universities|| [#to further reform|| their management systems#].

In sentence (4c) the focus of A, i.e. “环境(conditions)”, is content-free, as is the case with XJ. In sentence (5c), however, A's focus “性自由(the liberal attitude)” is characteristic of content, which is not allowed in the case of XJ. As to sentence (6c), its A “地方...办学(Local ... in education)” takes the form of SE that never occurs in XJ.

2.2 A conceptual analysis of verbs commonly used in action-effect sentences

The generalized AEC grounds both the classification of principal primitive concepts and the semantic categorization of sentences (Huang, 2001). Since the SC of a sentence is predominantly determined by the core of its EK, and the core of an EK is invariably a verb, the syntactico-semantic classification of sentences is closely linked with the conceptual/notional classification of verbs by the HNC conceptual/semantic network...

As a special subtype of action sentences, action-effect sentences strongly correlate with the 00-node concepts, i.e. basic action concepts. Verbs that express concepts subordinate to this node can all, in principle, be used in action-effect sentences. Under node 00 are the following four son nodes: node 003 (action that is invariably accompanied by its effect or result), node 008 (macro physical action), node 009 (micro chemical action) and node 00a (biological action); and node 003 has its own son nodes: node 0038 (causative action) and node 0039 (compelling action). Verbs expressing concepts subordinate to node 0038 and node 0039 are called causative verbs and compelling verbs respectively, examples of which are to be given in a later part. Verbs expressing concepts subordinate to node 008 (like “咬(bite)”, “吸(inhale)”, “拉(drag)”, “打(beat)”), node 009 (like “烧(burn)”, “熔(melt)”, “溶解(dissolve)”) and node 00a (like “蛀(eat by moth)”, “消化(digest)”, “分泌(excrete)”) are all called general acting verbs.

We can thus draw some inferences about verbs commonly used in action-effect sentences. Firstly, causative verbs such as “使”, “令”, “叫”, “让”, “使得” in Chinese and “make”, “get”, “cause”, “enable” in English directly result in action-effect sentences, as shown in sentences (7c)/(7e) and (8c)/(8e).

(7c) 残暴与不公正||常常使||我们||[#怒不可遏#]。

... Refer to Huang Zengyang (2002b) for details about HNC conceptual/semantic network.

(7e) Cruelty and injustice|| often make|| [#our blood|| boil#].

(8c) 新技术||使得||外科医生||[#能打开并修复||心脏#]。

(8e) New techniques|| enable|| surgeons|| [#to open and repair|| the heart#].

Secondly, compelling verbs such as “催”，“逼”，“催促”，“督促”，“逼迫”，“胁迫”，“强迫”，“强制”，“迫使”，“促使”，“驱使” in Chinese and “force”，“compel”，“coerce”，“drive”，“impel”，“press”，“urge” in English also result in action-effect sentences in a direct way, as shown in sentences (9c)/(9e) and (10c)/(10e).

(9c) 资金缺乏||最终将会迫使||他||[#找||工作#]。

(9e) Lack of funds|| will eventually force|| him|| [#to look for|| work#].

(10c) 形势||迫使||我们||[#当时必须采取行动#]。

(10e) The circumstances|| impelled|| us|| [#to take action at that time#].

Thirdly, as far as the Chinese language is concerned, general acting verbs can engender action-effect sentences in an indirect way, i.e. via the use of “得(de)” construction. The auxiliary word “得(de)” is used in such a way that two independent clauses are bridged to form a cause-effect relationship. The predicate verb and the auxiliary “得(de)” combine to function as the EK (i.e. XY) of the sentence. Action-effect sentences of this sort are ubiquitous in Chinese, and are inclined to take !113 SF and !123 SF, two variant forms of regular SF. Take sentences (11c)/(11e) and (12c)/(12e) for example.

(11c) 蚊子||咬得||我||[#睡不着觉#]。

(11e) The mosquitoes|| bit|| me ++[so that] I|| could not fall asleep.

(12c) 小女孩||被继母||打得||[#遍体鳞伤#]。

(12e) The little girl|| was beaten black and blue|| by her stepmother.

In sentence (11c), the auxiliary “得(de)” is used to connect two otherwise independent clauses: “蚊子咬我(The mosquitoes bit me)” and “我睡不着觉(I could not fall asleep)”. The predicate verb “咬(bit)” and the auxiliary “得(de)” combine to serve as the XY of this XYJ sentence. Similarly, sentence (12c) is formed, via the use of “得(de)”, by bridging the following two independent clauses: “继母打小女孩(The stepmother beat the little girl)” and “小女孩遍体鳞伤(The little girl was black and blue)”, and its XY is composed of the predicate verb “打(beat)” and the auxiliary word “得(de)”. In addition, sentence (12c) takes !123 as its SF which, as well as the !113 SF, is the usual case with action-effect sentences embedded with a “de” construction.

Lastly, two distinct colloquial Chinese words, “搞” and “弄”, deserves much of our attention. They can be called vague verbs, verbs with an obscured denotative meaning for action. In fact these two frequently used words are characteristic of both causative verbs and general acting verbs. Conceptually, they belong to node 0038 and therefore are causative verbs. What distinguishes them from other causative verbs, however, is the fact that they are grammatically more like general acting verbs. For example, together with a word expressing concepts of generalized effect, they can form a compound word which expresses the blended concept of action and its effect or result, such as “搞好(do...well)” and “弄坏(ruin, spoil)”. What's more, they can only be used in an action-effect sentence via the use of “得(de)” construction, which is characteristic of general acting verbs. Take the following two sentences for example.

(13c) 这件事||搞得||他||[#很痛苦#]。

(13e) It|| made|| him|| [#distressed#].

(14c) 你那玩笑||弄得||她||[#很生气#]。

(14e) Your joke|| got|| her|| [#very angry#].

3 SC transfer and SC TransFrame

3.1 SC transfer

SC transfer is defined as the change of SC from one into another without affecting the meaning of the sentence. It falls into two categories: intralingual SC transfer and interlingual SC transfer. Intralingual

SC transfer is referred to as the change of SC from one into another within a specific language, whereas interlingual SC transfer is used of the change of SC from one into another between two different languages. This paper focuses on interlingual SC transfer.

Interlingual SC transfer, which plays a pivotal role in the translation engine of any HNC-based bilingual MT systems, can be divided into three types: bare transfer, obligatory transfer and optional transfer. Bare SC transfer applies to cases where no SC transfer occurs when a SL sentence is translated into its corresponding TL equivalent. Obligatory SC transfer applies to cases where SC transfer is a must to the successful translation of a SL sentence into a TL sentence. Optional SC transfer, somewhere between the two extremes, applies to cases where the SC of the SL sentence may or may not change in the process of translation. With respect to the second and the third types, SC transfer is further described as deterministic and non-deterministic. Deterministic SC transfer denotes the single-valued SC mapping relationship where the SC of a SL sentence is definitely transferred to the SC of its corresponding TL sentences. In contrast, non-deterministic SC transfer denotes the multi-valued SC mapping relationship where the SC of a SL sentence can be transferred to different SCs of its translations. For examples that illustrate the preceding terms, please refer to Zhang Keliang (2002).

3.2 SC TransFrame

Before proceeding to the actual analysis of the SC transfer of action-effect sentences from Chinese to English, we need to define a formal approach to describe SC transfer, whether intralingual or interlingual. Therefore, SC transfer frame (or TransFrame in short) is proposed, and the TransFrame of sentence J to sentence J' is defined as

$$\text{TransFrame}(J', J) = [(E'J, EJ), (i', i), (K', K)].$$

In the above expression, EJ, i and K represent respectively the SC, SF and semantic chunk (including supplementary chunk fK) of the source sentence J, while E'J, i' and K' represent those of the target sentence J'. EJ and E'J, i and i', K and K' correspond to their respectively defined range of values. It should be noted that to a given SC transfer pair (E'J, EJ), chunk transfer pair (K', K) is repeatable. Alternatively, (K', K) can be rewritten as ((K1', K1), (K2', K2),...). And the maximum number of chunk transfer pairs is assumedly no more than four, something obvious according to the HNC theory.

4 SC transfer of action-effect sentences from Chinese to English

In the following sections, the SC transfer of action-effect sentences in the context of Chinese-English machine translation is investigated in terms of the verbs commonly used in this type of sentences.

4.1 Causative verbs

Causative verbs, forming a closed set in presumably any language, express 0038-node concepts and can definitely form action-effect sentences, as explicated in 2.2. Generally, when the Er of a Chinese action-effect sentence of this sort pertains to a generalized effect concept, the syntactico-semantic structure of the corresponding English translation is to be generated by way of bare SC transfer. In other words, the SC and the SF as well of the English sentence remain the same as those of the Chinese sentence. Take the following sentence for example.

$$(15c) \text{ 意外的困难} \parallel \text{并没有使} \parallel \text{他们} \parallel \text{[动摇了或退缩\#]} \circ (XYJ, B+YC=[\#YJ\#])$$

A XY B YC

Sentence (15c) is an action-effect sentence engendered by the typical Chinese causative verb “使”; its B and YC combine to form a complete effect sentence YJ. When being translated into English, it complies with bare SC transfer. Accordingly, its TransFrame is [(XYJ, XYJ), (!0, !0), ((A, A), (XY, XY), (B, B), (YC, YC))], and the default form is [(XYJ, XYJ), (!0, !0)]. This TransFrame determines the number and types of the main chunks as well as the order of their occurrence (hence the syntactico-semantic structure) of the corresponding English sentence, as is shown in the reference translation sentence (15e) below.

$$(15e) \text{ The unexpected hardships} \parallel \text{did not make} \parallel \text{them} \parallel \text{[waver or retreat\#]}.$$

A XY B YC

Take another example.

(16c) 不等价交换||使||穷国||[#更穷#]。(XYJ, B+YC=[#S04J#])

A XY B YC

Like sentence (15c), sentence (16c) is also an action-effect sentence engendered by the causative verb “使”, and its B and YC combine to form a concise state sentence S04J. According to the default TransFrame for sentence (16c), i.e. [(XYJ, XYJ), (!0, !0)], the syntactico-semantic structure of its corresponding English sentence can be well determined, as shown by the following reference translation sentence (16e):

(16e) Exchange of unequal values|| makes|| the poor countries|| [#poorer#].

A XY B YC

There are two points worthy of note. For one, words like “使”, “令”, “叫”, “让” in Chinese, as well as words like “make”, “get”, “put” in English, are all multi-SC verbs, and that sentences containing any of these verbs may not necessarily be action-effect sentences. Sentences of different SCs have different transfer frames and should be translated into English using different SC transfer strategies. Listed below are some typical examples:

(17c) 绝大部分西方游客||都不会使||筷子。

TransFrame: [(XJ, XJ), (!0, !0), ((A, A), (X, X), (B, B))]

(17e) Most western tourists|| cannot use|| chopsticks.

(18c) 医生||叫||她||[#卧床休息#]。

TransFrame: [(T3XY*31J, T3XY*31J), (!0, !0), ((TA, TA), (T3XY, T3XY), (B, B), (YC, YC))]

(18e) The doctor|| ordered|| her|| [#to stay|| in bed#].

(19c) [请||叫||]下一个申请人||[#进来#]。

TransFrame: [(T3XY*31J, T3XY*31J), (!31, !31), ((T3XY, T3XY), (B, B), (YC, YC))]

(19e) Ask|| the next applicant|| [#to come in], [please].

(20c) 父亲||不|让||她||[#去||南方#]。(X21XY*31J)

TransFrame: [(X21XY*31J, X21XY*31J), (!0, !0), ((X2A, X2A), (X21XY, X21XY), (B, B), (YC, YC))]

(20e) Father|| did not allow|| her|| [#to go|| to the south#].

For the other, optional SC transfer is applied instead when the Er of a Chinese action-effect sentence expresses the concepts subordinate to nodes 710 (mental reaction) and 713 (emotive expression). That is, the English translation may or may not inherit the SC of the source sentence, despite the fact that it does, more often than not, take a different one. Obviously, the SC transfer for this kind of action-effect sentences is non-deterministic, and they may choose for the SC of their corresponding English translations from among the following four options: XYJ, X2J, X22J and X22S*22J. Let's take sentence (21c).

(21c) 他的行为||让||我||[#大吃一惊#]。(XYJ, YC=[#!31X20S*11J#])

(1) If XYJ is chosen as the SC of its English translation, then the TransFrame for sentence (21c) will be [(XYJ, XYJ), (!0, !0), ((A, A), (XY, XY), (B, B), (YC, YC))]. Guided by the TransFrame, the sentence could be translated into an action-effect sentence like (21e1).

(21e1) His behavior|| made|| me|| [#(feel) very much surprised#]. (XYJ, YC=[#!31X20S*11J#])

In sentence (21e1), B and YC combine to form a complete reaction-state sentence that is semantically independent (yet grammatically dependent), i.e. B+YC=[#X20S*11J#].

(2) If X2J is chosen, the TransFrame will be [(X2J, XYJ), (!0, !0), ((XAC, A), (X2, XY+YC//X2S), (XBC, B))], by which sentence (21c) could be translated into an action-reaction sentence like (21e2).

(21e2) His behavior|| greatly surprised / startled|| me. (X2J=XAC+X2+X2BC)

Action-reaction sentences are meant in the HNC theory to describe the AEC from the end of action. They are widely seen in English but not in Chinese.

(3) If X22J is picked, the TransFrame for sentence (21c) will be [(X22J, XYJ), (!0, !0), ((X2B, B), (X2, YC//X2S), (XAC, A))]. Under its guidance a passive reaction sentence like (21e3) could be generated.

(21e3) I|| was greatly surprised|| by his behavior. (X22J=X2B+X22+XAC)

In opposition to action-reaction sentences, passive reaction sentences are meant to describe the AEC from the end of effect with focus on the entity affected by the action (the patient). Additionally, a logical chunk marker is needed to introduce the doer of the action (the agent) represented by XAC. As far as the English language is concerned, the required chunk marker is exclusively the preposition “by”.

(4) If X22S*22J is chosen, the TransFrame for sentence (21c) will be [(X22S*22J, XYJ), (!0, !0), ((X2B, B), (X2S, YC//X2S), (XAC, A))] and the Chinese sentence could be put into a passive reaction-state sentence like (21e4).

(21e4) I|| was very surprised|| at his behavior. (X22S*22J=X2B+X2S+XAC)

Like passive reaction sentences, passive reaction-state sentences are also meant in the HNC theory to describe the AEC from the end of effect. But they differ from each other in that the latter focus on the state of the bearer of the action while the former concentrate on the bearing per se of the action. Another differentiating feature is that passive reaction-state sentences prefer to use “at” or “with” as the required logical chunk marker preceding XAC while passive reaction sentences invariably use “by”.

4.2 Compelling verbs

When translated from Chinese into English, action-effect sentences engendered by compelling verbs follow a simple SC transfer strategy: unconditional bare SC transfer. Sentence (22c), for example, is an action-effect sentence derived from the Chinese compelling verb “强迫”.

(22c) 我们||不能强迫||他们||[#接受||马克思主义思想#]。(XYJ, YC=[#!31T1J#])

Its B and YC combine to form a reception sentence T1J. This is an EC sentence and could otherwise be independent both syntactically and semantically in the Chinese language. The default TransFrame for sentence (22c) is [(XYJ, XYJ), (!0, !0)], by which the corresponding English translation like (22e) could be generated.

(22e) We|| cannot force|| them|| [#to adopt|| the Marxist ideology#]. (XYJ, YC=[#!31T1J#])

Similar Chinese sentences and their reference English translations are given below:

(23c) 事态的发展||迫使||他||[#重新考虑||自己的决定#]。

(23e) The march of events|| compelled|| him|| [#to reconsider|| his decision#].

(24c) 盟军||将迫使||德军||[#投降#]。

(24e) The allied forces|| would force|| the German army|| [#to surrender#].

4.3 General acting verbs

As explored in 2.2, action-effect sentences engendered by general acting verbs contain a “de” construction and are prone to !113 SF and !123 SF. Generally, they take three different approaches to decide on the SC of the corresponding English translations.

Firstly, if a given Chinese action-effect sentence is in basic format (!0 SF), the basic SC (XYJ, that is) will be transferred to a compound SC by putting the Chinese sentence embedded with the “de” construction into an English complex sentence with an adverbial clause of result. For example, sentence (25e) is an action-effect sentence in basic SF that is engendered by the general acting verb “咬”. Its reference translation, sentence (25e), is a complex sentence composed of a main cause, whose SC is XJ, and a subordinate cause, whose SC is S0J.

(25c) 蚊子||咬得||我||[#睡不着觉#]。(XYJ, YC=[#!31SJ#])

A XY B YC

(25e) The mosquitoes|| bit|| me ++[so that] I|| could not fall|| asleep. (XJ++S0J)

A X B SB S0 SC

Secondly, if the Chinese action-effect sentence has a regular SF of !113, the basic SC (XYJ) will be transferred to a composite SC by blending the core of the Ep and the Er of XYJ into the core of the EK of the English translation, and the SF will be transferred from regular (!113) to basic (!0). In addition, the EK will be represented by an English verb or verbal phrase that expresses the blended concept of action and effect. Take the following sentence for example.

(26c) 小小的希腊军队||即把意军||打得||[#落花流水#]。(!113XYJ, B+YC=[#YJ#])

This Chinese sentence is an action-effect sentence in the regular SF of !113. According to the rule, it can be translated into English like sentence (26e).

(26e) The small Greek army|| routed|| the Italians. (XY0*22J=X+XY0+B)

Sentence (26e) is an action-effect composite sentence in basic SF. Its EK is represented by the word “rout” (meaning “cause to flee or retreat in a disorderly way”), a typical English verb that expresses the blended concept of action and effect.

Similarly, if the Chinese action-effect sentence has a regular SF of !123, the basic SC (XYJ) will be transferred to a composite SC and the regular SF(!123) to basic SF(!01). The EK of the English sentence generated is derived from the blending of the core of the Ep and the Er of the XYJ of the source sentence and represented by a verb or verbal phrase expressing the blended concept of action and effect. Sentence (27c), for example, is an action-effect sentence in the regular SF of !123 and can be properly translated into sentence (27e). The English translation is an action-effect composite sentence in basic form (!01), its EK derived from the blending of the core of the Ep(“炸”) and the Er(“粉碎”) of the XYJ of sentence (27c), and represented by the verbal phrase “blow ... to smithereens”, a phrase that expresses both action and its effect or result.

(27c) 元首的这个英明战略||被扔在珍珠港的炸弹||炸得||[#粉碎#]。

(!123XYJ, B+YC=[#Y9J#])

(27e) This wise strategy of the Fuhrer|| was blown to smithereens|| by Pearl Harbor.

(!01XY9*22J=B+XY9+^A)

Additionally, when it comes to action-effect sentences engendered by vague verbs like “搞” and “弄”, the preceding three approaches for the case of general acting verbs can be referred to for the SC and SF transfer, as shown in the following three pairs of Chinese sentences and their corresponding English translations.

(28c) 你那玩笑||搞得||她||[#很生气#]。(XYJ, B+YC=[#X20S*11J#])

(28e) Your joke|| got|| her|| [#very angry#]. (XYJ, B+YC=[#X20S*11J#])

(29c) 那些客人||把客厅||搞得||[#乱七八糟#]。(!113XYJ, B+YC=[#S04J#])

(29e) Those visitors|| messed up|| the sitting-room. (XS1*22J=A+XS1+B)

(30c) 希特勒||显然为其自己的表演和里宾特洛甫的不断保证||弄得||[#神魂颠倒了#]。

(!123XYJ, B+YC=[#X20S*11J#])

(30e) Hitler apparently got carried away by his own playacting and the constant assurances of Ribbentrop. (!01XX20*22J=B+XX20+^A)

5 Conclusion

Based on the conceptual classification of the verbs that engender Chinese action-effect sentences, we have explored in this study the SC and SF transfer of this kind of sentences from Chinese to English and discovered some underlying rules. The rules have been applied to a collection of 145 Chinese action-effect sentences drawn from an aligned bilingual corpus of more than 8,000 Chinese-English sentence pairs. The findings show that these transfer rules can be successfully applied to 131 sentences, i.e. they can cover 90.3 percent of all the sentences in question.

Interlingual SC transfer is very complex, though. Apart from action-effect sentences, HNC-based Chinese-English MT engine research should also focus on concise state sentences, basic judgment sentences, comparative judgment sentences, bearing sentences, unilateral relation sentences and some subtypes of effect sentences, which all together cover 90 per cent and over of the real-text sentences that need to be transferred in terms of SC and SF when translated from Chinese into English. And these sentences will be dealt with in our future work.

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