CSCanada
Studies in Literature and Language
Vol. 3, No. 3, 2011, pp. 25-28
DOI:10.3968/j.sll.1923156320110303.033

ISSN 1923-1555[Print]
ISSN 1923-1563[Online]
www.cscanada.net
www.cscanada.org

The Formalization of English Structures with Preposition "in" and Their Chinese Translations

GUAN Xiaowei[1,*]

[1]School of Foreign Languages, Dalian University of Technology, Dalian, China
Ph.D, Lecturer. Main research areas are machine translation and comparison of C-E and E-C translation.
[*]Corresponding author.

Supported by "the Fundamental Research Funds for the Central Universities. Number: DUT10RC(3)46"

Received 17 October 2011; accepted 1 December 2011

Abstract
One of the main problems that affect the quality of machine translation is how to express the knowledge of language in precision. Based on the theory of Semantic Element (SE) and Semantic Element Representations (SER) in Unified Linguistics, the classification of English structures with preposition "in" is proposed from the perspective of C-E and E-C translation. These English structures and their Chinese translations are further formalized into English and Chinese SER respectively.

Key words: English preposition "of"; Chinese translation; Formalization; SE; SER

GUAN Xiaowei (2011). The Formalization of English Structures with Preposition "in" and Their Chinese Translations. *Studies in Literature and Language, 3*(3), 25-28. Available from: URL: http://www.cscanada.net/index.php/sll/article/view/j.sll.1923156320110303.033
DOI: http://dx.doi.org/10.3968/j.sll.1923156320110303.033

INTRODUCTION
The history of machine translation is more than a half century long, but its quality is still poor and the machine translation systems still haven't reached the practical phase. The key lies in linguistics, that is, the knowledge of language cannot be expressed in precision, although many famous linguists have made many important achievements from different angles of study.

Prepositions are a class of active and commonly-used words in Chinese, which are seldom used alone, but with verbs, nouns and adjectives. Therefore we should set the study of prepositions into a dynamic context and analyze the relationships between prepositions and their collocated elements. Scholars at home or broad have studied on prepositions from various angles. In linguistics, prepositions have been studied in the aspects of syntax, pragmatics, cognition and second language teaching (Zhang, 2002; Yong, 2007; Cai, 1999). In MT field, prepositions have been studied in the aspects of PPA (prepositional phrase attachment) and WSD (word sense disambiguation) (Guan, 2009; Zhao, 2001, Feng, 2004).

In order to improve the quality of machine translation, we need to represent natural languages precisely. This paper offers an account of one problem of the precision of natural language: the formalization of English structures with preposition "in" and their Chinese translations. In section 2, we discuss the classification of English structures with preposition "in". Section 3 presents the formalization of English structures with preposition "in" and their Chinese translations based on the theory of SE and SER.

1. THE CLASSIFICATION OF ENGLISH STRUCTURES WITH PREPOSITION "IN"
"COBUILD English-Chinese Dictionary"(COBUILD English-Chinese Dictionary, 2002), "Collins COBUILD Grammar Patterns 1: Verbs"(Collins, 2000) and "Collins COBUILD Grammar Patterns 2: Nouns and Adjectives"(Collins, 2002) give a comprehensive account of the verb, noun and adjective patterns of English, using COBUILD (The Bank of English) which now stands at 350 million words of current written and spoken English. Through the reliability and objectivity of the computer evidence, words can be subdivided according to pattern,

and patterns can be seen to correlate with meaning.

In this paper, N denotes noun, A denotes adjective, V denotes verb, Pposs denotes possessive pronoun, V_{ing} denotes verb with progressive tense, $W_{h\text{-}clause}$ denotes clause with relative adverb, "|" represents the relation "or", "[ ]" represents the words in it can appear in this structure.

1.1 The Structure: "in N"

There are 51 types of the structure "in N" by the semantic meaning of collocated "N" in Collins(2000). We can further divide them into the following types—set phrase (e.g.: in turn), "in [P_{poss} |the] N |V_{ing}" (e.g.: in agony), "N be in [A] N |V_{ing}" (e.g.: The building was in flames.), "in [a |an |the] N+ other preposition +N |V_{ing}" (e.g.: in a state of collapse).

1.2 The Structure: "N in N"

There are 19 types of the structure "N in N" by the semantic meaning of collocated "N" before "in" in Collins(2000). We can represent the structures by only one expression "[P_{poss} |the |a |an] N in N |V_{ing} |$W_{h\text{-}clause}$" (e.g.: decline in sales; a believer in creating competition; an object lesson in how to make the worst possible use of our assets).

1.3 The Structure: "N be A in N"

There are 20 types of the structure "N be A in N" by the semantic meaning of collocated "A" before "in" in Collins(2000). We can represent the structures by only one expression "N be [P_{poss}]A in N |V_{ing} " (e.g.: She is adamant in her refusal to make any statement.).

1.4 The Structure: "N V in N"

There are 4 types of the structure "N V in N" according to [9]. We can further divide them into the following types—set phrase (e.g.: People want to participate in making decisions.), "N V in N |V_{ing}" (e.g.: He delights in stirring up controversy and strife.).

1.5 The Structure: "N V N in N"

There are 2 types of the structure "N V N in N" according to Collins (2000). We can represent the structures by only one expression "N V N in N |V_{ing} " (e.g.: You may split it in half.).

1.6 "In" in some Sentence Structures

There are 2 types of sentence structure with "in" according to Collins (2002)— "What be A in N be N | that J |$W_{h\text{-}clause}$" (e.g.: What was striking in these photographs were the changing expressions on the faces of the high party officials.) and "There be something |nothing |anything A in N |V_{ing}" (e.g.: There is nothing new in offering customer discounts.)

2 THE FORMALIZATION OF ENGLISH STRUCTURES WITH PREPOSITION "IN" AND THEIR CHINESE TRANSLATIONS

2.1 The Theory of SE and SER

In 1980's, Institution of Computing Technology (ICT) of the Chinese Academy of Science (CAS) proposed a new concept, i.e., semantic element representation (SER) with variables and without variables. The concept of Semantic Element and Semantic Language was discussed in detail in Gao, & Gao (2009), and Gao et al. (2003).

An element to express a semantic meaning in an SS is called Semantic Element (SE). The representation of an SE in a natural language-I, such as English, Chinese…, is called the Representation of Semantic Element in Language-I (SERi). Semantic of SER is SE. For example, the Chinese sentence is "李先生是教授*Li xiansheng shi jiaoshou* (Mr. Li is a professor.)". The four SEs in this sentence are 李(Li), 先生($X_{surname}$) (Mr. (X)), 教授 (professor), 是$_{title}$(X_{people}, Y_{title}) (Is$_{title}$(X_{people}, Y_{title})). "X" and "Y" are two parameters. SE is an abstract concept and form. Actually, the above mentioned examples of SEs are only some remembrance forms to represent SE by using Chinese characters or English words. We can use "1" to substitute the SE "Li", or use "4(X_{people}, Y_{title})" or "4(N_{people}, N_{title})" to substitute "是$_{title}$(X_{people}, Y_{title})". The subscript denotes the semantic type of the word. A SER can reflect the semantics and syntax relations of the word in a phrase or a sentence.

2.2 The formalization of English Structures with Preposition "in" and Their Chinese Translations

English structures with preposition "in" and their Chinese translations are formalized based on the theory of SE and SER. SERc denotes Chinese SER; SERe denotes English SER. In the phrase and sentence structure with "in", the meaning of noun is defined as Thing Semantic, which is the Semantic meaning expressed by nouns representing things. The collocated nouns, especially in the phrase "in N" and "N in n", are described as "N_x", and "A" in the structure "N be A in N" are described as "A_x", which mainly determine the meaning of "in". Here, x denotes the semantic type of the noun or adjective or verb. Nouns or adjectives with the same semantic type can be substituted by each other in a SER. In addition, we use AD to represent adverb, $N_{pron\text{-}refl}$ to represent reflexive pronoun. The semantic types are summarized based on Collins(2000, 2002).

2.2.1 The Formalization of the Structure "in N"

Table 1
SERe and SERc of "in N"

SERe	SERc	SERe	SERc
in $N_{feeling\ |amount\ |quantity\ |popular\ |voice\ type}$ in $N_{situation}$	$AD_{feeling\ |amount\ |quantity\ |popular\ |voice\ type}$ 处于 | 在$N_{situation}$ [状况|情况][下]	in $P_{poss\ Ncontrol\ |possesion}$ $N_{thing\ |person}$ be in A $N_{condition}$	由 $N_{person\ Vcontrol\ |possesion}$ $N_{thing|person}$ 处于 A $N_{condition}$ $N_{thing\ |person}$ $N_{condition}$ A
in $N_{place\ |position\ |time}$ in $N_{light\ |shade\ |filming}$ in N_{aspect} in $N_{way\ of\ arranging}$ in $N_{form\ |way\ of\ doing\ things}$ in P_{poss} $N_{opinion}$ in $N_{clothes}$	在 $N_{place\ |position\ |time}$ 在 $N_{light\ |shade\ |filming}$ 中|里|下 在 N_{aspect} 上|方面 成 $N_{way\ of\ arranging}$ 状 以 $N_{form\ |way\ of\ doing\ things}$ 的方式 N_{person} 的 $N_{opinion}$ 是 穿 $N_{clothes}$	N_{person} be in $N_{physical\ or\ emotional\ state}$ $N_{thing\ |plant}$ be in $N_{state\ |plant}$ $N_{thing\ |person}$ be in $N_{situation}$ in N_{action} of in $N_{action\ |relation}$ with N in P_{poss} N_{role} as N	N_{person} $A_{physical\ or\ emotional\ state}$ $N_{thing\ |plant}$ $V_{state\ |plant}$ $N_{thing\ |person}$ 处于 $N_{situation}$ V_{action} 与 N $V_{action\ |relation}$ N_{person} 作为 N

2.2.2 The Formalization of the Structure "N in N"

Table 2
SERe and SERc of "N in N"

SERe	SERc
$N_{chang\ |skill\ |employment}$ in $N_{thing\ |job}$ $N_{action\ |attempt}$ in Nthing |Ving |Wh-clause $N_{factor\ |\ time\ |fault\ |physical\ feeling\ |skill\ |\ education\ term}$ in N_{thing} $N_{point\ of\ event\ |hole\ |problem\ |defference|similarity}$ in N_{thing} Ninvolve in N_{thing} P_{poss} $N_{belief\ |feeling\ in\ Nperson\ |thing}$	[在] $N_{thing\ |job}$ 方面的$N_{chang\ |skill\ |employment}$ 在 $N_{thing\ |V\ |Wh\text{-}clause}$方面的 $N_{action\ |attempt}$ N_{thing} [方面的] $N_{factor\ |\ time\ |fault\ |physical\ feeling\ |skill\ |\ education\ term}$ [在] N_{thing} 上|中的 $N_{point\ of\ event\ |hole\ |problem\ |defference|similarity}$ $V_{involve}$ [于]N_{thing} N_{person} 对 $N_{person\ |thing}$ 的 $N_{belief\ |feeling}$

2.2.3 The Formalization of the Structure "N be A in N"

Table 3
SERe and SERc of "N be A in N"

SERe	SERc
N_{person} be $A_{involved\ |interested\ |care\ in\ Nperson\ |thing}$ $N_{person\ |thing}$ be $A_{coverd\ |missing}$ in $N_{person\ |thing}$ N_{person} be $A_{attitude\ |speed\ |success\ |care}$ in N_{thing} |V_{ing} N_{person} be $A_{quality\ |skilled\ |obvious\ |important\ |similar\ |success\ |lucky\ |right}$ in N_{thing} N_{person} be P_{poss} $A_{working\ attitude}$ in $N_{thing\ |person}$ N_{person} be $A_{way\ of\ dressing}$ in $N_{clothes}$ N_{person} be $A_{feeling}$ in $N_{thing\ |person}$ N_{thing} be A_{useful} in N_{thing} N_{thing} be A_{exist} in N_{thing}	N_{person} $V_{involved\ |interested\ |care\ Nperson\ |thing}$ N_{person} $V_{involved\ |interested}$ $N_{person\ |thing}$ N_{person} $AD_{attitude\ |speed\ |success\ |care}$ V_{thing}|V N_{person} 在 N_{thing} 方面 $A_{quality\ |skilled\ |obvious\ |important\ |similar\ |success\ |lucky\ |right}$ N_{person} $AD_{working\ attitude}$ $N_{thing\ |person}$ N_{person} $V_{way\ of\ dressing}$ $N_{clothes}$ N_{person} 对 $N_{thing\ |person}$ [感到] $A_{feeling}$ N_{thing} 对 N_{thing} A_{useful} N_{thing} V_{exist} 于 N_{thing}

2.2.4 The Formalization of the Structure "N V in N"

Table 4
SERe and SERc of "N V in N"

SERe	SERc
$N_{person\ |thing\ Vinvolve\ |learn\ |believe\ |work\ |quantity\ |appear}$ in $N_{person\ |thing}$ N_{person} $V_{succeed}$ in $N_{thing\ |Ving}$ N_{person} V_{enjoy} in N_{thing} N_{thing} $V_{increase}$ in N_{thing} N_{thing} V_{begin} in N_{thing} $N_{person\ |thing}$ $V_{enter\ |exist}$ in N	$N_{person\ |thing\ Vinvolve\ |learn\ |believe\ |work\ |quantity\ |appear}$ $N_{person\ |thing}$ N_{person} $AD_{succeed}$ V_{thing} |V N_{person} 在 N_{thing} |V 方面 $V_{succeed}$ N_{person} 对于 N_{thing} V_{enjoy} N_{thing} 在 N_{thing} 方面 $V_{increase}$ N_{thing} 以 N_{thing} V_{begin} $N_{person\ |thing}$ $V_{enter\ |exist}$ 在|于 N

2.2.5 The Formalization of the Structure "N V N in N"

Table 5
SERe and SERc of "N V N in N"

SERe	SERc
N_{person} V_{divide} $N_{person\ |thing}$ in N	N. 把 Nperson |thing Vdivide 成 N
N_{person} V_{cover} $N_{person\ |thing}$ in N	N_{person} 把 $_{Nperson\ |thing}$ V_{cover} 在 N 中
N_{person} $V_{concentrate}$ $N_{pron\text{-}refl}$ in N	$N_{person\ concentrate}$ $N_{pron\text{-}refl}$ 于 N
$N_{person\ Vput\ |prepare\ food\ |trap\ |involve}$ $N_{person\ |thing}$ in N	N_{person} 把 N $_{person\ |thing}$ $V_{put\ |prepare\ food\ |trap\ |involve}$ 进|入 N
N_{person} $V_{do\ harm}$ N_{person} in N_{body}	N_{person} 把 N_{person} $V_{do\ harm}$ 进 N_{body}
N_{person} $V_{make\ hole}$ N_{hole} in N_{thing}	N_{person} 把 N_{hole} $V_{make\ hole}$ N
N_{person} V_{write} N_{thing} in N_{thing}	N_{person} 把 N_{thing} V_{write} 入 N_{thing}
N_{person} $V_{take\ part\ |teach}$ N_{person} in N_{thing}	N_{person} $V_{take\ part\ |teach}$ N_{person} V_{thing}
$N_{person\ |thing}$ V_{cause} $N_{emotion}$ in N_{person}	$N_{person\ |thing}$ V_{cause} N_{person} 的 $N_{emotion}$
N_{person} V_{find} $N_{emotion\ |quality}$ in N_{thing}	N_{person} 在 N_{thing} 中 V_{find} $N_{emotion\ |quality}$

2.2.6 The Formalization of "in" in some Sentence Structures

Table 6
SERe and SERc of "in" in Sentence Structures

SERe	SERc
What be A in N be N |that J $|W_{h\text{-}clause}$	在 N 中|下 A是 J $|W_{h\text{-}clause}$
There be something |nothing |anything $A_{quality}$ in N $|V_{ing}$	在 N |Ving 中[没]有[任何] $A_{quality}$ 的事情

CONCLUSION

This paper focuses on solving one of key problems of describing language phenomenon precisely in MT—the formalization of English structures with preposition "in" and their Chinese translations. A classification The English structures with preposition "in" are classified and formalized together with their Chinese translations based on the theory of SE and SER. The study in the paper will beneficial to the process of word disambiguation and selection in MT. More efforts should be made to put this method into practice and to improve the quality of lexical translation in machine translation.

REFERENCES

COBUILD English-Chinese Dictionary. (2002). Shanghai: Shanghai Translation Publishing House.

D. Z. Zhang (2002). *A Practical English Grammar.* Beijing: Foreign English Teaching and Research Press.

H. M. Yong (2007). *A Temporary Dictionary of English Prepositions*. Shanghai: Shanghai Translation Publishing House.

J. P. Cai (1999). A Cognitive Semantic Approach to Prepositions. *Foreign Languages and Their Teaching, 8.*

Q. S. Gao, et al. (1989). The Principle of Human-like Machine Translation. *Computer Research & Development 26*, 1-7.

Q. S. Gao, X. Y. Gao (2009). *Foundations of Unified Linguistics*. Beijing: Science Press.

Q. S. Gao, et al. (2003). Semantic Language and Multi-Language MT Approach Based on SL. *J. Comput. Sci & Technol, 18*, 848-852.

Sinclair J. Collins (2000). *COBUILD grammar patterns 1: verbs*. Shanghai: Shanghai Foreign Language Education Press.

Sinclair J. Collins (2002). *COBUILD grammar patterns 2: nouns and adjectives*. Shanghai: Shanghai Foreign Language Education Press.

T. J. Zhao (2001). *Theory of Machine Translation*. Harbin: Harbin Institute of Technology Press.

X. W. Guan (2009). *Study on Several Key Problems in the Machine Translation System Based on Semantic Language*. Dalian: Dalian University of Technology.

Z. W. Feng (2004). *Study on Machine Translation*. Beijing: China Translation and Publishing Corporation.