# The Text Deduction and Model Realization of the Lexical Meanings in Dictionaries Based on "Synset-Lexeme Anamorphosis" and "Basic Semantic Elements and Their Structures"

Guozheng Xiao<sup>1</sup> and Xinglong Wang<sup>1,2,3</sup>

<sup>1</sup> Center for Study of Language and Information, Wuhan University, Wuhan 430072 gzxiao@foxmail.com <sup>2</sup> College of Chinese Language and Literature, Ludong University, Yantai 264025

<sup>3</sup> Key Laboratory of Language Resource Development and Application of Shandong Province, Yantai 264025

wangxinglong100@163.com

**Abstract.** This paper discusses the definition deduction and model realization of word meanings in dictionaries from the combined perspectives of "Synset-Lexeme Anamorphosis" and "Basic Semantic Elements and their Structure". The paper attempts to prove the reliability of the semantic items in dictionaries and the implementation of the model used to deduce some semantic items in *Modern Chinese Dictionary* (MCD), including the deduction of semantic items of some compound-word and phrases. Then, some semantic items deriving from the two theories are illustrated.

**Keywords:** Synset-Lexeme Anamorphosis, basic semantic element (BSE), structure of the basic semantic elements (SBSE), definition model, semantic item, deduction.

# 1 Drawback in Traditional Lexicographical Theories and Methodologies

Lexicography serves as the important basis for word meaning and natural language processing (NPL), as well as the key object for studies in dictionary compilation and semantic theories. Ideal and accurate definition is expected to secure meaning computation and identification.

Noted Chinese dictionary defining models or approaches fall into three categories: 1) the six "dictionary defining models" devised by Fu[1], who depicts the word class of acts and behaviors with the definitions in *Modern Chinese Dictionary* (MCD) as the basis; 2) the meta language defining model with like field and manner designed by Li[2], inspired by theories in semantics, grammar and meta language; and 3) the three defining models for nouns established by Pan[3], i.e., the model with central elements at the front, the model with central elements in the beginning, and the model with central elements in the middle.

These models and approaches have their disadvantages. Firstly, the defining models are more theoretically-oriented than practically-feasible, rendering it hard for the realization of semantic items. Secondly, most of them lack comprehensive, scientific or systematic theories as their supporting cornerstone. Thirdly, the deduction of defining models is seldom workable, and the arrangement of semantic items is weak in logic. Lastly, they fail to make the best of existing dictionary defining frameworks and defining sources.

As a modified or improved move, this paper attempts to testify the feasibility of the defining models and the realization of the semantic items. A template is actually stipulated as to how to innovate and improve the models in modern lexicographic definition. The advantages of the defining model designed in this paper will be detailed elsewhere.

# 2 Theories of "Synset-Lexeme Anamorphosis" (SLA) and "Basic Semantic Elements and Structure of Basic Semantic Elements" (BSE/SBSE)

The SLA theory and BSE/SBSE theory are fabricated, after years of study on related semantic theories and techniques, by Xiao. The former is a theory in which words are aggregated on the basis of word senses. A lexeme consists of the sememe and grapheme of a word. The grapheme is the form in which a word is articulated and written. One sememe may correspond to several graphemes; in other words, these graphemes express the same sememe. Therefore, these graphemes stay together as a synonym group, which we term as "Synset." A Synset is thus a set of words which share the same sememe. [4] The basic semantic elements (BSE's) in the latter BSE/SBSE theory refer to the most fundamental and necessary conceptual ingredients that make up a word sense. Different BSE's of a word or Synset aggregate in certain structure or hierarchy, constituting the SBSE, or structure of BSE's, for the meaning of the word or Synset. BSE's are divided into core BSE's, generic BSE's, main BSE's and pragmatic BSE's. [5] If the core or basic word in a Synset is called the "essence word", then the SBSE of the core word is called "essence SBSE". Likewise, the other words in the Synset establish what is called "anamorphosis (or variant) SBSE's". The relations of such concepts are shown in Fig. 1.:

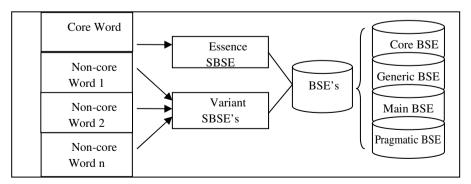


Fig. 1. Basic semantic elements and structure of basic semantic elements in a Synset

# 3 Systematic Deduction of Semantic Items in Modern Chinese Dictionary (MCD)

#### 3.1 Deduction of Semantic Items from the Perspective of BSE/SBSE

The various semantic items of a dictionary entry or word are usually closely related. If we attempt to deduce, with the guidelines given in the BSE/SBSE theory, the relationships between the items under the Chinese word 【用】 (*YONG*, Use), we are near to a new template that could be used to separate and establish the semantic items of other words entered in MCD. The above-mentioned "core word", however, will be modified as "core meaning", which usually occurs as the first semantic item under an entry. Hereinafter, the contents contained within [] are the BSE's of a sense,  $\land$ means conjunction ("and"),  $\lor$  means disjunction ("or"),  $\emptyset$  means the zero form or absence of such BSE's, j means the trace for meaning transfer, () and {} are for better hierarchy, and the arrow shows the route or approach of the deducing process. If "① 使用" is deemed as the essence SBSE, then items ②, ③ and ④ could be seen as the variant SBSE's of the first essence structure. They are deduced as follows:

#### 【用,YONG】

① 动(dong, v.) 使用(shiyong, to use): ~ 具(yongju, utensil, thing to use) | ~  $\hbar$ (yongli, be forceful, use force or strength) | ~ 兵(yongbing, resort to arms, use military forces) | 公 ~ (gongyong, common, for everyone to use) | 大材小 ~ (dacai xiao yong, waste one's talent on a petty job, use talented people for trivial tasks) | ~ 笔写字(yong bi xiezi, write in pen or pencil, use a pen or pencil to write).

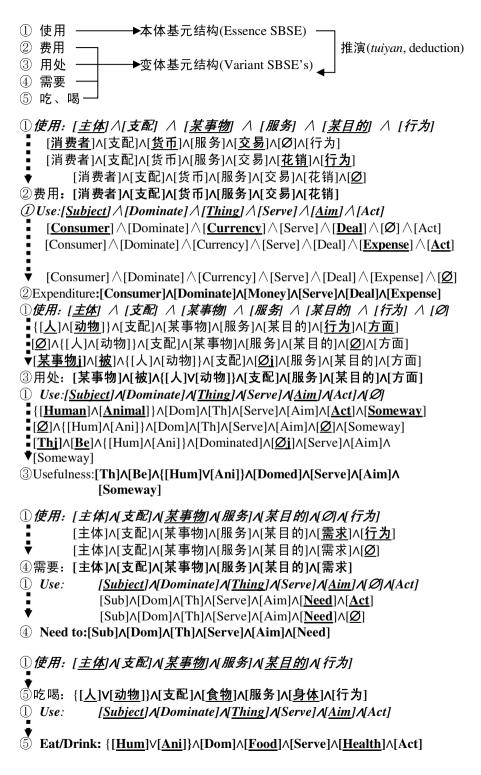
② 名(*ming*, n.) 费用(*feiyong*, fare or expenditure): ~  $\overline{\eta}(yongxiang, budget, possible expenditure) | 家 ~ ($ *jiangyong*, family expenses, home expenditure).

③ 名(ming, n.) 用处(yongchu, use, usefulness): 功~(gongyong, function, use) |多少总会有点~(duoshao zonghui youdian yong, be more or less useful, have usefulness anyway)。

④ 动(dong, v.) 需要(xuyao, need to) (多用于否定式(duo yongyu foudingshi, often in negation)): 天还很亮, 不~开灯(Tian hai mei liang, buyong kaideng, You don't need to turn on the light for it's still daytime) | 东西都准备好了, 您不~ 操心了(Dongxi dou zhunbei hao le, nin buyong caoxin le, You don't need to bother as everything is ready)。

⑤ 动(dong, v.) 吃、喝(chi/he, eat/drink) (含恭敬意(han gongjing yi, respectfully)): ~饭(yong fan, have or eat one's meal, help oneself to food) | 请~ 茶(Qing yong cha, Please have or drink tea)。

⑥ <书>连(<shu, lit.>) 因此; 因(yinci/yin, hence; therefore) (多用于书信(duo yongyu shuxin, often in letter)): ~特函达(yong te han da, hence this letter)。⑦名 (ming, n.) 姓(Xing, Surname)。



Observed from the perspective of BSE and SBSE, the structures of BSE for semantic items 2 to 4 almost remain constant with that for 1, except for the few variable elements in the structure of semantic item 1.

#### 3.2 Deduction of Semantic Items from the Perspective of BSE/SBSE

Under the entry of 【用】 (*YONG*, Use) in MCD are 30 double-syllable items (two Chinese characters united as one word/phrase), which constitute a Synset with the BSE's and SBSE of 【用】 as the basis. The senses of 【用】 form the essence SBSE, while those of other words/phrases establish the variant SBSE. We attempt to improve, driven by the fore-said two theories, present-day lexicographic models and items, an effort that is expected to make dictionary definitions more systematic, logical and reader-friendly.

The BSE's and SBSE of the entry  $[\Pi]$  (YONG, Use) are generalized, after examination of large quantities of language data and reference to dictionary definitions, as follows:

#### [主体]^[支配]^[某事物]^[服务]^[某目的]^[行为] [ZT]^[ZP]^[MSW]^[FW]^[MMD]^[XW]

(Abbreviations of their Chinese *pinyin* initials are equally effective.)

 $[Subject] \land [Dominate] \land [Thing] \land [Serve] \land [Aim] \land [Act] (Translated)$ 

Besides, the above SBSE can be regarded as the essence structure for the Synset of 【用】 (*YONG*, Use), rendering the SBSE for other words or senses attainable through similar deduction. Discussions as such are made from the aspects of core BSE's, generic BSE's, main BSE's and pragmatic BSE's. Only one example for each type is provided.

# 3.2.1 Core BSE's: [支配] ([ZP], [Dominate]) and [服务] ( [FW], [Serve])

It is evident from analysis that the various SBSE's for the items under the entry of [用] (YONG, Use) share the core BSE's of [支配](Dominate) and [服务](Serve). In other words, these two BSE's stand as the essential reasons for the aggregation of the Synset members. Core BSE deduction means the SBSE of some word meanings can only be attainable through substitution with other core BSE's, and on the basis of the essence SBSE. The deduction of this type of BSE's are inevitably related to other core BSE's like [ZP] (Subject) and [FW] (Serve).

# (1) Deduction of Core BSE [ZP] ([Dominate]):

【用】(YONG, Use)

#### [Subject]^[Dominate]^[Thing]^[Serve]^[Aim]^[Act]

(This line to be omitted hereinafter)

【用命】(YONGMING, Obey)

 $\label{eq:linear} $$ Inferior \A[Dominate] \Command] \A[Serve] \A[Superior] \A[Act] Deduction I \\Inferior] \A[Execute] \A[Command] \A[Serve] \A[Superior] \A[Act] Deduction II \\$ 

#### (2) Deduction of Core BSE [FW] ([Serve]):

【用刑】 (YONGXING, Punish)

 $[Punisher] \land [Dominate] \land [Instrument] \land [Serve] \land [Punishee] \land [Act] \\ Deduction I$ 

 $[Punisher] \land [Dominate] \land [Instrument] \land [Punish] \land [Punishee] \land [Act] \\ Deduction II$ 

#### 3.2.2 Generic BSE: [行为]([XW], [Behavior])

Most SBSE's for the items under the entry of 【用】 (YONG, Use) share the core BSE of [行为] ([Act]). In other words, [Act] stands as the essential reason for the aggregation of the Synset members.

#### (1) Main BSE→Generic BSE

The original generic BSE will disappear, under the effect of the interaction of other BSE's, and leave a vacancy for its absence. The original main BSE('s) will then be displaced and fill the vacancy, thus forming a new generic BSE.

## • Type [ZP] ([Dominate]):

【用户】(YONGHU, User)

 $[Human] \land [Dominate] \land [Thing] \land [Serve] \land [Aim] \land [Act] Deduction I$  $[Øj] \land [Dominate] \land [Thing] \land [Serve] \land [Aim] \land [Act] \land [Human] Deduction II$  $[Dominate] \land [Thing] \land [Serve] \land [Aim] \land [Human] Deduction III$ 

#### • Type [MSW] ([Thing]):

【用人】(YONGREN, Servant)

 $[\mathcal{O}] \land [Human] \land [Dominate] \land [Another] \land [Serve] \land [Aim] \land [Act]$ Deduction I

 $[Be] \land [Human] \land [Dominated] \land [\emptyset] \land [Serve] \land [Aim] \land [\emptyset] \land [Another j]$ Deduction II

# [Be]/[Human]/[Dominated]/[Serve]/[Aim]/[Another]

Deduction III

#### (2) Pragmatic BSE→Generic BSE

The original generic BSE will disappear, under the effect of the interaction of other BSE's, and leave a vacancy for its absence. A new pragmatic BSE may occur under the effect of the compound-word senses. It will then fill the vacancy, thus forming a new generic BSE.

【用场】(YONGTU, Usefulness)

 $[\emptyset] \land [Human] \land [Dominate] \land [Thing] \land [Serve] \land [Aim] \land [Act] \land [\emptyset] Deduction I$ [Thing]  $\land [Be] \land [Hum] \land [Dominated] \land [\emptyset] \land [Serve] \land [Aim] \land [\emptyset] \land [Someway]$ 

Deduction II

 $[Thing] \land [Be] \land [Hum] \land [Dominated] \land [Serve] \land [Aim] \land [Someway] Deduction III$ 

# 3.2.3 Main BSE's: [主体] ([ZT], [Subject]), [某事物] ([MSW], [Thing]), and [某目的] ([MMD], [Aim])

The SBSE's for the Synset members under the entry of 【用】 (YONG, Use) in MCD share the three BSE's of [Subject], [Thing] and [Aim]. A few entry members possess

only the three elements, while a larger part have the hyponymy variants from these three. It is because of the existence of the main BSE's that the Synset, with  $(\square, \square)$  (*YONG*) as the essence, has become varied and rich.

#### (1) BSE Variant 1: [ZT]([Subject]), [MSW] ([Thing]), and [MMD] (Aim)

The SBSE's of some word senses can usually be acquired by replacing [Subject], [Thing] or [Aim] with their hyponyms.

【用兵】(YONGBING, Use arms)

[将领]^[Dominate]^[士兵]^[Serve]^[战争]^[Act]

When the elements of [Subject], [Thing] and [Aim] are replaced with [将领] ([General]), [士兵] ([Soldiers]) and [战争] ([War]), respectively, the structure for 【用兵】 (YONGBING) is thus formed.

# (2) BSE Variant 2: [ZT] ([Subject]) and [MSW] ([Thing])

# Direct Replacement

Direct replacement of BSE's means that the structure of some senses can be directly developed by replacing [ZT] ([Subject]) and [MSW] ([Thing]), usually with their hyponyms.

【用人】(YONGREN, Employ)

[上级]^[Dominate]^[下级]^[Serve]^[Aim]^[Act]

When [ZT] ([Subject]) and [MSW] ([Thing]) are replaced with [上级] ([Superior]) and [下级] ([Inferior]), respectively, the structure for 【用人】 (YONGREN, Employ) is thus established.

## • Indirect Replacement

Indirect replacement of BSE's means that the structure of some senses cannot be directly developed. But rather, the structure shall be deduced for two or more than two steps, and be connected with the main element [MSW] ([Thing]).

【用事1】(YONGSHI 1, Be in (supreme) power)

[Human]∧[Dominate]∧[事务]∧[Serve]∧[Aim]∧[Act] Deduction I

# [Human]^[Dominate]^[权利]^[Serve]^[Aim]^[Act] Deduction II

The structure for 【用事1】(YONGSHI 1, Be in (supreme) power) can only establish itself when [*Thing*] is replaced with [事务] ([*Affair*]), which in turn is replaced with [权利] ([*Power*]).

# (3) BSE Variant 3: [ZT] ([Subject])

【用处】(YONGCHU, Use(s))

[Ø]^{[人]V[动物]}^[Dominate]^[Thing]^[Serve]^[Aim]^[Act]^[Ø] Deduction I [Be]^{[人]V[动物]}^[Dominate]^[Thing]^[Serve]^[Aim]^[Ø]^

# [Someway]

Deduction II

[Thing j]^[Be]^{[人]V[动物]}^[Dominated]^[Øj]^[Serve]^[Aim]^ [Someway] Deduction III

[Thing]∧[Be]∧{[人]∨[动物]}∧[Dominated]∧[Serve]∧[Aim]∧[Someway] Deduction IV The structure for 【用处】(YONGCHU, Use(s)) can only be developed by replacing [Subject] with its hyponyms {[人]V[动物]} ([Human] or [Animal]), and by deducing otherwise.

#### 3.2.4 Pragmatic BSE's: [X]

[X] refers to an open, uncertain pragmatic element. It is based on the essence structure for BSE's, and aimed at distinguishing the several variant structures. Therefore, the number of [X] is controllable.

Pragmatic elements are effective in two ways. On the one hand, they help to fine tune and clarify the particular features of some word senses, an effect the deduction with only core elements, generic elements and main elements is unable to achieve. On the other, they serve to tell apart some items that are very close in meaning and are only subtly different from each other.

## (1) Direct Addition

Direct addition of BSE refers to the practice in which the structures for some word meanings can be attained by replacement with main BSE's, and then by direct addition of some new pragmatic elements.

## • Core-BSE Oriented

In this type of element addition, a new pragmatic BSE is added on the basis of core element(s), or to modify the core element(s).

【用事2】(YONGSHI 2, Act on impulse)

[Human] / [草率] / [Dominate] / [Affair] / [Serve] / [Aim] / [Act]

The newly-added [草率] ([Impulsively]) is oriented to the core element [Dominate].

#### • Main-BSE Oriented

In this type of element addition, a new pragmatic BSE is added on the basis of main element(s), or to modify the main element(s).

【用劲】(YONGJIN, Exert one's strength)

{[Human]V[Animal]}^[Dominate]^[大量]^[力气]^[Serve]^[Aim]^[Act]

The newly-added [大量] ([Much]) is oriented to the main element [力气] ([Strength]).

#### • All-BSE's Oriented

In this type of element addition, a new pragmatic BSE is added on the basis of all the elements, or to modify the whole set of BSE's.

【用餐】 (YONGCAN, Have one's meal, Help oneself to food or drink)

 ${[Human] \vee [Animal]} \land [Dominate] \land [Food] \land [Serve] \land [Health] \land [Act] \land$ 

# [正式]

The newly added [正式] ([Formally]) is oriented to all the BSE's preceding it.

#### (2) Deducing Addition

Deducing addition of BSE refers to the practice in which the structures for some word meanings cannot be attained by further adding—after replacement of main element(s)—a new pragmatic element, but can be attained—after replacement—by other means like replacing, adding, deleting or even displacing some other elements.

## • Main-BSE Oriented

【用功2】(YONGGONG 2, Earnest, Dedicated)

[Human]^[Dominate]^[Ø]^{[时间]V[精力]}^[Serve]^[Aim]^[Act]^[Ø] Deduction I

[Human]^[Dominate]^[大量]^{[时间]V[精力]}^[Serve]^[Aim]^[Ø]^

[特点]

Deduction II

[Human]^[Dominate]^[ 大量]^{[ 时间]/[ 精力]}^[Serve]^[Aim]^[ 特点] Deduction III

The newly-added [大量] ([Much]) is oriented to the main elements {[时间]V[精力]} ([Time] or [Energy]). The added [特点] ([Quality]) in the end denotes this entry is an adjective (or adverb).

## • All-BSE's Oriented

【用费】(YONGFEI, Use money, Expend)

[消费者]^[Dominate]^[货币]^[Serve]^[交易]^[Act]^[花销]^[Ø] Deduction I [消费者]^[Dominate]^[货币]^[Serve]^[交易]^[Ø]^[花销]^[普通] Deduction II [消费者]^[Dominate]^[货币]^[Serve]^[交易]^[花销]^[普通]

Deduction III

The newly-added element [普通] ([Neutrally]) is oriented to all the basic elements including [消费者] ([Consumer]), [货币] ([Currency]), [交易] ([Deal]), and [花销] ([Expense]).

• Core-BSE Replaced

In this type of element replacement, the structure for some word meanings are attained by deleting the generic elements within the essence SBSE and then adding some other generic BSE('s).

【用法】(YONGFA, Usage)

[Human]^[Dominate]^[Thing]^[Serve]^[Aim]^[Act]^[Ø] Deduction I [Human]^[Dominate]^[Thing]^[Serve]^[Aim]^[Ø]^[方法] Deduction II [Human]^[Dominate]^[Thing]^[Serve]^[Aim]^[方法] Deduction III

After deleting the element [Act], the newly-added generic element [方法] (Means) constitutes, along with others, the structure for the entry 【用法】(YONGFA, Usage)

# 4 Transition from SBSE and Text Deduction to Defining Practice

So far, the structure of BSE has set up the defining framework for dictionary entries. As BSE's are the necessary conceptual ingredients for entries to be defined, these basic semantic elements shall be aggregated—in defining practice—in an effective manner with meta language. A few examples are given below<sup>1</sup>:

<sup>&</sup>lt;sup>1</sup> For better readability, some defining texts could be further improved.

【用】(YONG, Use) 主体支配某事物服务某目的的行为(Act of Subject Dominating a Thing to Serve an Aim)

【用典】(YONGDIAN, Use literary quotations) 人利用典故服务写作和言论的 行为(Act of Human Quoting a Sentence/Story to Serve Writing and Speech)

【用兵】(YONGBING, Use arms) 将领支配士兵服务战争的行为 (Act of General Dominating Arms to Serve War)

【用エ】(YONGGONG, Use labor force) 管理者支配工人服务厂企等的行为 (Act of Management Dominating Staff to Serve Production)

【用语】(YONGYU, Use language) 说话者支配言语服务交际的行为 (Act of Speaker Dominating Language to Serve Communication)

【用费】(YONGFEI, Use money, Expend) 消费者支配货币进行交易的花销, 较普通(Act of Consumer Dominating Currency to Serve Purchase)

Similar main BSE's shall be put together to better compare and distinguish different senses. Alphabetic order is not necessarily preferable in this manner.

# 5 Conclusion

Based on the theories of "SLA" and "BSE/SBSE", the essence SBSE of an entry's senses is depicted, the relations between and regularity of such senses generalized, and the original dictionary-borne semantic items deduced in a systematic manner. The variant SBSE's of all other semantic senses under the entry, except for the very first core sense, are subsequently described. In turn, a whole new template of semantic defining version is formulated.

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