

Compositional Operations of Mandarin Chinese Verb “da³”: A Generative Lexicon Approach

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Abstract

The compositional operations of Mandarin Chinese predicates are very complex. In a highly analytic language such as Mandarin Chinese, a verb can often choose from a wide range of nouns/nominal compounds as its arguments. This paper hopes to capture a different picture of such an operation through investigating authentic corpus data of Chinese verb “打” (da³, *to hit*). In this study, we’d like to show that the qualia structure and type system proposed by Pustejovsky’s (1995) the *Generative Lexicon* can affect the interpretation of verb-argument composition of “da³”, and to examine whether the compositional operations of “da³” varies under different senses with its own type selection preference. Our results show that, given that Wang and Huang (2010)’s similar investigation on the perceptual verb “看” (look at) indicates diverse mechanisms, the compositional operation patterns of “da³” are much like those proposed by Pustejovsky’s (2008). In view of this, we also provide some limitation and future direction of this study in the last section.

Keywords: verb-argument composition, accommodation, introduction, selection

1. Introduction

The compositionality of a verb and its arguments differs from one to another. Traditionally, although distributional analysis can provide us a glimpse of how a lexical word patterns across different surface structures of propositions, it is more intriguing to explore how a verb selects its arguments based on deeper decomposition of the lexical item, namely, the verb and argument itself. One of the ways to analyze the verb-argument composition is to consider that by word sense enumeration, a verb can potentially have several polysemous senses contributing to multiple meanings in the lexicon. Take *want* in the following sentences for example.

- (1) a. Mary wants another cigarette.
- b. Bill wants a beer.

c. Mary wants a job.

To capture each use of *want*, we can explicitly refer to the manner of the wanting relation in different contexts and have the following correspondent word sense enumeration, rendering the word *want* a selectional polysemy [3].

- (2) a. want₁: to want to smoke;
 b. want₂: to want to drink;
 c. want₃: to want to have

However, enumeration is unable to exhaustively list all the senses that verbs assume in new contexts [1]; that is, it cannot characterize all the possible meanings of the lexical item in the lexicon. Instead of adopting this approach, Pustejovsky [3] proposes that the way how verbs are combined with arguments can fit into more finely grounded compositional operations, extended from the type theory and qualia structures he developed in *Generative Lexicon* [2][3], as shown in Table 1.

Table 1: Verb-Argument Composition

Argument is	Verb selects		
	Natural	Artifactual	Complex
Natural	Selection/Accommodation	Qualia Introduction	Dot Introduction
Artifactual	Accommodation	Selection/Accommodation	Dot Introduction
Complex	Dot Introduction	Dot Introduction	Selection/ Accommodation

In view of this, we aim to capture a full description of the composition between Mandarin Chinese verb “da³” (hit) indicating hand motions and its arguments collected from authentic corpus data, including Academia Sinica Balanced Corpus of Modern Chinese¹ and Plurk data as a complement in this paper. Since there are over one-hundred different senses of the word “da³” listed in Chinese Wordnet², we will re-categorize the senses of “da³” by referring to Huang’s definition [5] in the following sections in order to process the later analysis of the compositional operations, and provides the characteristics of such operations under the frame of Generative Lexicon (GL). We further predict that, due to the complexity of the senses of “da³”, the verb-argument composition will yield different results from those suggested by Pustejovsky [3] in Table 1.

¹ <http://db1x.sinica.edu.tw/kiwi/mkiwi/>

² <http://cwn.ling.sinica.edu.tw/>

2. Theoretical Framework

In the GL model, Pustejovsky [1] proposes that a lexical item is given an explicit type for a word positioned within a type system for the language, where qualia can be unified to create more complex concepts out of simple ones. The lexical typing structure and the qualia structure (modes of explanation, composed of FORMAL, CONSTITUTIVE, TELIC, and AGENTIVE roles) mentioned above, together with the event (defining the event type of a lexical item or a phrase) and argument (specifying the number and type of the arguments to a predicate) structure, comprise a richer and deeper decomposition of a lexical item. According to Pustejovsky [2], he divides the type structure into the following three levels:

- (1) Natural Types: Concepts of natural kind made up of reference only to Formal and Constitutive qualia roles such as *dog*, *man*, and *bird*;
- (2) Artifactual Types: Concepts consisting of reference to Telic (purpose or function), or Agentive (origin) qualia roles such as *pet*, *doctor*, and *plane*;
- (3) Complex Types: Concepts making reference to an inherent relation between types from the other levels such as *book*, *picture*, or *sign*.

In addition, there are three mechanisms at work in the selection of an argument by a predicative expression [3]. These are, as pointed out by Pustejovsky [2]:

- (1) Pure Selection (Type Matching): the type a function requires is directly satisfied by the argument;
- (2) Accommodation: the type a function requires is inherited by the argument;
- (3) Type Coercion: the type a function requires is imposed on the argument type. This is accomplished by either:
 - a. Exploitation: taking a part of the argument's type to satisfy the function;
 - b. Introduction: wrapping the argument with the type required by the function.

Under the three mechanisms, Pustejovsky argues that the ability to assign more than one interpretation to a lexical or phrasal expression is a result of type coercion and this is when polysemy arises in grammar.

3. Basic semantic analysis of “da³”

In Huang's thesis [5], nominal arguments of the verb “da³” are thoroughly analyzed under GL framework. There are eight semantic components in “da³” as follows: *to make contact with*, *to make use of*, *to cause a displacement*, *to change the internal state of*, *to move outward*, *learnability*, *by media*, and *with company*. Based on the existence of these semantic components, nine basic senses of the verb “da³” can be distinguished and derived as shown in Table 2. These are:

- (1) to make contact with sth.
- (2) to get sth.
- (3) to make sth.
- (4) to deal with sth.
- (5) to have skills of sth.
- (6) to make use of sth.
- (7) to exclude/depart from sth.
- (8) to participate in sth.
- (9) to trigger physical/mental activities

Furthermore, these nine senses can derive richer meanings in the lexicon by the mechanism of metonymy and metaphors. Through co-composition, which describes a structure allowing, superficially, more than one function application, “da³” can create new senses with a variety of different nominal arguments to form a verbal polysemy.

On the other hand, Chinese Wordnet also lists 121 senses of “da³” in total. Since it does not group together those senses with basically similar semantic components, in this paper we adopt the nine categories of senses in “da³” proposed by Huang [5] to avoid word sense enumeration analysis and demonstrate a more general pattern of its argument combination.

Table 2: The Semantic Components and Senses of “da³”

Senses	Semantic Components
(1) to make contact with sth.	[+to make contact with] [-to make use of] [-to cause a displacement]
(2) to get sth.	[+to make contact with] [-to make use of] [+to cause a displacement] [-to move outward]
(3) to make sth.	[-to make contact with] [+by media]
(4) to deal with sth.	[+to make contact with] [-to make use of] [+to change the internal state of]
(5) to have skills of sth.	[+to make contact with] [+to make use of] [+learnability]
(6) to make use of sth.	[+to make contact with] [+to make use of] [-learnability]
(7) to exclude/depart from sth.	[+to make contact with] [-to make use of] [+to cause a displacement] [+to move outward]
(8) to participate in sth.	[-to make contact with] [-by media] [+with company]
(9) to trigger physical or mental activities	[-to make contact with] [-by media] [-with company]

4. Analysis and Discussion

In this section, we take a closer look at how the Mandarin Chinese verb “da³” combines with

its nominal arguments under the three compositional operations.

4.1 “da³”: to make contact with sth.

The most basic sense of “da³” is *to make contact*, which is a broader sense of the common interpretation of this verb, *to hit*. Under this sense, it can combine with any physical objects as its arguments. The compositional operations of different types of arguments thus are provided as follows.

4.1.1 “da³”+Natural Types

(1) Selection/Accommodation

Many natural type arguments can be combined with “da³”. For example, they can be human, animals, or body parts such as “人” (people), “小孩” (children), “耳光” (ears), “穴” (acupuncture points), or “蚊子” (mosquitoes). Furthermore, they can be accommodation as shown in the following example. In this case, the subject may hit the child on his/her partial body, namely, the face, not the whole part of the child. All these arguments are similar in that they are physical objects (phys).

- (3) 他 打 了 小孩 一 個 耳光。
He hit ASP child one CL ear
“He hit the child on the face.”

4.1.2 “da³”+Artifactual Types

(1) Accommodation

As argued in Pustejovsky [1], an artifactual type can be further decomposed into a head type and a tail type. The head type (the FORMAL quale role) need not be an atomic type (natural), but can be arbitrarily complex itself. If the head alone is exploited, the operation is type accommodation [3]. For instance, in Mandarin Chinese, “da³” can take “鼓” (drums), “桌球” (table tennis), “靶” (targets), or “鐘” (alarms) as arguments and the head *physical object* is exploited. In a more extended sense, “da³” can also take “前鋒” (forward) as its artifactual type arguments to indicate a player need to *reach* a specified location to play in a basketball game.

4.2 “da³”: to get sth.

4.2.1 “da³”+Natural Types

(1) Selection

Under this category, “da³” can be combined with natural resources or creatures like “水”

(water), “柴” (firewood) and “魚” (fish) to express *to get/retrieve*. All the arguments are physical objects.

(2) Qualia Introduction

On the other hand, there are some more abstract resources accessible to us like “天下” (world) or “江山” (river and mountain). Since they are originally features of places, by introducing the FORMAL value “something that can be owned” to these words, we can say “打江山” (to get and own the country) as if the argument itself is concrete.

geographical features \otimes_{formal} something that can be owned: “江山” (river and mountain)

4.2.2 “da³”+Artifactual Types

(1) Accommodation

Instances in this category are the arguments including “飯菜” (rice and vegetable), “香腸” (sausage), or even “回票” (return tickets). Likewise, the head *physical object* is exploited so that they can be combined under the accommodation operation.

4.3 “da³”: to make sth.

4.3.1 “da³”+Artifactual Types

(1) Accommodation

The third sense of “da³” is to make or produce something which is represented in the arguments such as “地鋪” (sleeping places with bedding on the floor), “毛衣” (sweaters), “井” (wells), “結” (knots), “洞/孔” (holes), “全壘打” (homerun), “空包彈” (blank cartridges), “項鍊” (necklace), and “根基” (foundation). Again, the head *physical object* is exploited so that they can be combined with “da³”.

(2) Artifactual Exploitation

There are some arguments denoting marks, rates, symbols, or numbers. Often when they are combined with “da³”, the intended meaning is to provide the information of thoughts, opinions, or evaluations towards things. For example, “字” (words), “成績” (scores), “鈎” (checks), “問號” (question marks), and “知名度” (prestige/popularity) can serve as artifactual type arguments. In these cases, the tail type is either an agentive or telic role as demonstrated and according to Pustejovsky and Jezek (2008), if the tail of an artifactual type is exploited, then it is artifactual exploitation.

number, rate \otimes_{telic} show information: “成績” (scores), “知名度” (prestige/popularity)
mark \otimes_{telic} show information: “鈎” (checks), “問號” (question marks)

symbol ⊗_{telic} show information: “字” (words)

4.3.2 “da³”+Complex Types: Dot Exploitation

Complex type arguments can have more than one meaning facets. A common example is *book* with the complex type (phys•info). It can both refer to the physical book or the information provided in the book. When they are combined with verbs, either one or two meaning facets can be exploited.

(1) Only one meaning facet can be exploited.

Some examples in this case (phys•info) are: “報告” (reports), “電報” (telegrams), and “草稿” (drafts). When they are combined “da³”, only the information aspect can be exploited.

(2) Both meaning facets can be exploited.

Some examples in this case (event•info) are: “手語” (sign languages), “手勢” (gestures), and “暗號” (secret signals). When these words are the arguments of “da³”, each of the two facets of meaning is likely to be exploited.

4.4 “da³”: to deal with sth.

“da³” with this sense can be combined with artifactual type arguments like “折扣” (discount), and natural type ones such as “蛋” (egg), “火” (fire) and “奶泡” (milk foam). In the former condition, an accommodation operation happens while in the latter, selection occurs, both leading to the meaning of dealing with something and rendering a resultative status.

4.5 “da³”: to have skills of sth.

“da³” can also be combined with various artifactual type arguments which indicate to carry out something such as “領帶” (tie), “牌” (cards), “麻將” (mahjong), “電動玩具” (video games), “電腦” (computers), “針” (needles), “蠟” (wax), “算盤” (abaci), “彈珠” (marbles), “禪” (meditation), and “陀螺” (top). In these cases, subjects must have the skills or ability of manipulating the following physical objects; otherwise, they need to learn to understand how to deal with them. All the arguments go through an accommodation operation.

4.6 “da³”: to make use of sth.

4.6.1 “da³”+Natural Types

(1) Selection

There are few instances in this category concerning the natural type arguments to be combined with “da³”: “石膏” (casts), and “光” (light). Under this operation, the words

denoting a physical material which is utilized can be selected as the verb's arguments.

4.6.2 “da³”+Artifactual Types

(1) Accommodation

A variety of artifactual type arguments can be combined with the verb “da³” such as “籃球” (basketball), “燈籠” (lantern), “傘” (umbrella), “電話” (telephone), “粉底” (foundation), “方向盤” (steering wheel), “口號” (slogans), “比方” (analogy), “官腔” (bureaucratic tone), “快攻” (fast break), “馬賽克” (mosaic) and “啞謎” (riddle). In these cases, either the head *physical object/appliance* or *abstract object* can be exploited so that the accommodation operation still works.

(2) Artifactual Exploitation

Under this category, “卡” (card) is found to be combined with “da³” to indicate the retrieval of temporal or spatial information of a specific moment by machines. The tail of this artifactual type exploited here is:

physical object ⊗_{telic} record information: “卡” (card)

4.6.3 “da³”+Complex Types: Dot Exploitation

(1) Only one meaning facet can be exploited.

The example arguments involving the dot exploitation are “擂台” (arena for contests) (phys•loc), “廣告” (advertisement) (event•info), and “半/全場” (half-/full- court)³ (phys•loc) with the complex type specified in the second parenthesis and the only exploited facet underlined

4.7 “da³”: to participate in sth.

Instances in this category are all artifactual arguments including “零工” (odd jobs), “仗” (war), “招呼” (greeting), “照面” (seeing each other), “官司” (lawsuits), “總決賽” (final) and “交道” (principles of interpersonal contact). In these cases, the head *event* is exploited so that they can be combined with “da³” under the accommodation operation.

4.8 “da³”: to trigger physical or mental activities

4.8.1 “da³”+Natural Types

“拳” (fist), “光腳” (bare foot), “赤膊” (shirtless), and “雷” (thunder) are several examples

³ It refers to playing a basketball game according to the area/court size defined by the arguments.

of natural type arguments which can be combined with “da³”. The selection operation occurs to make these physical objects or activities carried out with one’s own will.

4.8.2 “da³”+Artifactual Types

Other examples under this category are “寒顫” (cold shiver), “盹” (nap), “哈欠” (yawn), “瞌睡” (doze), “噴嚏” (sneeze), “鼾” (snore), “主意” (plan) or “拍子” (tempo). By accommodation operation, the head *event* is exploited. Besides, there are two extended usage of “da³” in this category, “先鋒” (vanguard) and “頭陣” (first array), which indicate one becomes/belongs to a certain role. In this case, the head *human* is exploited under the accommodation operation.

4.9 “da³”: to exclude/depart from sth.

A typical instance of “da³” combined with natural type arguments to indicate removing of specific substances or objects is “胎” (fetus). By selection, all physical objects including animate beings can serve as the argument of “da³”.

A summary of the above analysis can be shown in the following table:

Table 3: Mechanisms of compositional operations of “da³”

Sense	Natural Types	Artifactual Types	Complex Types
make contact with	selection/accommodation	accommodation	-
get	selection/ qualia introduction	accommodation	-
make	-	accommodation/ artifactual exploitation	dot exploitation
deal with	selection	accommodation	-
have...skills	-	accommodation	-
make use of	selection	accommodation/ Artifactual Exploitation	dot exploitation
participate in	-	accommodation	-
trigger physical/mental activities	selection	accommodation	-
exclude	selection	-	-

As indicated in Table 3, we find that the sense “to make use of something” is rather active among all the senses concerning “da³”. It can go through three different kinds of

composition with all three types of arguments, which signals the highest compositional ability. Other senses owning a high compositional ability include “to make contact with”, “to get something”, and “to make something”; however, they have fewer argument type choices compared with the sense “to make use of something”. On the other hand, how the Mandarin Chinese verb “da³” selects its argument types is also demonstrated in Table 3. For example, a verb has to choose a typical type, either natural types, artifactual types or complex types as indicated in Table 1. Yet, in Table 3, only the senses “to have...skills”, “to participate in” and “to to exclude/depart from” have this trait. Except for that, it is surprising that the overall patterns of the compositional operations show the correspondence with what Pustejovsky [3] proposes in Table 1 with regard to the abundant senses of the word. But it perhaps is due to our lack of focus on the usage of fixed phrases, idioms, and a variety of other metonymic or metaphorical expressions of “da³” springing up recently in online resources such as “打屁” (chat leisurely), “打牙祭” (enjoy a feast) or “打高空” (unrealistic attitudes or speeches). Though the result of this preliminary study differs from what Pustejovsky and Jezek [3] pointed out after investigating *listen* that “how difficult it is to map each context into the appropriate slot” in Table 1, which is further evidenced by Wang and Huang [4] with the verb “kàn” (look at), it can still provide an elaborative description of the compositional operations exerted on verbs other than perceptual ones and clarify the characteristics of argument selection patterns between different verb types in Mandarin Chinese.

Reference

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