Compositionality of NN Compounds: A Case Study on 
[N₁+Artifactual-Type Event Nouns]

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Abstract
Generative Lexicon theory (GL) establishes three mechanisms at work when a predicate selects an argument, i.e. pure selection, accommodation and type coercion. They are widely used in verbal selection of nouns in the entity domain. However, little attention has been devoted to the compositionality of [N₁+event noun] type NN compounds. This paper extends the usage of these mechanisms in two ways: 1) the eventive nominal head selection of a nominal modifier, and 2) their use in the eventive domain, through the case study on [N₁+比賽bisài ‘competition’]. Moreover, it reveals a new compositional mechanism subcomposition. It also discovers the domain contribution in type coercion. This work enriches the study on compositionality and GL.

1 Introduction
Event nouns in Mandarin Chinese have generated extensive interest (Han 2007, 2011; Liu 2004; Ma 1995; Wang & Huang 2011a, 2011b, 2012a, 2012c, 2012d). However, little research has concerned about the compositional mechanisms at work in [N₁+event noun] type [N₁[N₂]₃] compounds.

Generative Lexicon theory (GL) provides a rich compositional representation through generative devices (Pustejovsky 1993, 2001, 2006, 2011; Pustejovsky & Jezek 2008). Under a tripartite system of the domain of individuals, including natural types, artifactual types and complex types (Pustejovsky 2001, 2006; Pustejovsky & Jezek 2008), GL establishes three mechanisms at work when a predicate selects an argument.

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:
   (i) Exploitation: taking a part of the argument’s type to satisfy the function;
   (ii) Introduction: wrapping the argument with the type required by the function.

Following Pustejovsky (2001, 2006) and Pustejovsky & Jezek (2008), Wang & Huang (2012e) establish a type system for event nouns, including natural types, artifactual types, natural complex types and artifactual complex types. The current paper only focuses on artifactual-type event nouns and explores the compositional mechanisms of nominal modification to these nouns in NN compounds. Furthermore, the domain information contribution to the reading of a NN compound is surveyed.

2 Data Collection
The data of this study are mostly extracted from Chinese Gigaword (second edition)¹ and Sinica Corpus² accessed through Chinese Word Sketch Engine³, with a few examples collected online through the search engines Google and Baidu.

1 http://www.ldc.upenn.edu/Catalog/catalogEntry.jsp?catalogId=LDC2009T14
2 http://db1x.sinica.edu.tw/kiwi/mkiwi/
3 http://158.132.124.36/, http://wordsketch.ling.sinica.edu.tw/
3 Compositional Mechanisms of \([N_1 + \text{Artifactual-Type Event Nouns}]\)

The internal structure of NN compounds has been widely investigated (Jackendoff 1975; Laurie Bauer 2008; Packard 2004; Warren 1978). In recent years, some research uses GL to analyze the relation between N1 and N2 (Johnston & Busa 1996; Lee et al. 2010; Qi 2012). The research using the GL gives a compositional treatment to capture the N1 and N2 relations, but it only concerns the situation when N1 is a qualia role of N2. It does not explain cases when N2 is a qualia role of N1. Moreover, it does not give a generalization for the qualia modification relation.

The following section analyses the compositional mechanisms of NN compounds. To make the discussion more concentrate, Section 3.2 and 3.3 use \( [N_1 + \text{比賽} \, \text{‘competition’}] \) as a case study. To introduce a new way of compositionality, sub-composition, Section 3.4 uses a wider range of data.

3.1 Interpreting \( \text{比賽} \, \text{‘competition’} \)

A \( \text{比賽} \, \text{‘competition’} \) is an activity in which one try to win against the opponents. Its semantic type system is depicted below.

\[
\begin{align*}
\text{比賽} \, \text{‘competition’} & = \{ \text{D-ARG1} = x: \text{individual} \}, \text{D-ARG2} = y: \text{individual}, \text{D-ARG3} = z: \text{organizer}, \text{D-ARG4} = r: \text{rule} \} \\
\text{EVENTSTR} & = \{ E_1 = e_1: \text{process} \} \\
\text{QUALIA} & = \{ \text{FORMAL} = a: \text{activity} \} \\
\text{CONSTITUTIVE} & = \{ x, y, z, r, c \} \\
\text{TELIC} & = \{ e_1 \text{ satisfies } r \rightarrow (x \vee y) \text{ win} \} \\
\text{AGENTIVE} & = \{ \text{organize} (z, a) \}
\end{align*}
\]

A competition usually sets rules so that the participant who has the best performance will be the winner. Therefore, the purpose of \( \text{比賽} \, \text{‘competition’} \), which is the telic role, is to win with some rules satisfied during the competing process \( e_1 \).

A competition could be either on the process of an event that participants involved in or the resultative product made during an event. In an \( [N_1 + \text{比賽} \, \text{‘competition’}] \) compound, \( N_1 \) specifies the subject of the competition. That is, it signifies the process on which people are judged or the product that people create in a competition. Wang & Huang (2012b) classify nouns into pure event nouns, nominals (event nominals and result nominals) and entity nouns. Following this classification, the following will examine which kinds of nouns fit the \( N_1 \).

If the competition is about the process, then the competition is based on the behavior of participants during the event. Three kinds of \( N_1 \) fit this case: 1) pure event nouns: 體操 \( \text{tīcāo} \ ‘\text{gymnastics}’, \) 馬術 \( \text{mǎshù} \ ‘\text{horsemanship}’, \) 雜技 \( \text{zájì} \ ‘\text{acrobatics}’, \) 圍操 \( \text{quāncāo} \ ‘\text{hoop gymnastics}’; \) 2) event nominals: 持重 \( \text{jīzhòng} \ ‘\text{weightlifting}’, \) 賽艇 \( \text{sàitǐng} \ ‘\text{boat racing}’, \) 攀巖 \( \text{pānyán} \ ‘\text{rock climbing}’; \) 3) entities: 龍舟 \( \text{lónghuó} \ ‘\text{dragon boat}’, \) 帆船 \( \text{fānchuán} \ ‘\text{yacht}’\).

If the competition is about the final product, then the rule to decide the winners will be based on the quality of the product. Two kinds of \( N_1 \) fit such as a case: 1) event nominals: 攝影 \( \text{shèyǐng} \ ‘\text{photography}’; \) 2) entities: 書畫 \( \text{shūhuà} \ ‘\text{painting} \) and calligraphy’, 航模 \( \text{hángmó} \ ‘\text{model airplane}’.

Summarizing, this section has illustrated the semantic type system of \( \text{比賽} \, \text{‘competition’} \).

A competition can be either on the process or result. If the competition is about the process, \( N_1 \) can be a pure event noun, an event nominal or an entity. If the competition is about the result, \( N_1 \) can be an event nominal or an entity (coerced to be an event). To achieve the goal of a competition (the telic role), usually to win, one should satisfy some rules.

\[\text{龍舟} \, \text{‘dragon boat’} \] and \[\text{帆船} \, \text{‘yacht’} \] can be treated either as an entity or activity in themselves. Here we treat them as an entity which is coerced to be an event through qualia exploitation. This is discussed in Section 3.3 in more details.
3.2 Pure Selection

When N₁ is an event nominal, the head 比賽 bǐsài ‘competition’ selects N₁ through pure selection. Because the verbal morpheme in the nominal N₁ already specifies what event it is. Examples are shown in Table 1 and Table 2.

| Words | Pinyin     | English    | Frequency | Saliency |
|-------|------------|------------|-----------|----------|
| 摄影 | shèyīng    | photography | 1074      | 51.01    |
| 舍重 | jūzhòng   | weightlifting | 957       | 48.31    |
| 赛艇 | sài tǐng  | boat racing | 314       | 47.85    |
| 攀岩 | pānyán    | rock climbing | 80        | 31.35    |
| 调酒 | tiáojiǔ   | wine mixing | 13        | 20.26    |

Table 1: VO Type Event Nominals in Gigaword

For instance, in Table 1, within the N₁ 摄影 shèyīng ‘photography’, the verbal morpheme 摄 shè ‘take a photograph of’ is embedded in the photographing action.

| Words | Pinyin     | English    | Frequency | Saliency |
|-------|------------|------------|-----------|----------|
| 邱打 | shūdǎ     | doubles    | 1775      | 62.01    |
| 單打 | dāndǎ    | singles    | 1799      | 59.5     |

Table 2: Adj-V Type Event Nominals in Gigaword

Similarly, in Table 2, the verbal morpheme 打 dǎ ‘play’ in both 邱打 shūdǎ ‘doubles’ and 單打 dāndǎ ‘singles’ already specify the playing event.

3.3 Type Coercion through Qualia Exploitation of N₁

3.3.1 N₁ as an Entity

If N₁ is an entity, there will be two possibilities: 1) the competition is dependent on the process of a potential event that is related to the entity; 2) the competition is dependent on the final product N₁, where a potential event is also involved which is an agentive role of the entity. In both cases, we would like to say that there is type coercion from the entity to their potential events.

3.3.1.1 Type Coercion with Ordered Events (Type Coercion with Event Combination)

Pustejovsky (2000) finds that the qualia provide three relations: <, o and >. According to temporal properties, the partial orderings of qualia roles are: Agentive < Formal, Constitutive o Formal, and Formal < Telic. In [N₁+比賽 bǐsài ‘competition’], N₁ can involve in more than one event. Type coercion of N₁ includes the combination of ordered events from different qualia roles. When N₁ is an entity, it sometimes requires the pre-existence of a creation event, which comes from the agentive role of N₁. The entity is produced through the creation event. 比賽 bǐsài ‘competition’ is to compare the quality of different products. The product quality can be decided according to either the formal or telic role.

In an art competition, what is being compared is the design, shape, color, etc., which are the formal role of the objects. These forms exist after the creation of the objects, which is the agentive role. Table 3 shows some examples.

| Words     | Pinyin  | English    | Frequency | Saliency | Qualia Roles |
|-----------|---------|------------|-----------|----------|--------------|
| 冰雕 | bīngdiāo | ice sculpture | 73        | 35.3     | agentive (做 zuò ‘make’) + formal |
| 沙雕 | shādiāo | sand sculpture | 33        | 27.9     | agentive (做 zuò ‘make’) + formal |
| 花灯 | huādēng | lanterns | 59        | 26.5     | agentive (做 zuò ‘make’) + formal |
| 写生 | xiěshēng | painting and calligraphy | 79 | 19.9 | agentive (制作 chuàng zuò ‘create’) + formal |

Table 3: Examples of Type Coercion with Ordered Events in Gigaword: Agentive > Formal

For instance, in Table 3, 冰雕比赛 bīngdiāo bǐsài ‘ice sculpture competition’ involves an event of making ice sculpture (the agentive role), and then the quality of 冰雕 bīngdiāo ‘ice sculpture’ (the formal role) is compared to determine the winner.

In a competition of an application field, what is being compared is the function of the objects, which is the telic role. The function exists after the creation of the objects. Examples are as shown in Table 4.

| Words     | Pinyin  | English    | Frequency | Saliency | Qualia Roles |
|-----------|---------|------------|-----------|----------|--------------|
| 航模 | hàng mó | model airplane | 33        | 28.38    | agentive (做 zuò ‘make’) + telic |

Table 4: Examples of Type Coercion with Ordered Events in Gigaword: Agentive > Telic
For example, in Table 4, 航模比賽 hangmó bìsài ‘model airplane competition’ first requires the creation of a model airplane (the agentive role), and then the function of different models (the telic role) is compared.

3.3.1.2 Type Coercion with one Individual Event

In 水餃比賽 shuǐjiāo bìsài ‘dumpling competition’, 水餃 shuǐjiāo ‘dumpling’ can be coerced to three events, eating, making, or tasting through the telic role, agentive role, and formal role respectively, as illustrated below.

水餃 shuǐjiāo ‘dumpling’
EVENTSTR = \[E_1 = e_1: \text{process} \newline E_2 = e_2: \text{process} \newline D-E_3 = e_3: \text{state}\]
ARGSTR = \[\text{ARG1} = x: \text{human} \newline \text{ARG2} = y: \text{dumplings}\]
QUALIA = \[\text{TELIC} = \text{eat}(e_2, x, y) \newline \text{AGENTIVE} = \text{make}(e_1, x, y) \newline \text{FORMAL} = \text{taste}(e_3, y)\]

水餃比賽 shuǐjiāo bìsài ‘dumpling competition’ has three readings through type coercion of dumplings’ different qualia roles: 1) through the telic role: x wins if x eats most dumplings; 2) through the agentive role: x wins if x makes most dumplings; 3) through the formal role: x wins if x’s dumplings tastes best. These readings indicate that the context for 水餃比賽 shuǐjiāo bìsài ‘dumpling competition’ is that if you meet some rules, then you win. This can be depicted below:

Telic role for 水餃比賽 shuǐjiāo bìsài ‘dumpling competition’: R → [φ] win
R: rules

For 水餃比賽 shuǐjiāo bìsài ‘dumpling competition’, [φ] is competing by eating or making or tasting. That is, 水餃 shuǐjiāo ‘dumpling’ can be coerced to any of the three events. Reading 1) and 2) have only one event involved respectively, while reading 3) comprises of an agentive event and the following formal role related event.

3.3.2 N₁ as a Pure Event Noun

Similar to N₁ as an entity in Section 3.3.1, when N₁ is a pure event noun, coercion is still at work. That is because just like an entity, an artifactual event comes into being (the agentive role) for some purpose (the telic role). Different from the diversity of N₁-as-an-entity coercion (including ordered events or an individual event), in [N₁+比賽 bìsài ‘competition’], N₁-as-a-pure event noun coercion normally only has one coerced event through the agentive role.

For example, in 體操比賽 tǐcāo bìsài ‘gymnastics competition’, the coerced event ‘perform gymnastics’ is through exploiting the agentive role of 體操 tǐcāo ‘gymnastics’. During a gymnastics competition, the existence of the gymnastics is the same as the process of the performance. Other examples of such N₁ include 馬術 mǎshù ‘horsemanship’, 雜技 zájì ‘acrobatics’, and 錦標 quǎncāo ‘hoop gymnastics’.

Summarizing, pure selection and type coercion have been used in verbal selection of nouns in the entity domain (Pustejovsky 1993, 2001, 2006, 2011; Pustejovsky & Jezek 2008). Section 3.2 and 3.3 have extended their usage in two ways: 1) nominal head selection of a nominal modifier, and 2) their use in the eventive domain, though a case study on [N₁+比賽 bìsài ‘competition’]. The results are shown in Table 5.

| [N₁+比賽 bìsài ‘competition’] | 比賽 bìsài ‘competition’: Process or Result | Compositional Mechanism: Pure Selection or Type Coercion |
|-------------------------------|------------------------------------------|-----------------------------------------------------------|
| Pure Event Noun+比賽 bìsài ‘competition’ | Process | Type Coercion |
| Event Nominal+比賽 bìsài ‘competition’ | Process or Result | Pure Selection |
| Entity+比賽 bìsài ‘competition’ | Process or Result | Type Coercion |

Table 5: Interpreting 比賽 bìsài ‘competition’
Table 5 shows that a competition can be either about the process or the result. For a process competition, N1 can be a pure event noun, an event nominal or an entity. For a result competition, N1 can be an event nominal or an entity. When N1 is an event nominal, pure selection is usually at work, while when N1 is a pure event noun or an entity, type coercion happens.

3.4 Sub-Composition

Pustejovsky (1995, 2012) introduces co-composition. A typical example is bake the cake. The operation of co-composition results in a qualia structure for the VP that reflects aspects of both constituents. These include: 1) the governing verb bake applies to its complement; 2) the complement co-specifies the verb; 3) the composition of qualia structures results in a derived sense of the verb, where the verbal and complement agentive roles match, and the complement formal quale becomes the formal role for the entire VP.

This section introduces a new way of compositionality, sub-composition, through exploring [N1+Artifactual-Type Event Noun]. There are two types of sub-composition: 1) N1 as an argument and N2 as a function, and 2) N1 as a function and N2 as an argument.

A function f is a relationship which links a set of input and a set of potential output. The input x is called a variable or an argument, while the output y is named as a dependent variable. The requirement of a function is that each variable should have and only have exactly one output.

We define the qualia role of a word as a function. Pustejovsky (1995) analyses how lexical items encode semantic information in the qualia structure. This structure has four roles, each with some values. 1) The constitutive role is about the relation between an object and its constituents or parts. Its role values include material, weight, parts and component elements. 2) The formal role can distinguish an object within a larger domain. Orientation, magnitude, shape, dimensionality, color, and position are its role values. 3) The telic role is about the purpose and function of the object. 4) The agentive role describes factors involved in the origin of an object, such as creator, artifact, natural kind, and causal chain.

We treat the four qualia roles as the four functions of a word:

- f1: FORMAL
- f2: CONSTITUTIVE
- f3: TELIC
- f4: AGENTIVE

In some cases, there is a verb in the telic or agentive role. For example, the telic role of 選拔賽 xuēnábáì ‘selection contest’ is [TELIC=select(x)], where x is an argument that is selected. Therefore the function of 選拔賽 xuēnábáì ‘selection contest’ is f2:[TELIC=select(x)]. For convenience, we will hide the predicate ‘select’ and use the qualia role to represent the function, i.e. 

\[ f_2:[\text{TELIC}(x)] \]

In a sub-compositional NN compound, either N1 or N2 can be a function, remaining the other as an argument (variable). The following section examines both Argument-Function Type and Function-Argument Type [N1+Artifactual-Type Event Noun].

3.4.1 Argument-Function Type [N1+Artifactual-Type Event Noun]

Qualia structure encodes the lexical information of a lexical item. When N1 has qualia modification to an NN, N1 is the argument and N2 is function. The following section examines both Argument-Function Type and Function-Argument Type [N1+Artifactual-Type Event Noun].

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A style is a formal role of boxing. Thus in the compound 泰式拳擊 tāi shí quánjí ‘Thai-style boxing’, the N1 泰式 tāi shí ‘Thai-style’ is the formal role of the N2 拳擊 quánjí ‘boxing’. This compound can be represented as Boxing [FORMAL (Tai-Style)].
2) \( f_{i, N_2} : \text{CONSTITUTIVE} \)
\( N_1 N_2 = N_2[\text{CONSTITUTIVE} (N_1)] \)

\[
\lambda x \exists y \left[ \text{game (x)} \land \text{crashing-through-barriers (y)} \land \text{subevent-of (y, x)} \right]
\]

A game is an activity that is composed of some subevents. In the above compound, the \( N_1 \) 'crashing through a barrier' is a subevent of the \( N_2 \) game, so this compound can be represented as Competition [CONSTITUTIVE (Crashing-Through-Barriers)].

3.4.2 Function-Argument Type \([N_1 + \text{Artifactual-Type Event Noun}]\)

When \( N_2 \) is a qualia role of \( N_1 \), \( N_1 \) is the function and \( N_2 \) is the argument.

1) \( f_{i, N_1} : \text{FORMAL} \)
\( N_1 N_2 = N_1[\text{FORMAL} (N_2)] \)

校慶活動 xiàoqìng huódòng 'school celebration activity'

\[
\lambda x \exists y \left[ \text{activity(x)} \land \text{school-celebration (y)} \land \text{a kind of (y, x)} \right]
\]

校慶 xiàoqìng 'school celebration'

QUALIA = {FORMAL = activity}

The \( N_1 \)校慶 xiàoqìng 'school celebration' is a kind of activity, so it has a formal role 'activity', which is the \( N_2 \)活動 huódòng 'activity'. This compound can be represented as School-Celebration [FORMAL (Activity)].

2) \( f_{i, N_1} : \text{CONSTITUTIVE} \)
\( N_1 N_2 = N_1[\text{CONSTITUTIVE} (N_2)] \)

運動會開幕式 yǐndōnghuì kāimǐshì 'sports meet opening ceremony'

\[
\lambda x \exists y \left[ \text{opening ceremony (x)} \land \text{sports meet (y)} \land \text{part of (x, y)} \right]
\]

運動會 yǐndōnghuì 'sports meet'

QUALIA = {CONSTITUTIVE = [opening ceremony, ...]}

運動會 yǐndōnghuì 'sports meet' is an event that includes many subevents, such as the opening ceremony, competitions and the closing ceremony. Therefore, in the compound 運動會開幕式 yǐndōnghuì kāimǐshì 'sports meet opening ceremony', the \( N_2 \)開幕式 kāimǐshì 'opening ceremony' is a constituent of the \( N_1 \)運動會 yǐndōnghuì 'sports meet'. This compound can be represented as Sports-Meet [CONSTITUTIVE (Opening-Ceremony)].

3) \( f_{i, N_2} : \text{TELIC} \)
\( N_1 N_2 = N_2[\text{TELIC} (N_1)] \)

火車運輸 huǒchē yǐnshū 'train transportation'

\[
\lambda x \exists y \left[ \text{transportation (x)} \land \text{train (y)} \land \text{purpose-of (x, y)} \right]
\]

火車 huǒchē 'train'

ARGSTR = {D-ARG1 = z: entity}
QUALIA = {FORMAL = r: vehicle
TELIC = transport (r, z)}
火车 huōchē ‘train’ is a vehicle that is usually used for transportation, carrying people and goods from one place to another. Thus, in the compound火车運輸 huōchē yǐnshū ‘train transportation’, the N₂ 运输 yǐnshū ‘transportation’ is the telic role of the N₁ 火车 huōchē ‘train’. This compound can be represented as Train [TELIC (Transportation)].

4) fi, N₂  :  AGENTIVE
N₁N₂ = N₁[AGENTIVE (N₂)]

電影拍攝 diànyíng pāishè ‘movie shooting’
\( \lambda x \exists y [\text{shooting} (x) \land \text{movie} (y) \land \text{produce} (x, y)] \)

電影 diànyíng ‘movie’ is produced by the shooting action. Hence in the compound電影拍攝 diànyíng pāishè ‘movie shooting’, the N₂ 拍攝 pāishè ‘shooting’ is the agentive role of the N₁ 電影 diànyíng ‘movie’. This compound can be represented as Movie [AGENTIVE (Shooting)].

It is common that NN compounds are ambiguous. For example,火车運輸 huōchē yǐnshū ‘train transportation’ may have these readings: 1) trains are used for transportation; and 2) trains are a means of transportation.

Section 3.4.2 of this paper has dealt with the reading 1), treating it as a Function-Argument relation. The semantic representation is Train [TELIC (Transportation)]. For reading 2), the N₁ 火车 huōchē ‘train’ is taken as the formal role of N₂運輸 yǐnshū ‘transportation’. Thus this is an Argument-Function relation, and this compound can be represented as Transportation [FORMAL (Train)].

In sum, this section has introduced a new mechanism of compositionality sub-composition. The structure N₁N₂ has two ways of sub-composition: 1) argument-function, when N₁ has qualia modification to N₂; and 2) function-argument, when N₂ is a qualia role of N₁. Because NN compounds are often ambiguous, they can have various relations according to different readings.

4 Domain Relevance of Type Coercion

Wang & Huang (2011a) has established the relation between type coercion and domain information. They reveal that type coercion can be dependent on a specific domain, because 1) intuitively, each domain often establishes a different type of event convention and NN compounds are always domain specific terms; 2) domain information can help to predict coercion types. Following this analysis, we argue that the coerced event is also domain relevant for eventive NN. We further observe that some domains have well-known conventional events, while some others do not. The former leads to a most probable and default reading, while the latter results in ambiguity. This point can be explained by the examples足球比赛 zúqiú bǐsài ‘football competition’ and 湯圓比賽 tāngyuán bǐsài ‘rice ball competition’.

Through qualia exploitation, both football zúqiú ‘football’ and rice ball tāngyuán ‘rice ball’ have the events demonstrated by the telic and agentive role. 足球 zúqiú ‘football’ has the playing event and producing event, while 湯圓 tāngyuán ‘rice ball’ has the eating event and making event as illustrated below.

5 In Mandarin Chinese, 足球 zúqiú ‘football’ can be treated either as an activity or an entity. When it is treated as an activity,足球比赛 zúqiú bǐsài ‘football competition’ combines through pure selection and there is no type coercion. When it is treated as an entity, there is type coercion through qualia exploitation. In this section, we treat it in the second way.
Corpus data support the above analysis. Table 6 demonstrates [Verb+足球 zuqiú ‘football’] in Gigaword. 踢 tǐ ‘kick’, 玩 wán ‘play with’, 打 dǎ ‘play’, 踢過 tīguò ‘kick-experiential ASPECT’, and 踢入 tīrù ‘kick into’ are the telic role of 足球 zuqiú ‘football’, while 製 zhi ‘make’, 缝製 fèngzhì ‘sew’, and 生產 shēngchǎn ‘produce’ are the agentive role.

| Words | Pinyin | English | Frequency | Salien cy | Qualia Role |
|-------|--------|---------|-----------|-----------|-------------|
| 踢 | tǐ | kick | 199 | 74.33 | telic |
| 玩 | wán | play with | 37 | 36.25 | telic |
| 打 | dǎ | play | 15 | 17.04 | telic |
| 踢過 | tīguò | kick-experiential ASPECT | 2 | 15.04 | telic |
| 踢入 | tīrù | kick into | 1 | 8.18 | telic |
| 製 | zhi | make | 4 | 11.46 | agentive |
| 缝製 | fèngzhì | sew | 2 | 10.83 | agentive |
| 生產 | shēngchǎn | produce | 7 | 7.51 | agentive |

Table 7 shows [Verb+汤圆 tāngyuán ‘rice ball’] in Gigaword. 吃 chí ‘eat’, 品嚐 pǐncháng ‘taste’, 食用 shíyòng ‘eat and use’, and so on are the telic role of 汤圆 tāngyuán ‘rice ball’, while 製作 zhīzuo ‘make’, 包 bāo ‘wrap’, and 搓 cuō ‘knead’, and so on are the agentive role.

| Words | Pinyin | English | Frequency | Salien cy | Qualia Role |
|-------|--------|---------|-----------|-----------|-------------|
| 吃 | chí | eat | 152 | 56.04 | telic |
| 品嚐 | pǐncháng | taste | 10 | 24.5 | telic |
| 食用 | shíyòng | eat and use | 2 | 20.73 | telic |

Table 7: 汤圆 tāngyuán ‘rice ball’ as Objects in Gigaword

However, as modifiers of 比赛 bǐsài ‘competition’, their activated coercions are different. 足球 比赛 zuqiú bǐsài ‘football competition’ has a strong convention of occurring in the sports domain, so the most possible reading comes from the telic role. That is, a competition of playing football rather than producing a football. By contrast, 汤圆比赛 tāngyuán bǐsài ‘rice ball competition’ does not show a preference for either the telic or agentive event, which renders both eating and making rice balls as possible readings.

This finding is confirmed by corpus data of Gigaword Corpus. We set window size as 5 tokens between N1 and N2. The result is indicated in Table 8.
In Table 8, 足球比賽 zúqǐú bí săi ‘football competition’ has 4432 occurrences, with all of them indicating telic events and none as agentive events. 湯圓比賽 tāngyuán bí săi ‘rice ball competition’ has seven hits in total, with two as telic events and five as agentive events, so this compound do not show strong tendency towards any of the two events.

5 Conclusions and Future Work

This paper discovers that [N1+Artifactual-Type Event Noun] type compounds usually get a syntagmatic relation through three mechanisms: pure selection, type coercion and sub-composition.

In GL, pure selection and type coercion have been used when a predicate selects an argument (Pustejovsky 1993, 2001, 2006, 2011; Pustejovsky & Jezek 2008). This paper extends their usage in two directions: 1) nominal head selection of a nominal modifier, and 2) their usage in the nominal event domain, though the case study on [N1+比赛 bí săi ‘competition’].

Moreover, this paper proposes a new compositional mechanism sub-composition. It is a relation between a function and an argument. The four qualia roles are treated as four functions. Two kinds of [N1+ artifactual-type event noun] type [N1,N2] compounds are composed through sub-composition: 1) N1 as an argument and N2 as a function, and 2) N1 as a function and N2 as an argument. In type 1), N1 is a qualia role of N2, and thus N1 has enriched the function behavior; in type 2), N2 is a qualia role of N1, and thus N2 has enriched the function behavior. Because a NN compound is often ambiguous, it may have several kinds of relations. The theorem for sub-composition can be generalized as follows.

In order for α and β to combine as [αβ], you need to extract some sub-elements from α or β depending on which is the function. If [αβ] is an argument-function relation, then [αβ] = β [fi (α)]. If [αβ] is a function-argument relation, then [αβ] = α [fi (β)].

Following Wang & Huang (2011a), this paper further demonstrates that some domains have strong conventional events, while some others do not. The former gives a default reading, while the latter brings about ambiguity.

This research has not only enriches the study on compositionality and GL, but also reveals the domain information contribution in type coercion.

In future work, we would extend the compositional mechanisms discussed here in two directions: 1) their usage to other types of event nouns, i.e., natural types, natural complex types and artifactual complex types, and 2) their usage to other constructions, such as ‘adjective + noun’.

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