

# Analysis of Chinese as Second Language Learners' Interpretations of Noun-Noun Compounds

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**Abstract** This study examined Chinese as second language (L2) learners' interpretations of noun-noun compounds of thematic and property relations within the theoretical framework of CARIN (Competition among Relations in Nominal) theory (Gagné CL. *J Mem Lang* 42:365–389, 2000) and Dual Process theory (Wisniewski EJ. Conceptual compound: possibilities and esthetics. In: Ward TB, Smith SM, Vaid J (eds) *Creative thought: an investigation of conceptual structures and processes*. APA Books, Washington, DC, pp 51–81, 1997). The CARIN theory postulates that conceptual compounding involves the selection of a thematic relation that describes how the modifier noun and the head noun are related. The Dual Process theory suggests that a compound is interpreted via one of two separate processes: thematic relation linking and property mapping. The thematic relation linking process involves building a thematic relation between the head noun concept and the modifier concept while the property mapping process involves mapping of specific properties from the modifier to the head noun.

A qualitative analysis was adopted in this study of 57 Chinese L2 learners. The results showed that both thematic relation linking and property mapping processes play roles in learners' interpretations, lending support to the Dual Process theory. The interaction between the two processes was found that thematic relation linking serves as the major interference in the interpretation of property relation compounds while property mapping serves as the major interference in the interpretation of thematic relation compounds. The results also demonstrated that the interpretations of L2 learners and Chinese native speakers share more similarities than differences. Pedagogical recommendations were made that instructors should not limit their teaching to the explanations of the meanings of noun-noun compounds. Instead, they should also emphasize the embedded semantic relations in the compounds and guide learners to use thematic relation linking and property mapping processes appropriately in different types of compounds to reach reasonable interpretations.

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## 1 Introduction

One interesting feature of Chinese is that a noun can directly modify another noun. For example, the noun 书 (shū, book) can modify the noun 桌 (zhuō, table) as in 书桌 (shūzhuō, book table), which refers to a particular type of table designed for reading books. The process of forming new concepts by integrating two (or more) concepts is called conceptual compounding and the result of this process is a compound. Several competing theories of conceptual compounding have emerged over the years. Some researchers, such as Gagné (2002), have argued that compounding involves the identification of a thematic relation between two concepts. Others (e.g., Wisniewski 1997) have hypothesized that there are two distinct forms of processing in compounding, namely the thematic-relation-linking and the property-mapping process. Studies have attempted to evaluate each of these two theories but they have tended to focus on native (L1) speakers rather than second language (L2) learners. Recent SLA research has shown a noticeable increase of interest in L2 vocabulary processing and mental lexicons, yet there still remains a lack of attention to noun-noun compound comprehension. In this article, I review studies conducted within the framework of semantic relation classification and theories involving conceptual compounding. I also look at studies of compound acquisition, and report findings of a study that analyzed Chinese L2 learners' interpretations of novel noun-noun compounds.

## 2 Background

### 2.1 *Semantic Relation Classification of Noun-Noun Compounds*

Many researchers have tried to divide noun-noun compounds into groups according to their semantic relations (Downing 1977; Hatcher 1960; Levi 1978; Lin 1953; Liu 1985; Lu 1951; Lu 2007; Packard 2001; Sun 1956; Warren 1978). Although detailed and thorough, these classifications have been considered arbitrary and subjective due to the lack of agreement on a consistent method.

Some scholars have taken another approach and used elements implied in deep structure to define semantic relations. Lauer (1995), for example, has described the semantic relations of noun-noun compounds by making use of eight prepositions such as OF, FOR, IN, etc. Yet it is difficult to differentiate some prepositions with overlapping meanings. Lees (1970) developed the concept of the *Common Verb* which depicts the semantic relations between a verb and two nouns in deep structure. Tan (2010) has also argued that the noun-noun compound is a special structure within which an *Implied Verb* connects two nouns.

So far, there has been no agreement on the classification of compounds by their semantic relations. The *Implied Verb*, however, serves in this study as a consistent scale for classification as it allows us, to some degree, to avoid arbitrariness,

fuzziness and subjectivity. We used the *Implied Verb* concept to classify noun-noun compounds in *Hanyu Shuiping Kaoshi (HSK) Vocabulary Level Syllabus* (Chinese Proficiency Test Center in Beijing Language and Culture University 2000) and designed experimental materials accordingly.

## 2.2 Conceptual Compounding of Noun-Noun Compounds

Noun-noun combining is an important word formation process in Chinese. The cognitive processing of combining two or more concepts into a new one is called conceptual compounding, and it plays a particularly important role in the formation of noun-noun compounds. Various models of conceptual compounding have emerged. Among them, Competition among Relations in Nominal (CARIN) theory and Dual Process theory have attracted considerable attention from scholars.

CARIN theory postulates that conceptual compounding involves the selection of a thematic relation that describes how the modifier noun and the head noun are related. A key assumption of the CARIN theory is that people use knowledge about the meaning of the modifier noun to interpret its relation with the head noun in other compounds. Consequently, the modifier's past usage in various compounds strongly influences the ease with which a new compound word can be understood (Raffray et al. 2007). In one study using CARIN, Gagné and Shoben (1997, 2002) selected 3239 noun-noun compounds within which 15 thematic relations were identified. They calculated the frequency of each thematic relation for both modifier and head noun. Participants were asked to judge the acceptability of the compound interpretations. The results revealed that the response to compounds with frequently used thematic relations for modifier nouns was much quicker than those with infrequently used thematic relations. In contrast, the frequency of thematic relations for head nouns did not impact response speed. Ji and Gagné (2007) investigated the cognitive processing of Chinese modifier-head compounds through three experiments that tested five different conditions involving the relationships between the prime and target words. Their results demonstrated that when there was a shared modifier noun, head noun, or thematic relation, the processing of target words was promoted. The facilitating effect was produced due to the increased accessibility of nouns in the mental lexicon. Gagné and Spalding (2004, 2006) found that thematic relation selection was also present in lexicalized compounds. Studies of aphasia patients (Jarema 2006; Libben 1998) showed that their interpretation of compounds involved the selection of various thematic relations as well.

Dual Process theory (Wisniewski 1997) suggests that a compound is interpreted through a combination of two separate processes, thematic relation linking and property mapping. The thematic relation linking process involves building a thematic relation between the head noun concept and the modifier concept while the property mapping process involves mapping of specific properties from the modifier to the head noun. The two mechanisms operate simultaneously and are equal in difficulty. The selection of a suitable mechanism depends on the similarity of the

two concepts. In other words, compounds of two highly similar concepts tend to be interpreted through the property mapping process; otherwise, they are interpreted through the thematic relation linking process. Wilkenfeld and Ward (2001) examined the influence of similarity between two concepts on interpretation and found that property mapping was more likely when there were many parallel differences between two concepts while a thematic relation linking was more likely when non-parallel differences were dominant. Zhong (2004) also explored how Chinese noun-noun compounds were interpreted; her experiment attested that high similarity between two concepts leads to property mapping while low similarity results in thematic relation linking.

So far, there has remained controversy about which theory can correctly describe conceptual compounding. Gagné (2000) was among the first scholars to compare and assess CARIN theory and Dual Process theory. Four experiments, including a sense/nonsense judgment, an interpretation test, a priming test, and a definition selection, as well as a corpus study offered converging evidence that property mapping is more difficult than thematic relation linking. The interpretations through property mapping were not readily encountered in written text, not frequently produced, not easily interpreted, and ultimately not judged as being acceptable. Instead of two parallel processes of equal difficulty as suggested by Dual Process theory, Gagné's results support a trend to rely on thematic relation linking for interpretations.

Based on theories of conceptual compounding, noun-noun compounds can be classified as thematic relation and property relation compounds. Thematic relation compounds are constructed through a thematic relation between the modifier and head noun while property relation compounds involve property mapping of the modifier and head noun. How do L2 learners interpret thematic relation and property compounds? Do learners differ in interpretations of these two types of compounds? The present study will try to answer these questions.

### ***2.3 Acquisition of Noun-Noun compounds***

Researchers have claimed that English-speaking children start to acquire noun-noun compounds as early as 2 years old (Clark and Berman 1987). Clark and her colleagues (Clark 1981; Clark et al. 1986) tried to explain the acquisition of compounds through an analysis of newly constructed words by children. They reported that these new words were often semantically transparent, simple, regular and productive (Clark and Berman 1984; Clark et al. 1986). Nicoladis (1999) argued that the main way children understand and learn new compound words is by analogy with known or similar compounds. Complicated noun-noun compounds with various semantic relations proved to be difficult for children to acquire (Clark 1981; Clark et al. 1985; Fabb 1998). Gottfried (1997) investigated English-speaking children and adults' comprehension of metaphoric compounds. He asked 44 3-year-old, 45 5-year-old children and 22 adults to choose a picture correctly describing the

meaning of metaphoric compounds based on shape and color. His results revealed that children could understand metaphoric compounds based on shape such as *stick-bug*, even when there was a competitive distracter. However, 3-year-old children had difficulty understanding metaphoric compounds based on color such as *zebra-shell*. Generally speaking, 5-year-old children outperformed their 3-year-old counterparts but lagged behind adults. Even 3-year-old children did not interpret compounds only based on their surface meanings, indicating that children could grasp the connotative meaning of metaphoric compounds.

There has been a large number of studies on Chinese-speaking children's acquisition of morpheme meaning (Xu and Zhang 2000) and compound structure (Hao and Shu 2003) although studies focusing on noun-noun compound are sparse. Jiang and her colleagues (Jiang et al. 2011) were the first scholars to investigate the influence of semantic relations on Chinese preschool children's comprehension of modifier-head compounds. Eighty four children of three age groups took part in the experiment and were asked to match words with MADE OF, Property and FOR relations with pictures. They found that comprehension of Property compounds was better than FOR compounds which was still better than MADE OF compounds. The youngest children developed only a preliminary ability to analyze compounds into morphemes and made a lot of errors. Older children improved in their comprehension of FOR and MADE OF compounds, especially MADE OF compounds. The oldest children had a fully-developed morpheme analysis ability. Children also used different information to interpret compounds of different semantic relations. MADE OF compounds were more likely to be interpreted based on the head noun while FOR compounds were more likely to be understood with reference to the modifier noun. The researchers concluded that children's morpheme analysis ability and awareness of semantic focus start quite early and that semantic relations do affect comprehension.

In the area of second language acquisition (SLA), especially in the Chinese as a second language (CSL) acquisition field, there are still few studies of noun-noun compound comprehension based on semantic relation. Most of the existing studies of CSL compound acquisition have explored issues such as the influence of Chinese-originated words on Korean and Japanese speaking learners (Gao and Li 2005; He 1998; Li 2011; Li 1991; Liu 2004; Qi 2000; Qu 1995; Quan 2004; Zhao 2011; Zhu 1996), error analysis (Chen 1998; Shi 2003; Xing 2003; Xu 2004; Zhang 2007a, b), and the development of morphological awareness and word formation knowledge (Chen 2005; Feng 2003; Gan 2008; Hao and Zhang 2006; Hong 2011; Zhang and Wu 2005).

Although there have been abundant L2 compound acquisition studies, research focusing on the semantic relations embedded in noun-noun compounds has been very limited. Since recognition of semantic relations plays an important role in compound comprehension, studies of semantic relations could shed light upon the mechanisms of L2 compound interpretation. Furthermore, since Chinese and English share similarities in the pattern of semantic relations in noun-noun compounds, it is important to test the validity of conceptual compounding theories for Chinese L2 learners.

It is widely accepted that there are numerous differences between L1 and L2 acquisition. It is a reasonable conjecture that Chinese L2 learners and Chinese L1 speakers differ in their interpretations of noun-noun compounds. As mentioned above, since compounds with thematic relations and with property relations are constructed through distinct processes and noun-noun compounds contain various thematic relations, there may be a discrepancy in interpretation among different types of compounds. This study explored the following questions: (a) how do Chinese L2 learners interpret novel noun-noun compounds? (b) What are the differences among CSL learners and Chinese L1 speakers in their interpretations of noun-noun compounds?

### 3 Method

#### 3.1 Participants

Fifty seven Chinese L2 learners (from USA, England, Australia, Japan, South Korea, Germany, Turkey, Russia, Malaysia, Indonesia and Thailand.) were recruited from Beijing Language and Culture University. The groups consisted of 21 participants (7 males and 14 females) of low L2 proficiency (the average period of Chinese learning was 3 months), 24 participants (10 males and 14 females) of intermediate L2 proficiency (the average period of Chinese learning was 3 years) and 12 participants (4 males and 8 females) of high L2 proficiency (the average period of Chinese learning was 4 years). The level of the textbook that these learners were using was also considered to identify their proficiency.

Twenty five Chinese native speakers (10 males and 15 females) participated in this study to provide a baseline.

#### 3.2 Materials

Forty five novel noun-noun compounds (see Appendix 1) were constructed for the present study. All compounds were created by changing one morpheme of a common Chinese word selected from the *HSK Vocabulary Level Syllabus* (Chinese Proficiency Test Center in Beijing Language and Culture University 2000) without changing the semantic relation between the two nouns. E.g. 毛帽 (máomào, hat made of fur) was made by changing 衣 (yī, clothes) in 毛衣 (máoyī, sweater/clothes made of fur) with 帽 (mào, hat). The semantic relation of 毛帽 was MADE OF, as in 毛衣. 45 compounds were divided into three groups: 15 were MADE OF compounds, 15 were FOR compounds and 15 were Property compounds. Of these, MADE OF and FOR compounds are related through thematic relation linking while

**Table 1** Examples of noun-noun compounds

Semantic Relation	Examples
MADE OF	毛帽 (máomào, hat made of fur)
FOR	雪伞 (xuěsǎn, umbrella for resisting snow)
Property	球糖 (qiú táng, ball-shaped candy)

**Table 2** Characteristics of materials

Semantic Relation	Frequency	Stroke Number
MADE OF	2.93	17.2
FOR	1.67	18.53
Property	1	19.8

Property compounds are connected through property mapping. Some examples are listed in Table 1.

To minimize the effects of familiarity and morphological complexity, word frequency and stroke number were calculated for each item. Results of the word frequency and stroke number count appear in Table 2. The frequency of the compound refers to the number of instances found in *CCL (Center for Chinese Linguistics)* corpus. Although all compounds were constructed by the researcher, some compounds appeared a few times in the *CCL* corpus. The mean frequency and stroke number of items for each of the three types were tested by means of a one-way analysis of variance (ANOVA). The three types of compounds showed no significant difference in frequency,  $F(2, 45) = 1.510, p = 0.233$ , or stroke number,  $F(2, 45) = 1.347, p = 0.271$ .

To ensure that a lack of comprehension of the Chinese characters did not hinder participants' understanding, explanations of all morphemes in the compounds were provided. All items were placed randomly.

### 3.3 Procedure

Participants were asked to write down the meaning of each item. Learner participants could use Chinese, their L1s or English (Almost all participants could speak and write in English). Most of the low and intermediate level learners chose to use English and few used their L1s. All high level learners wrote in Chinese. Each participant performed the task individually. The researcher communicated with the participant when there was confusion to ensure that all interpretations the participant provided were understood precisely. Although there was no time limit, all participants finished the task within 20 min. Interpretations that did not match the researcher's original answers were analyzed.

## 4 Results

Since the interpretation patterns for L2 learners of different proficiency were quite similar, the analysis was conducted for L2 learners as a whole group instead of for three proficiency groups.

### 4.1 MADE OF Compounds

There were 188 deviating interpretations for MADE OF compounds, falling into eight types (See Table 3).

Property interpretations, constructed through property mapping rather than thematic relation linking, accounted for the majority of the deviating interpretations among both L2 learners and L1 speakers. For example, some participants decoded 纸鞋 (zhǐxié, shoes made of paper) as 质量不好的鞋 (zhìliàng bùhǎo de xié, shoes of poor quality) or 轻的鞋 (qīng de xié, light shoes), mapping paper's property of being weak or light onto the concept of 鞋 (xié, shoes). Likewise, 铁柜 (tiěguì, cabinet made of iron) was understood as 重的柜子 (zhòng de guizi, heavy cabinet), with iron's property of heaviness being retrieved and used for mapping.

The second frequently used strategy to understand MADE OF compounds was to build other thematic relations between the modifier and the head (See Table 4). Most interpretations were based on a FOR relation. Several L2 participants

**Table 3** Interpretations of MADE OF compounds

	L2 Learners	L1 Speakers
Image-related	28	0
Only one morpheme	5	0
Other thematic relations	37	4
Joint relation	5	0
Order reverse	5	0
Property	72	20
Other morpheme meaning	1	0
Others	11	0
Sum	164	24

**Table 4** Other thematic relations for MADE OF compound interpretations

	L2 Learners	L1 Speakers
FOR	34	4
Blended	3	0
Sum	37	4

interpreted 纸碗 (zhǐwǎn, bowl made of paper) as 放纸的碗 (fàng zhǐ de wǎn, bowl for storing paper). A few L1 participants also explained 石柜 (shíguì, cabinet made of stone) as 放石头的柜子 (fàng shítóu de guǐzi, cabinet for storing stones). Some interpretations were made by combining more than one thematic relation. For instance, one L2 learner gave an explanation of 画在纸上的裤子设计图 (huà zài zhǐ shàng de kùzi shèjìtú, the trousers design drew on the paper) for 纸裤 (zhǐkù, trousers made of paper), mixing LOCATED and MADE OF relations together.

The other six types of interpretations were all created by L2 learners. Image-related interpretations were mainly created through associated images triggered by the constituent morphemes. For example, one participant comprehended 毛鞋 (máo xié, shoes made of fur) as 袜子 (wàzi, socks), probably inspired by the images of the thickness accompanying 毛 (máo, fur) as well as 袜子 (wàzi, socks) related to 鞋 (xié, shoes). Another instance was 博物馆 (bówùguǎn, museum) for 石柜 (shíguì, cabinet made of stone), possibly because they were thinking of museum display windows which are often similar to cabinets and exhibit fossils which are associated with stone.

There were five cases of Only one morpheme interpretation, in which only one morpheme, often the head, was explained. For example, 纸碗 (zhǐwǎn, bowl made of paper) was understood as 碗 (wǎn, bowl) without the information from 纸 (zhǐ, paper).

Some participants provided Joint relation interpretations, displayed as “and” phrases. For instance, 纸鞋 (zhǐxié, shoes made of paper) was considered as 纸和鞋 (zhǐ hé xié, paper and shoes), a simple combination of two separate objects.

Order reverse interpretation refers to an explanation following the head-modifier order. For example, 毛帽 (máomào, hat made of fur) was interpreted as 帽子的毛 (màozi de máo, fur on the hat), with 毛 (máo, fur) as the head and 帽 (mào, hat) as the modifier.

Only one participant gave an interpretation based on the alternative meanings of one or two morphemes. He interpreted 石箱 (shíxiāng, box made of stone) as 石做的霜 (shí zuò de shuāng, frost made of stone). A possible reason is that the participant mistook box for forest because Chinese characters of box and frost are visually similar.

There were 11 cases of interpretations difficult to analyze, and these were labeled as Others. One example was that 石杯 (shíbēi, cup made of stone) was interpreted as 文件 (wénjiàn, files, documents).

## 4.2 FOR Compounds

There were 147 deviating interpretations of FOR compounds, which we divided into six categories (See Table 5).

Property interpretations again were of the highest frequency, contributed by both L2 learners and L1 speakers. A few participants offered 白色的伞 (báisè de sǎn, white umbrella) for 雪伞 (xuěsǎn, umbrella for resisting snow), choosing the snow's property of whiteness for their interpretations.

**Table 5** Interpretations of FOR compounds

	L2 Learners	L1 Speakers
Image-related	24	3
Other thematic relations	18	6
Order reverse	19	0
Property	27	21
Other morpheme meaning	13	2
Others	14	0
Sum	115	32

**Table 6** Other thematic relations for FOR compound interpretations

	L2 Learners	L1 Speakers
MADE OF	12	4
LOCATED	2	0
HAS	4	2
Sum	18	6

The second most commonly used strategy for L2 learners was to rely on relevant images. For instance, 药杯 (yàobēi, cup for holding medicine) was interpreted as 糖浆 (tángjiāng, syrup), with the images of both the liquid medicine and the cup combined. Similarly, 果碗 (guǒwǎn, bowl for putting fruits) was understood as 水果沙拉 (shuǐguǒ shālā, fruit salad), with the image of the fruits and the shape of cup blended together.

The rest of the interpretations were almost equally distributed among the four categories. Order reverse interpretations were all provided by L2 learners and all of those for 奶马 (nǎimǎ, horse for producing milk) were explained as 马奶 (mǎnǎi, horse's milk).

Other thematic relations were also employed for comprehension (See Table 6). There were 12 cases of MADE OF interpretations, such as 裤子做的柜子 (kùzi zuò de guìzi, cabinet made of trousers) for 裤柜 (kùguì, cabinet for putting trousers). Four HAS interpretations included 报桌 (bào zhuō, desk for reading newspaper) as 桌上有报纸 (zhuōshàng yǒu bàozhǐ, there is newspaper on the desk). Moreover, there were 2 LOCATED interpretations, such as 店里的桌子 (diànlǐ de zhuōzi, desks in the store) for 桌店 (zhuōdiàn, store for selling desks).

Other morpheme meaning interpretations were mostly created by L2 learners. For example, 奶碗 (nǎiwǎn, bowl for holding milk) was interpreted as 奶奶做的菜 (nǎinǎi zuò de cài, dish made by grandma), because milk and grandma share the same Chinese character.

Fourteen interpretations were hard to analyze, all from L2 learners. One example was 椅店 (yǐdiàn, store for selling chairs) being understood as 广告 (guǎnggào, advertisement).

### 4.3 Property Compounds

There were 449 deviating interpretations of Property compounds, which we classified as eight types (See Table 7).

The category of Other thematic relations dominated the deviating interpretations for both L2 learners and L1 speakers (See Table 8). About half of them were based on LOCATED relation. For instance, 船鞋 (chuánxié, boat-shaped shoes) was interpreted as 船上穿的鞋 (chuánshàng chuān de xié, shoes on the boat). Another large proportion had a FOR relation. Many participants comprehended 鱼灯 (yúdēng, fish-shaped lamp) as 打渔用的灯 (dǎyú de dēng, lamp used for fishing). The examples of HAS interpretations included 有球的碗 (yǒu qiú de wǎn, bowl that has balls) for 球碗 (qiúwǎn, ball-shaped bowl). For MADE OF interpretations, 板帽 (bǎnmào, board-shaped hat) was interpreted as 板子做的帽子 (bǎnzi zuò de màozi, hat made of board). Blended thematic relations also emerged. Incorporating LOCATED and FOR relations, participants interpreted 板茶 (bǎnchá, board-shaped tea) as 板子之间喝茶的地方 (bǎnzi zhījiān hēchá de dìfāng, a place for drinking tea, between boards).

Interpreting in a reverse order was another popular approach for L2 learners and L1 speakers. The instances included 发光的鱼 (fāguāng de yú, shining fish) for 鱼灯 (yúdēng, fish-shaped lamp), with 鱼 (yú, fish) as the head and 灯 (dēng, lamp) as the modifier.

**Table 7** Interpretations of property compounds

	L2 Learners	L1 Speakers
Image-related	10	0
Only one morpheme	25	10
Other thematic relations	250	49
Joint relation	6	0
Order reverse	40	24
Other property	10	14
Other morpheme meaning	5	4
Others	2	0
Sum	348	101

**Table 8** Other thematic relations for property compound interpretations

	L2 Learners	L1 Speakers
FOR	77	30
MADE OF	18	7
LOCATED	112	9
HAS	22	0
Blended	21	3
Sum	250	49

A number of participants chose to emphasize only one morpheme, such as 板茶 (bǎnchá, board-shaped tea) being interpreted as 茶 (chá, tea) leaving 板 (bǎn, board) unexplained.

Other properties were activated for the interpretations. Quite a few participants understood 刀眉 (dāoméi, knife-shaped eyebrow) as 锐利的眼睛 (ruìlì de yǎnjīng, sharp eyes), making use of the property of sharpness instead of the knife shape.

Other morpheme meanings were also used. For example, 板帽 bǎnmào “board-shaped hat” was interpreted as 老板的帽子 (lǎobǎn de màozi, boss’s hat) since the Chinese character 板 (bǎn, board) in 老板 (lǎobǎn, boss) is the same as in 板帽 (bǎnmào, board-shaped hat).

The other three types were all from L2 learners. Image-related interpretations included 码头 (mǎtóu, dock) for 船碗 (chuánwǎn, boat-shaped bowl), because the shape of the bowl was similar to that of a dock with and a dock usually had boats.

Participants also provided Joint relation interpretations, such as 盆田 (péntián, basin-shaped field) being explained as two separate objects, 盆和田 (pén hé tián, basin and field).

Other interpretations included 游行 (yóuxíng, parade) for 船杯 (chuánbēi, boat-shaped cup).

## 5 Discussion

### 5.1 *Interpretations of Semantic Relations in Noun-Noun Compounds*

The number of deviating interpretations for the two thematic relation compounds, MADE OF (188) and FOR (147), was far fewer than for property mapping compounds, Property (449). The difficulty in interpreting Property compounds lends support to the claim by Gagné (2000) that compounds made through the property mapping mechanism are less easily understood. Quantitatively, the evidence from this study does not support the statements of Dual Process theory that thematic relation linking and property mapping are equally difficult.

However, qualitative results seemed to support the Dual Process theory claim that thematic relation linking and property mapping operate simultaneously. Participants most frequently interpreted the two types of thematic relation compounds, MADE OF and FOR, as Property compounds. Likewise, the largest proportion of deviating interpretations for Property compounds were based on thematic relations.

For MADE OF compounds, most interpretations were produced by the property mapping mechanism. The tendency to explain a MADE OF compound through mapping properties from the modifier to the head morpheme could be attributed to the specific semantic field formed by the extended meaning of the modifier morpheme. The modifier morphemes constituting MADE OF compounds were limited, containing only a few material nouns such as iron, paper, and stone. Properties such

as heaviness, thickness, and weakness embedded in these morphemes were often activated and retrieved automatically to build a reasonable interpretation.

Similarly, FOR compounds were also mostly interpreted using properties of the modifier morpheme. The top two compounds for Property interpretation were 雪伞 (xuěsǎn, umbrella for resisting snow) and 奶马 (nǎimǎ, horse for producing milk). It should be noted that the modifier morphemes of these two compounds had salient properties, with the former being whiteness and the latter being whiteness and youth. The properties embedded in the morphemes 雪 (xuě, snow) and 奶 (nǎi, milk) were so striking that they were drawn on in the mapping process.

A majority of the Property compounds, on the other hand, were explained through the thematic relation linking mechanism. The two compounds that were most frequently interpreted as thematically related were 裙房 (qúnfáng, skirt-shaped house) and 板茶 (bǎnchá, board-shaped tea). The two morphemes in the compounds share little similarity. 裙 (qún, skirt) is soft and small while 房 (fáng, house) is hard and big. Likewise, 板 (bǎn, board) is heavy, stiff, and big while 茶 (chá, tea) is light, soft, and small. The sharp difference between the two morphemes made it difficult to map properties from one to the other. In contrast, compounds with two morphemes sharing more similarity were more likely to be understood based on property mapping. 球糖 (qiú táng, ball-shaped candy), 球瓜 (qiú guā, ball-shaped melon), and 筒楼 (tǒng lóu, cube-shaped building) are the top three compounds interpreted as Property ones. One possible reason is that the two morphemes in the compounds (ball and candy, ball and melon, cube and building) are more similar in certain respects (e.g. the shape). The results were consistent with those from Wilkenfeld and Ward (2001) and Zhong (2004), further suggesting that similarity between the two nouns in the compounds affects the mechanisms used. According to Dual Process Theory, a high degree of similarity enhances the possibility of property mapping from the modifier to the head, since the corresponding properties are more easily identified.

The results showed that compounds created by thematic relation linking (MADE OF and FOR) were often interpreted through property mapping while compounds made through property mapping (Property) were often explained based on thematic relations. The complimentary pattern confirms the simultaneously operating mechanisms predicted by Dual Process Theory, that thematic relation linking and property mapping play equally important roles in the interpretative process.

## 5.2 *Differences Between L2 Learners and L1 Speakers in Interpretations*

L2 learners provided far more deviating interpretations than L1 speakers. However, the differences in interpretation patterns between L2 learners and L1 speakers were small.

For MADE OF compounds, L2 learners adopted a greater variety of properties of the modifier morpheme, gave more image-related interpretations, and showed a stronger tendency to interpret based on FOR relation.

To understand FOR compounds, L2 learners made numerous order reverse interpretations focusing only on one compound, 奶马 (nǎimǎ, horse for producing milk), which was not found in L1 speakers.

The preferred thematic relations for Property compounds were slightly different for L2 learners and L1 speakers, with the former more likely to use a LOCATED relation and the latter more likely to employ a FOR relation. The domination of LOCATED relations in L2 learners' interpretations might be due to the very frequent usage of the modifier morpheme in LOCATED compounds in L2 input. Most LOCATED explanations were presented for the compounds with the modifier morpheme of 船 (chuán, boat). As a vehicle with relatively closed space, boat is usually associated with a place or a location. Boat also appeared in many LOCATED compounds such as boat lamp, boat cover, etc. According to Gagné (2002), the past usage of boat in LOCATED compounds facilitates its processing as LOCATED relation. The preference shown by L1 speakers for FOR relations might be due to an inclination to perceive and interpret objects based on functions (Jiang et al. 2011; Liu 2012). Children begin to pay attention to the function of objects very early. One infant participant in Jiang et al. (2011) insisted on using *things for injecting* to refer to *cotton swab*, indicating her emphasis on the function. The results of this study also showed that L1 adults preferred to interpret novel compounds based on function relation.

## 6 Conclusion

The results of this study partly supported Dual Process theory. Both thematic relation linking and property mapping processes play roles in learners' interpretations, displayed in the fact that learners tended to use the thematic relation linking mechanism in property compound comprehension and rely on property mapping in thematic relation compound interpretation. However, some statements of CARIN theory were also supported. Property compounds are more difficult to interpret than thematic relation compounds, indicated by the far higher number of deviating interpretations for property compounds.

The results also demonstrated that although L2 learners gave far more deviating interpretations, they shared more similarities than differences in their interpretation patterns with L1 speakers.

These results have pedagogical implications too. Instructors should emphasize the embedded semantic relations in the compounds and guide learners to use thematic relation linking and property mapping processes appropriately for different types of compounds.

## Appendix

Compound	Frequency	Stroke No.
<b>MADE OF</b>		
毛帽 (máomào, hat made of fur)	3	16
纸裤 (zhǐkù, trousers made of paper)	1	19
铁帽 (tiěmào, hat made of iron)	18	22
石杯 (shíbēi, cup made of stone)	4	13
毛鞋 (máoxié, shoes made of fur)	0	19
毛伞 (máosǎn, umbrella made of fur)	0	10
纸碗 (zhǐwǎn, bowl made of paper)	0	20
石碗 (shíwǎn, bowl made of stone)	3	18
铁杯 (tiěbēi, cup made of iron)	1	18
纸椅 (zhǐyǐ, chair made of paper)	5	19
石柜 (shígùì, cabinet made of stone)	1	13
纸鞋 (zhǐxié, shoes made of paper)	2	22
石箱 (shíxiāng, box made of stone)	2	20
纸床 (zhǐchuáng, bed made of paper)	4	14
草伞 (cǎosǎn, umbrella made of grass)	0	15
<b>FOR</b>		
表店 (biǎodiàn, store for selling watches)	4	16
雪鞋 (xuěxié, shoes for resisting snow)	7	26
药杯 (yàobēi, cup for holding medicine)	1	17
果碗 (guǒwǎn, bowl for putting fruits)	0	21
桌店 (zhuōdiàn, store for selling desks)	0	18
奶马 (nǎimǎ, horse for producing milk)	0	8
雪伞 (xuěsǎn, umbrella for resisting snow)	0	17
帽柜 (màoɡuì, cabinet for putting hats)	1	20
奶碗 (nǎiwǎn, bowl for holding milk)	1	17
椅店 (yǐdiàn, store for selling chairs)	0	20
裤柜 (kùɡuì, cabinet for putting trousers)	0	20
奶杯 (nǎibēi, cup for holding milk)	4	13
报桌 (bào zhuō, desk for reading newspaper)	1	17
笔箱 (bǐxiāng, box for putting pens)	0	25
雪帽 (xuěmào, hat for resisting snow)	6	23
<b>Property</b>		
板帽 (bǎnmào, board-shaped hat)	1	20
裙房 (qúnfáng, skirt-shaped house)	5	19
刀眉 (dāoméi, knife-shaped eyebrow)	1	11
船鞋 (chuánxié, boat-shaped shoes)	2	26
球船 (qiúchuán, ball-shaped boat)	0	22
盆田 (péntián, basin-shaped field)	0	14
鱼灯 (yú dēng, fish-shaped lamp)	5	14

(continued)

Compound	Frequency	Stroke No.
球碗 (qiúwǎn, ball-shaped bowl)	0	24
筒楼 (tǒnglóu, cube-shaped building)	0	25
球瓜 (qiúguā, ball-shaped melon)	0	16
球糖 (qiútáng, ball-shaped candy)	1	27
船碗 (chuánwǎn, boat-shaped bowl)	0	24
船杯 (chuánbēi, boat-shaped cup)	0	19
球杯 (qiúbēi, ball-shaped cup)	0	19
板茶 (bǎnchá, board-shaped tea)	0	17

## References

- Chen, F. (1998). Negative L1 transfer of Japanese-speaking learners on Chinese compound acquisition. *Journal of Beijing Normal University (Social Science Edition)*, 6, 79–82.
- Chen, P. (2005). *Research on the effect of the meaning of morpheme on the acquisition of lexical meaning of Chinese as a second language* (Unpublished master's thesis). Jinan University, Guangzhou, China.
- Chinese Proficiency Test Center in Beijing Language and Culture University. (2000). *Hanyu shuiping kaoshi (HSK) vocabulary level syllabus*. Beijing: Economic Science Publisher.
- Clark, E. V. (1981). Lexical innovations: How children learn to create new words. In W. Deutsch (Ed.), *The child's construction of language* (pp. 299–328). London: Academic Press.
- Clark, E. V., & Berman, R. A. (1984). Structure and use in the acquisition of word formation. *Language*, 60, 542–590.
- Clark, E. V., & Berman, R. A. (1987). Types of linguistic knowledge: Interpreting and producing compound nouns. *Journal of Child Language*, 14, 547–567.
- Clark, E. V., Gelman, S. A., & Lane, N. M. (1985). Noun compounds and category structure in young children. *Child Development*, 56, 84–94.
- Clark, E. V., Hecht, B. F., & Mulford, R. C. (1986). Coining complex compounds in English: Affixes and word order in acquisition. *Linguistics*, 24, 7–29.
- Downing, P. A. (1977). On the creation and use of English compounds. *Language*, 53, 810–842.
- Fabb, N. (1998). Compounding. In A. Spencer & A. M. Zwicky (Eds.), *The handbook of morphology* (pp. 66–83). Oxford: Blackwell Publishers.
- Feng, L. (2003). The intermediate Chinese learner's awareness of lexical structure and the development of reading competence. *Chinese Teaching in the World*, 2, 66–71.
- Gagné, C. L. (2000). Relation-based combinations versus property-based combinations: A test of the CARIN Theory and Dual-process Theory of conceptual combination. *Journal of Memory and Language*, 42, 365–389.
- Gagné, C. L. (2002). Lexical and relational influences on the processing of novel compounds. *Brain and Language*, 81, 723–735.
- Gagné, C. L., & Shoben, E. J. (1997). Influence of thematic relations on the comprehension of modifier-noun compounds. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 23, 71–87.
- Gagné, C. L., & Shoben, E. J. (2002). Priming relations in ambiguous noun-noun compounds. *Memory and Cognition*, 30, 637–646.
- Gagné, C. L., & Spalding, T. L. (2004). Effect of relation availability on the interpretation and access of familiar noun-noun compounds. *Brain and Language*, 90, 478–486.
- Gagné, C. L., & Spalding, T. L. (2006). Conceptual compound: Implications for the mental lexicon. In G. Libben & G. Jarema (Eds.), *The representation and processing of compound words* (pp. 145–168). New York: Oxford University Press.

- Gan, H. (2008). The effect of semantic transparency on vocabulary learning in intermediate Chinese reading. *Applied Linguistics*, 1, 82–89.
- Gao, L., & Li, J. (2005). An experiment study of Japanese learners of Chinese of their lexical access. *Chinese Teaching in the World*, 3, 96–105.
- Gottfried, G. M. (1997). Comprehending compounds: Evidence for metaphoric skill? *Journal of Child Language*, 24, 163–186.
- Hao, M., & Shu, H. (2003). Study on age of acquisition of children's spoken words. *Advances in Psychological Science*, 5, 523–528.
- Hao, M., & Zhang, W. (2006). Role of morphological awareness in Chinese learning. *Chinese Language Learning*, 1, 60–65.
- Hatcher, A. G. (1960). An introduction to the analysis of English noun compounds. *Word*, 16, 356–373.
- He, G. (1998). Words from Chinese in Korean and vocabulary instruction to Korean-speaking Chinese learners. *Journal of East China Normal University (Philosophy and Social Sciences)*, 2, 92–94.
- Hong, W. (2011). An experimental research on the morphemic effects on synonyms learning by CSL learners. *Language Teaching and Linguistic Studies*, 1, 34–40.
- Jarema, G. (2006). Compound representation and processing: A cross-language perspective. In G. Libben & G. Jarema (Eds.), *The representation and processing of compound words* (pp. 45–70). New York: Oxford University Press.
- Ji, H., & Gagné, C. L. (2007). Lexical and relational influences on the processing of Chinese modifier-noun compounds. *The Mental Lexicon*, 2, 387–417.
- Jiang, Z., Sun, J., & Wei, X. (2011). The effect of semantic relation between morphemes in compounds on preschool Chinese children's compound understanding. *Applied Linguistics*, 3, 87–95.
- Lauer, M. (1995). *Designing statistical language learners: Experiments on compound nouns*. Sydney: Macquarie University.
- Lees, R. B. (1970). Problems in the grammatical analysis of English nominal compounds. In M. Bierwisch & K. E. Heidolph (Eds.), *Progress in linguistics* (pp. 174–186). Paris: Mouton.
- Levi, J. N. (1978). *The syntax and semantics of complex nominals*. New York: Academic Press.
- Li, Q. (1991). Some issues on word interpretation of Chinese as foreign language instruction. *Chinese Language Learning*, 3, 33–35.
- Li, B. (2011). Effects of the word forms on Chinese vocabulary acquisition of Japanese students. *Language Teaching and Linguistic Studies*, 5, 65–71.
- Libben, G. (1998). Semantic transparency in the processing of compounds: Consequences for representation, processing, and impairment. *Brain and Language*, 61, 30–44.
- Lin, H. (1953). Issues on noun phrase. *Studies of the Chinese Language*, 5, 7–10.
- Liu, S. (1985). Characteristics and categories of Chinese compound inner structure. *Studies of the Chinese Language*, 3, 186–192.
- Liu, H. (2004). Analysis of the mistakes made by the Korean students in the usage of Chinese vocabulary. *Journal of Shenyang Normal University (Social Sciences Edition)*, 3, 108–110.
- Liu, Z. (2012). A study on the tendency of the semantic combination of A [Measurement] and N [Artifact]. *Language Teaching and Linguistics Studies*, 1, 76–82.
- Lu, Z. (1951). *Monosyllable word in Beijing dialect*. Hongkong: Chongwen Store.
- Lu, W. (2007). *A study on the relationship between grammatical relations and semantic relations of Chinese compounds* (Unpublished master's thesis). Guangxi Normal University, China.
- Nicoladis, E. (1999). Where is my brush-teeth? Acquisition of compound nouns in a bilingual child. *Bilingualism: Language and Cognition*, 2, 245–256.
- Packard, J. L. (2001). *The morphology of Chinese: A linguistic and cognitive approach*. Beijing: Foreign Language Teaching and Research Press.
- Qi, H. (2000). The study on the transfer of Chinese-originated words in Korean language. *Chinese Language Learning*, 1, 46–50.
- Qu, W. (1995). The study on Chinese-originated words in Japanese language. *Journal Liaoning Normal Quiverish*, 6, 34–37.

- Quan, X. (2004). An analysis of errors of homographs in Chinese and Korean. *Chinese Language Learning, 3*, 56–61.
- Raffray, C. N., Pickering, M. J., & Branigan, H. P. (2007). Priming the interpretation of noun-noun compounds. *Journal of Memory and Language, 7*, 380–395.
- Shi, W. (2003). Mistakes of Chinese words made by Japanese and Korean students. *Journal of Yunnan Normal University, 5*, 28–31.
- Sun, C. (1956). *Chinese vocabulary*. Changchun: Jilin People Press.
- Tan, J. (2010). Semantic relation between nouns and noun modifiers and their roles in dictionary definition. *Studies of the Chinese Language, 4*, 342–384.
- Warren, B. (1978). *Semantic patterns of noun-noun compounds*. Goterborg: Acta Universitatis Gothoburgensis.
- Wilkenfeld, M. J., & Ward, T. B. (2001). Similarity and emergence in conceptual compound. *Journal of Memory and Language, 45*, 21–38.
- Wisniewski, E. J. (1997). Conceptual compound: Possibilities and esthetics. In T. B. Ward, S. M. Smith, & J. Vaid (Eds.), *Creative thought: An investigation of conceptual structures and processes* (pp. 51–81). Washington, DC: APA Books.
- Xing, H. (2003). An analysis of the error compound words used by foreign learners of Chinese. *Chinese Teaching in the World, 4*, 67–78.
- Xu, X. (2004). *The morphological awareness of overseas students in the acquisition of Chinese compound words* (Unpublished master's thesis). Beijing Language and Culture University, Beijing, China.
- Xu, C., & Zhang, B. (2000). Primary school children's morphological awareness development and reading comprehension. *Psychological Science, 6*, 745–757.
- Zhang, B. (2007a). Synonymy, near-synonymy and confusable word: A perspective transformation from Chinese to interlanguage. *Chinese Teaching in the World, 3*, 98–107.
- Zhang, B. (2007b). On confusable words in Chinese inter-language and related research methods. *Language Teaching and Linguistics Studies, 6*, 37–45.
- Zhang, J., & Wu, X. (2005). The effect of meaning and morphology factors on doing vocabulary multiple-choice items by overseas students. *Chinese Teaching in the World, 2*, 72–78.
- Zhao, Y. (2011). L2 acquisition of Chinese lexicon by Korean speaking learners. *Chinese Teaching in the World, 3*, 412–421.
- Zhong, W. (2004). *Application research on the Dual Process Theory in Chinese noun-noun conceptual compounds* (Unpublished master's thesis). Hunan University, Changsha, China.
- Zhu, Y. (1996). An analysis of homographs in Chinese and Korean from HSK vocabulary level syllabus. *Chinese Language Learning, 5*, 38–43.