TOPOLOGICAL SPATIAL RELATIONS, CONTAINMENT AND SUPPORT: A

CONTRASTIVE STUDY OF MANDARIN AND ENGLISH

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ABSTRACT

This dissertation investigates two topological spatial relations, containment and support, which are assumed to exist in the minds of all speakers because of their basis in a shared physical world. However, cross-linguistic studies on the use of the spatial-characterizing elements *on/in* and the corresponding words *shàng/lǐ* in Mandarin show that they do not fully overlap. The dissertation focuses on two aspects: first how speakers of English and Mandarin encode the two spatial relations, and second whether the similarities and differences of the two spatial terms affect the acquisition of the L2 learners.

To address the question how speakers of English and Mandarin encode the two spatial relations, the study adopted an embodied cognitive approach, the proto-scene model that is under the Framework of Polysemy Network by Tyler and Evans (2001, 2003). Via this model, the dissertation demonstrated how the encodings of the two spatial terms between the two languages overlap and diverge.

Furthermore, in order to confirm whether cross-linguistic difference plays a role in the acquisition of L2 learners and if it is, to what extent does it affect their learning, the study conducted two experiments to examine the question. The results of the two studies suggested that cross-linguistic difference is a factor in the acquisition of the two spatial terms, which was resulting from the conceptual transfer (Jarvis and Palvenko, 2008; Odlin 2005). Furthermore, the results also suggested that the conceptual differences between the two spatial terms are difficult to acquire even for the learners at high proficiency level.

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1	first person
2	second person
3	third person
CL	classifier
DAT	dative case
DUR	durative aspect
NEG	negation
PL	plural
SG	singular
SUB	subordinator

CHAPTER 1

INTRODUCTION

1.1 The relationship between Language and Space

Language allows humans to talk about space— to describe the shape of an object, to talk about the location of an object, to give direction and so forth— through spatial terms that are encoded with spatial notions. Space and language have been widely studied over the past decades. Research in pure theoretical, functional descriptive, empirical and neuroscience approaches have examined how human beings conceptualize space; how space is encoded in languages; whether there is a universal spatial endowment, Euclidian space, in our brains. If we assume that language reflects the "real world," then linguistic descriptions of spatial scenes are Euclidean in nature. However, Talmy (1988, 2000) argued that spatial notions are conceptualized and topological, rather than Euclidean, and that spatial notions are relativistic relationships rather than absolutely fixed quantities, such as fixed distances, sizes, and amounts. Talmy points out that the spatial terms that were used to represent the physical world were schematized, which means that what was chosen to encode space into the linguistic form is idealized, prominent and representative information. Further, it has been observed by a number of researchers that languages do not categorize spatial relations in the same way (Bowerman 1996; Bowerman and Choi 1994, 2001; Bowerman and Levinson 2001; Herskovits 1986; Levinson 1996, 2003; Talmy 1983, 2000).
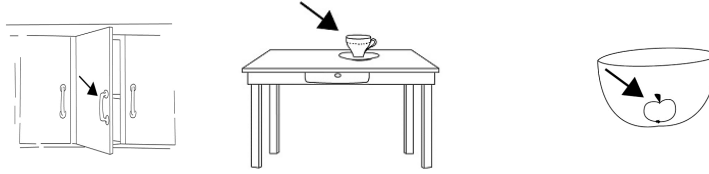
1. English ⎯⎯⎯⎯ on ⎯⎯⎯⎯ ⎯⎯ in ⎯⎯
2. Dutch ⎯ op ⎯⎯ aan ⎯⎯ ⎯⎯ in ⎯⎯
3. Spanish ⎯⎯⎯⎯⎯ en ⎯⎯⎯⎯⎯
4. Finish ⎯⎯ -lla ⎯⎯ ⎯⎯⎯⎯-ssa ⎯⎯⎯⎯

Figure 1.1 Different categorizations on topological spatial relations across four different languages (Bowerman 1996: 394)

As shown in Figure 1.1, spatial scenes are described using different spatial terms across these four languages, English, Dutch, Spanish and Finish. Spanish has a one-way distinction, English and Finish have a two-way distinction, and Dutch has a three-way distinction in grouping these spatial scenes. In addition, different spatial properties are chosen and encoded in the spatial terms, such as English and Finish. The examples above raise many questions: Do all languages use the same mechanism to code spatial relations into the spatial terms? Is there a universal basis for how languages encode spatial relations? If the answer is negative, then what information do languages choose to encode and what elements of spatial encoding are included? This dissertation consists of two parts. The first part will be on the discussion of cross-linguistic differences on the encodings of spatial concepts in English and Mandarin Chinese. In this part, in order to further explain previous studies, we adopt an embodied cognition approach, "the proto-scene model" under the framework of Polysemy Network developed by Evans and Tyler

(2004b) and Tyler and Evans (2001, 2003) to provide a more comprehensive explanation to address the issues of the relationship between language and space. The second part will focus on the acquisition of spatial relations of containment and support from second language learners of Mandarin and English respectively. In this part, two experiments were conducted to determine whether the differences of encodings of spatial concepts affect the learners of second languages in English and Mandarin.

1.1.1 Topological spatial relations

The notion of topological relationships indicates spatial relations that are topological in nature, such as geometry and dimensionality between X and Y. The simplest topological adpositions, such as English prepositions, *in*, *on*, *near,* etc., express this type of relationship.

Bowerman and Pederson (1992) conducted an empirical study to elicit the usage of certain topological spatial relations. In their study, they have developed a series of simple line drawings (Topological Relations Picture Series, TRPS), which cover a wide range of spatial scenes that can be used to elicit possible IN, and ON relationships. In total, there are 71 line drawing pictures. The elicitation of possible IN and ON relationships using TRPS has been proven effective and has been adopted by many researchers (Bowerman & Pederson 1992, Bowerman & Choi 2001, Levinson et al. 2003, Levinson & Wilkins 2006, Zhang et al. 2011).

This dissertation will examine how the spatial relations containment and support are mapped in Mandarin and English from a theoretical perspective and also using empirical results that used TRPS as a tool. Containment and support are the focus

because these two spatial relations exist nonlinguistically (Clark 1973); thus it is often assumed that there are universal semantic categories associated with these two spatial concepts. As a result, the two spatial notions, containment and support, can be used as a testing ground for cross-linguistic studies on spatial representations in Mandarin and English.

1.1.2 Containment and support

To characterize the location of an object or a figure, as stated by Talmy (1983, 2000), in terms of a relatum or ground, English relies heavily on closed-class linguistic forms, such as the prepositions *at*, *on* and *in*. The basic geometric information, such as whether a figure and its ground are in a contact, support, or containment spatial relations—as well as the ground's dimensionality—is encoded in English prepositions. In Mandarin however, in order to mark the spatial relation of a figure and its ground, the language mainly relies on a quasi open-class[1] of spatial morphemes, such as 上 *shàng* 'above/up', 下 *xià* 'below/down', 裡 *lǐ* 'in(side) ', 外 *wài* 'out(side) ', 中 *zhōng* 'middle' etc. Although this group of spatial monosyllabic morphemes are associated with their content meaning, syntactically, they can't stand freely as nouns can. Because of the syntactic characteristics, before proceeding to examine the spatial encodings of English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ*, in Chapter 2, we will first show that Mandarin 上 *shàng*/裡 *lǐ* adpositions to establish the standards for later chapters.

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[1]The syntactic categorizations of this group of spatial monosyllabic morphemes are still controversial. To class them into noun or adposition categories is still hotly debated among many researchers (Ding 1961; Fang 2004; Liu 2003; Chao 1968; Zhang 2000). However, all the researchers agree that the syntactic behaviors of spatial monosyllabic morphemes are not exactly like nouns.

Unlike the structure of the English prepositional phrase "preposition + NP," two structures of locative phrases are used in Mandarin to express locations of objects: (1) preposition + NP + postposition, and (2) NP + postposition, as illustrated below.

(1)   書在桌子上

   shū zài huōzi shàng

   book at table   on

   'The book is on the table.'

(2)   桌子上有一本書

   zhuōzi shàng yǒu yì běn shū

   table on exist   one CL book

   'There is a book on the table.'

In Mandarin, when telling a location of X, such as when answering the question of "Where is X?," the first structure (1) is often used; whereas, when introducing a location of X, the second structure is used (2). In Mandarin, however, the preposition 在 *zài* is vacuous in meaning[2], since it does not convey any specific geometrical information, such as dimensionality or the spatial relations between the located object and the reference object, regardless of whether the located object is in contact with or is enclosed by the reference object, as English prepositions do. To express the containment

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[2] According to Chu (2004), 在 *zài* doesn't have a core meaning but it does have the notion of "positioning". The presence of 在 *zài* was constrained by (1) the number of the syllables of a location phrase (2) the structure of the location phrase (3) the internal structure of the location phrase and (4) the notions of 在 *zài*.

spatial relation, English uses the preposition *in* to mark the relationship with the located object and the reference object, such as *toy in the box*, whereas the equivalent 裡 *lǐ* is used in Mandarin, 玩具在箱子裡 *wánjù zài xiāngzi lǐ*. The support relationship is characterized by the English preposition *on* as *book on the table* and its correspondence 上 *shàng* in Mandarin, as 書在桌子上 *shū zài zhuōzi shàng*. However, cross-linguistic studies have shown that the semantics of the spatial terms in these two languages do not fully overlap (Tai, 1993). For instance, the spatial relations in pictures a–c are expressed by the English preposition *in* to mark the containment relationship; however, only picture a is expressed by the corresponding Mandarin word 裡 *lǐ*. Pictures b–c are marked by the spatial expression 上 *shàng* as (4) b–c.
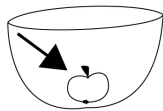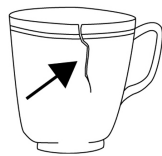
a.   b.   c.
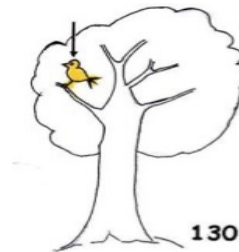
(3)   a.   the apple in the bowl
         b.   the crack in the cup
         c.   the bird in the tree

(4)   a.   *蘋果在 碗裡*
               pinggǔo zài   wǎn lǐ
               apple at bowl in

b.　　*裂縫在杯子上*

　　lièfèng zài bēizi shàng

　　 crack at cup on

c.　　*鳥在樹上*

　　niǎo zài shù shàng

　　bird at tree on

These examples mark the mismatch in the categorization of IN[3] and ON[4] between English and Mandarin. The mismatch between the spatial categories containment and support shows that the two spatial categories in both languages do not fully overlap and the mismatch might be attributed to different spatial conceptualizations or different observing perspectives from the speakers of the two languages, which will be discussed in detail in Chapter 4.

The mismatch of the two spatial categories in Mandarin and English brings our attention to second language learners of Mandarin and English. Whether the differences between Mandarin and English affect Mandarin learners of English L1 and English learners of Mandarin L1 on the acquisition of spatial relations, containment and support sparks our interests. In the following section, we will give a brief background survey on the second language learning related to spatial relations.

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[3] The capital IN is used a semantic primitive for English *in* and Mandarin *裡 lǐ*.

[4] The capital ON is used a semantic primitive for English *on* and Mandarin *上 shàng*.

1.2 Background survey of Second language learning related to spatial relations

It has long been recognized that the acquisition of spatial terms appears to be very challenging to second language learners (Cui 2005; Boquist 2009; Wei 2007; Celce-Murcia and Larsen-Freeman 1999). Spatial concepts such as containment, support, contiguity, proximity, etc., which are represented as semantic primitives IN, ON, UNDER, etc. are the most basic, yet most complicated to master. English prepositions *in* and *on* are especially difficult to acquire even for learners who have reached high proficiency in English (Celce-Murcia and Larsen-Freeman 1999). Several factors may account for the difficulties. First, learners make inferences based on their L1 knowledge and since different languages have different ways to encode space, errors result. For instance, in the previous examples (3b-c) versus (4b-c), the mismatch of uses of spatial terms IN and ON in between Mandarin and English would make the acquisition of the two spatial terms more challenging since different uses of the spatial terms might cause interference when they use the spatial terms in their target languages. Further, the differences in spatial categorizations across languages could also come from the internal differences in a spatial category. For instance, Korean speakers distinguish the fit in between a figure and a ground; therefore, to depict a "tight fit" relationship (e.g., videotape in a case), the verb *kkita* is used, while to describe a "loose fit" relationship (e.g., apple in a bowl), the verb *nehta* is used (Bowerman & Choi 2003). Although the subtle differences do not prevent speakers of different languages from seeing the physical spatial relations in a shared world; the divergence might lead the speakers to pay heed to

different aspects of spatial relations (Jarvis and Pavlenko 2008). Second, learners often rely on the semantic L2 equivalences of L1 spatial terms, which do not always match up from one language to another. For instance, the spatial meanings of the spatial terms in English, German, and French do not have equivalent meanings, as illustrated in examples (5) and (6) (Celce-Murcia and Larsen-Freeman 1999: 401).

(5) English *to* = German *zu*   English *at*=German *an* (or *in* or *bei*)
   (but) John is at home. = Johna ist zu Hause.
(6) English *to* = French *à* English *for* = French *pour*
   (but) a glass for cognac = un verre à cognac

As the example above show, the mismatch of spatial meanings in spatial terms among these languages would increase the difficulties for second language learners of these languages in the acquisition of spatial semantics. Last but not least, learners have challenges using spatial terms grammatically since spatial semantics are encoded in different linguistic forms across languages. For instances, German, Russian, and Latin express spatial senses through inflections, English through prepositions, Japanese and Mandarin through postpositions. For instance, Mandarin uses "(preposition) + NP + postposition" (see section 1.1.2) to express the spatial relations, while English uses "preposition + NP". Due to the structural differences of locative phrases in between Mandarin and English, English speakers learning Mandarin often make mistakes by overly using the preposition or omitting the postpositions when expressing objects' locations in Mandarin. Evidence can be seen in Cui's (2005) study, in which he has reported that Indo-European language speakers learning Mandarin generally made more

mistakes using the Mandarin preposition 在 *zài* "be located" compared to learners who spoke Korean and Japanese. Types of mistakes mentioned earlier are overgeneralization and omission of thepreposition 在 *zài* "be located," as illustrated in the following examples (Cui 2005: 89-90).

(7)　　a. *在北京城裡情況很熱鬧。*　　　　　　　(English L1)
　　　zài Běijīng chéng lǐ　　　qíngkuàng　hěn rènào
　　　at Beijing city　in(side)　　circumstance very lively
　　　'The atmosphere in downtown Beijing is lively.'
　　　b. *在爐子裡的木頭很香。*　　　　　　　(German L1)
　　　zài lúzi lǐ　　　　　de　　mùtóu hěn　xiāng
　　　at stove in(side)　　DE　　log　very　aromatic
　　　'The logs in the stove smell very aromatic.'

(8)　　a. *我們在火車上坐著兩三個小時。*　　　(English L1)
　　　wǒmen zài　　huǒchē shàng zuò-zhe liǎng sān ge　xiǎoshí
　　　1PL　at　　train　on　　sit-ZHE two three CL hour
　　　'We have been sitting on the train for two or three hours.'
　　　b. *大里的天氣晴的時候能在湖水中反射出來。*　(German L1)
　　　Dàlǐ de tiānqì qíng de shíhou néng zài húshuǐ zhōng fǎnshè chū-lai
　　　Dali DE weather　DE moment can at　lake　middle reflect out-come
　　　'When the weather is sunny, it can be reflected on the lake.'

The underlined parts were the mistakes made by the learners of Mandarin, who were speakers of English and German. Examples (7a-b) show overgeneralization in using the Mandarin preposition 在 *zài* "be located" by the learners. In these two sentences, the presence of the preposition 在 *zài* "be located" made the sentences ungrammatical since when the locative phrases appear in subject position, the structure

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"NP + postposition" is used to express the location of the objects. On the other hand, the ungrammaticalities of examples (8a-b) are due to the omission of postpositions 上 *shàng* 'top/above' and 中 zhōng 'middle' in the locative phrases. Unlike English and German, the Mandarin preposition 在 *zài* 'be located' does not indicate a spatial relation between a figure and a ground, but the spatial relations are expressed through postpositions, such as 上 *shàng* 'above/up', 下 *xià* 'below/down', 裡 *lǐ* 'in(side) ', 外 *wài* 'out(side) ', 中 *zhōng* 'middle,' etc. That could explain why Mandarin learners who speak Indo-European languages as their native languages tend to omit the postpositions since in their native languages spatial relations are often expressed through prepositions.

In this section, we have briefly discussed some factors that have caused challenges for second language acquisition of spatial terms, such as IN and ON. In sum, cross-linguistic differences of spatial terms in learners' L1 and L2 could make it more difficult for L2 learners to acquire spatial terms. In order closely examine the groups of second language learners, and to address the issue with empirical evidence, we have conducted two experiments to testify whether the differences of learners' L1s would influence the acquisition of spatial terms in their target languages. Through a contrastive analysis using an empirical approach, we will discuss second language spatial language learning.

1.3 Research outlines

Base on the above observations and previous studies, this dissertation aims to understand: first, how spatial relations, particularly containment and support, are coded

differently in English and Mandarin. Second, I examine whether or not speakers' native languages have an impact on the acquisition of the target languages' spatial terms (e.g. L2 learners of Mandarin who speak English as their native language and L2 leaners who speak Mandarin as their native language). Following the second research question, if there is an impact, I would also like to know to what extent the native language influences the target language acquisition. In addition, I would also like to understand whether language proficiency in the target language has an influence on the uses of these spatial terms. In this dissertation, we will examine these three questions and try to provide a comprehensive analysis for the questions.

1.4 Overview of the dissertation

The dissertation consists of six chapters organized as follows. The first chapter provides a brief introduction of current issues in topological spatial representation, particularly focused on L2 learning and research questions. Chapter two encompasses a comprehensive review of formal studies on the containment and support in English and Mandarin. Chapter three introduces our theoretical framework, an embodied cognitive approach, *proto-scene* model, for the cross-linguistic issues of topological spatial representations. Chapter four presents our analysis for the similarities and differences in use of English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ* under the framework of the proto-scene model. Chapter five addresses empirical studies of topological spatial relations, which include sections on participants, material designed, analysis of the data and so forth. The

last chapter discusses the findings of the study and discusses implications for future studies in L2 spatial acquisition and teaching.

CHAPTER 2

LITERATURE REVIEW

2.0   Introduction

As briefly reviewed in Chpater1, to express the spatial relations, containment and support, English spatial terms *in/on* and Mandarin *裡 lǐ/上 shàng* are often associated and used. However, English and Mandarin present the two spatial relations with different locative structures. For instance, English uses "in/on + NP" and Mandarin uses "在 zài + NP +裡 lǐ/上 shàng" and or "NP +裡 lǐ/上 shàng ". As also pointed out in Chapter 1, the differences in locative structures between the two languages could increase difficulties in second language acquisition. Thus in order to have a better understanding of the differences of locative expressions in English and Mandarin, this Chapter will first review previous studies on Chinese locative expressions and compare with English. Furthermore, as also stated in Chapter 1, the syntactic categorizations of Mandarin *裡 lǐ/上 shàng* are still very controversial in literature; therefore we will also review previous studies on the categorizations of *裡 lǐ/上 shàng* and provide our own stance. The second part of this Chapter will focus on the reviews of the semantics of English *in/on* and Mandarin *裡 lǐ/上 shàng*.

2.1 Containment and support in English and Mandarin: Syntactic representation

English locative phrases are formed by a preposition and a noun, which appear generally in the post-verbal position. Locative phrases in English are normally functioned as an adjunct as in (1a-b), or a complement as in (1c) in a prepositional phrase.

(1)   a. The teacher is sitting <u>in the classroom</u>.
        b. He works part-time <u>in that restaurant</u>.
        b. The cup is <u>on the table</u>.

In contrast, Mandarin locative phrases can be formed in different ways and appear in different positions in a sentence. First, Mandarin locative expressions can be formed by the morpheme 在 *zài* '(located) at, to exist, (to be) in' and a noun, as illustrated in (2a). In this case, a monosyllabic morpheme indicating the spatial relation between the located object and the reference object can be *optionally* added to the position after the noun, as in (2b) and (2c).

(2)   [在 *zài* + Noun (+spatial morpheme)]
        a. *老師<u>在教室</u>。*

           lǎoshī   <u>zài   jiàoshì</u>.
           teacher   ZAI   classroom
           'The teacher is in the classroom.'
        b. *老師<u>在教室 裡</u>。*

           lǎoshī   <u>zài   jiàoshì   lǐ</u>.
           teacher   ZAI   classroom   in(side)
           'The teacher is in the classroom.'
        c. *他<u>在那家餐廳（裡）</u>做兼職。*

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tā zài nà-jiā cāntīng (lǐ) zuò jiānzhí

3SG ZAI that -CL restaurant   (in)   do   part-time job

'He works part-time in that restaurant.'

Second, Mandarin locative expressions can be formed by 在 *zài*, a noun, and an

obligatory spatial morpheme like 'top, inside', as shown in (3).

(3)   [在 *zài* + Noun *(+spatial morpheme)]

a. *杯子在桌子上*。

   bēizi   zài   zhuōzi shàng

   cup   ZAI   table   top

   'The cup is on the table.'

b. **杯子在桌子*。

   * *bēizi   zài   zhuōzi.*

   cup   ZAI   table

   Intended: 'The cup is on the table.'

a'. *老師坐在教室裡*。

   lǎoshī   zuò   zài   jiàoshì lǐ

   teacher   sit   ZAI   classroom in(side)

   'The teacher is sitting in the classroom.'

b'. **老師坐在教室*。

   * *lǎoshī   zuò   zài   jiàoshì.*

   teacher   sit   ZAI   classroom

   Intended: 'The teacher is in the classroom.'

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Third, Mandarin locative expressions can also be formed by a noun and a spatial morpheme, as in (4); in this case, the locative expressions generally appear in the pre-verbal position, and the entire sentence expresses a meaning of 'there exists something somewhere.'

(4)　　[Noun +spatial morpheme]

　　a. *桌子上有一個杯子*

　　zhuōzi　　*shàng*　*yǒu*　　*yì-ge*　*bēizi*

　　table　　　top　　exist　　one-CL　cup

　　'There is a cup on the table.'

　　b. *牆上掛著一幅畫。*

　　qiáng　　　*shàng*　*guà-zhe*　　*yì-fu*　　　*huà*

　　wall　　　　top　　hang-ZHE　　one-CL　painting

　　'There hangs a painting on the wall.'

Given the various formations of Mandarin locative phrases as shown in (2) - (4): a. [*在 zài* + Noun (+spatial morpheme)], b. [*在 zài* + Noun *(+spatial morpheme)] and c. [Noun +spatial morpheme], the syntactic categories of the post-noun monosyllabic spatial morphemes are still controversial.

There are quite a few post-noun monosyllabic spatial morphemes in Mandarin, as listed below.

(5)　　List of Mandarin post-noun monosyllabic spatial morphemes

上 shàng　　　'above/top'
下 xià　　　　'below/down'

裡 *lǐ*   'in(side)'

外 *wài*   'out(side)'

前 *qián*   'front'

後 *hòu*   'back/behind'

旁 *páng*   'next to/by'

中 *zhōng*   'middle/center'

內 *nèi*   'within/inside'

Note that, the monosyllabic morphemes 上 *shàng* 'above/top', 裡 *lǐ* 'in(side)', 後 *hòu* 'back/behind' and others can freely combine with the morphemes 邊 *biān* 'side', 面 *miàn* 'surface', 頭 *tóu* 'head', 方 *fāng* 'direction' to form disyllabic directional nouns or location nouns (Ernst, 1988), such as 上面 *shàngmiàn* 'top-surface', 裡邊 *lǐbiān* 'in-side', 後頭 *hòutóu* 'back-head', and etc.

Now the question is what the syntactic category of these monosyllabic spatial morphemes such as '上 *shàng*/裡 *lǐ*' is. There are two main views, to be viewed in the following section. One regards '上 *shàng*/裡 *lǐ*' as nouns or noun-like elements; whereas the other treats them as postpositions. In this thesis, I will adopt the latter view and treat '上 *shàng*/裡 *lǐ*' as postpositions and provide additional arguments for this view in the following section as well.

2.1.1　'上 *shàng*' and '裡 *lǐ*' compare with 'English on and in'

The syntactic categorizations of the monosyllabic spatial morphemes are still hotly debated among many syntacticians (Ding, 1961; Djamouri, Paul and Whitman, 2013b; Fang 2004; Huang, Li, and Li, 2009; Liu, 2002, 2003, 2004; Paul, 2015; Chao,

1968; Zhang, 2000). The disagreement on the syntactic categorizations of this group of monosyllabic spatial morphemes appears mainly on the categories of nouns and adpositions.

In the literature, the post-noun monosyllabic spatial morphemes 上 *shàng* 'above/top', 下 *xià* 'below/down', 裡 *lǐ* 'in(side)', 外 *wài* 'out(side)', 前 *qián* 'front', 後 *hòu* 'back', 旁 *páng* 'by', 中 *zhōng* 'middle', 內 *nèi* 'inside' are called 'localizers' in Chao (1968). The term "localizer", argued in Huang et al's (2009) studies, is a deviant of the noun category. The status of 'localizer', agreed by the syntacticians A. Li, (1985), Huang et al. (2009) and Y. Li (2003), is considered as a class of nouns, as the structure represented in (5).

(5)   **Noun**
       [NP [N zhuōzi] [N shàng]]

For the noun account (A. Li, 1990; Y. Li, 2003; Huang et al., 2009), it is argued that the post-noun monosyllabic spatial morphemes are evidenced as class of noun since they behave like nouns, which can stand in subject or object position.

(6)   a. *他們的城市/城外很美麗*

       tāmende   chéngshi/chéng wài   hěn   měilì
       3PL   city/city outside   very   beautiful
       'Their city /Their outside the city is beautiful.'

       b. *我去過他們的城市/城外*

       wo qù-guò   tāmende   chéngshi/chéng   wài
       1SG go-GUO   their   city/city   outside

'I have been to their city/outside the city'

(7)   a. *他*(在)那個城市舉辦過一個展覽會*

        tā   *(zài) nàge chéngshi   jǔbàn-gùo   yī-ge zhǎnlǎnhuì

        3SG   P   that   city   hold-GUO   a-CL exhibition

        'He held an exhibition *(in) that city.'

     b. *他*(在)那個城外/裡舉辦過一個展覽會*

        tā   *(zài) nàge chéng wài/lǐ   jǔbàn-gùo   yī-ge zhǎnlǎnhuì

        3SG   P   that   city   outside/in   hold-GUO   a-CL exhibition

        'He held an exhibition outside/inside the city.'

                                        (Huang et al., 2009:13)

As argued in Huang et al. (2009:13), the localizer resembles nouns that can serve as subjects as in (6a) or objects as in (6b). Further, as nouns, the localizer is positioned in the last word in a noun phrase, comparing examples (7a) and (7b). Accordingly, following the argumentations for examples (6) and (7), the categorization of 上 *shàng* "top", 裡 *lǐ* "in(side)" would be classed into the noun category. However, if their analysis was adopted, there would still remain questions that need to be answered. First of all, according to the principle of economy in linguistics, is it necessary to create a subclass of noun, say the "localizer"? Or could they simply be categorized into the category of adposition? Second, are the argumentations in Huang et al. (2009) sufficient to categorize the monosyllabic spatial morphemes into nouns while they can't be intervened by the subordinator *de*, which is the most essential way to test noun category? The two questions will be addressed again in section 2.1.3, where I will argue both from the theoretical and empirical points of views.

Another account for the status of 上 *shàng*/裡 *lǐ* 's syntactic category is to consider them as the class of adposition—more specifically, postposition, owing to the positions they occur (cf. 桌子上 *zhuōzi shàng* 'on the table' versus *上桌子 *shàng zhuōzi* 'on the table'); The structure of postposition is demonstrated in (8).

(8)   **Postposition**
         [PostpP [NP zhuōzi] [Postp shàng]]

For the postposition account (Ernst, 1988, Djamouri et al.'s, 2013b; Paul, 2015), evidence suggests that spatial morphemes fail to stand along like nouns in the following three aspects—1) unlike nouns, they cannot be modified by the subordinator 的 *de*, 2) unlike nouns, they cannot be stranded in subject position when undergoing topicalization, and 3) unlike other nouns, they are not able be stranded in relativized clause.

Modified by Subordinator 的 *de*

(9)   a. 桌子(*的)上

         zhuōzi   (*de)   *shàng*

         table   SUB   top

         'on the table'

         b. 桌子(的)上面

         zhuōzi   (*de)   *shàng-miàn*

         table   SUB   top-surface

         'on the top of the table'

         c. 小王*(的)照片

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XiǎoWáng *(de)   zhàopiàn

Little Wang SUB   picture

'Little Wang's photo'

Stranding in Topicalization

(10)   a. *那輛汽車，上趴著一隻貓*

     nà-liàng qìchē, shàng   pā-zhe   yì-zhī māo

     that CL car   top   lie-DUR   one CL cat

     '*That car, a cat lying on.'

    b. *那輛汽車，上面趴著一隻貓*

     nà-liàng qìchē, shàng-miàn pā-zhe   yì-zhī māo

     that CL car   top-side   lie-DUR   one CL cat

     'That car, a cat lying on the top.'

    c. *那件衣服，質料很不錯*

     nà-jiàn yīfu, zhìliào   hěn bùcùo

     that-CL cloth material   very nice

     'That piece of cloth is made of good material.'

Stranding in Relative Clause

(11)   a. *裡没有人住的那棟房子*

     lǐ méi yǒu   rén   zhù de nà-dòng fángzi

     in NEG exit people live DE that CL house

     '*that house where there are no one living in'

    b. *裡/面頭没有人住的那棟房子*

     lǐ-miàn/tóu méi yǒu rén zhù de nà-dòng fángzi

     inside NEG exit people live DE that CL house

     'That house where no one lives inside.'

c. *質料很不錯的那件衣服*

　zhìliào hěn bùcùo de nà-jiàn yīfu

　material very nice de that CL cloth

'That piece of cloth which is made of good materials.'

As shown above, the syntactic distributions of 上 *shàng*/裡 *lǐ* as in (9a), (10a) and (11a) are quite different from their disyllabic spatial morphemes (9b), (10b) and (11b) which behave like the class of nouns as examples in (9c), (10c) and (11c). As a result, it has been argued that the status of 上 *shàng*/裡 *lǐ* is in the class of adposition rather than noun since 上 *shàng*/裡 *lǐ* does not behave as noun. On the other hand, the disyllabic counterparts (e.g. 上面/頭/邊 *shàngmiàn/tóu/biān* 'top-surface' and 裡面/頭/邊 *lǐmiàn/tóu/biān* 'inside') are disguised from 上 *shàng*/裡 *lǐ,* which are considered as a class of nouns. In my study, I will adhere to the postposition account, especially the proposals in Djamouri et al.'s (2013b) and Paul (2015). More comprehensive analysis will be provided in the next section, and for expository purpose, examples will be repeated in the following sections.

In the following, I will provide both theoretical arguments and empirical arguments for my view.

Theoretically, if 上 *shàng*/裡 *lǐ* is considered as the class of nouns, as argued in Huang et al. (2009), according to the principle of economy in linguistics, is it necessary to create a subclass of noun, say the "localizer" or could they simply be categorized into the category of adposition? Moreover, quite a number of historical studies of Chinese localizers argued and evidenced in the literature that they have undergone a process of

grammaticalization from content word to function word (Fang, 2004; Liu 2003; Zhang, 2000). Among Chinese localizers, 上 *shàng* and 裡 *lǐ* are the most productive[5] ones; as a result, it is not implausible to consider 上 *shàng*/裡 *lǐ* as adposition from the perspectives of grammaticalization.

Typologically, in quite a few of languages such as German, Islenska (Icelandic), Afrikaans and many others, prepositions and postpositions are able to coexist and co-occur to form a larger adpositional phrase (Djamouri et al., 2013b; Greenburg, 1980 and 1995; Liu, 2003; Paul, 2015; Svenonius, 2007). Hence, it is reasonable to propose 上 *shàng*/裡 *lǐ* as adposition, since the co-existence of the preposition and postposition in Mandarin Chinese is not impossible from the perspective of typology. Owing to the co-occurrence of preposition and postposition in a complex prepositional phrase, the structure is called a circumpositional phrase (CircP hereafter) (Djamouri et al., 2013b; Greenburg, 1980 and 1995; Liu, 2003; Paul, 2015; Svenonius, 2007). However, in my dissertation I will argue that it is more plausible to consider the combination of prepositional and postpositional phrase as a composition of two adpositonal phrases—prepositional phrase and postpositional phrase, rather than a CircP. Detailed analysis will be provided in the following sections.

Empirically, the syntactic distributions of 上 *shàng*/裡 *lǐ* are more prone to adpositions rather than nouns. For instance, as maintained above, the syntactic behaviors of the monosyllabic spatial morphemes are different from their disyllabic counterparts, as shown below.

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[5] The uses of 上 *shàng*/裡 *lǐ* in the post-noun positions did not become productive until Song and Yuan dynasty; in addition, the occurrence of 裡 *lǐ,* indicating the spatial meaning, was not found in the ancient time (Zhang, 2015).

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(12)   a. 桌子(*的)上

      zhuōzi   *(*de)*   *shàng*

      table   SUB top

      'on the table'

    b. 桌子(的)上面

      zhuōzi   *(de)*   *shàng-miàn*

      table   SUB   top-surface

      'on the top of the table'

Ernst (1988) argued that the monosyllabic spatial morphemes are postpositions, functioning like prepositions, which do not allow the subordinator 的 *de* to be inserted between the head and complement, as example (12 a). The sentence is ungrammatical since the monosyllabic spatial morpheme 上 *shàng* 'top/above' do not behave as a noun; as a result it cannot be intervened by the subordinator *de* with the noun 桌子 *zhuōzi* 'table'. Comparing with its disyllabic counterpart 上面 *shàngmiàn* 'top-surface' as example (12 b), the disyllabic spatial morphemes function as a noun, which allow the subordinator 的 *de* inserting in between two nouns. This has been used as evidence that the monosyllabic spatial morphemes should not be categorized as nouns but instead, should be considered as adpositions. Given the fact that the monosyllabic morphemes do not behave like nouns, Huang et al. (2009) proposed a special category, localizer – a category that is diverged from a subclass of noun. In Huang et al.'s (2009) studies, they argued that the syntactic categorization of the so-called "localizer" is a subclass of noun category and they argued with the following examples (Huang et al. 2009:13).

(13)   a. *他們的城市/城外很美麗*

   tāmende   chéngshi/chéng wài   hěn   měilì

   3PL   city/city outside   very   beautiful

   'Their city /Their outside the city is beautiful.'

   b. *我去過他們的城市/城外*

   wo qù-guò   tāmende   chéngshi/chéng   wài

   1SG go-GUO   their   city/city   outside

   'I have been to their city/outside the city'

(14)   a. *他*(在)那個城市舉辦過一個展覽會*

   tā   *(zài) nàge chéngshi   jǔbàn-guò   yī-ge zhǎnlǎnhuì

   3SG   P   that   city   hold-GUO   a-CL   exhibition

   'He held an exhibition *(in) that city.'

   b. *他*(在)那個城外/裡舉辦過一個展覽會*

   tā   *(zài) nàge chéng wài/lǐ jǔbàn-guò   yī-ge zhǎnlǎnhuì

   3SG   P   that   city   outside/in   hold-GUO   a-CL   exhibition

   'He held an exhibition outside/inside the city.'

As argued in Huang et al. (2009:13), the localizer phrases can serve as subjects as in (13 a) or objects as in (13 b). Further, the localizers act as nouns which are positioned in the last word in a noun phrase, comparing examples (14 a-b). Accordingly, following the argumentations for example (13) and (14), the categorization of the monosyllabic morphemes would be classed into the noun category. As mention earlier in 2.1, if their proposal was adopted, there still remain questions that need to be answered from theoretical point of view, and empirical evidences addressed at the beginning of this

section. Here I will argue against the proposal in Huang et al. (2009) and introduce a comprehensive analysis in Djamouri et al.'s (2013b) for empirical evidences.

Djamouri et al. (2013b) and many other researchers' analysis as well on that the monosyllabic spatial morphemes should be classed into the category of adposition, and to be more specifically, the postposition. Djamouri et al. (2013b) and Paul (2015) have provided a comprehensive analysis on the syntactic categorizations of the monosyllabic spatial morphemes as postpositions. First, the postpositions, like prepositions cannot be stranded, illustrated in the following examples (cited from Djamouri et al.'s (2013b)).

(15) a. *我跟不熟 的那個人

  *[DP [TP Wǒ [PreP gēn [e]] [bù shóu]   de   nèi-ge rén]

     1SG   with   NEG   familiar SUB   that CL person

  'the person I am not familiar with'

  b. *張三我跟不熟

  *Zhāngsān [TP wǒ [PreP gēn [e]] bù shóu]

  Zhangsan   1SG   with   NEG familiar

  'Zhangsan, I'm not familiar with.'   (Huang 1982:499, (109a-b))

(16) a. *上趴著一隻貓的那輛汽車

  *[DP [TP [PostP [e] shàng] pā-zhe yī zhī māo] de [nà liàng qìchē]]

                 top   lie-DUR one CL cat SUB that CL car

  'that car on the top of which a cat is lying'

  b. *那輛汽車, 上趴著一隻貓

  *[TopP [Nà liàng qìchē], [TP [PostP [e] shàng] pā-zhe yī zhī māo]].

           that CL   car   top   lie-DUR one CL cat

  'That car, a cat is lying on the top.'

As shown in example (15a-b). Either in a relativization (15a), or in a topicalization (15b), the preposition 跟 *gēn* 'with' cannot be stranded. Similar to the prepositions, the postpositions are also not allowed to be left stranded, either in a relativization (16a), or in a topicalization (16b). On the contrary, NPs and VPs allow stranding. In the following, we will illustrate with the disyllabic counterparts.

(17)   a. *上面趴著一隻貓的那輛汽車*

       [DP [TP [NP [e] *shàng-miàn*] *pā-zhe yī zhī māo*] *de* [*nà liàng qìchē*]]

                top-surface   lie-DUR one CL cat SUB that CL car

      'that car on the top of which a cat is lying'

    b. *那輛汽車, 上面趴著一隻貓*

       [TopP [*Nà liàng qìchē*], [TP [NP [e] *shàng-miàn*] *pā-zhe yī zhī māo*]].

            that CL   car   top-surface lie-DUR one CL cat

      'That car, a cat is lying on the top.'

As shown above, we can confirm again that the behaviors of the monosyllabic spatial morphemes are unlike the disyllabic spatial morphemes. If the monosyllabic spatial morphemes are in the noun category, then why don't they behave like them? Second, evidence also shows from their syntactic distributions. Like prepositions, the postpositions can appear in the argument positions, comparing the sentences below (Djamouri et al.'s (2013b): 83).

(18)   a. *他寫了幾個字在黑板上*

      Tā xiě-le   [DP *jǐ-ge zì*]   [PreP *zài hēibǎn shàng*]

      3SG write-PERF   several-CL character at blackboard top

      'He wrote several characters on the blackboard.'

b. *他的故事登在了報紙上*

   Tā-de gùshi [V0 *dēng-zài*] *-le* [PostP *bàozhǐ shàng*]

   3SG-SUB story   publish-be.at-PERF   paper top

   'His story got published in the newspaper.'

Comparing the prepositional phrase (PreP, hereafter) in (18a) and the postpositional phrase (PostP, hereafter) in (18b), the PostP is like a PreP, which can appear in post-verbal argument positions. Note here, the 在 *zài* "be-at" in (18b) is a verb particle which is in par with the verb, that is why it can appear before 了 *le* "perfective marker", which differs itself from the preposition 在 *zài* "in/on/at" in (18a). Moreover, when appearing in the adjunct positions, similar to PrePs. PostPs can express spatial, temporal and abstract locations (Djamouri et al.'s (2013b): 80-81).

Spatial location:

(19)   a. *桌子上你可以放書, 椅子上你可以放大衣*

       [PostP *zhuōzi shàng*], *nǐ kěyǐ fang shū*,   [PostP *yǐzi shàng*] *nǐ kěyǐ fàng dàyī*

          table   top   2SG can put book   chair top   2SG can put coat

       'On the table, you can put the books, and on the chair, you can put the coat.'

   b. *在上海他有很多朋友*

       [PreP *zài Shànghǎi*] *tā*   *yǒu hěn duō*   *péngyǒu*

          at Shanghai   3SG have very much friend

       'In Shanghai, she has a lot of friends.'

Abstract location:

(20)   a. *原則上你們可以這樣做*

       [PostP *yuánzé shàng*]   *nǐmen kěyǐ zhèyàng zùo*

principle top　　　　2PL　　can　this way do

　　　　'In principle, you can do it this way.'

　　b. *在這方面你要多幫助他*

　　　　[PreP *zài zhè fāngmiàn*]　　*nǐ　　　yào duō bāngzhù tā*

　　　　　　at　this respect　　2SG need much help　3SG

　　　　'In this respect, you have to help him more.'

What I have shown above is that '上 shàng/裡 lǐ' behaves similarly to

prepositions; however, we cannot simply treat them as prepositions since the position in

which '上 shàng/裡 lǐ' is different from the regular prepositions like '在 zài', '跟 gēn',

'從 cóng' and others. Given the position that '上 shàng/裡 lǐ' appears in as well as its

characteristics shown above, it is not unconvincing to treat these elements as postposition.

In the following subsection, we will discuss '在 zài…上 shàng/裡 lǐ'.

2.1.2　Mandarin '在 zài…上 shàng' and '在 zài…裡 lǐ'

　　　　The question to be answered in this section is how we treat '在 zài…上 shàng/裡

lǐ'. There are at least two possibilities. One is to treat '在 zài…上 shàng/裡 lǐ' as

circumpositions (Djamouri et al., 2003b; Liu, 2003; Paul, 2015; Svenonius, 2007). The

other treats '在 zài…上 shàng/裡 lǐ' compositionally, i.e. *在 zài* as a preposition taking a

postpositional phrase as a complement (Wu, 2015). In the next subsection, we are going

to explore both possibilities and to show that it is more reasonable to treat '在 zài…上

shàng/裡 lǐ' compositionally.

It is important to note that no matter which possibilities that one pursues, it needs to be explained why in some cases '上 shàng/裡 lǐ' must co-occur with 'zài' (e.g. *在櫃子 zài guìzi**(*裡 lǐ/上 shàng*) 'at cabinet *(in/on)') as well as why in some cases '上 shàng/裡 lǐ' are optional with 'zài' (e.g. *在學校 zài xuéxiào*(*裡 lǐ*) 'at school (in)').

One thing to distinguish prepositional phrases (PrePs) from postpositional phrases (PostPs) is that PrePs can select PostPs as their complements while not the other way around, the PostPs cannot select PrePs as their complements. Given the restriction, it has also been used to argue that the syntactic categorization of this group of monosyllabic morphemes is noun rather than adposition. Nevertheless, Svenonius (2007) observed that Mandarin prepositions consistently denote path and postpositions consistently denote place. Moreover, Svenonius also noticed that postpositions have a closer relation with nouns than prepositions, which can be seen in the hierarchical structure developed by Svenonius (2007).

(21)
```
                      PathP
                     /     \
              Path          PlaceP
              cóng          /     \
              from      DP          Place
                        zhūozi      shàng
                        table       on
```
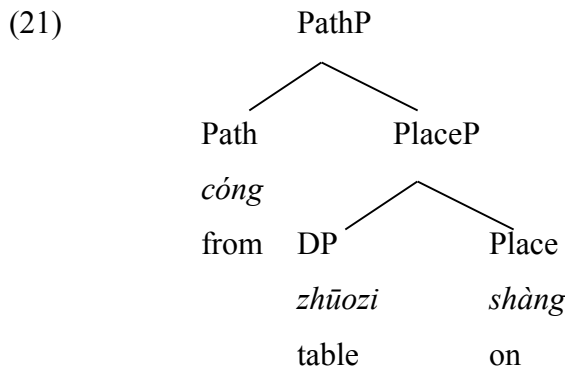
Built on Svenonius's (2007) observation and later refined by other scholars (Cinque and Rizzi, 2010), this hierarchical structure was used to argue that there is an internal structure in the circumpositional phrases (CircPs) which is why a PostP cannot take a PreP as its complement. Given this head-initial and head-final structure in

Mandarin, we now can proceed to an in-depth discussion about the unique structure CircP.

CircP, a complex adpositional phrase, which consists of both a preposition and a

postposition, has been recognized for decades among many researchers (Ding 1961;

Djamouri et al. 2013b; Fang 2004; Huang et al. 2009; Liu 2002, Liu 2003 and 2004; Paul

2015). Mandarin is rich in CircPs, which express spatial, temporal, and abstract meanings.

Such as 在 *zài* …上 *shàng* /裡 *lǐ* /旁 *páng* 'on/in/by' in expressing spatial meanings, 自

zì…(以 *yǐ*)來 *lái* /起 *qǐ* 'since' in expressing temporal meaning, and 像 *xiàng*…似的 *sìde*

'similar to' (Liu 2003). As mentioned earlier, from typological perspective, the category

of circumposition is not impossible in Mandarin since languages like German, Islenska

(Icelandic), Afrikaans and many others also have rich CircPs. Note here, the internal

structures of CircPs diverge from language to language, as shown in the German

examples (22)-(24) (Djamouri et al. 2013: 94-95).

(22)　　a. *unter*　　　　[DP *der*　　　*Brücke*]　　　*durch*
　　　　　under　　　　　　　　the　　　　Bridge.DAT　　through
　　　　　'through under the bridge'

　　　　　*b. [DP der　　　Brücke]　　　*durch*
　　　　　　　　　the　　Bridge.DAT　through

(23)　　a. *an*　　[DP *dem*　　　*Bahnhof*]　　　*vobei*
　　　　　at　　　　　　the.DAT　station.DAT　　beyond
　　　　　'past the station'

　　　　　*b. [DP *dem*　　*Bahnhof*]　　　*vobei*
　　　　　　　　the.DAT　　　station.DAT　　beyond

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(24) a. an [DP *dem* *Fluss*] *entlang*

  at the.DAT river.DAT along

  'along the river'

  *b. [DP *dem* *Fluss*] *entlang*

  the.DAT river.DAT along

As demonstrated in the German examples (23)-(24), these examples confirm the "Path over Place" hierarchy in CircPs; though the internal structures of the CircPs are different in Mandarin and German: path is encoded in Mandarin preposition and while path is encoded in German postposition and place in preposition. However, as observed in Svenonius's (2007) research, the hierarchical structure "PathP over PlaceP" is unique to Mandarin. From the ungrammatical constituencies in (22 b), (23 b) and (24 b), we know that head of the PlaceP will merge with its complement first rather than merge with the head of the PathP. Given the data shown in Mandarin and German, two things can be generalized: first, both path and place have a broader distribution of PPs, and second, the universal hierarchical structure [Path [Place]. In the following, we will demonstrate the hierarchical structures of the CircPs in both Mandarin and German.

Now the question is how does the phrase 在桌子上 *zài zhuōzi shàng* 'on the table' fit in the structure of CircP since the preposition 在 *zài* 'at' does not denote the meaning of path as 從 *cóng* 'from' or 到 *dào* 'to' does.

The solution proposed by Djamouri et al. (2013b), also in line with the other syntacticians (Cinque 2010a; Li 1990; Riemsdijk 1990), is that Mandarin prepositions by default denote path and need to select PlacePs as their complements. The preposition 在 *zài* 'at' has been known for its lacking of essential meaning, which is also called

"semantically vacuous" by Y. –H. Audrey Li's (1990), and further, given the prevalence

of 在 *zài* 'at' in CircPs, Djamouri et al. (2009, 2013b) and Paul (2015) postulated that 在

zài 'at' should be considered as a functional preposition, a prepositional light *p* which

selects a PlaceP as complement, as the path-denoting prepositions 從 *cóng* 'from' and 到

dào 'to' do, as illustrated in the following examples.

(25)　　a. *他們每天在地鐵*(上)/天安門見面*

　　　　tāmen měitiān zài [PostP *dìtiě *(shàng)*]/[NP *Tiān'ānmén*] *jiàn miàn*

　　　　 3PL　　everyday at　　　　subway top　/　Tian'anmen　see face

　　　　'They meet in the subway/at Tian'anmen everyday.'

　　　　b. *他從北京/火車站/院子*(裡)回來了*

　　　　tā cóng [NP *Běijīng*]/[NP *huǒchēzhàn*]/[PostP *yuànzi *(lǐ)*] *huílai-le*

　　　　 3SG from　　Beijing/　　trainstation/　　　courtyard in return-PERF

　　　　'He has come back from Beijing/ the station/ the courtyard.'

　　　　c. *他到北京/ 裡邊/ 房子*(裡)去了*

　　　　tā dào [NP*Běijīng*]/[NP *lǐbiān*]/[PostP f*ángzi *(lǐ)*] *qù-le*

　　　　 3SG to　　Beijing/　　inside/　　　house in　　go-PERF

　　　　'He went to Beijing/ inside/ into the house.'　　(Paul 2015: 123-124)

Comparing examples (25 a-c), the preposition 在 *zài* 'at', does not express path;

like the path-denoting prepositions 從 *cóng* 'from' and 到 *dào* 'to', it is the head of the

adpositional phrases, which selects DP or PostP as its complement.

34

(26) a.

```
              pP
             /  \
            p    DP
           zài   /\
              Tiān'ānmén
              Tian'anmen
```

b.

```
              pP
             /  \
            p   PlaceP
           zài   /  \
               DP    Place
              dìtiě  shàng
              subway  on
```
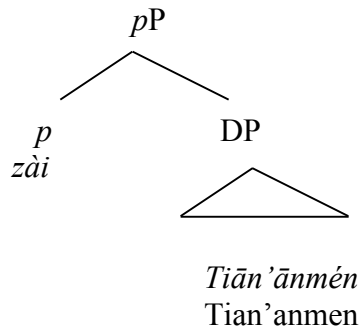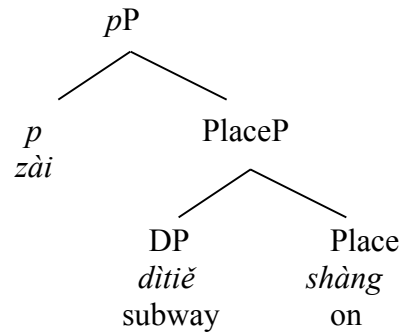
As shown in (26 a-b), the preposition 在 *zài* 'at' selects a DP or PostP as its complement in order to assign a case to its complement. Note here, the postposition is hypothesized to not have the ability to assign case to its complement in a PostP; as a result, in order to have the case checked, a complement of a PostP needs to move to the specifier of P where the case can be checked by a preposition or within a higher verbal projection (Djamouri et al. 2013).

(27)   [p *zài* [PlaceP *dìtiě*   [Place *shàng*] t *dìtiě*]]]

                        subway   top

'on the subway'

Evidences that support the hypothesis can be seen in following sentences (Djamouri et al. 2013: 84).

(28)   a. (*在)車子上趴著一隻貓

          *[PreP   *Zài chēzi shàng*]   *pā-zhe yī-zhī māo*

                    at   car   top   lie-DUR one-CLF cat

      b. (*在)屋子裡很暖和

          [(*Zài*) *wūzi lǐ*]   *hěn   gānjìng*

              at   room in(side)   very   clean

35

'It's very clean in the room.'

As shown in (28 a-b), the ungrammaticalities of the appearance of 在 *zài* 'at' in the prepositional phrases were that since the postpositional complements *chēzi* 'car' and *wūzi* 'room' have checked their features with T, 在 *zài* 'be.at' is not allowed to license the case to the postpositional complement.

To sum, the proposal of treating '在 zài…上 shàng/裡 lǐ' as a CircP seem to rule out the syntactic puzzle that PostPs do not take PreP as their complements. And the solutions are, first given the universal hierarchical structure Path over Place, Chinese PostPs by default denote place and as a result, are restricted to select PrePs as their complements for one reason (Cinque 2010a; Djamouri et al., 2013; Li 1990; Riemsdijk 1990; Svenonius 2007). Second, it is hypothesized that PostPs cannot assign case as their counterpart PrePs for another reason (Djamouri et al. 2013). However, there still remain questions to be answered; first, the preposition 在 *zài* 'at' does not express the meaning of path, as 從 *cóng* 'from' and 到 *dào* 'to'. Although 在 *zài* 'at' is categorized as a functional category by Djamouri et al. 2013, owing to the fact that, similar to 從 *cóng* 'from' and 到 *dào* 'to', 在 *zài* 'at' can take a PostP as its complement, it may not necessarily fit in the universal hierarchical structure 'Path over Place'. The other question is that it still needs to be explained why in some cases '上 shàng/裡 lǐ' must co-occur with '在 zài' (e.g. 在櫃子 *zàiguìzi**(*裡 lǐ/上 shàng*) 'at cabinet *(in/on)') as well as why in some cases '上 shàng/裡 lǐ' are optional with 'zài' (e.g. 在學校 *zài xuéxiào*(*裡 lǐ*) 'at school (in)'). As a result, I propose another view; to treat '在 zài…上 shàng/裡 lǐ' compositionally.

The second account is to treat '在 zài…上 shàng/裡 lǐ' compositionally. As stated earlier, the question that why in some cases '上 shàng/裡 lǐ' must co-occur with 'zài' as well as why in some cases '上 shàng/裡 lǐ' are optional, still remain to be answered, as illustrated with the following examples.

(29)   a. *車子上趴著一隻貓*

    [PostP *chēzi shàng*]　　*pā-zhe*　*yī-zhī māo*

        car　top　　　lie-DUR one-CL cat

'On the car is lying a cat.'

    b. *屋子裡有很多人*

    [PostP *wū lǐ*]　　　*yǒu hěn　duō　rén*

        room in(side) have very much people

'There are many people in the room.'

    c. *山坡上全是粟子樹*

    [PostP *shān-pō shàng*]　　*quán shì lìzhishù*

        mountain-slop top　　all　be chestnut.tree

'All over the mountain slop, there are chestnut trees.'

                           (Djamouri et al. 2013:83)

First, PostPs can occur in subject positions in locative inversion sentences as in (29a), existential sentences as in (29b) and copular sentences as in (29c). If '在 zài…上 shàng/裡 lǐ' is treated as a CircP, a fixed adpositional phrase— coexists with a preposition and a postposition, then the question is how we explain the fact that in some cases PostPs do not co-occur with PrePs as in (29a-c). Evidence can be seen from the ungrammatical sentences in (30a-b). Examples are repeated here for explanatory purpose.

(30) a. (*在)車子上趴著一隻貓

　　　*[PreP　　　*zài chēzi shàng*]　　　*pā-zhe　yī-zhī　māo*

　　　　　　　　at　car　　top　　　　lie-DUR one-CL cat

　　b. (*在)屋子裡很暖和

　　　[(*zài) wūzi　　　lǐ]　　　　　hěn　　gānjìng

　　　　　at　room　　in(side)　　　very　　clean

　　　'It's very clean in the room.'

　　　Again, if '在 zài…上 shàng/裡 lǐ' is treated as a CircP, then the occurrences of PreP are mandatory, as a result, lead to ungrammaticalities of the sentences. As stated in 2.1.4.1, the ungrammaticalities are caused by the occurrences of these sentences, since the postpositional complements *chēzi* 'car' and *wūzi* 'room' have checked their features with T, 在 *zài* 'at' is not allowed to license the case to the postpositional complement.

　　　Second, I would like to argue why that in some cases, the occurrence of 上 *shàng/*裡 *lǐ* is optional as in (31b), while in other cases, the occurrence of 上 *shàng/裡 lǐ* is mandatory as in (31a).

(31)　a. 在櫃子 *(裡/上)

　　　 zài guìzi　*(lǐ/shàng)

　　　'at cabinet *(in/on)'

　　b. 在學校 (裡)

　　　 zài xuéxiào lǐ

　　　 'at school (in)'

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It has been noticed in the literature (Chu, 1997a and 2004; Fang, 2002; Liu 2002), that the occurrences of postpositions have relation to do with the nouns in the adpositional phrases. According to Chu (2004), the occurrences of the postpositions are optional if the nouns in the adpositional phrases are one of the four types.

(32) Type 1: noun phrases that form with monosyllabic directional morphemes

牆角 *qiángjiǎo* 'the corner of the wall'　　山腰 *shānyāo* 'mountainside'

湖心 *húxīn* 'the middle of the lack'　　桌邊 *zhuōbiān* 'tableside'

(33) Type 2: "ordeal number + classifier + noun" noun phrase structure

第一棟樓 *dìyīdònglóu* 'the first building'

第二排 *dìèrpái* 'the second row'

(34) Type 3: nouns that indicate locations, including proper nouns

家 *jiā* 'home'　　公園 *gōngyuán* 'park'

港 *gǎng* 'harbor'　　鎮 *zhèn* 'twon'

Chu's (1997a, 2004) initial observations on the nouns that are optionally followed by postpositions are on the right track. In addition to the nouns, Chu (2004) also proposed other factors[6], however owing to the length and focus in this section, I will not discuss further. The examples presented in this section, lend support to argue against the analysis of the CircPs account.

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[6] Details please see Chu (2004).

Add on to Chu's (1997a, 2004) analysis, I would like to provide my own observations on that there seem to have other restrictions that also contribute to the occurrence of the postpositions, as illustrated with the following examples.

(35)   a. *他在北京(*裡)住了三個月了*
    tā zài Běijīng zhù le sān-ge yuè le
    3SG at Beijing live (*in) LE three-CL month SPF
    'He has been living in Beijing for three months.'

    b. *他現在在公司(?裡)加班*
    tā xiànzài zài gōngsī jiābān
    3SG now at company (? in) work overtime
    'He is working for extra hours at his work place.'

    c. *他剛坐在這個位置(上)*
    tā gāng zuò zài zhè-ge wèizi (shàng)
    3SG just sit at this-CL position (top)
    'He just sat at this place.'

(36)   a. 他把蘋果放在冰箱 (*裡)
    tā bǎ píngguǒ fàng zài wǎn lǐ
    3SG BA apple put at bowl (*in)
    'He put the apples in the refrigerator.'

    b. *他把書放在桌子(*上)*
    tā bǎ shū fàng zài zhuōzi shàng
    3SG BA book put at table (*top)
    'He put the book on the table.'

As (35a-c) demonstrates above, what was proposed in Chu (2004) might not be a complete picture of the occurrences of the postpositions with the nouns that inherit the meanings of location, position, area and etc. For instance, the occurrence of 裡 *lǐ* in (35a) makes the sentence become unnatural, since it overly specifies the location in the proposition, which create a meaning overload. There is a similar situation in (35b), the sentence would have sounded much more natural without the postposition 裡 *lǐ* since, in the sentence, the listener would not pay attention to a specified location, saying whether the person is working inside or outside the workplace, but an approximate location. Comparing (35c), the appearance of 上 *shàng* is optional, since the proposition of the sentence is to give information of a specific location where the person sat on; therefore, the appearance of 上 *shàng* does not create an information overload to the listener. On the contrary, comparing the nouns in (36a-b), the occurrences of the postposition 上 *shàng/*裡 *lǐ* are mandatory since the nouns 冰箱 *bīngxiāng* 'refrigerator' and 桌子 *zhuōzi* do not demote the meanings of location, position, and etc.; and as a result, the locations of the objects need to be specified with the help of postposition 上 *shàng/*裡 *lǐ* . The proposal to treat '在 zài…上 shàng/裡 lǐ' compositionally rather than as CircPs up to this point, has been argued from the syntactic, semantic and pragmatic aspects.

2.1.3   Interim summary

In this section, we have discussed the syntactic categorizations of Mandarin monosyllabic spatial postpositions by reviewing recent studies (Djamouri et al. 2013; Huang et al. 2009; Paul 2015; Wu 2015). Following the discussion, I argued against that

'上 shàng/裡 lǐ' should be considered as postpositions rather than nouns from theoretical and empirical perspectives. Furthermore, owing to the fact that '上 shàng/裡 lǐ' often occurs with preposition 在 *zài* , in literature, the unique pattern is treated as "Circumpositional Phrase"—is formed by both a preposition and a postposition. However, I argued that '在 zài…上 shàng/裡 lǐ' is a complex adpositional phrase which is formed compositionally rather a fix pattern, a CircP. The argumentation is supported by the cases that the PostPs can stand along and appear in subject positions in locative inversion sentences, such as 有 *yǒu* 'exist', the copula 是 *shì* 'be' and etc. There are also cases that *上 shàng/裡 lǐ'* are optional, such as 在北京(裡) *zài Běijīng (lǐ*) 'at Beijing (in)', 在湖面 (上) *zài húmiàn (shàng)* 'at the surface of the lack (on)' and others. Furthermore, following in line with Djamouri et al.'s proposal, I adopted their analysis and consider Mandarin preposition 在 *zài* 'at' a functional category in a CircP, which must select a Place as its complement in order to license case feature to it.

2.2   Containment and support in English and Mandarin: Semantic representation

Spatial semantics has been studied in a significant amount in the past decades (Bennett, 1975; Cooper, 1968; Herskovits, 1986; Landau and Jackendoff, 1993; Leech, 1969; Levinson, 2001; Miller and Johnson- Laird, 1976). Spatial semantics, generally speaking, refers to the study of the meanings of spatial language, and yet, what is considered as spatial language, needs to be further defined. Are they terms that we use in

order to find out location of an object? Or are they terms we use to find out directions of places in a larger scale? One direction of the studies in spatial semantics is to form a class for spatial expressions, such as the "closed-class" in Talmy's (1983) studies, the "spatial prepositions" in Landau & Jackendoff's (1993) research, or the spatial terms Levinson's (2001) paper. In these studies, the meanings of the spatial adpositions are from the geometrical spatial relations between figures and grounds that are associated with them. In the following sections, we will first review previous studies on the semantics of English prepositions *on* and in.

2.2.1 English 'on and in'

2.2.1.1 Geometric account

The traditional view on semantics of spatial prepositions is to define them through the geometric relations between the figures and the grounds that are associated to them. Geometric spatial relations generally refer to the spatial terms that are associated with representations that can be decoded into spatial primitives, expressed in terms of geometric or topological relations such as enclosure, contiguity, proximity and etc. (Garrod, Ferrier and Campbell 1999: 169). A number of researchers use the geometric spatial account to express the geometric relations of the two spatial prepositions *in* and *on*, as shown in Table 2.1(Garrod et al. 1999: 170).

Table 2.1
Geometric relations of English spatial prepositions in and on

Bennett (1975)	
in *y*	Locative (interior (*y*))
on *y*	Locative (surface (*y*))
Cooper (1968)	
x **in** *y*	*x* is located internal to *y*, with the constraint that *x* is smaller that *y*
x **on** *y*	A surface of *x* is contiguous with a surface of *y*, with the constraint that *y* supports *x*
Leech (1969)	
x **in** *y*	*x* is 'enclosed' or 'contained' either in a two-dimensional or in a three-dimensional place *y*
x **on** *y*	*x* is contiguous with the place of *y*, where *y* is conceived of either as one-dimensional (a line) or as a two-dimensional (a surface)
Miller and Johnson- Laird (1976)	
in (*x*, *y*)	A reference *x* is in a relatum y if: [PART (*x*, *z*) & INCL (*z*, *y*)]
on (*x*, *y*)	A reference *x* is 'on' a relatum *y* if: (i) (INCL (*x*, REGION (SURF (*y*))) & SURT (*x*, *y*); otherwise go to (ii) PATH (*y*) & BY (*x*, *y*)
Herskovits (1986)	
in (*x*, *y*)	Inclusion of a geometric construct of *x* in a one-, two-, or three-dimensional geometric construct of *y*
on (*x*, *y*)	For a geometric *x* to be contiguous with a line or surface *y*; if *y* is the surface of an object O_Y, and *x* is the space occupied by another object O_X, or O_Y to support O_X

As shown in Table 2.1, although these definitions are defined through their geometric spatial relations, there does not seem to have a consistent definition for the spatial prepositions *in* and *on* among these researchers. For instance, to define the spatial relation of *in*, different terminologies are used, such as "interior" as in Bennett (1975), "internal" as in Cooper (1968), "enclosed or contained" as in Leech (1969) and many

others. In addition to the problem of definitions, another problem pointed out by Herskovits (1986, 1988), is that the geometric spatial relations are not sufficient to express the complete range of the spatial relations. Given that the geometric meanings of the preposition *in* and *on* defined by Herskovits (1986) as shown in Table 2.1, are only ideal; the idea meaning of preposition refers to a geometric idea, which is from all uses of that preposition derive in terms of various adaptations and shifts. Moreover, Talmy (1988b, 2000) has also argued from the same point of view. He argued that the conceptualized space we used in languages does not reflect the Euclidean in nature, that is to say that it does not reflect the real geometry such as distance, size, contour, angle and etc. He pointed out the conceptualized space is topological in nature, that is it is in a relative relationship rather than absolute relation. Their argumentations can be proofed with examples illustrated in the following. For instance, if you show a picture of Figure 2.1 to the speakers of English and ask the speaker where the pear is. Most of the speakers of English would provide the answer "The pear is in the bowl". However, as definitions of *in* shown in table 2.1, none of definitions is accounted for the spatial scene in Figure 2.1.

Figure 2.1 The pear is in the container

As shown in Figure 2.1, the pear is physical higher than the rim of the bowl and thus not completely enclosed in the bowl; however, the preposition *in* is used to describe the geometric relation between the pear and its reference object despite the fact that *the pear* is not enclosed in a three dimensional space, *the bowl* in this case. Take another example, the geometric relation meaning for *on* is that the figure is contiguous with a line or surface of the ground. For the spatial scene in Figure 2.2, one would say, "The dictionary is on the desk".

Figure 2.2 The dictionary is on the table

As shown in Figure 2.2, the figure *the dictionary* is not contacting with the ground, which is *the desk* here. Again the geometric relation in Figure 2.2 is not held but the spatial preposition *on* is used. Why is it that the spatial relations do not reflect on the geometric relation since the geometric descriptions are not held and yet the spatial preposition *in* and *on* are still selected? What are other possible factors that could affect how the spatial terms are selected? These two examples are pieces of evidence to support either Herskovits's (1968, 1988) or Talmy's (1988b, 2000) observation on that spatial terms such as *in* and *on* are associated with not merely their geometric spatial relations

but also extra-geometric relations, say the functional relations, and control relations

(Garrod et al., 1999; Garrod and Sanford, 1989).

In the following section, the functional account of the spatial prepositions *in* and

on will be discussed.

2.2.1.2 Functional account

As illustrated through the examples in previous section, the use and construal of

spatial terms are underdetermined by geometric spatial relations, and are actually

influenced by extra-geometric relations. The extra-geometric relations, according to

Coventry (1999:145), include a range of varieties to do with the functions of the objects,

and whether the objects can fulfill their functions in context. For instance, the functional

spatial relation associated with *in*, according to Coventry (1998) and Garrod and Sanford

(1989), is as follows: "*in* is appropriate if the ground is conceived of as fulfilling its

containment function". In Figure 2.3, four different scenes are used to illustrate the

functional relation associated with the preposition *in*.
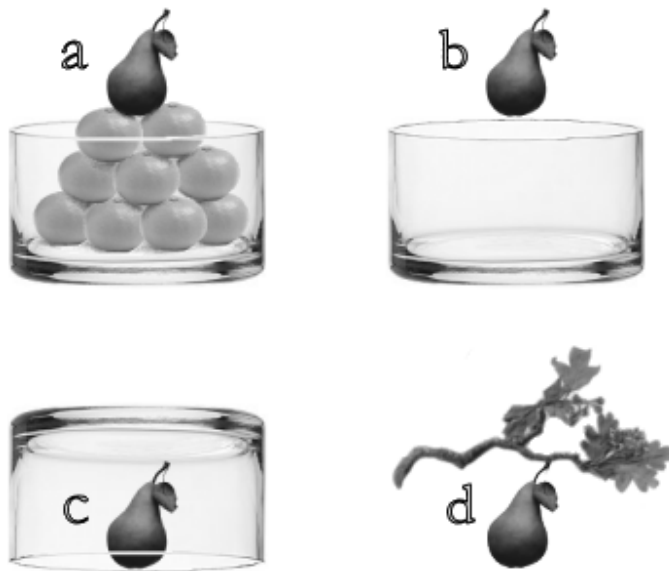
Figure 2.3 Functional relation associated with *in*

As the spatial scenes shown in Figure 2.3, *bowl* is often associated with its function of containment, such as (a) in Figure 2.3. For (a) in Figure 2.3, one would describe the scene as *a pear is in the bowl*, since the pear is contained in the bowl. However, if we empty the bowl as in (b), or turn the bowl upside down as in (c), it would not be appropriate to describe those scenes by using the spatial term *in* since the bowl is no longer associated with its function. The same situation holds true for the spatial scene in (d); one would describe the scene as *the pear is on the twig*, since the twig is associated with the function to support the fruit and prevent the fruit from falling to the ground. From Figure 2.1-2.3, we can see that the functions of the object play a role in describing the spatial relations. However, in addition to the functions of the grounds, Garrod and Sanford (1989) and Vandeloise (1991) argue that spatial terms are sometimes associated with the physical constraints on the relationship between the figure and the ground. As proposed by Garrod and Sanford (1989: 173) with their empirical findings,

one of the constraints is *location control*— "the way in which the objects are seen to control the location of other objects through physical forces in the world".

It is more precisely defined by Garrod et al. (1999: 173), underlying this functional geometric account, the spatial relation associated with *in* is "If Y **fcontians** X, then Y's location controls X's location by virtue of some degree of spatial enclosure of X by Y". According to Garrod et al.'s (1999) definition of *in*, the inner space of Y reflects a certain sort of control whereby Y constraints the location of X. For instance, compare Figure 2.3 (a) and (b), the positions of the pears are similar; however, it would be not appropriate to describe *the pear is in the bowl* for Figure 2.3 (b), since the location of the pear is not controlled by the bowl. On the other hand, the spatial relation associated with *on* is "If Y **fsupport** X, then Y's location controls X's location with respect to a unidirectional force (by default of gravity) by virtue of some degree of contact between X and Y" (Garrod et al. 1999: 174). With the meanings of functional geometric relations of containment and support, more can be explained in terms of the insufficiency of the pure geometrical relations, such as the spatial scene in Figure 2.1, Figure 2.2 and Figure 2.3. Garrod et al.'s functional geometric account provides plausible explanations why sometimes *in* and *on* are used despite the fact that the geometric relations between the figures and grounds are not held.

Coventry (1998), Richards, Coventry and Clibbens (2004) all pointed out that the functional spatial relations indeed have more impact than the geometric spatial relations on the choice of languages used to describe spatial scenes. Evidence is found in Richards et al.'s (2004) study. Richards et al. (2004) examine 80 children (age raging from 3 year 4 months [3; 4] to [7; 8]) on using the English spatial prepositions, *in* and *on*. Participants

were prompted with the scenario where a puppet moved a located object (e.g. an apple) to a new location (e.g. on top of a pile of fruit in a container), and the participants needed to tell a blindfolded puppet where the located object had been placed. Their results showed that children are more sensitive to the locational control than the location. Moreover, the effect of geometry increased with age while the effect of the function of the location stays constant across age groups. Their results also suggest that language specific functional spatial relation perhaps is determined as early as the age of three in children's spatial language acquisition. This claim is also echoed in Bowerman and Choi (1994, 2001, 2003) and Choi (1991). It is pointed out that cross-linguistic differences— the subtle spatial semantic categories— are formed early in language learning (Bowerman & Choi, 1994, 2001, 2003; Choi & Bowerman, 1991). For instance, these studies show that nine-month-old infants can easily make spatial distinctions encoded in English and Korean, while they can only distinguish language-specific spatial categories by the age of 18 months.

The functional account fills the gap for geometric account and also plays an important role in spatial encodings, nevertheless, for some cases, the spatial relations could not be accounted by the functional account, considering the following examples.
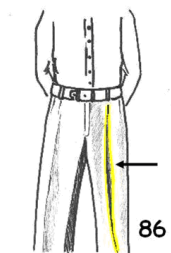
(37) a. A crease is in the pants.   b. The shadow is on the wall.
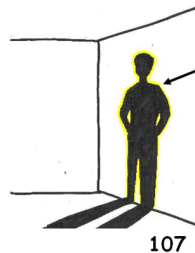
For cases like (37a-b), the two examples cannot be simply accounted by the functional account proposed by Garrod et al. (1999) since first, the grounds do not serve as a function for the figures, and second, the locations of the figures are not constrained by the grounds. For instance, in (37a) *in* is associated to express the spatial scene neither the function of the *pants* is associated nor the *pants* control the location of the *crease* since the *crease* is part of the *pants*. Again, in (37b), the uses of *on* is not triggered either by the function of the ground, the *wall*, or by the locational control relation between the figure, the *shadow* and the ground, the *wall*. Moreover, the spatial relations in these two examples are used differently in Mandarin. To depict the spatial relation in (37a), *shàng* 'top' is associated while in (37b), *lǐ* 'in(side)' is used. Hence, the uses of spatial terms are far more complicated, we will propose a more plausible account in Chapter 4 to account for the mismatched uses of English *on*/*in* and Mandarin *shàng*/*lǐ*.

To summarize, this section reviewed the semantic of prepositions *on* and *in* and addressed the insufficiency of geometric spatial relation account, which brought out the studies of functional geometry account, and helps to explain the uses of spatial terms are not all motived by the geometrical relations, but also by functional relations between the figure and the ground.

2.2.2 Mandarin '上 shàng and 裡 lǐ'

Previous studies have pointed out that the meanings of 上 *shàng* and 裡 *lǐ* are the most "versatility" (Chao, 1968; Gaoqiao,1992; Liu 2003); therefore more are accounted by functional or cognitive approach (Ma 2008; Yu and Ma, 2010). In the following, I will focus on the review of the literature that is studied from the perspective of functional/cognitive approach.

Mandarin '上 shàng'

Yu & Ma (2010) studied the semantics of 上 *shàn* via spatial construal and semantic features and proposed an analysis through the construal of figure, ground, the topological relation between figure and ground and the functional relation between figure and ground. They adopted semantic attributes that represent geometric information and functional relations such as blob, contact, dimension, support, contain, and so forth, to define the semantics of 上 *shàng*. According to Yu & Ma (2010: 103), 上 *shàng* is associated with three distinct spatial meanings, as demonstrated in the following.

(38) a. 上 *shàng* 1 [blob + contact + support + two-dimension]

鋼琴上放著樂譜

gāngqíng shàng fàng-zhe   yuèpǔ

piano   top   place-ZHE   music-score

'There is a piano sheet music set on the piano.'

b. 上 *shàng* 2 [blob + direct contact + attach + two-dimension]

繩子上掛著衣服

shéngzi shàng guà-zhe   yīfu

line   top   hang-ZHE   cloth

'The clothes are hung on the clothesline.'

c. 上 *shàng* 3 [blob + higher position/without contact + one-, two-, or three dimension]

桌子上方有盞燈

zhuōzi shàng-fāng   yǒu zhǎn dēng

table   top-side   exist CL bulb

'There is a pendant almp above the table.'

As shown in (38a-c), 上 *shàng* is associated with three distinct spatial meanings which are represented by combinations of semantic attributes from different parts of construal in spatial scenes. Yu & Ma (2010) tended to provide a comprehensive analysis that could account for the spatial scene encodings from four different construal; however, their analysis did not provide systematic generalizations on spatial encodings. First of all, the semantic attributes adopted to generalized the meanings of 上 *shàng* 1 and 上 *shàng* 2 are not clear defined. For instance, the differences between "contact" and "direct contact" cannot be differentiated in (38a) and (38b). Second, the functional semantic attribute "attach" in (38b) is not precisely used to describe the relation since in (38b) the located object *clothes* are supported by the ground *clothesline* from the help of extra tools, such as cloth pins, rather than attaching to the *clothesline*. Last, the dimensionality of the ground in (38b) is a one-dimensional ground rather than two-dimensional. Yu & Ma (2010) attempt to provide a comprehensive account which includes geometric and functional account as well as figure/ground geometry, yet, a more systematic analysis need to be proposed; for instances, clearer definitions of the semantic attributes used in their study, and how those semantic attributes can be used systematically to generalize the uses of 上 *shàng*.

Mandarin 裡 *lǐ*

Ma (2008) conducted a comparative study of English and Mandarin spatial categorizations of *in* and *on* versus 裡 *lǐ* and 上 *shàng*, and provided an analysis based on

the categorization theory to find out the similarities and disparities between the two

spatial categories in the two languages. Ma (2008) postulated that there exist variations

among speakers of different languages. For instance, when describing identical spatial

scenes, speakers of different languages might observe from different vintage points and

which might result in different spatial categorizations in the equivalent spatial terms in

English and Mandarin, such as *on*/上 *shàng* and *in*/裡 *lǐ*. By comparing with the semantic

category of *in*, Ma (2008) proposed that 裡 *lǐ* shares three core semantic members

[containment], [enclosure] and [occluding] with *in*, as shown in the following examples.

(39) a. [containment + partial enclosure + partial occluding]
蘋果在碗里
píngguǒ zài wǎn lǐ
apple   at   bowl in(side)
'The apple is in the bowl.'

b. [containment +full enclosure +fully occluding]
兔子在籠子裡
 tùzi zài lóngzi lǐ
rabbit at cadge in(side)
'The rabbit is in the cage.'

c. [partial enclosure + full occluding]
松鼠在草叢裡
sōngshǔ zài cǎo-cóng   lǐ
squirrel at grass brush in(side)
'The squirrel is in the underbrush.'

As shown above, the semantic category of 裡 *lǐ*, according to Ma (2008) is defined by three core semantic members; however, to generalize all the uses of 裡 *lǐ*, such as 綠洲在沙漠裡 *lùzhōu zài shāmò lǐ* 'The oasis is in the desert' or 那艘船在湖裡 *nà sōu chuán zài hú lǐ* 'The boat is in the middle of the lake', the spatial relations in these two examples cannot be generalized by these three semantic members. One could probably go as exhausted as they could on the semantic attributes that are associated with the spatial terms as in Ma's (2008) studies. However, this type of analysis cannot provide a unified approach along with predictions accounting for spatial semantics associated with particular spatial terms.

2.2.3   Interim summary

In this section, we first reviewed the previous accounts on the semantic studies of English *on* and *in*. As discussed earlier, the traditional geometric account failed to account for the spatial scenes that do not reflect pure geometry (see Figure 2.1, 2.2). Therefore, we also reviewed another account that was functional based. However, functional account also failed to account for the spatial scenes that do not show functional relation (see Figure 2.3c). For the semantics of Mandarin 上 *shàng* and 裡 *lǐ*, we have also review Yu & Ma's (2010) and Ma's (2008) studies. The studies of the semantics of Mandarin 上 *shàng* and 裡 *lǐ* under the framework of semantic categorization theory are exhausted, but cannot suggest a unified account along with predictions for spatial relations. Thus, in Chapter 4, we will propose our new account to tackle the issues that could not be accounted in previous studies of English *on*/*in* and Mandarin 上 *shàng* /裡 *lǐ*.

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CHAPTER 3

THEORETICAL FRAMEWORK

3.0   Introduction

It has been held in Cognitive linguistics that meanings essentially involve an "imaginative" projection via the means of schematization, categorization, metaphor and metonymy (Lakoff 1987), which is especially held true in spatial semantics. Tyler and Evans (2003) proposed that if the interaction of our bodies and the physical world gives rise to meaning, say, the conceptual structure, then the concepts expressed by the language should largely driven from our perception of spatio-physical experience. Many cognitive scientists also suggested that embodiment experience gives rise to the conceptual structure (Tyler & Evans 2003). Thus, the present Chapter will introduce a cognitive linguistic theory, an embodied cognitive approach, and review two of the very relevant models: image-schema and the proto-scene, which are both grounded in the theoretical base.

3.1   The theoretical framework: An embodied cognitive approach

Embodied cognition proposes that our body can shape our cognition. The theory of embodiment was formulated in the twentieth century by Merleau-Ponty, a philosopher. To better explain his theory, he took perception of space as an example, as a quote from his work in the following.

Far from my body being no more than a fragment of space, there would be no space at all for me if I had no body.

(Merleau-Ponty 1945/1962: 102; cited in Holme 2009: 31)

The central idea of embodiment is how we maintain an awareness of our body; for example, how our limbs are positioned in space, and such awareness is fundamental to almost any physical activity. Spatial relation such as containment is something that we experience in our daily life. Every morning, we pour ourselves a cup of coffee, we use a bowl to contain the oatmeal, and etc. Such experience, according to Tyler and Evans (2003) is called "embodied experience". Embodied experience constitutes the notion that human experience of the world is mediated by the kinds of bodies we have, and thus, how we experience the world is immensely determined by the nature of the bodies and their mediation with the world (Tyler & Evans 2003: 23). Owing to the meditation between the world and our bodies, it gives rise to conceptual structure. Theorized on the embodied experience, Tyler and Evans (2003) proposed that "meaning itself is embodied", which is suggested by a number of researchers (Jackendoff 1983, 1991; Lakoff and Johnson, 1980, 1999; Talmy, 2000). Under the framework of embodied cognition, we will provide more plausible explanations to account for the similarities and differences in the uses of spatial terms English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ*.

3.2 Two approaches on spatial prepositions

In this section, I will review two approaches: "image-schema" and "proto-scene", which are both grounded on the theory of embodiment— the physical world of spatial experience is meaningful to us through the interactions of our bodies and the spaces we occupy. The model "image-schema" is of particular interest to a significant number of researchers, and has been widely used to study the meanings of spatial prepositions and their non-spatial meanings. Another more recent model, termed "proto-scene" developed by Tyler and Evans (2001, 2003) under their framework of Principled Polysemy, is an idealized mental representation across the recurring spatial scenes associated with a particular spatial term. In Tyler and Evans's Principled Polysemy framework, the proto-scene model is used to tackle the polysemous problem created by spatial terms. Nevertheless, the present study will only focus on the spatial meanings rather than the extended non-spatial meanings associated with the spatial terms. The two approaches "image-schema" and the "proto-scene", definitely provide indicative directions and analysis on the studies of spatial prepositions. However, before we review the two approaches, in the next section we will first introduce two important technical notions, which are constantly used to explain the configurations of image-schema or proto-scene.

3.2.1 Trajector and Landmark

Two important notions, the trajector (TR) and landmark (LM), have been widely used in cognitive linguistics. The terms TR and LM are derived from Langacker's Foundations of Cognitive Grammar, in which TR stands for figure and indicates the

highlighted entity or most prominent element in any relational structure whereas LM

refers to the other entity in a relation. Furthermore, the TR, when compared to the LM,

tends to be a smaller, more mobile entity, which is located in relation to the LM, and

serves as a reference entity to locate the TR. For instance, the spatial relation of

containment in between a TR and an LM is demonstrated in Figure 3.1.
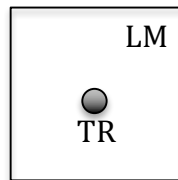
Figure 3.1 A TR in a LM

As shown in Figure 3.1, the containment spatial relation as demonstrated in the figure by

a TR, the black solid dot, and an LM, the square. The TR is the highlighted object, which

is in the middle of the square, and the LM serves as a background in relation to the TR.

The notions of TR and LM are important in explaining the theory of image-schema, and

two notions will also be used to explain the spatial relations of containment and support

in the thesis.

3.2.2 Previous approaches: "Image-schema"

Image-schema has been recognized as a long-standing cognitive linguistic model

used to explain the mental conceptualizations and their mediation with the embodied

experience in the physical world. Lakoff and Johnson (1980) pioneered the concept of

image-schema and develop the concept into a full-fledge theory, which provide a solid

cognitive linguistic perspective in understanding the mental activities and human

activities. In cognitive linguistics, *image* refers to perception in all acts of

conceptualization; through the presentations of the perceptual compositeness of visual, auditory, haptic, motoric, olfactory, and gustatory experiences, concepts are formed (Oakley 2007: 216). *Schema*, on the other hand, can be thought of as "fixed templates" which is used to render meaningful representation (Kent1781 cited from Oakley 2007).

Image-schema, according to Lakoff (1987) and Johnson (1987), refers to the recurring patterns of sensorimotor experience from the interactions of our bodies and the world that we understand and act within to further our purposes. To have a better understanding of the concept of image-schema, here we quote the definition in Johnson (1987:29).

"Image-schema refers to the patterns "emerge as meaningful structure for us mainly at the

level of our bodily movements through space, our manipulations of objects, and our perceptual interactions".

Simply speaking, image-schema is a representation of perceptual experience for the purpose of mapping the spatial structure to conceptual structure. For instance, objects such as a cup, a bowl and such. can serve as an imaginative base for creating a "schematized" mental image of a container. The CONTAINER image-schema is used to define the concept of the English preposition *in*, which is generally consisted of a boundary, an interior, and an exterior (Johnson and Rohrer 2007). For instance, when we say, "The apple is in the refrigerator," we understand that *the refrigerator* is a bounded space where *the apple* is contained in the interior of this bounded space. The

configuration of CONTAINER image-schema is normally represented as Figure 3.1, where a TR, the black solid sphere, is located inside an LM, the square. The most important schemas are listed by Johnson (1987:126) rendered according to convention in small capitals: CONTAINER; BALANCE; COMPULSION; BLOCKAGE…PART-WHOLE; MERGING; SPLITTING; FULL-EMPTY…SURFACE; OBJECT; COLLECTION.

A character of image-schema is that it is a composite notion; therefore, it is neither fixed nor specific (Oakley 2007: 216). Given the fact that many image-schemas have "topological" characteristics, they all contribute part of the constitution of "space", without specifying the magnitude, shape, or material. Take the English word "into" for example, it is a composite of two image-schemas: the preposition "in" evokes a CONTAINER schema with the interior profiled and the preposition "to" evokes a SOURCE-PATH-GOAL schema with the destination (endpoint) profiled (Johnson and Rohrer 2007). Owing to the lack of specificity and content, which makes image-schema highly flexible pre-perceptual and primitive patterns used for reasoning in an array of contexts (Johnson 1987:30). The characteristics of image-schema can be summarized as the following (Johnson and Rohrer 2007:18).

   (1) recurrent patterns of bodily experience,

   (2) "image"-like in that they preserve the topological structure of the perceptual whole, as evidence by pattern-completion,

   (3) operating dynamically in and across time,

(4) realized as activation patterns (or "contours") in and between topologic neural maps,

(5) structures which link sensorimotor experience to conceptualization and language, and

(6) structures which afford 'normal' pattern completions that can serve as a basis for inference.

In the next section, I will introduce the current approach, the proto-scene, which is in relation to image-schema, proposed by Tyler and Evans (Evans & Tyler, 2004b; Tyler & Evans 2001b, 2003, 2007).

3.2.3 Current approach: The Proto-scene

The concept of a proto-scene is in the related vein with image-schema in that it is a meaningful representation that is formed through an embodied experience in the spatio-physical world. Yet the proto-scene differs from George Lakoff's or Mark Johnson's image-schema model in that it is not merely associated with the natural TR-LM configuration, but also with the functions of the configuration (Evans & Tyler, 2004b; Tyler & Evans 2001b, 2003, 2007). For instance, when we see a spatial scene of a fruit in a container, what was triggered through the scene is not merely that a configuration that the TR (the fruit) is in the LM (the bowl), and also a meaningful representation that the fruit is contained by a container which prevents the fruit from falling out. The spatial configuration is meaningful since there are consequences from the real world, which result from entities being involved in such a configuration (Evans & Tyler, 2004b; Tyler & Evans 2001b, 2003, 2007). This is an important distinction to differentiate the proto-

scene from the image-schema, which makes the proto-scene a more comprehensive account to explain cross-linguistic differences in the usages of spatial terms.

The term *proto*, according to Tyler and Evans (2003:52), indicates the idealized aspect of conceptual/mental relation, and the term *scene* refers to the spatio-physical and thus perceptual awareness of a spatial scene. Furthermore, a proto-scene is an idealized mental representation across recurring spatial scenes and which is often associated with spatial particles (Evans & Tyler, 2004b; Tyler & Evans 2001b, 2003, 2007). The proto-scene is an abstract representation and which is high frequent spatial experience that is resulting from our daily life activities in the real world. What makes the proto-scene approach more plausible than the Lakoff's and Johnson's image-schema model is that the proto-scene is not restricted only to the spatial configuration, and therefore has to fully-specify in accounting for all possible usages that are associated to the configuration. Rather, the proto-scene approach takes context into consideration, since different functions or usages could derive from a most prototypical scene.

Now let us take the English preposition *over* for instance to demonstrate how the proto-scene account can tackle the polysemous problem as well as the nuance created in different spatial contexts and how these meanings could derive from the most prototypical sense. The earliest sense associated with over is "higher than, or above" according to *Oxford English Dictionary*. Examples are illustrated in the following sentences (Tyler & Evans 2001b, 2003, 2007).

    (4)   The picture is over the mantel

    (5)   The bee is hovering over the flower

(6)   The tree is leaning over the river

Sentences (4)–(6) can be generalized to an idealized spatio-functional configuration associated with over in that the TR is higher than, or above the LM. This abstracted mental representation of the primary sense, as introduced earlier, is termed the proto-scene by Tyler and Evans (2003). The proto-scene of *over* is diagramed in Figure 3.2. (Tyler & Evans 2001b, 2003, 2007).
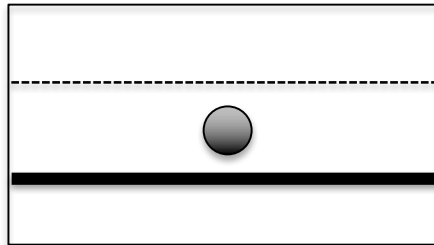
Figure 3.2 Proto-scene for over

As shown in Figure 3.2, the TR is represented by the solid sphere; the LM is represented by the thick horizontal line; and the dashed line represents a potential contact of the LM. The proto-scene of *over* is associated with its configuration information that is, the conceptual spatial relation that relates to the TR and the LM. For instance, the spatial scenes depicted in sentences (4) -(6), capture a spatial relation in which the TR is higher than but within potential contact of the LM which means that the TR is close enough to the LM which could result in contacting with the LM (e.g., picture creep down the wall as the string-ties stretch with age, bees land on flowers, trees touch the river) (Tyler & Evans 2001b, 2003, 2007). With this configuration information/conceptualized spatial

relation associated with the proto-scene, *over*, now we can understand the nuance

associated with *over* in the following spatial contexts (Tyler & Evans 2001b, 2003, 2007).

(7)   The cross-country skier skimmed over the snow

(8)   ?The cross-country skier skimmed above the snow

The primary sense associated with *over* is "higher than or above"; however, the spatial

relation in sentences (7) is that the TR, *the skier*, is higher than the LM, *the snow*, but

with reach of the LM, as in this case, the TR is in contact with the LM. This meaning

associated with *over* in (7) that the TR is higher than the LM within a potential contact of

LM is confirmed by switching spatial prepositions *over* to *above* which leads to a

problematic reading in (8).

The proto-scene is also associated with functions of the configuration, which

reflects the way that the proto-scene is normally used. In other words, the proto-scenes

are typically employed by language users in ways that are resulting from the functional

consequence of interacting with spatial scenes of certain kinds in human activities (Evans

& Tyler, 2004b; Tyler & Evans 2001b, 2003, 2007). Again, let us take the English

preposition *over* for example, as claimed by Tyler and Evans (Tyler & Evans 2001b,

2003, 2007), the function associated with the configuration of the proto-scene, *over*, has

the sense of "control", which is resulting from the fact that the TR and LM are within

each other's sphere of influence. This could be understood as that a consequence of being

within potential reach of the LM, and that the TR can affect the LM at some

circumstances and vise versa (Tyler & Evans 2001b, 2003, 2007). This spatio-physical

experience of "higher than within potential contact of LM" can be associated with or

mapped to our life experience in that when someone is higher than you regarding age, social status, superiority and etc. has more control or influence over you. On the other hand, we can control something or someone, only if we are physically proximal to the entity we seek to control (Tyler & Evans 2003:68), as demonstrated in the following sentences.

(9)   She has a strange power over me [Lakoff, 1987]

(10)   ?She has a strange power above me

As shown above, both *over* and *above* are associated with the spatial relation that the TR is higher than the LM; however, only *over* designates the function relation of "control", which is, as discussed earlier, a consequence of the spatial configuration that the TR is higher than the LM within a potential contact between the TR and the LM. This is again confirmed by switching the spatial prepositions over to above resulting in a problematic reading in (10).

Tyler and Evans's (2001b, 2003, 2007) proto-scene model, as introduced above, can be used to better account for the polysemous problem or nuance spatial relations driven by the spatial prepositions. The proto-scene model differs from the image-schema model in that different senses associated with the proto-scene are related or derived from the most prototypical sense of the spatial preposition rather than a full-specified use of the spatial preposition in an image-schema account. More importantly, the function of a spatial preposition is indeed associated to its spatial configuration that attributes to the consequences of our spatial experience or interaction in the physical world. The proto-

scene model would actually help to explain the insufficiency of the pure geometry account in the uses of spatial terms, or a full-specified account such as image-schema.

3.2.4   Previous analysis of the proto-scene for English 'in'

The proto-scene for English preposition *in*, according to Evans and Tyler (2004b) and Tyler and Evans (2003), is a TR located within an LM that has three salient parts: an interior, a boundary and an exterior, as diagramed in Figure 3.3.
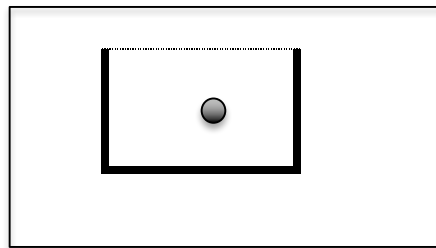
Figure 3.3 Proto-scene for *in*

The proto-scene for *in* is represented by a TR, the shade sphere, located within an LM, the square with solid lines on the two sides and bottom, and a dash line on the top. Sentences associated with the spatial configuration represented by the proto-scene for *in* are shown in (11a-b).

(11)   a. Mom is in the kitchen
        b. The rabbit is in in the box

As shown above, the spatial scenes in (11a-b) are associated with the spatial preposition *in* since the TRs, *mom and the rabbit* are located within the LMs, *kitchen and the box* respectively. However, the most prominent part of the model is that the proto-

scene for *in* is not merely associated with the designed spatial configuration, but also with the function of the containment (Tyler & Evans, 2003). In the following, we will review how the proto-scene for *in* is employed in language by providing a full account of the usages of *in*.

3.2.4.1 The bounded LM

It is initially proposed by Tyler and Evans (2003) and Evans and Tyler (2004b) in their studies of proto-scene for *in*, that the TR is in a bounded LM. As addressed in previous section, the *proto-scene* is an abstract representation which is also a high frequency spatial experience that is resulting from our daily life activities in the real world. Thus, this helps us to understand how the bound concept is associated with the proto-scene for *in*. The bounded LM is actually motivated from the functional nature of containment and which is the consequence of our interaction with bounded LM, which happens quite early as in our infant stages. For instance, a mother puts her infant in a cradle, which prevents the infant from falling out. The fans or the bars on the four sides of the cradle form a bounded LM where the infant experiences the bounded area. Actually we are experiencing a bounded LM in our daily life, such that every morning we pour ourselves a cup of coffee, the cup is a bounded LM which helps to contain the liquid and prevents it from running everywhere or we use a bowl to contain the milk and the cereal, which again provides a bounded area and prevents the contents from flowing everywhere so we can enjoy our breakfast. In addition to the containers that we can actually hold and feel, we ourselves, is the TR who lives within a bounded LM, such as a room, an apartment, a house, and other containers. For instance, everyday we walk from

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one room to the other and go out from the house where we experience bounded LMs everyday. The bounded LMs we experience everyday helps us to build up an abstract spatial representation in our mind and thus reflect to how we use the spatial terms that are associated to the functional nature of containment. The bounded LM is a key element in the proto-scene for *in* since many abstract nouns that used with *in* are associated with the meaning of bounded LM. In the following sections, we will also introduce the noun types that also play a role for the uses of *in*.

3.2.4.2 Non-canonical bounded LM

In Tyler and Evans (2003) and Evans and Tyler (2004b), it was argued that the proto-scene for *in* formulates a spatial relation so that a TR is located within an LM, which constitutes three salient parts: an interior, a boundary, and an exterior. However, sometimes the conceptualization for *in* can be employed in a spatial relation where the LM is a non-canonical LM, to put it in another way a non three-dimensional LM, as demonstrated in the following examples (Evans & Tyler, 2004b; Tyler & Evans, 2003).

(12)   a. The cow munched grass in the field
          b. The tiny oasis flourished in the desert

As shown above, the LM *the field* and *desert* are not three-dimension space since the two LMs, *the field* and *the desert* are conceptualized as planar rather than cubic. If we only consider the geometrical spatial relation of the two LMs in (12a) and (12b), then we might have chosen another spatial term *on*, of which the uses of *on* is normally associated with a two-dimension LM. However, in language uses, the preposition *in* is selected to

encode the spatial relation rather than *on* since the bounded concept/event is associated with the activity that livestock are often bounded with barriers such as gates, fences or hedgerows which constraints the movement of the livestock. We have shown evidence that the uses of spatial terms do not rely merely on the geometric spatial relation or functional spatial relation. Recall the functional account proposed by Garrod et al. (1999:173) for English preposition *in*—the functional relation of containment is "If Y fcontians X, then Y's location controls X's location by virtue of some degree of spatial enclosure of X by Y". Garrod et al.'s (1999) revised definition for preposition *in* has incorporated with the functional spatial relation; however, the revised definition still fails to account for sentences (12a) and (12b). Since more often, the uses of spatial terms are associated with our embodied spatial experience— human spatial experience and activities are recursive and thus, foster our spatial conceptualization, which make proto-scene a better model to account for the mismatch of uses of spatial terms.

CHAPTER 4

CROSS-LINGUISTIC SPATIAL ENCODINGS: ENGLISH VERSUS MANDARIN

4.0   Introduction

The encoding systems of spatial relations vary across languages. Speakers of different languages may have different conceptualizations or pay attention to different parts of an identical spatial scene (Bowerman 1996; Bowerman and Choi 1994, 2001; Bowerman and Levinson 2001). This chapter investigates two topological spatial concepts, containment and support, which are assumed to exist in the mind of all speakers (Levinson et al. 2003). Given the assumption, this chapter studies the two spatial notions since they could serve as a playground for the studies of cross-linguistic spatial encodings.

We begin our studies by comparing the uses of Mandarin 裡 *lǐ*/上 *shàng* and English *in*/*on* since the two sets of spatial terms are often associated with the two spatial notions "containment" and "support" respectively. We examine data from The Beibal parallel translational corpus in Chinese and English and reanalyze the uses of Mandarin 裡 *lǐ*/上 *shàng* and English *in*/*on* from two aspects: geometric spatial relation and functional spatial relation. In addition to the data observed from the corpus, we also include the findings in Zhang, Segalowitz and Gatbonton's (2011) study, which is very relevant to our studies. Zhang et al. (2011) conducted an empirical study on the similarities and differences in using spatial terms that are associated with the spatial concepts, containment and support, by Mandarin and English speakers. By investigating

data from both Zhang et al.'s (2011) study and The Beibal parallel translational corpus in Chinese and English, we will present the similar, mismatched and unique uses between Mandarin 裡 *lǐ*/上 *shàng* and English *in*/*on* in this chapter.

Regarding the encoding system of the two sets of spatial terms, Mandarin 裡 *lǐ*/上 *shàng* and English *in*/*on*, there still exist distinctive ways to construe spatial scenes in the two languages. In the second part of the chapter, I postulate that the similar, different, mismatched and or unique uses between Mandarin 裡 *lǐ*/上 *shàng* and English *in*/*on* can be accounted by an embodied cognitive approach, the proto-scene model, which has yet been addressed in previous studies. We adopt the proto-scene model under the Principled Polysemy Framework developed by Tyler and Evans (2001b, 2003, 2007) and propose the proto-scene for English *on* and Mandarin 上 *shàng* and 裡 *lǐ*. With the proto-scene model, we are able to better understand when the uses of English *on* and *in* and Mandarin 上 *shàng* and 裡 *lǐ* overlap and differ as well as when the uses are uniquely associated with the two sets of spatial terms.

4.1 Similarities and differences between English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ*

Zhang et al. (2011) studied the similarities and differences between and within groups of Mandarin and English speakers, in using spatial terms that are associated to the spatial concepts of containment and support. In their study, they adopted a tool called

Topological Relations Picture Series (TRPS)[7]. Other than TRPS, they also designed their

own simple line drawing pictures to include more scenes that could be possibly elicit

containment and support spatial relationships. In total, they have used 116 simple line

drawing pictures and have found consistent results of the terms that are used to express

the two spatial relationships by the two language groups. They discovered that in both

Mandarin and English groups, twenty-two pictures were consistently described as

containment relationship, thirty-five pictures were consistently described as support

relationship; thirteen pictures were consistently described as support relationship in the

Mandarin group while containment relationship in the English group, one picture was

consistently described as containment relationship in Mandarin while support relationship

in English. Their findings suggest that in some circumstances, the uses of Mandarin(在

zài)…*裡 lǐ* and (在 *zài*)…*上 shàng* versus English *in* and *on* overlap while in some

circumstances, they mismatch in use.

The uses of English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ*, in addition to physical

spatial relations (Zhang et al., 2011), are also used in non-physical spatial relations; thus

in order to have a full discussion on the uses of English *on*/*in* and Mandarin 上 *shàng*/裡

lǐ, we investigate data from The Babel parallel translational corpus in Chinese and

English[8].

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[7] Topological Relations Picture Series (TRPS) is developed by Bowerman and Pederson
(1992) which has been successfully used to elicit the spatial terms that are used to express
the two spatial concepts of containment and support.
[8] The Babel English-Chinese Parallel Corpus, created by Richard Xiao, on a research
project Contrasting English and Chinese (ESRC Award Reference RES-000-23-0553),
contains 20 million Chinese characters and 10 million English words. Available online at
http://111.200.194.212/cqp/babel1c/

4.1.1 Similar uses of *on* and 上 *shàng*

In Zhang et al.'s (2011) findings, 35 out of 116 pictures are described by English *on* and Mandarin 上 *shàng*. The 35 pictures correspond to five types of situations, as summarized in Table 4.1.

Table 4.1

Situations in which English on corresponds to Mandarin (在 zài)…上 shàng

Configurations	Examples
i The loc obj rests on the surface of the ref obj	*a.cup on table　　b 杯子在桌上*
ii The loc obj is adhered to the ref obj	*a.stamp on envelop b. 郵票貼在信封上*
iii The loc obj is joined by devices to the ref obj	*a.handle on door　b. 門上的手把*
iv The loc obj is encircled and in contact with the ref obj	*a.ring on finger　　b. 手指上的戒指*
v The loc obj is impaled/spiked by the ref obj	*a.paper on spike　b. 紙插在針上*

* loc (located), ref (reference), obj (object)[9]

In the following, in addition to the configurations pointed out in Zhang et al.'s (2011) study, we will have a comprehensive study of the similarities between *on* and 上 *shàng* from two aspects: geometric spatial relation and functional spatial relation. The examples were extracted from The Babel parallel translational corpus in Chinese and English.

Regarding the aspect of geometric spatial relation, both *on* and 上 *shàng* are selected for the geometric construct in which the located object is in touch with the

surface of a two-dimensional reference object. The two-dimensional reference object is commonly associated with its salient surface, as shown in (1).

(1) **Two-dimensional reference object**

a. 走在羅馬街上。

 zǒu zài Luómǎ jiē shàng

 walk at Rome street top

'Walk <u>on</u> the street of Rome.'

b. 放在陽台上的書架。

 fàng zài yángtái shàng de shūjià

 put at porch top DE bookshelf

'The book shelf placed <u>on</u> the porch.'

c. 一個演員站在舞台上。

 yī-ge yǎnyuán zài wǔtái shàng

 one-CL performer at stage top

'A performer stands <u>on</u> the stage.'

As shown in (1a-c), the reference objects, *jiē* 'street', *yángtái* 'porch', and *wǔtái* 'stage' are typically associated with their flat planes rather than their edges, margins, or sides. While in some cases *on* and 上 *shàng* can be used in the geometric construct in which the located object is in touch with one-dimensional reference object, as shown in (2).

(2) **One-dimensional reference object**

a. 點在線上。

diǎn zài xiàn shàng

dot at line top

'The dot is <u>on</u> the line.'

b. 吊墜在項鍊<u>上</u>。

diàozhuì zài xiàngliàn shàng

pendant at necklace top

'The pendant is <u>on</u> the necklace.'

c. 那個人正在鋼索<u>上</u>走著。

nà-ge rén zhèngzài gāngsuǒ shàng zǒu-zhe

that-CL PROG tightrope top walk-ZHE

'The man is walking <u>on</u> a tightrope.'

As shown above, the reference objects *xiàn* 'line', *xiàngliàn* 'necklace' and *gāngsuǒ* 'tightrope' are one-dimensional objects of which shapes are related to "line". As in (2), the located objects are in contact with any surface point or segment of the reference objects.

Next we will discuss the similar uses *on* and 上 *shàng* from the aspect of functional spatial relation. Both *on* and 上 *shàng* are selected to encode the spatial relation in which the located object is in contact/contiguous with the surface of the reference object where the located object is supported by the reference object. Two functional relations are often associated with the uses of *on* and 上 shàng and first is the "attach/adhere" supporting spatial relation, as demonstrated in (3).

(3)   **Attach/adhere**

a. *把郵票貼在信封上。*

bǎ yóupiào tiē zài xìnfēng shàng

BA stamp stick at envelope top

'Stick the stamp <u>on</u> to the envelope.'

b. *把這個手指甲套在你的食指上。*

bǎ zhè-ge shǒu zhǐjiǎ tào zài nǐde shí-zhǐ shàng

BA this-CL hand fingernail put at your index-finger top

'Put this fingernail <u>on</u> your index finger.'

c. *把彈頭裝在飛彈上。*

bǎ dàn-tóu zhuāng zài fēidàn shàng

BA bullet-head set at missile top

'Load the warhead <u>on</u>to the missile.'

In the examples above, the located objects are attached or adhered to the reference

objects either with adhesive, as in (3a, b) or attached to a special device, such as arming

device on the reference object, as in (3c).

Second, the functional spatial relation commonly associated to *on* and 上 *shàng* is

the "uphold" supporting relation, as illustrated in (4).

(4)   **Uphold**

a. *將牛頭掛在樹枝上。*

jiāng niú tóu guà zài shù-zhī shàng

JIANG bull head hang at tree-branch top

'Hand the bull's head <u>on</u> the tree branch.'

b. *餐具放在架子上。*

 cānjù fàng zài jiàzi shàng

 cutlery place at shelf top

 'The cutlery is <u>on</u> the shelf.'

c. *見桌上一瓶酒。*

 iiàn zhuō shàng yī-píng jiǔ

 see table top one-CL wine

 'I saw a bottle of wine <u>on</u> the table.'

As shown in (4a-c), the located objects are in contact/contiguous with the surface of the reference objects which afford the support to the located objects. The reference objects in (4a-c) serve the functions to resist the push or pull from the weight of located objects, considering the law of gravity.

Third, *on* and 上 *shàng* are often associated with the spatial relations where take places in transportation, as demonstrated in (5).

(5) **Transportation**

a. *戴安娜在遊艇上渡假。*

Dàiānnà zài yóutǐng shàng dù jià

Diana at yacht top pass vacation

'Diana's holiday <u>on</u> the yacht.'

b. *飛機上放置了一枚炸彈。*

 fēijī shàng fàngzhì-le yī-méi zhàdàn

 plane top place-LE one-CL bomb

'A bomb has been planted <u>on</u> the plane.'

As shown in (5a, b), the located objects *Dàiānnà* 'Diana' and *zhàdàn* 'bomb' are in located within the three-dimensional reference objects *yóutǐng* 'yacht' and *fēijī* 'plane' respectively. However, the uses of *on* and 上 *shàng* in (5a, b) are associated with the functional relation in which the the located objects are carried/transported by the reference objects.

Last, both *on* and 上 *shàng* are also used to depict non-physical spatial relation, as demonstrated in the following examples.

(6) **Non-physical spatial relation**

a. *這是互聯網上的第一個電影網站。*
 zhè shì hùliánwǎng shàng de dì yī-ge diànyǐng wǎngzhàn
 this be internet   top   DE first one-CL movie website
 'This was the first movie-studio site <u>on</u> the Internet.'

b. *公布在站上。*
 gōngbù zài zhàn shàng
 announce at website top
 'Announced <u>on</u> the website.'

c. *節目單上沒有你的名字。*
 jiémù-dān shàng méiyǒu nǐde míngzi
 program-list top   NEG   your name
 'Your name is not <u>on</u> the list.'

d. *這樣許多人都能在同個頻道上說話。*

zhè-yàng xǔduō rén dōu néng zài tóng ge píndào <u>shàng</u> shuōhuà

 this-way many people all can at same CL channel top talk

'So that many people may speak <u>on</u> the same channel.'

e.*地球<u>上</u>將有 26 個超級大城。*

 dìqiú <u>shàng</u> jiàng yǒu 26 ge chāojí dà chéng

 planet top   will have 26 CL super big city

'There will be 26 extremely big sites <u>on</u> the planet.'

As shown in (6), both *on* and 上 *shàng* are associated with the usages for non-physical

spatial relation, which indicate a sense of "range".

In this section, we showed two spatial constructs in geometric spatial relation and

four types of situations in functional spatial relation, which are summarized in the

following table.

Table 4.2

Summary of the similarities in use of on and 上 shàng

	Geometric spatial relation	Functional spatial relation
on v.s 上 *shàng*	i) loc obj is in contact with the surface of one–dimensional ref obj ii) loc obj is in contact with two-dimensional ref obj	i) attach/adhere ii) uphold iii) carry/transport iv) range (non-physical spatial relation)

* loc (located), ref (reference), obj (object)

4.1.2   Similar uses of *in* and 裡 *lǐ*

This subsection will present a comprehensive description of the matching uses

between English *in* and Mandarin 裡 *li*. According to Zhang et al.'s (2011) findings, 22

out of 116 pictures were consistently described by using the spatial terms *in* and *裡 li*. I

summarized their findings in the table below.

Table 4.3

Configurations and examples for spatial term IN elicitation

Configurations	Examples
i) The loc obj was fully or partially contained by a three-dimensional ref obj	a. rabbit in cage b. 兔子在籠子裡
ii) The loc obj was located within the space defined by an outline of a group of objs	a. squirrel in grass b. 松鼠在草欉裡
iii) The loc obj was a member of a group	a. girl in line b. 女孩在隊伍裡
iv) The loc obj was in an interior space defined by two planes at an angle	a. bookmark in book b. 書籤在書裡
v) The loc obj was in a two-dimensional bounded area	a. circle in rectangle b. 圓圈在三角裡

* loc (located), ref (reference), obj (object)

In the following, from the geometrical and functional aspects, we will again demonstrate

data collected from The Babel paralleled translational corpus in Chinese and English and

provide a detailed categorization on the spatial configurations shared by *in* and *裡 li*.

From the aspect of geometric spatial relation, *in* matches the uses with *裡 li* in

eight types of situations. First, *in* and *裡 li* are typically associated with the geometric

construct in which the located object is located within a fully enclosed three-dimensional

reference object as in (7).

(7) **Fully enclosed three-dimensional space**

a. *橱窗裡可口的糕点。*

chúchuāng lǐ kěkǒu de gāodiǎn

window　in delicious DE cake

'The delicious cakes <u>in</u> the showcase.'

b. *教室裡的五台計算機。*

jiàoshì lǐ de wǔ-tái jìsuànjī

classroom in DE five-CL computer

'Five computers <u>in</u> the classroom.'

c. *錢存在郵局裡。*

qián cún zài yóujú lǐ

money deposit at post office in

'Money was deposited <u>in</u> the bank.'

Second, *in* and *裡 li* are also associated with the geometric construct where the located

object is located within a partially enclosed three-dimensional reference object, as in (8).

(8) **Partially enclosed three-dimensional space**

a. *一大堆人在游泳池裡。*

yī-dà-duī rén zài yóuyǒngchí lǐ

one-big-heap people at swimming pool in

'Lots of people <u>in</u> the pool.'

b. *洞穴裡住著一個人。*

dòngxuè lǐ zhù-zhe yī-ge rén

cave　　in live-ZHE one-CL person

'A man lives <u>in</u> a cave.'

c. *他在一座亭子裡休息。*

 tā zài yī-zuò tíngzi lǐ xiūxí

 3SG at one-CL pavilion in rest

'He rests in a pavilions.'

Third, *in* and *裡 li* are used for the spatial relation in which the located object is located in a non-canonical three-dimensional reference object, such as the space marked with boundary by fence, gate, and other impediments, as shown in (9).

(9) **Space bounded by barrier**

 a. *母親在園裡種菜。*

 mǔqīn zài yuán lǐ zhòng cài

 mother at garden in grow vegetable

 'Mother grows vegetables in the garden.'

 b. *他在院子裡。*

 tā zài yuànzi lǐ

 3SG at yard in

 'He is in the yard.'

The reference objects *yuán* 'garden' and *yuànzi* 'yard' are not canonical three-dimensional configurations such as box, room, bowl and so forth, but two-dimensional configurations marked by barriers, which form boundaries. A space that has boundary is considered to be a bounded space which has an interior distinguishing exterior space, and thus is associated with the uses of *in* and *裡 li*.

Fourth, *in* and 裡 *li* are associated with the spatial relation where the located object is located in a non-canonical three-dimensional reference object which does not have physical barrier, as shown in (10).

(10)　**Bounded space without physical barrier**

　　a. *一個旅行者在沙漠<u>裡</u>迷路。*

　　yī-ge lǚxíng-zhě zài shāmò <u>lǐ</u> mílù

　　one-CL travel-man at desert in lost

　　'A traveler lost his way <u>in</u> the desert.'

　　b. *我在一個水坑<u>裡</u>玩。*

　　wǒ zài yī-ge shuǐ-kēng <u>lǐ</u> wán

　　1SG at one-CL water-pit in play

　　'I was playing <u>in</u> a puddle.'

As shown in (10a-b), the reference objects *shāmò* 'desert' and *shuǐ-kēng* 'puddle' are not canonical three-dimensional configurations, which differ from the reference objects in (9a-b) in that their boundaries are associated with the natural division or its own shape rather than physical barriers. Say, the the boundaries of the reference objects in (10) are divided by the areas that are not belong to the *shāmò* 'desert' and *shuǐ-kēng* 'puddle'.

Fifth, both *in* and 裡 *li* are often associated with the spatial relations where take place our body parts, as shown in (11).

(11)　**Space related to body parts**

　　a. *胸腔<u>裡</u>肺葉的跳動。*

　　xiōngqiāng <u>lǐ</u> fèi-yè de tiào-dòng

chest   in lung-lobe DE beat-motion

'The beating of the blades <u>in</u> my chest.'

b. *我們頭腦<u>裡</u>的基因。*

wǒmen tóunǎo <u>lǐ</u> de jīyīn

 1PL   brain   in DE gene

'Genes <u>in</u> our brain.'

c. *子宮<u>裡</u>的胎兒。*

zǐgōng <u>lǐ</u> de tāi'ér

 womb in DE fetus

'A fetus <u>in</u> a womb.'

The human body is considered as a cylinder with volume, which has an inside space where organs, cells, blood, bones, and etc. are posited. Therefore, it is commonly associated with the uses of *in* and *裡 li*.

Sixth, both *in* and *裡 li* are used in the situation in which the located object is mixed within a substance reference object, as shown in (12).

(12) **Space related to substance**

a. *土豆泥<u>裡</u>有牛肉末。*

 tǔdòu-ní <u>lǐ</u> yǒu niúròumò

 potato-paste in exist ground beef

'There is some ground beef <u>in</u> the mashed potato.'

b. *它能在溶劑<u>裡</u>溶解。*

 tā néng zài róngjì <u>lǐ</u> róngjiě

 3SG can at solvent in dissolve

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'It would dissolve <u>in</u> solvents.'

c. *你兒子的脊髓<u>裡</u>長了一個大腫瘤。*

 nǐ érzi de jǐsuǐ <u>lǐ</u> zhǎng-le yī-ge dà zhǒngliú

 2SG son DE spine in grow-LE one-CL big tumor

'Your son has a large tumor <u>ins</u>ide his spinal cord.'

Seventh, *in* and *裡 li* are also used in the spatial context where the reference object is a collection of individual object, as demonstrated in (13).

(13) **Space related to aggregation of individual object**

a. *狼在森林<u>裡</u>覓食。*

 láng zài sēnlín <u>lǐ</u> mì shí

 wolf at forest in search food

'Wolves hunt their prey <u>in</u> the forest.'

b. *她在遊行隊伍<u>裡</u>。*

 tā zài yóuxíng duìwǔ <u>lǐ</u>

 3SG at parade-rank in

'She is <u>in</u> the parade.'

c. *兔子在樹欉<u>裡</u>。*

 tùzǐ zài shù-cóng <u>lǐ</u>

 rabbit at tree bush in

'The rabbit is in the bushes.'

Last, both *in* and 裡 *li* can be used in the spatial context in which the reference

object is marked with geo-physical boundary, such as seas, regions, continents, and

provinces, as shown in (14).

(14) **Space related geo-physical division**

a. *在這個金錢至上的大都市裡*。

 zài zhè-ge jīnqián zhì shàng de dà dūshì lǐ

at   this-CL money most top DE big metropolitan in

'<u>In</u> this money-mad metropolis.'

b. *一個國家裡發生的事情影響到旁邊許多國家*。

 yī-ge guójiā lǐ fāshēng de shìqíng yǐngxiǎng dào pángbiān xǔduō guójiā

one-CL country in happen DE thing affect to adjacency many country

'What happens <u>in</u> one country impacts many others.'

c. *黃石國家公園裡有很多溫泉*。

 Huángshí guójiā gōngyuán li yǒu hěnduō wēnquán

 Yellow Stone National Park in exist many hot spring

'There are quite a few hot springs <u>in</u> Yellowstone National Park.'

Next, I will discuss the similar uses between *in* and 裡 *li* from the aspect of

functional spatial relation. There are three types of situations in which English *in* matches

the uses of Mandarin 裡 *li*. First, in the containment functional spatial relation, *in*

corresponds with 裡 *li*.

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(15)   **Containment**

a. *我把那些信放在一個鞋盒裡。*

 wǒ bǎ nàxiē xìn fàng zài yī-ge xié hé lǐ

 1SG BA those letter place at one-CL shoes box in

'I kept those letters in a shoe box.'

b. *在同一個抽屜裡，我藏有一張幻燈片。*

zài tóng yī-ge chōutì lǐ, wǒ cáng yǒu yī-zhāng huàndēng piàn

 at same one-CL drawer in, 1SG hide exist one-CL slide

'<u>In</u> the same desk drawer, I kept a photographic slide.'

c. *影迷們在睡袋裡過夜。*

 yǐngmímen zài shuìdài lǐ guòyè

 fanPL   at sleeping bag in overnight

'Fans slept <u>in</u> the sleeping bags.'

As shown above, the reference objects *xié hé* 'shoes box', *chōutì* 'drawer', and *shuìdài* 'sleeping bag' all serve the function to contain the located objects, and thus both *in* and 裡 *li* are associated with this functional spatial relation.

Second, both *in* and 裡 *li* are used in the spatial context where takes place in the vehicle type of reference object. Vehicles which have hollow volume enclosed by the doors, such as car, truck, helicopter and so forth are normally associated with the uses of *in* and 裡 *li*.

(16)   **Transportation**

a. *在他拖拉機的駕駛艙裡有無限電話。*

 zài tā tuōlājī de jiàshǐ-cāng lǐ yǒu wúxiàn diànhuà

at 3SG tractor DE cockpit in exist wireless telephone

'The cap <u>in</u> his tractor has a wireless phone.'

b. *我在車裡坐了一個小時。*

 wǒ zài chē lǐ zuò-le yī-ge xiǎoshí

 1SG at car in sit-LE one-CL hour

'I set <u>in</u> the car for an hour.'

Third, both *in* and *裡 li* can be used in situations in which the reference object is a

non-physical space but an abstract space, as shown in (17).

(17) **Non-physical spatial relation**

a. *我把一切美好的東西都放到這部影片裡了。*

 wǒ bǎ yīqiè měihǎo de dōngxī doū fàng-dào zhè-bù yǐngpiàn lǐ le

 1SG BA whole wonderful DE thing all put-to this-CL film in SPF

'I put everything good <u>in</u> this movie.'

b. *那些詩全都在這本書裡。*

 nà-xiē shī quán dōu zài zhè-běn shū lǐ

 those poem all all at this-CL book in

'Those poems are all *in* this book.'

c. *我在神經病學圈裡聽過。*

 wǒ zài shénjīngbìngxué quān lǐ tīng-guò

 1SG at neurology circle in hear-GUO

'I had heard <u>in</u> neurological circle.'

d. *在空氣裡寫字。*

 zài kōngqì lǐ xiězì

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at air in write

'Write <u>in</u> the air.'

e. 人們喜歡在溫暖的天<u>裡</u>展現自己的肌肉。

rénmen xǐhuan zài wēnnuǎn de tiān <u>lǐ</u> zhǎnxiàn zìjǐ de jīròu

people like at warm DE weather in demonstrate self DE muscle

'People like to show off their bodies <u>in</u> the warm weather.'

For instance, in (17) the reference objects *yǐngpiàn* 'movie' and *shū* 'book' are conceptualized as containers where the located object *dōngxī* 'everything' and *shī* 'poems' can be compiled or collected in them. The reference object *quān* 'circle' in (17c) is extended from the physical bound space as if there is an abstract boundary where people in the same profession form a group/circle. The reference objects *kōngqì* 'air' and *tiān* 'weather' in (17d-e) are two abstract nouns and are conceptualized as if there are abstract spaces of which the volumes are filled with these abstract substances, *kōngqì* 'air' and *tiān* 'weather'.

In this subsection, we have discussed the similarities of the uses in geometric and functional spatial relations as well as non-physical spatial relations that are associated with *in* and 裡 *li*, as summarized in the following table.

Table 4.4

Summary of the similarities in use of in and 裡 li

	Geometric spatial relation	Functional spatial relation
in v.s 裡 *li*	i) loc obj is within a three-dimensional ref obj fully or partially ii) loc obj is located in a bounded ref obj (with physical barrier) iii) loc obj is located in a bounded space without barrier iv) loc obj is within body part ref obj v) loc obj is blended in the substance ref obj vi) loc obj is located in a aggregation of individual ref obj vii) loc obj is located within a geo-physical ref obj	i) containment ii) transportation iii) bounded event

* loc (located), ref (reference), obj (object)

4.1.3   Mismatched uses

In Zhang et al.'s (2011) study, 13 out of 116 pictures were consistently described by using the spatial terms *in* and 上 *shàng* and one picture was described by using *on* and 裡 *lǐ*, as shown in Table 4.5.

Table 4.5

Configurations and examples for mismatched uses of on/in and 上 shàng/裡 lǐ

in	*上 shàng*
i)The loc obj is partially included in or surrounded by the ref obj	i)The loc obj is supported by ref obj on its surface
Examples	Examples
a. *hole in wall* b. *gap in fence* c. *crack in cup* d. *nail in board*	a. 牆上有洞 b. 柵欄上有洞 c. 杯上有裂痕 d. 釘子在板子上
ii)The loc obj is partially included in the ref obj	ii) The loc obj is supported by ref obj
Examples	Examples
a. *muscle in leg* b. *crease in pants* c. *knot in rope*	a.肌肉在腿上 b.褲子上的摺痕 c.結打在繩上
iii)The loc obj is contained within the outline of the ref obj	iii)The loc obj is in contact with the ref obj
Examples	Examples
a. *bird in tree* b. *fruit in tree*	a. 鳥在樹上 b. 樹上結果實
on	*裡 lǐ*
i) The loc obj is supported by the ref obj	i) The loc obj is surrounded and contained by the ref obj
Examples	Examples
food on plate	食物在盤子裡

* loc (located), ref (reference), obj (object)

As summarized in the above table, three types of situations found in Zhang et al.'s (2011) studies where *in* is dissimilar with 裡 *lǐ* but corresponds to the uses of 上 *shàng*, and one type of situation where *on* is incongruent with 上 *shàng* but corresponds to the uses of 裡 *lǐ*. In addition to Zhang et al.'s findings, in the following we will provide more examples,

including physical spatial as well as non-physical spatial relations from The Babel parallel translational corpus in Chinese and English for further discussion.

We have found additional four types of situations where *in* is dissimilar with 裡 *lǐ* but matches the use of 上 shàng, and additional three types of situations where *on* is incongruent with 上 *shàng* but matches the use of 裡 *lǐ*. In the following, we will begin our discussion with the mismatched uses between *in* and 上 *shàng*.

First, the mismatched uses between *in* and 上 *shàng* can be seen in the physical spatial relations in which the reference objects are conceptualized differently in English and Mandarin, as shown in (18).

(18)   **Physical spatial relation**
   a. *我躺在床上輾轉反側。*
    wǒ tǎng zài chuáng shàng zhǎn-zhuǎn fǎn-cè
    1SG lie at   bed   top   toss-over turn-over
   'I tossed and turned <u>in</u> bed.'

   b. *一種在葡萄皮上發現的物質。*
    yī-zhǒng zài pútáo pí shàng fāxiàn de wùzhí
    one-kind at grape skin top discover DE substance
   'A substance found <u>in</u> grape skins.'

   c. *他在法庭上出示這些證據。*
    tā zài fǎtíng shàng chūshì zhè-xiē zhèngjù
    3SG zt court top show these evidence
   'He produces this evidence <u>in</u> court.'

In (18a), the reference object *chuáng* 'bed' is perceived as a two-dimensional space in Mandarin; thus 上 *shàng* is used. However, in English, the reference object *bed* is conceptualized as a three-dimensional space which has an interior where the located object is contained in the space between the blanket and the surface of the *bed*; therefore, *in* is selected. As for (18b), in Mandarin, the reference object *pútáo pí* 'grape skin' is conceptualized as a two-dimensional plane and thus 上 *shàng* is used, while in English, the reference object *grape skin* is conceptualized as a three-dimensional space which has an interior where the substance is contained in the space of the inner layer of the grape skin. For (18c), the reference object *fǎtíng* 'court' is conceptualized as a two-dimensional space where some activities are carried on, whereas, in English the reference object *court* is associated with its physical three-dimensional construct, and thus *in* is used. Similar uses of 上 *shàng* in (18c) can also be seen in 社會上 *shèhuìshàng* 'in the society', 世界上 *shìjièshàng* 'in the world' and so forth.

Second, the mismatched uses between 上 *shàng* and *in* can also be seen in non-physical spatial relations in which the reference obejcts are text type of nouns, as illustrated in (19).

(19)   **Non-physical space as in text type of nouns**
       a. *雜誌上刊登了一項 發現。*
       zázhì shàng kāndēng-le yī-xiàng fāxiàn
       magazine top post-LE   one-CL discover
       'A discover reported in magazine.'

       b. *在 1,200 多種報紙上刊載。*
       zài 1,200 duō zhǒng bàozhǐ shàng kānzǎi

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at 1,200 many kind newspaper top publish

'Appear <u>in</u> more than 1,200 newspapers.'

c. *時尚和生活方式專欄上已有報導。*

shíshàng hé shēnghuó fāngshì zhuānlán <u>shàng</u> yǐ yǒu bàodǎo

fashion CONJ life　　style　　column　　top　already have report

'It has been <u>in</u> the fashion and lifestyle sections.'

In (19), the reference objects *zázhì* 'magazine', *bàozhǐ* 'newspaper', and or *zhuānlán* 'section' are text type of nouns and are normally associated with volume, front/back cover, content, binary, page, section, margin and so forth. In (19), the reference object *magazine*, *newspaper* and *section* are conceptualized as three-dimensional space where the located objects are contained within the space. However, in Mandarin, the reference objects *zázhì* 'magazine', *bàozhǐ* 'newspaper', and or *zhuānlán* 'section' are all associated with a sense of "range"; more specifically, a range of contents that are specific in subjects, topics, fields, and so forth.

Third, the mismatched uses between 上 *shàng* and *in* are also found in non-physical spatial relations in which the reference objects are abstract nouns, as shown in (20).

(20)　**Abstract nouns**

a. *在羅輯上他們難以發現。*

zài luó-jí <u>shàng</u> tāmen nán yǐ fāxiàn

at logic　top　　3PL difficult to discover

'<u>In</u> logic, they can scant ignore.'

b. *這使合作人在任何交易上舉步唯艱。*

zhè shǐ hézuòrén zài rènhé jiāoyì shàng jŭbù wéi jiān

 this cause partner at any   deal   top   lift-walk only difficult

'This made partners work hard <u>in</u> any deal.'

c. *事實上，這比原本設計得要好。*

shìshí shàng, zhè bǐ yuánběn shèjì dé yào hǎo

 fact   top,   this COM original design DE AUX good

'<u>In</u> fact, this is better than the original design.'

As shown above, the reference objects are abstract nouns, such as *luó-jí* 'logic',

jiāoyì 'deal' and *shìshí* 'fact' which are conceptualized differently in the two languages.

In English, they are conceptualized as three-dimensional space in which the sense of

"boundary" is associated, whereas in Mandarin, they are conceptualized as two-

dimensional plane in which the sense of "range" is associated.

Fourth, the mismatched uses in between 上 *shàng* and *in* can also be seen in the

spatial relations in which the reference objects are vehicles, as in (21).

(21)   **Transportation**

　　a. *與直升機上的飛行員通話。*

　　yǔ zhíshēngjī shàng de fēixíngyuán tōnghuà

　　 with chopper top   DE pilot   conference

　　'Talk to the pilot in the chopper.'

　　b. *爸爸坐在一條小漁船上。*

　　bàba zuò zài yī-tiáo xiǎo yú-chuán shàng

　　father sit at one-CL small fishing-boat top

　　'Father set in a small fishing boat.'

c. *我還在筏子上嗎*?

wǒ hái zài fázi shàng ma

 1SG still at raft top   Q

'Was I still in the raft?'

In English, vehicles with smaller capacity which do not have walkways as in (20a-c), are normally associated with *in*, whereas vehicles with larger capacity which contain walkways such as bus, airplane, train and so forth, are normally associated with *on*. However, in Mandarin this does not seem to be a factor regarding the selections of 上 *shàng* and 裡 *lǐ*, as shown in (21a-c).

Next, we will discuss the situations where the use of 裡 *lǐ* is dissimilar with *in* but corresponds to the uses of *on*. There are only two examples found in the corpus, as shown in (22).

(22)   a. *他的父母仍然住在農場裡*。

 tā de fùmǔ réngrán zhù zài nóngchǎng lǐ

 3SG DE parents still live at farm   in

'His parents still live <u>on</u> the farm.'

b. *一個她保存在文檔裡的故事*。

 yī-ge tā bǎocún zài wéndàng lǐ de gùshì

 one-CL 3SG keep at file   in DE story

'A story she keeps on file.'

The reference objects *nóngchǎng* 'farm' and *wéndàng* 'file' are conceptualized differently in the examples we presented here; in English, the plane or surface of the

reference objects in (22a) is associated and thus *on* was used, while in Mandarin, the boundary of the reference objects are associated, for instance, the fence surround the farm, and thus 裡 *lǐ* was used. In (22b), the reference object *wéndàng* 'file' is conceptualized as a two-dimensional space in which the sense "range" is associated, and thus on was used; on the contrary, in Mandarin it is conceptualized as a three-dimensional space in which the containment function is associated, and hence, 裡 *lǐ* was used.

In this subsection, we have discussed the the mismatched uses between 上 *shàng* and *in* as well as 裡 *lǐ* and *on*, which are resulting from different conceptualizations of the same spatial scenes by English and Mandarin speakers. Therefore, in the following table, we will provide a comprehensive summary of Zhang et al.'s findings as well as our data.

Table 4.6

Summary of the mismatched uses between on/in and 上 shàng/裡 lǐ

上 *shàng*	*in*
i) the loc obj is the salient part as it appears on top of the ref obj (e.g., 釘子在板子上)	i) the loc obj is contained in the ref obj (e.g., nail in board)
ii) the loc obj is the missing part of the ref obj and which is perceived as on the surface of the ref obj (e.g., 牆上有洞，杯上有裂痕)	ii) the loc obj is the missing part of the ref obj and which is perceived as contained in the ref obj (e.g., hole in wall, crack in cup) Associated with the function "containment" (e.g., *bed*, *court*, *grape skin*)
iii) the loc obj is part of the ref obj and which is perceived as appear on the surface of the ref obj (e.g., 肌肉在腿上，結打在繩上)	iii) the loc obj is part of the ref obj and which is perceived as embedded in the ref obj (e.g., muscle in leg, knot in rope)
	iv) the loc obj is contained in the outline of the ref obj (e.g., bird in tree, fruit in tree)

iv) the loc obj is supported bu the reference ref obj or the log obj is physically higher than the speaker (e.g., 鳥在樹上，樹上結果實)

v) the salient part of the ref obj is associated (e.g., *床, 葡萄皮*)

vi) the ref obj is conceptualized as a two-dimensional space that is associated with the sense of "range" where specific activities are carried on (e.g., *法庭, 交易*)

vii) the surface of the ref obj, such as seat, walkway, and etc. is associated (e.g., *直升機, 漁船, 筏子*)

viii) the ref obj is conceptualized as a two-dimensional space which is associated with the sense of "range" about specific topics, fields, professions (e.g., *雜誌，報紙, 專欄*)

ix) the ref obj is conceptualized as a two-dimensional plane which is associated with the sense of "range" (e.g.,*羅輯, 事實*)

v) the ref obj is perceived as a three-dimensional space which has an interior to contain the loc obj (e.g., bed, grape skin)

vi) the loc obj is located within a three-dimensional space (e.g., court)

vii) the loc is contained within a three-dimensonal space (e.g., *chopper*, *fishing boat, raft*)

viii) the ref obj is conceptualized as a three-dimensional space (e.g., *magazine, newspaper, column*)

ix) the ref obj is conceptualized as a three-dimensional space which is associated with the sense of "boundary" (e.g., *logic, deal, fact*)

裡 lǐ	*on*
i) the ref obj is conceptualized as a three-dimensional space in which the loc obj is contained in it (e.g., 食物在盤子裡) ii) the ref obj is conceptualized as a three-dimensional space which is associated with the sense of "boundary" (e.g. *農場*) iii) the ref obj is conceptualized as a three-	i) the ref obj is in contact with the surface of the reference obj (e.g., food on plate) ii) the plane or surface of the ref obj is associated (e.g., *farm*) iii) the ref obj is conceptualized as a two-dimensional space which is associated with the sense of "range" (e.g., *file*)

dimensional space, in which the function of

containment is associated with (e.g., 文檔)

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* loc (located), ref (reference), obj (object)

4.1.4 Unique uses of 上 *shàng* and 裡 *lǐ*

In this subsection, we will demonstrate the unique uses of 上 *shàng* and 裡 *lǐ*

which do not correspond to *on* nor *in* in English. We will begin with the unique uses of

上 *shàng*, which overlaps the uses of three other English prepositions, *above*, *around* and

at.

First, 上 *shàng* can also be used in the spatial relation in that the located object is

above the reference object without physical contact, which corresponds to the uses of

English preposition *above*, as in (23).

(23)   上 **shàng** and **above**

太平洋<u>上</u>夏日的天空。

Tàipíngyáng <u>shàng</u> xià-rì de tiānkōng

Pacific Ocean above summer-day DE sky

'The blue sky <u>above</u> the Pacific.'

Second, 上 *shàng* can be used in the situation which corresponds to English

preposition *around*, as illustrated in (24).

(24)   上 **shàng** and **around**

你可以將可穿戴式電視掛在脖子<u>上</u>。

nǐ kěyǐ jiāng kě-chuāndài-shì diànshì guà zài bózi <u>shàng</u>

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2SG can JIANG wearable TV hang at neck top

'You can set the wearable TV <u>around</u> your neck.'

As shown in (24), the located object *kě-chuāndài-shì diànshì* 'wearable TV' is supported by the reference object *bózi* 'neck' by setting around the reference object *bózi* 'neck', of which the sense of "surround" is associated to the uses of English preposition *around* rather than *on*.

Third, 上 *shàng* is associated with the spatial relation which corresponds to the uses of English preposition *at*, as demonstrated in (25).

(25)　　*上 shàng* **and** *at*

　　　　a. *會議上發表的一份研究報告。*

　　　　huìyì shàng fābiǎo de yī-fèn yánjiù bàogào

　　　　conference top present DE one-CL research report

　　　　'A research paper presented <u>at</u> a conference.'

　　　　b. *在奧斯卡的頒獎典禮上。*

　　　　zài Àosīkǎ de bānjiǎng diǎnlǐ shàng

　　　　at Oscar　DE award　ceremony top

　　　　'At the Oscar rewards ceremony.'

　　　　c. *在世界杯足球賽上。*

　　　　zài shìjièbēi zúqiú sài shàng

　　　　at Word Cup soccer game top

　　　　'<u>At</u> a football World Cup.'

In English, the reference object *huìyì* 'conference', *diǎnlǐ* 'ceremony', and *zúqiú sài* 'World Cup' are construed as a point where the located objects are in contiguous with; thus *at* is selected. In Mandarin, these reference objects are perceived as a two-dimensional plane where some activities are carried and therefore 上 *shàng* is used.

Next, we will proceed to the discussion of the unique uses of 裡 *lǐ*, which overlaps the uses of two English prepositions, *under* and *at*. First, 裡 *lǐ* can be used in some situations where *under* is used, as illustrated in (27).

(27)　　*裡 lǐ* **and** *under*

　　a. *他的指甲蓋裡仍藏著些許污泥。*

　　tā de zhǐjiǎ gài lǐ réng cáng-zhe xiēxǔ wū ní

　　3SG DE fingernail in still hide-ZHE some dirt mud

　　'Some dirt is still <u>under</u> his fingernails.'

　　b. *他西裝裡穿著防彈背心。*

　　tā xīzhuāng lǐ chuān-zhe fángdàn bèixīn

　　3SG suit　　in wear-ZHE bullet-proof jacket

　　'He wore a bullet-proof jacket <u>under</u> the suit.'

In (27a), the located object *wū ní* 'dirt' is covered underneath the inner surface of the reference object *zhǐjiǎ* 'fingernail', and in (27b), the located object *bèixīn* 'jacket' is located under the interior of the reference object *xīzhuāng* 'suit'.

Second, 裡 *lǐ* can be used in some cases in which *at* is used, as shown in (28).

(28)　　*裡 lǐ* **and** *at*

　　a. *在市場心理實驗室裡。*

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zài shìchǎng xīnlǐ shíyànshì lǐ

at market mind laboratory in

'<u>At</u> the "Mind and Market" laboratory.'

b. 我停留在一個小村莊裡。

 wǒ tíngliú zài yī-ge xiǎo cūnzhuāng lǐ

 1SG stay   at one-CL small village in

'I stop <u>at</u> a small village.'

In English, the the reference objects *shíyànshì lǐ* 'laboratory' and *cūnzhuāng* 'village' are

conceptualized as a point and thus at is used. However, in Mandarin, the reference

objects *shíyànshì lǐ* 'laboratory' and *cūnzhuāng* 'village' are perceived as three-

dimensional space, and therefore 裡 *lǐ* is selected.

Table 4.7

Summary of unique uses of 上 shàng and 裡 lǐ

Unique uses of 上 *shàng*		
above	太平洋<u>上</u>夏日的天空 *Tàipíngyáng <u>shàng</u> xià rì de tiānkōng*	The blue sky <u>above</u> the Pacific.
around	你可以將可穿戴式電視掛在脖子<u>上</u> *Nǐ kěyǐ jiāng kě chuāndài shì diànshì guà zài bózi <u>shàng</u>*	You can set the wearable TV <u>around</u> your neck.
at	會議<u>上</u>發表的一份研究報告 *Huìyì <u>shàng</u> fābiǎo de yī fèn yán jiù bàogào*	A research paper presented <u>at</u> a conference.

Unique uses of 裡 *lǐ*		
under	他西裝<u>裡</u>穿著防彈背心 *Tā xīzhuāng <u>lǐ</u> chuānzhuó* *fángdàn bèixīn*	He wore a bullet-proof jacket <u>under</u> the suit.
at	在市場心理實驗室<u>裡</u> *Zài shìchǎng xīnlǐ shíyàn shì <u>lǐ</u>*	<u>At</u> the "Mind and Market" laboratory.

4.1.5   Generalization and interim summary

In section 4.1, we have examined (i) the similar uses between 上 *shàng* and on (ii) the similar uses of 裡 *lǐ* and in (iii) the mismatched uses between 上 *shàng*/裡 *lǐ* and on/in and (iv) the unique uses of 上 *shàng* and 裡 *lǐ*. First, from the aspect of geometric aspect, both *on* and 上 *shàng* are associated with the spatial configurations in which the located object is in contact with the surface of a one or two-dimensional reference object. From the functional spatial aspect, both *on* and 上 *shàng* are associated with the spatial relations in which the reference object might serve a function to support the located object in different manners. Second, from the aspect of geometric spatial relation, both *in* and 裡 *lǐ* are associated with the spatial configuration in which the located object is enclosed/included/contained fully or partially within a three-dimensional space. From the aspect of functional spatial relation, both *in* and 裡 *lǐ* are used in the spatial relations in which the reference objects serve a function to contain the located objects. Third, in some cases, 上 *shàng* dislike on and overlapped the uses of *in* while in some situations 裡 *lǐ* dislike in and overlapped the uses of *on* when the the spatial scenes were conceptualized differently, which might result from different vintage points, cultures,

pragmatics, and or conventional usages. Fourth, in some cases, the uses of 上 *shàng*

correspond to the uses of English prepositions "above", "around", and "at", while in

some case, the uses of 裡 *lǐ* covered the use of "under" and "at".

Having seen that Mandarin 上 *shàng and* 裡 *lǐ* can be used in various situations

we will inspect in next section and propose a cognitive analysis of Mandarin 上 *shàng*

and 裡 *lǐ* and in and on, which can help us to explain the similarities and differences

between Mandarin and English.

4.2   The proposed cognitive account

In line with the analysis of the English preposition *in* discussed in Evans and

Tyler (2004b) and Tyler and Evans (2003), in this section, we adopt the model of proto-

scene and will demonstrated our proposal for English *on* and Mandarin 上 *shàng*/裡 *lǐ*.

Following the establishment of the proto-scene models for English *on* and Mandarin 上

shàng/裡 *lǐ* , we will use the model to account for the similarities and differences in the

use of Mandarin 上 *shàng*/裡 *lǐ* and English *on*/*in*.

4.2.1   The proto-scene for English 'on'

The spatial relation designated by *on*, according to our definitions in Chapter 2,

includes geometric and functional spatial relations. According to our geometric and

functional spatial definitions of *on*, we know that *on* is typically associated with its

geometric spatial relation of one entity being in contact with another entity and with its

functional spatial relation being that one entity is supported by another entity. Examples are demonstrated below.

(29)
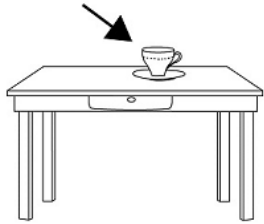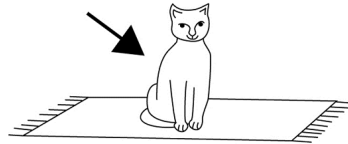
a. The cup is on the table   b. The cat is on the rug

Spatial scenes in (29a-b) are generally associated with the spatial preposition *on*. Sentences in (29a-b) can be generalized to an idealized spatio-functional configuration associated with *on* in that the TR is in contact with or in proximity to the surface of the LM and which may result in a functional consequence of "support" if the TR's weight presses or pulls it; the LM then supports the TR by resisting the push or pull. The proto-scene for *on* is then diagramed in Figure 4.1.

Figure 4.1 Proto-scene for *on*

As shown in Figure 4.1, the proto-scene for *on* is designated for the spatial relation that the TR is in contact with or in proximity to the surface of the LM, a solid square. The primary scene associated with the proto-scene for *on*, according to Evans (2010) is the sense of "contact," and as the configuration of the proto-scene shown in Figure 4.1, the TR is typically in contact with the surface of a two-dimensional LM, a square in a horizontal direction. The functional consequence of the TR's contact with the surface of the LM is to support or uphold the TR against gravity. For instance, example (29a) illustrates the situation. The TR, *the cup* is supported by the LM, *the table* from dropping down to the floor by holding up the bottom of the saucer (TR) with the two-dimensional surface horizontally (LM). However, different spatial contexts, such as if the surface of the LM is positioned in different directions, are also associated with the configuration of the proto-scene for *on*; consider the following examples.

(30)
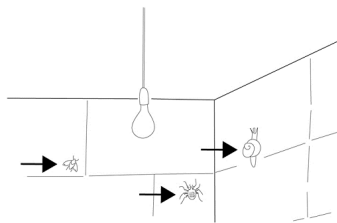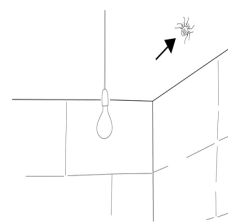
a. The bugs are on the wall   b. The spider is on the ceiling

In (30a) the TR, *the bugs* are in contact with the surface of the LM, *the wall,* which is a vertical surface. In (30b) the TR, *the spider* is on the horizontal surface of the LM, *the ceiling*, which is horizontal surface facing downward. The spatial scenes depicted in example (30a-b) capture the spatial relations in which the TRs are in contact

with the surface of the LMs in different orientations, which are associated with the configuration of the proto-scene for *on*. In the following, we demonstrate the configuration of the proto-scene for *on* in different orientations.
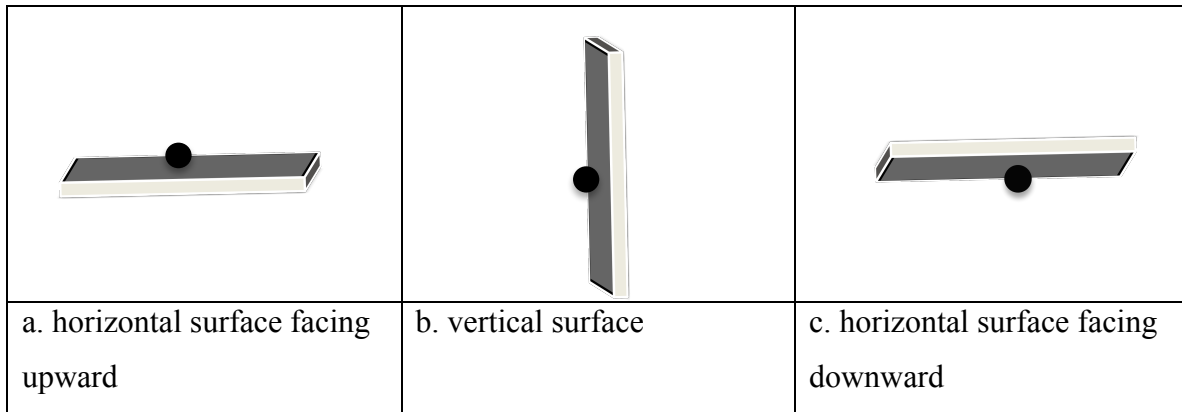
a. horizontal surface facing upward	b. vertical surface	c. horizontal surface facing downward

Figure 4.2 Proto-scene for *on* in different orientations

In the present study, we claim that the most prototypical sense associated with *on* is that the TR is in contact or is proximity to a horizontal, upward facing surface of the LM as in Figure 4.2a. Configuration 4.2b and 4.2c, in our claim, are derived from Figure 4.2a by turning the direction 90 degrees and 180 degrees, respectively. Through our spatial experience and our understanding of the natural law of physics, we know that for a TR to stay in contact with a vertical surface of a LM, it must have a force working against gravity; however, the force could be afforded by the LM as in (29a-b) or by the TRs as in (30a-b). In (29a-b), the LM affords support to the TR while in (4a-b), it is the TR, *the bugs* and or *the spiders* respectively, which afford support through the unique hair on their feet to hold on or adhere the surface of the LMs. Given the spatial scenes in examples (30a-b), we argue that the configurations in Figure 4.2b-c are not the most prototypical "contact" relation as in Figure 4.2a, which represents the spatial scenes in
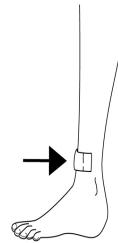
(29a-b), since extra forces are required for the TR to stay in contact with the LM.

Therefore, we propose that the configurations of Figure 4.2b-c are derived from the

proto-scene for *on*, and the sense of "adhere/attach" associated to *on* is resulting from the

extra force for a TR to stay in contact with the surface of the LM in a direction where it

must overcome the law of gravity. With the configuration information in Figure 4.2, we

understand how the senses of "adhere/attach" and "support" are associated with the

proto-scene for *on*, as shown in the following examples.

(31)
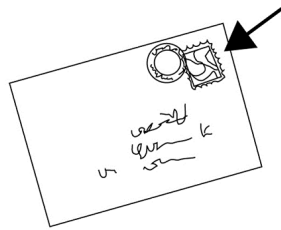
a. The stamp is on the letter.   b. The bandage is on his leg.

(32)
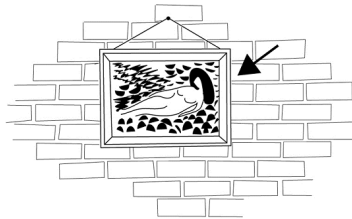
a. The painting is on the wall.   b. The coat is on the hook.
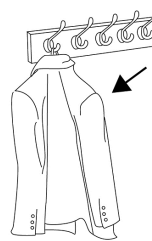
The proto-scene for *on* is designated as a two-dimensional configuration;

however, the linguistic uses of *on* could also be associated with a one-dimensional LM.

The one-dimensional LM is actually associated with the two-dimensional configuration when you look at it from different angles, as illustrated in Figure 4.3.

Figure 4.3 Proto-scene for *on* in different angle

When looking at a surface from a 180-degree angle, the surface is perceived as a line, as in Figure 4.3. The configuration is associated with a contact relation such that the TR is in contact with or proximity of a surface of a one-definitional LM, a line. A two-dimensional space is formed by lines, and thus entails one-dimensional space in it. Linguistic data can be seen in the following examples.

(33)
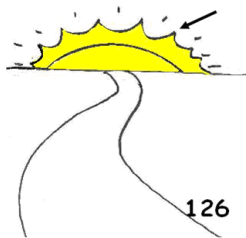
a. The sun is on the horizon.

b. The dot is on the line.

This analysis of the English preposition *on* has shown that the nuances in different spatial contexts are associated with the proto-scene for *on*. As stated earlier, the prototypical sense of *on* is "contact" in that the TR is in contact with or proximity of a horizontal surface of the LM facing upward. However, different orientations of the

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surface of the LM are also associated with the proto-scene for *on*, such as "The bugs are on the wall" and "The fly is on the ceiling", which yields a sense of "adhere/attach." The reading of "adhere/attach" associated with *on* is resulting from that for a TR to stay in contact with a vertical surface of the LM or a horizontal surface of the LM facing downward, extra force coming from the LM or TR is required to against the force of gravity and as a result, the TR is in contact with the LM by adhering or attaching to it.

These spatio-physical experiences occur in our everyday life, and thus, have become common mental representations, which are highly schematic yet meaningful/contextual, since they can always be traced back to their base configurations. With the spatio-configurational information of a proto-scene, we are able to map the spatial relations to spatial terms as well as understand different spatial scenes conveyed by the spatial terms in different spatial contexts.

Now we would like to establish a partial semantic network of spatial senses that are associated with the proto-scene for *on* in the following diagram.
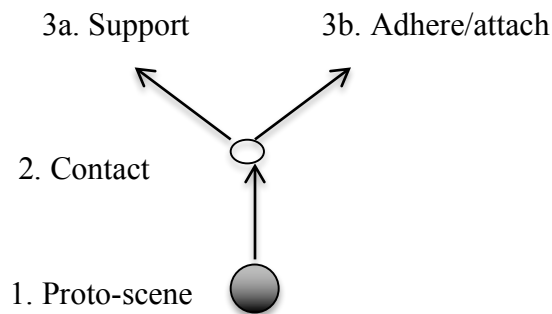
3a. Support   3b. Adhere/attach

2. Contact

1. Proto-scene

Figure 4.4 Partial semantic network of *on*

As shown in Figure 4.4, the senses of "support" and "adhere/attach" are arising from the primary sense "contact" of the proto-scene for *on*. As argued, the senses of "support" and "adhere/attach" are the consequences resulting from the spatial interactions between the TRs and the LMs and our knowledge of the real world, such as physics, the law of gravity, functions of the objects and so forth.

The semantic network of *on* in my dissertation is only partial and which only focus on the spatial senses. The purpose of building up the semantic network for proto-scene for *on*, is to explain how the speakers of L1 and L2 understand the senses of "support" or "adhere/attach" are associated with the proto-scene for *on* and how they are linked together with the connection of physical bases and our spatial experience.

4.2.2   The proto-scene for Mandarin '上 shàng'

As discussed earlier, the spatial semantics of 上 *shàng* has been recognized as having at least three meanings in the literature (Yu & Ma, 2010; Zhou, 2010) — (a) the TR is in contact with the surface of the LM, (b) the TR is above or over the LM, and (c) the TR is attached to the surface of the LM. These meanings of 上 *shàng* at first glance are distinct and unrelated. In this subsection, we would like to build up the proto-scene for 上 *shàng*, and demonstrate how these senses are associated with the proto-scene for 上 *shàng* and what relations there are among them.

According to Chinese etymology, the character 上 *shàng* is an ideograph which represents a concept of "above" by showing a short line above another long line. The spatial sense "above" is considered as the primary sense of 上 *shàng*, as shown in the following.

(34)
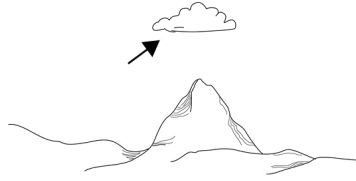
a. *那朵雲飄在山上*

nà duǒ yún piāo zài shān shàng

that CL cloud at mountain on

'That cloud is above the mountain'
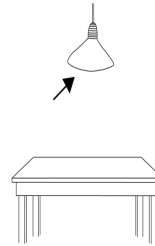
b. *吊燈在桌子的上面*

diào-dēng zài zhuōzi de shàng-miàn

suspend-lamp at table DE on-surface

'The pendant lamp is above the table.'

Examples (34a-b) capture a spatial relation that the TR is vertically higher than the LM without contacting the LM. Note here the spatial relation "higher than" is perceived from the observer's vantage point, which is called the viewer-center (Miller and Johnson-Laird, 1976; Garlson-Radvansky and Irwin, 1994). In the frame of the viewer-center, the observer's body is the deictic center, which is to say that the position of the TR and LM is defined by the observer's vantage point (Miller & Johnson-Laird 1979). Thus, if the observer changes the position of his/her body, the frame of reference will also change. For instance, the canonical position of standing is that the observer's feet touch the ground and the head is pointed toward sky; however, if the observer changes the position of his/her body 180 degrees, the position of the TR and LM will now be defined differently.

However, in some cases the observer also plays a role in the frame of reference (Hsieh 2015). Say the observer is one of the LMs that serves as one of the reference objects for the TR in the spatial relation. Now consider the following examples.

(35)

a. 鳥在樹上

  niǎo zài shù shàng

  bird at tree on

  'The bird is in the tree.'

b. 人在屋頂上

  rén zài wūdǐng shàng

  person at roof   on

  'That person in on (top) of the roof.'

Examples (35a-b) capture the spatial relation that the TR is higher than the LM. However, the reference objects in (35a-b) are not the LMs 樹 *shù* 'tree' or 屋頂 *wūdǐng* 'roof', but the observer him/herself. The spatial sense "higher than" in (35a-b) is associated with 上 *shàng* since the observer takes his/her position into consideration. In the spatial scenes (35a-b), the TRs, 鳥 *niǎo* 'bird' and 人 *rén* 'person', are higher than the observer's position. More interestingly, in some cases, the LM in the "higher than" spatial relation associated with 上 *shàng* could be an imagery reference object besides the observer, as illustrated below.

(36)   我把糖果放到冰箱上了, 所以小孩拿不到

 wǒ bǎ tángguǒ fàng dào bīngxiāng shàng le, suǒyǐ xiǎohái ná bù dào

1st singular BA sweets put to refrigerator on LE, so children fetch NEG RC

'I have put the sweets on top of the refrigerator, so the kids cannot reach them.'

The spatial relation captured in (36) is that the TR 糖果 *tángguǒ* 'sweets' is in contact with the top surface of the LM, 冰箱 *bīngxiāng* 'refrigerator', as a result, the TR is at a position higher than the imagery reference object, the 小孩 *xiǎohái* 'children'. The spatial experience of "putting something at a higher position" can be seen quite often in our daily life.

According to the above discussion, the proto-scene for 上 *shàng* is designated as follows.
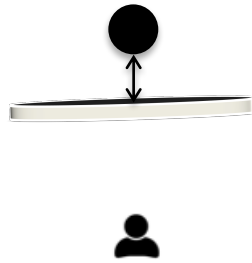

Figure 4.5 Proto-scene for 上 *shàng*

As shown above, the proto-scene for 上 *shàng* is designated for the spatial relation in which the TR is vertically higher than the LM, a solid square with potential contact, which is represented by the double arrows. The potential contact can be understood from the spatial scenes in (36a-b), in that the TRs 鳥 *niǎo* 'bird' and 人 *rén* 'person' are higher than the observer since the TRs, 鳥 *niǎo* 'bird' and 人 *rén* 'person'

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posit at the LMs 樹 *shù* 'tree' and 屋頂 *wūdǐng* 'roof' respectively, which are physically

higher than the observer. The "contact" relation is a consequence of the spatial interaction

that the TRs, 鳥 *niǎo* 'bird' and 人 *rén* 'person' are in contact with or proximity of the

surface of the LMs 樹 *shù* 'tree' and 屋頂 *wūdǐng* 'roof', respectively in (36a-b). This

serve as the reason 上 *shàng* is also associated with the contact, support, and

adhere/attach spatial relations. Recall the proto-scene for *on*, which is also associated

with these senses. This could explain why English *on* and Mandarin 上 *shàng* are similar

in uses when associated with these spatial senses.

In line with our discussion, in the following, we will present the relations of these senses

with the spatial semantic network of 上 *shàng*.

4a. Support   4b. Adhere/attach
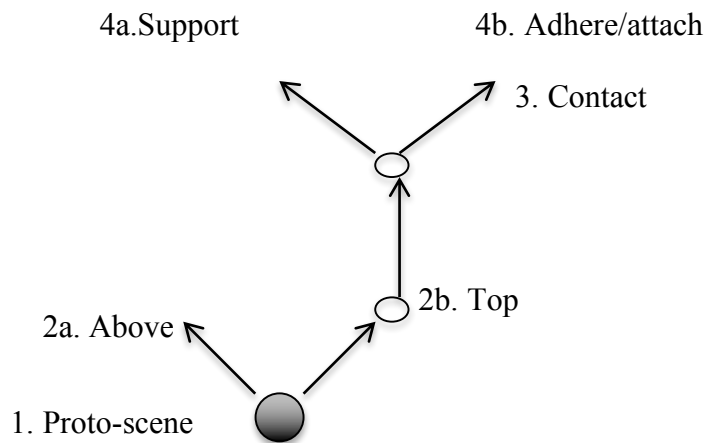
3. Contact

2b. Top

2a. Above

1. Proto-scene

Figure 4.6 Partial semantic network for 上 *shàng*

As shown in Figure 4.6, the primary sense associated with the configuration of the

proto-scene 上 *shàng* (see Figure 4.1) is that the TR is higher than the LM within

potential contact. Thus, the sense of "above" is directly associated with the proto-scene

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for 上 *shàng*. The sense of "top" is yielded from the consequence of the spatial interaction between the TR and the LM, such that the TR is at the top surface of the LM and as a result, the TR is in contact with the surface of the LM, which could also bring out the sense of "contact," which is associated with this spatial relation. Finally, the senses of "support" and "adhere/attach" are functional/spatial derivations from the "contact" spatial interaction between the TR and LM.

The semantic network for 上 *shàng* again, is only presented as partial semantic network which is particularly focused on the spatial semantics of 上 *shàng*. However, it could help us to understand the similarity and difference between English *on* and Mandarin 上 *shàng*.

4.2.3   The proto-scene for Mandarin '裡 lǐ'

In 現代漢語八百詞 Xiàndài Hànyǔ Bābǎi Cí 'Modern Chinese Eight Hundred Words' (Lü, 1980), 裡 *lǐ* is defined as "within a certain boundary." However, tracing back to classical Chinese, the meaning of 裡 *lǐ* varies from Modern Chinese and is not used as a spatial term. According to Chinese etymology, 裡 *lǐ* originally refered to the interior of clothing, and contrasted with 表 *biǎo* 'exterior'. In the Western Han Dynasty (206 B.C.— A.D. 23),裡 *lǐ* appeared in books of medical science in a post-noun position, referring to the body-part nouns indicating the meaning of "inside" (Wang 1999). The uses of 裡 *lǐ* to indicate "inside" became more frequent and entrenched within time, especially during the Wei and Jin Dynasties (A.D. 220-581) and was often used in contrast to 外 *wài* 'outside'. As a result, through the development of the semantics of 裡

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lǐ over time, we would like to propose the proto-scene for 裡 *lǐ* is that the TR is located

within the LM, which has three salient parts: an interior (distinguish from an exterior), a

boundary, and an inside space (distinguished from an outside space). The proto-scene for
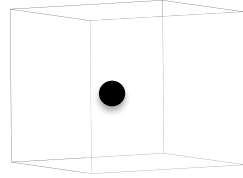
裡 *lǐ* is then diagramed as follows.

Figure 4.7 Proto-scene for 裡 *lǐ*

As shown in Figure 4.7 the proto-scene for 裡 *lǐ* is designated for the spatial

relation that the TR is located within the LM, a three-dimensional square. Unlike Tyler

& Evans' (2003) proto-scene for *in*, our LM is designated as a three-dimensional square

since the sense of "inside" is essential to the semantics of 裡 *lǐ* as introduced earlier. In

addition, the three-dimensional configuration of the proto-scene for 裡 *lǐ* could help to

explain a wider use of 裡 *lǐ* than the one designated by Tyler and Evans (2003), since it

could provide a plausible solution for the use of 裡 *lǐ* in a one or two-dimensional LM,

and why in some cases 裡 *lǐ* and 上 *shàng* are interchangeable.

The typical spatial scenes that are associated with the proto-scene for 裡 *lǐ* can be
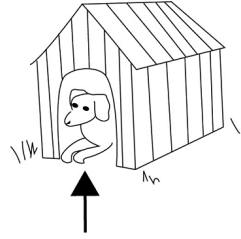
seen in the following.

(37)

      a. 魚在魚缸裡   b. 狗在狗窩裡

      yú zài yúgāng lǐ   *gǒu zài gǒuwō lǐ*
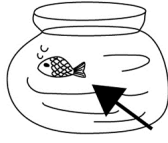
      fish at fish-jar in   dog at dog-house in

      'The fish is in the fish bowl.'   'The dog is in the dog house.'

The spatial scenes in (37a-b) capture the spatial relation that the TRs, 魚 *yú* 'fish' and 狗 *gǒu* 'dog' are located within the three-dimensional LMs, 魚缸 *yúgāng* 'fish bowl' and 狗窩 *gǒuwō* 'dog house', which have the three salient parts: an interior, a boundary and an inside space. However, in (37a-b), an additional functional consequence, "containment" is also included, since the TRs, 魚 *yú* 'fish' and 狗 *gǒu* 'dog' are contained by the LMs, 魚缸 *yúgāng* 'fish bowl' and 狗窩 *gǒuwō* 'dog house'. Now, let us consider the following examples.

(38)
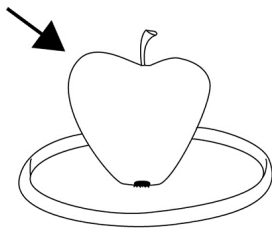
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a. *蘋果在圈圈裡*　　　　　　　　　　b. *房子在籬笆裡*

píngguǒ zài quānquan lǐ　　　　　　*fángzi zài líbā lǐ*

apple　at　circle　in　　　　　　　 house at fence in

'The apple is in the ring.'　　　　　 'The house is inside the fence.'

As shown in (38a-b), the two spatial scenes capture the spatial relation of 裡 *lǐ* ;

however, the two LMs 圈圈 *quānquan* 'ring' and 籬笆 *líbā* 'fence' respectively, are two-

dimensional LMs, not the canonical three-dimensional LMs as the LM in the

configuration of the proto-scene for 裡 *lǐ*. This is because the sense of "boundary" is also

associated with 裡 *lǐ*. According to Tyler and Evans (2003) and Evans and Tyler (2004b),

LMs that have an interior, a boundary such as a track, road, fence or hedge, which marks

the perimeter and an exterior, can be construed as including a bounded LM, and thus a

containment relationship. That is to say, the two LMs 圈圈 *quānquan* 'ring' and 籬笆

líbā 'fence' are conceptualized as three-dimensional spaces since the boundary of the

barrier of the LMs is associated with the circle of the ring and the fence, and thus is

construed as a containment relationship. However, here we would like to add on to Tyler

and Evans's analysis; indeed, the bounded concept can also be associated with the LM

configuration of the proto-scene for 裡 *lǐ*, as illustrated with the following configuration.
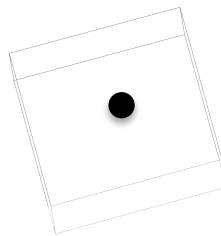

Figure 4.8 Proto-scene for 裡 *lǐ* from different angle

As shown in Figure 4.8, if you look at the three-dimensional configuration from the top, you can see the salient planer part which is the bottom of the configuration. Even if the heights of the four sides become very shallow, we know that the planer part has a boundary since it is bound by its four sides. For instance, we might all have the experience that when the airplane takes off, and we look out the window; all the buildings, cars, and people turn into flat objects gradually, and when the airplane reaches a certain height, what we perceive of the city is a planer space. Although the city looks like a plane from the sky, we can still see the boundary of the city, and thus, the "bounded" concept arises. This could explain why in some cases 裡 *lǐ* is used in the spatial relation in which the TR is located in the one- or two-dimensional LM, since the LM is a bound LM. However, note here, for spatial relations associated with 上 *shàng* in which the TR is in contact with or proximity of the surface of the two- or one dimensional LM cannot be bound, as illustrated with the following examples.

(39)   蘋果放在箱子上
         píngguǒ fàng zài xiāngzi shàng
          apple   place at box   on
         'The apple was placed on top of the box.'

The spatial relation captured in (39) can only be that the TR 蘋果 *píngguǒ* 'apple' is in contact with the surface of the exterior of LM, 箱子 *xiāngzi* 'box' on the exterior top/bottom/side surface of the box, but not any interior surface of the box. The sentence will be incorrect if one intends that the apple is on the surface of the interior of the box;

in this case, one would use 裡 *lǐ* to express the spatial relation since the three-dimensional LM triggers the bounded concept. As our discussion has touched upon the issue of 上 *shàng*/裡 *lǐ* alternation mentioned earlier, we will come back to talk about this issue in the following sections. Now, continuing on the above discussion, let us establish a partial semantic network for 裡 *lǐ*.

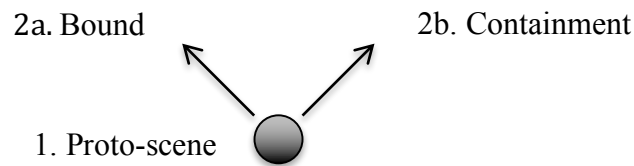2a. Bound   2b. Containment

1. Proto-scene

Figure 4.9 Partial semantic network for 裡 *lǐ*

As shown in Figure 4.9, the primary sense associated with the configuration of the proto-scene for 裡 *lǐ* (see Figure 4.7) is that the TR is located within the LM, which has three salient structures: an interior, a boundary, and an inside space. The sense of "bound" as argued earlier, is associated with the configuration of the three-dimensional LM, while the sense of "containment" is a functional consequence that arises from the spatial interaction or the function of the LM itself.

Again, the semantic network for 裡 *lǐ*, is only presented as partial semantic network, which is particularly focused on the spatial semantics of 裡 *lǐ* discussed above. However, it could help us to understand the similarities and differences between English *in* and Mandarin 裡 *lǐ*.

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4.3   The proposed account for the similarities and differences between English *on/in* and Mandarin 上 *shàng*/裡 *lǐ*

4.3.1   Similarities and differences between English *on* and Mandarin 上 *shàng*

In this section, we compare the proto-scenes for *on* and 上 *shàng*. Let us first compare by looking at the two proto-scene models, as shown below.

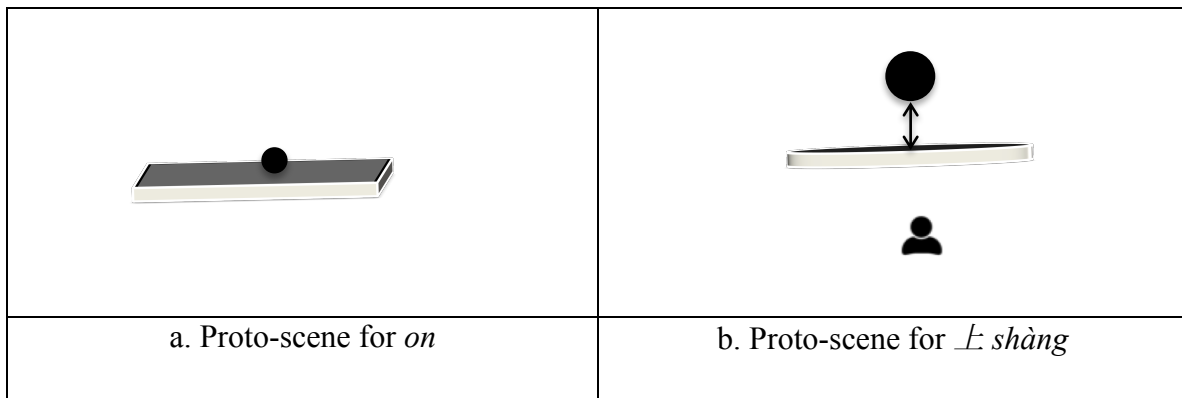| a. Proto-scene for *on* | b. Proto-scene for 上 *shàng* |

Figure 4.10 Comparison for the proto-scene for *on* and 上 *shàng*

As shown above, the spatial configurations associated with the proto-scene for *on* and 上 *shàng* are quite different. As stated in previous sections, the proto-scene for *on* represent the spatial relation that the TR is in contact with or proximity of the horizontal upward surface of the LM, while the proto-scene for 上 *shàng* represents a spatial relation in which the TR is higher than the LM with potential contact, of which the "higher than" spatial relation is observer-centered, and the observer could be a LM in the frame of the reference. Therefore, the major difference between English *on* and Mandarin 上 *shàng* is

that 上 *shàng* is used to express a "higher than" spatial relation which cannot be

expressed by *on*. Examples will be repeated here again for the explanation purpose.

(40)

    a. That cloud is <u>above</u> the mountain   b. The pendant lamp is above the

                                                          table.

a'. *那朵雲飄在山<u>上</u>*   b'. *吊燈在桌子的<u>上面</u>*

 nà duǒ yún piāo zài shān <u>shàng</u>   *diào-dēng zài zhuōzi de <u>shàng-miàn</u>*
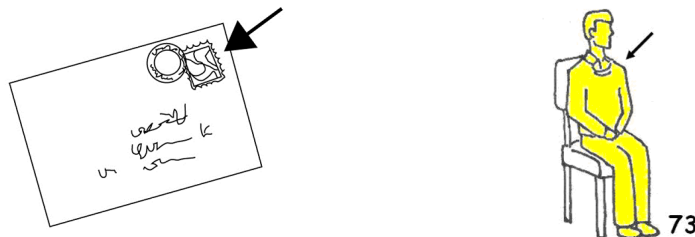
 that CL cloud at mountain <u>on</u>   suspend-lamp at table DE <u>on-surface</u>

    The spatial relations captured in (40) are expressed by the English preposition

above, as in (40a-b); while in Mandarin, they are associated with 上 *shàng* as in (40a'-b').

However, the two spatial terms do share similarities in use as shown below.

(41)

    a. The stamp is <u>on</u> the envelope.   b. The man is sitting <u>on </u>the chair

    a'. *郵票貼在信封<u>上</u>*   b'. *人坐在椅子<u>上</u>*

yóupiào tiē zài xìnfēng shàng   *rén zuò zài yǐzi shàng*

stamp stick at envelope <u>on</u>   man sit at chair <u>on</u>

As shown above, English *on* and Mandarin 上 *shàng* are both associated with the spatial senses "adhere/attach" as in (41a) and (41a') and "support" as in (41b) and (41b'). The two spatial senses are the consequences resulting from the spatial interactions between the TR and the LM. In (41a) and (41a'), for the TR, stamp, to stay on the surface of the LM, the envelope, extra force, such as adhesive, is needed, yielding the sense of "adhere/attach." As for (41b) and (41b'), the TR, the man, is in contact with the surface of the LM, the chair. A functional consequence is associated with the spatial interaction since the TR's weight presses the LM and the LM supports the TR by resisting the push.

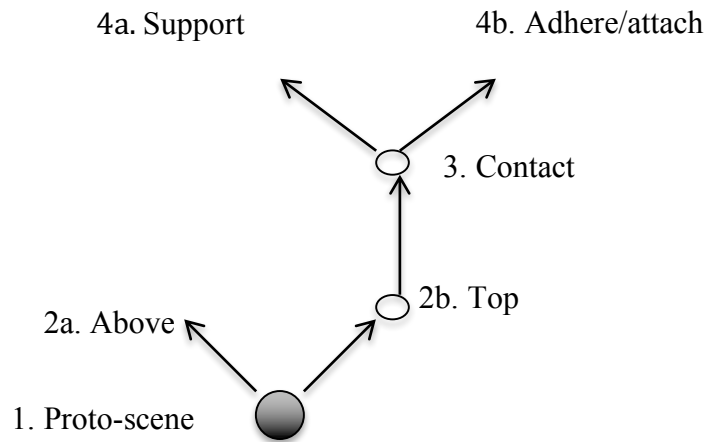Now I would like to compare the partial semantic networks for *on* and 上 *shàng*.
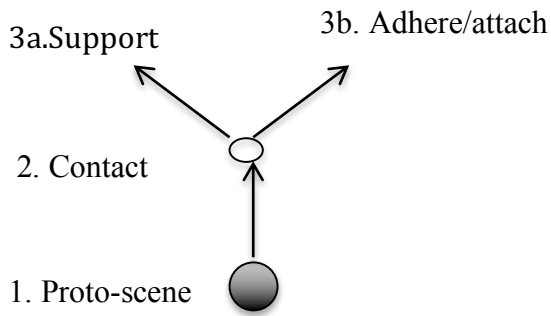
3a.Support   3b. Adhere/attach   4a. Support   4b. Adhere/attach

2. Contact   3. Contact

1. Proto-scene   2b. Top

2a. Above

1. Proto-scene

Figure 4.12 Mandarin 上 *shàng*

Figure 4.11 English *on*

From the two figures shown above, we can see where English *on* and Mandarin 上 *shàng* overlap and where they diverge. Our proto-scene models do not suggest a prototype relation in our models, but focus more on how the senses associated with the proto-scene are derived and linked.

4.3.2   Similarities and differences between English *in* and Mandarin 裡 *lǐ*

In this section, we will compare the similarities and differences between the proto-scene for *in* and 裡 *lǐ* in English and Mandarin. Let us first compare by looking at the two proto-scene models, as shown below.

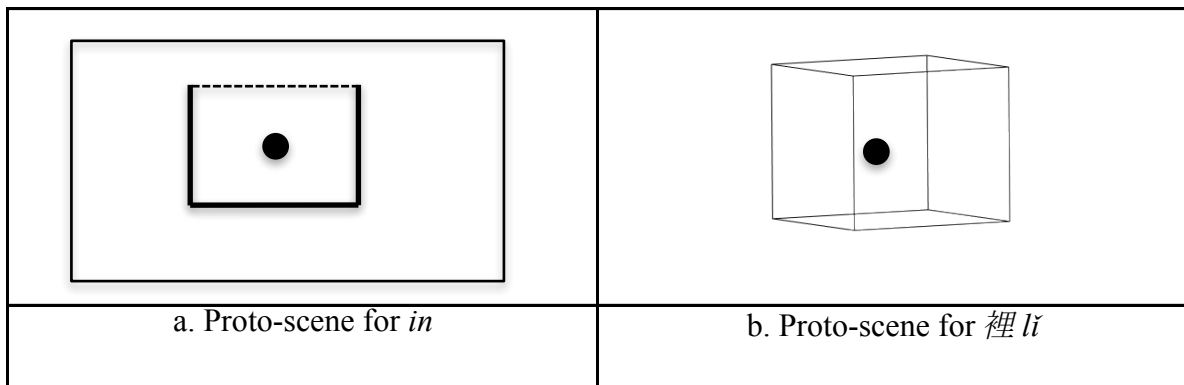| a. Proto-scene for *in* | b. Proto-scene for 裡 *lǐ* |

Figure 4.13 Comparison for the proto-scene for *in* and 裡 *lǐ*

As shown in Figure 4.17, the configuration of proto-scene for *in* designated by Tyler & Evans (2003) is a two-dimensional configuration which constitutes a spatial relation in that a TR is located within a LM which has three salient parts: an interior, a boundary, and an exterior. While the proto-scene for 裡 *lǐ* , designated by us, constitutes a spatial relation in which a TR is located within a LM which has three salient parts: an

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interior (distinguish from an exterior), a boundary, and an inside space (distinguish from a outside space). One of the salient parts differing from the proto-scene for *in* is "inside", which is because of the sense of "inside" is essential to the semantics of 裡 *lǐ* developing within time, as discussed in previous section. Now let us demonstrate the spatial scenes that are associated with both *in* and 裡 *lǐ*. For explanation purposes, examples are repeated here.
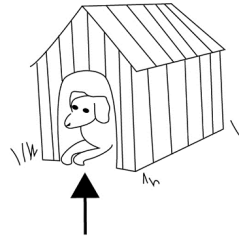
(42)
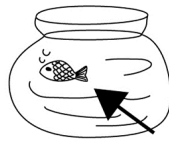
a. The fish is <u>in</u> the bowl. b. The dog is <u>in</u> the doghouse.

a'. *魚在魚缸<u>裡</u>* b'. *狗在狗窩<u>裡</u>*

yú zài yúgāng <u>lǐ</u> *gǒu zài gǒuwō <u>lǐ</u>*

fish at fish-jar <u>in</u> dog at dog-house <u>in</u>

As shown above, English *in* and Mandarin 裡 *lǐ* both constitute the spatial relation in which the TR is located within a three-dimensional LM that has an interior, a boundary and an exterior or an inside space. However, the two spatial scenes are also associated with a functional element, "containment," as a result of the spatial interactions. In addition, both *in* and 裡 *lǐ* can be used in a two-dimensional LM, as shown below.

(43)
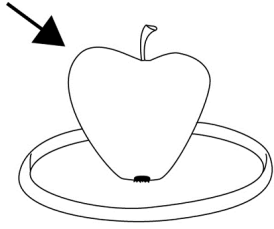
a. The apple is <u>in</u> the ring.   b. The house is <u>inside</u> the fence.

a'. *蘋果在圈圈<u>裡</u>*   b'. *房子在籬笆<u>裡</u>*

píngguǒ zài quānquan <u>lǐ</u>   *fángzi zài líbā <u>lǐ</u>*

apple   at   circle   <u>in</u>   house at fence <u>in</u>

The two spatial scenes are associated with English *in* and Mandarin 裡 *lǐ*, since the TRs, *the apple* and *the house* are located within bounded LMs, *the ring* and *the fence*. As discussed earlier, the non-canonical three-dimensional LMs, such as ring and fence are construed as bounded LMs because the ring and the fence entail a boundary, which contrasts with the space outside the ring and the fence. Therefore, the "bound" sense is also shared by English *in* and Mandarin 裡 *lǐ*.

The two spatial terms *in* and 裡 *lǐ* do not contrast with each other in terms of spatial semantics; however, there are some mismatched uses of English *in* and Mandarin 裡 *lǐ* that are attributed to different conceptualizations between the two languages, such as "the bird in the tree," "鳥在樹上 niǎo zài shù shàng", "food is on the plate" and "食物在盤子裡 shíwù zài pánzi lǐ", etc. For these groups of mismatched uses of English *on/in* and Mandarin 上 *shàng*/裡 *lǐ*, we will have an in-depth discussion in the following sections.

4.3.3 English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ* alternation

As we have established the proto-scenes for English on and Mandarin 上 *shàng*/裡 *lǐ*, we have a better understanding that how the spatial scenes of these spatial terms arise from our spatial experiences and become entrenched mental representations in our brains. The alternative uses between English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ* can be understood through our proto-scene models for each spatial term. I would like to use the proto-scene for 上 *shàng*/裡 *lǐ* as an example. Recall the configuration of the proto-scene for 裡 *lǐ*, which constitutes a spatial relation that the TR, *a shade sphere* is located within the LM, *a three-dimensional square*, which has three salient parts: an interior, a boundary and an inside space. While the proto-scene for 上 *shàng* constitutes a spatial relation in which the TR is higher than the LM with potential contact.

The question of why 上 *shàng* and 裡 *lǐ* are interchangeable in some cases remains. This is because the alternative uses of 上 *shàng* and 裡 *lǐ* are purely pragmatically driven and grounded in physical spatio-configurations associated to 上 *shàng* and 裡 *lǐ*.

Let us first draw the attention back to the proto-scenes for 上 *shàng* and 裡 *lǐ*. The LM designated in the proto-scene for 裡 *lǐ* is a three-dimensional square, as shown below.
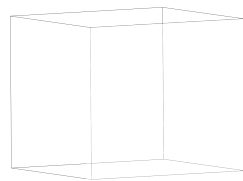

Figure 4.14 Three-dimensional square

As shown above, a three-dimensional square constitutes six two-dimensional faces. Each face constitutes four one-dimensional lines. That is to say a three-dimensional space entails two-dimensional and one-dimensional space, and which is the reason why sometimes 裡 *lǐ* can be used with a two-dimensional or one-dimensional LM. However, note that only the physical or imaginary three-dimensional space could have interchangeable use of 上 *shàng* and 裡 *lǐ*. Examples are illustrated below.

(44)
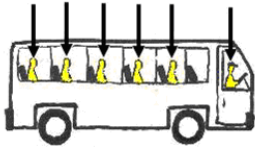
98
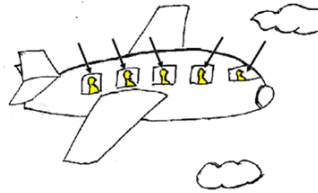
99

a. 人在公車上/裡

rén zài gōngchē shàng/lǐ

 people at bus   on/in

'The people are on/in the bus.'

b. 人在飛機上/裡

rén zài fēijī shàng/lǐ

 people at airplane on/in

'The people are on/in the plane'

(45)   那張紙上/*裡有一隻螞蟻

    nà zhāng zhǐ shàng/*lǐ yǒu yì zhī mǎyǐ

    that CL paper on/*in exist one CL ant

    'There is an ant on/*in that piece of paper.'

As agued above, the alternative use of 上 *shàng* and 裡 *lǐ* can only happen in a physical three-dimensional LM, such as 公車 *gōngchē* 'bus' and 飛機 *fēijī* 'airplane' in (44a-b) respectively; however, no interchangeable use can apply to the two-dimensional

LM, 紙 *zhǐ* 'paper' in (45). The selection of the 上 *shàng* and 裡 *lǐ* is pragmatically driven and varies individually in terms of the speakers.

The variation could lie in different focus, such as a focus on the physical space, capacity, function, path, goal, control and etc. That is to say, the selection of 上 *shàng* and 裡 *lǐ* is based on what one tries to focus on and different conceptualizations of the space in the speakers' mind. For instance, imagine a situation in which you are on a moving bus and receive a phone call from a friend asking "where are you?" and you answer "I am on a bus", since the speaker has a destination to go, and also the function of the bus is to transport passengers from A to B by supporting them on the seats one might select *shang*. In contrast, if the bus is not moving, one might select *li*.

Talmy (2000) pointed out that regarding vehicles, such as a bus, airplane, or train, that has a walkway, *on* is selected; on the other hand, if the vehicle does not have a walkway, such as car, canoe, carriage, or truck, then *in* is selected. Talmy's argumentation cannot account for the use of 上 *shàng* and 裡 *lǐ* in Mandarin. For the reasons argued above, the selection of 上 *shàng* and 裡 *lǐ* is pragmatically driven.

4.4   Mismatches between English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ*

In previous sections, we have compared the proto-scene models for *on* and 上 *shàng* versus *in* and 裡 *lǐ* respectively. In the discussion, we have noticed that there are some cases of mismatch between in *on* and 上 *shàng* and between *in* and 裡 *lǐ*. In this

section, we have an in-depth discussion and account for the puzzle in terms of proto-scene models. First, let us look at the examples below.
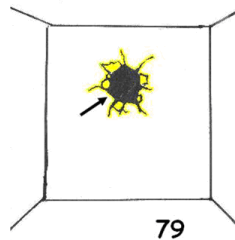
(46)

a. The cork is <u>in</u> the bottle.

a'. *軟木塞塞在瓶嘴<u>上</u>*

ruǎnmùsāi sāi zài píngzuǐ <u>shàng</u>

cork   stuff at bottle neck <u>on</u>

b. The hole is <u>in</u> the wall.

b'. *有個洞在牆<u>上</u>*

yǒu ge dòng zài qiáng <u>shàng</u>

exist CL hole at wall   <u>on</u>

As shown above, the two spatial scenes in (46) were depicted differently by English speakers and Mandarin speakers. In (46a), the spatial scene is construed as an IN relation in that the TR, *the cork* is located within the LM, *the bottle*, and thus *in* is used, while in (46a'), the spatial scene is construed as an ON relation in that the TR is higher than the LM with potential contact, and thus 上 *shàng* is used. This is because English speakers pay more attention to the whole than the part while Mandarin speakers pay more attention on the part than the whole. Take (46a) and (46a') for instance, English speakers pay more attention to *the bottle*, which triggers the proto-scene for *in* and leads to the functional consequence "containment" as *the bottle* contains *the cork*, and thus *in* is used; on the other hand, Mandarin speakers pay more attention to the part, *the cork*, which triggers the proto-scene for 上 *shàng* and leads to the spatial relation that *the cork* is higher than *the*

bottle, and thus 上 *shàng* is used. Again, in (46b), English speakers pay more attention on the whole, *the wall*, as *the wall* contains *the hole*, and thus *in* is used; on the other hand, Mandarin speakers pay more attention to the part, the hole, as the hole is on top of surface of the wall, and thus 上 *shàng* is used. More examples can be seen in the following.

(47) a. The crease <u>in</u> the pants.
   b. *褲子<u>上</u>的摺痕*
    kùzi <u>shàng</u> de zhéhén
    pant <u>on</u> DE crease
(48) a. The gap <u>in</u> the fence.
   b. *柵欄<u>上</u>有個洞*
    zhàlán <u>shàng</u> yǒu ge dòng
    fence <u>on</u> exist GE hole
(49) a. The flower <u>in</u> the hair.
   b. *花插在頭髮<u>上</u>*
    huā chā zài tóufa <u>shàng</u>
    flower stick at hair <u>on</u>

Examples (47)-(49) show additional mismatched uses between English *in* and Mandarin 上 *shàng*, and as we proposed, English speakers consistently pay more attention to the whole, and thus are prone to trigger the "containment" relation. Mandarin speakers, on the other hand, consistently pay more attention to the part, and thus are prone to trigger the "higher than/top/salient" relation.

4.5   Summary and conclusions

In this Chapter, we show that spatial encodings do not purely rely on geometric information, as examples discussed earlier showed that functional spatial relations also play an important role in the spatial encodings. As a result, we proposed a hybrid account of geometric and functional spatial relations for the spatial encodings across English on/in and Mandarin 上 *shàng* / 裡 *lǐ*.

To better account for the similarities and differences in English on/in and Mandarin 上 *shàng* / 裡 *lǐ*, we adopted an embodiment cognitive approach, the proto-scene model, under Tyler and Evans' (2001b, 2003) framework of Principled Polysemy. In line with their approach, we built up the proto-scene model for English *on*, Mandarin 上 *shàng* and 裡 *lǐ*. We then compared the similarities and differences between English *on* versus Mandarin 上 as well as English *in* versus Mandarin 裡 *lǐ*. Through the comparison and analysis in terms of the proto-scene for English *on*/*in* and Mandarin 上 *shàng* / 裡 *lǐ*, we reached a conclusion that the mismatch in English *on*/*in* and Mandarin 上 *shàng* / 裡 *lǐ* is attributed to different attention that English and Mandarin speakers are prone to focus on.

In the next chapter, we will show that experimental work on L1 speakers of English and Mandarin confirms the generalizations and analysis advanced in this chapter. It will also be shown that our generalization/conclusion and analysis have very practical implications for L2 learners of Mandarin and English.

CHAPTER 5

TOPOLOGICAL SPATIAL REPRESENTATION: EMPIRICAL STUDIES

5.0   Introduction

The relationship between space and language has been studied for decades; however, despite this, studies that were conducted through empirical approaches are relatively rare. One recent study on topological spatial relations - containment and support - with direct relevance to our study, was conducted via empirical approach by Zhang, Segalowitz and Gatbonton (2011). Zhang et al.'s (2011) study, elicits two spatial relations, containment and support, from native English speakers (n=25) and native Mandarin speakers (n=25) via the Topological Relations Picture Series (TRPS) (n=71) together with the simple line drawing pictures developed by Zhang et al. (2011) (n=45). The results in their study show that for the group of English speakers, approximately 38% of the pictures elicit the IN[10] domain, and approximately 34% elicit the ON[11] domain. For the Mandarin group, approximately 22% of the pictures elicit the IN domain, and approximately 53% elicit the ON domain. These results show that through the 116 simple line drawing pictures, more pictures are elicited as ON spatial relations (53%) than IN spatial relation (22%) in the Mandarin speaking group. Their findings suggest that first, the semantic categories of IN and ON in English and Mandarin are not mapped fully, and second, in the Mandarin group, there seems to exists a gradient among the two spatial

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[10] The capital IN is used as a primitive for the semantics of English preposition *in* and Mandarin postposition 裡 *lǐ*.

[11] The capital ON is used as a primitive for the semantics of English preposition *on* and Mandarin postposition 上 *shàng*.

relations. Based on the results presented in Zhang et al.'s study on the similarities and differences in use of IN and ON between English and Mandarin, the present study targets at L2 learners of English and Mandarin, respectively and aim at finding out whether the similarities and differences in their L1 affect the processing of mapping the spatial concepts containment and support to the spatial terms IN and ON in their target languages. The results of our two studies will be discussed in terms of conceptual transfer (Jarvis and Pavlenko, 2008; Jarvis, 2011), which was caused by different conceptualizations in learners' L1 and L2. In addition, the results of our studies will also provide evidences for our proposal of proto-scene model for *on*/*in* and 上 *shàng*/ 裡 *lǐ* in Chapter 4. In the next section, we will first compare the data we collect from the two L1 groups in English and Mandarin as well as have a preliminary analysis on the data and compare with our discussion of proto-scene model for *on*/*in* and 上 *shàng*/ 裡 *lǐ* in Chapter 4.

5.1   English L1 and Mandarin L1: Preliminary study

5.1.1   Participants

A total 5 speakers of English participated in this task, 3 male and 2 female graduate/undergraduate students, solicited from University of Hawaiʻi at Mānoa. For our Mandarin group, a total 5 speakers of Mandarin speakers participated in this task, 5 female graduate students, solicited from University of Hawaiʻi at Mānoa as well as National Chung-Cheng University in Taiwan. They were volunteering in the participation without any monetary compensation.

5.1.2   Materials and Procedure

We adopted the Topological Relation Picture Serious (TRPS) as our tool to elicit data from the five speakers of English and Mandarin, respectively. Our task was a production task, which is an offline task. It involves 71 simple black and white line-drawing pictures presented to each participant one at a time. Participants of English L1 were prompt with a question "Where is the object X where the black arrow pointing at in the picture?", while participants of Mandarin L1 were prompt with a equivalent question in Mandarin "圖片中黑色箭頭指著的物體在哪裡 *túpiàn zhōng hēisè jiàntóu zhǐzhe de wùtǐ zài nail*?" and each participant needs to respond to the question. Pictures were presented to each participant one at a time via a 13 inch MacBook Air laptop computer, and participants' task was to respond to the question "Where is the object X where the black arrow pointing at in the picture?" when shown a TRPS picture, as shown in Figure 5.1.
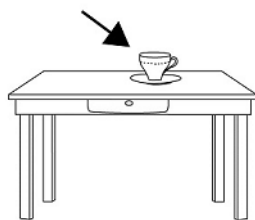

Figure 5.1 CUP ON TABLE

Prompt: *Where is the cup where the black arrow pointing at in the picture?*

5.1.3　Results

Based on the data we elicited with the tool "Topological Relation Picture Serious" from five English native speakers, we would like to have a preliminary discussion of the data we collected from the 71 line drawing pictures from TRPS. Our results of the production task from five speakers of English can be summarized in Table 5.1.

Table 5.1

Total number and percentage of the responses of the 71 TRPS from five speakers of English

	English speakers
IN	75 (21.1%)
ON	205 (57.7%)
OTHER*	80 (22.5%)

* The spatial terms elicited are neither IN nor ON

As you can see from Table 5.1, from the 355 utterances (5 x 71), we have the total counts on the responses from three categories: IN, ON and OTHER, which are spatial terms of *in*, *on* and neither in nor on. Our results show that English speakers were elicited almost twice more ON relation than IN relation. Now let us look at the results in Mandarin group.

Table 5.2

Total number and percentage of the responses of the 71 TRPS from five speakers of Mandarin

	Mandarin speakers
IN	65 (18.3%)
ON	245 (69%)
OTHER*	45 (12.6%)

* The spatial terms elicited are neither IN nor ON

As shown in Table 5.2, from the 355 utterances (5x71), we have the total counts on the responses from three categories: IN, ON and OTHER, spatial terms of 裡 *lǐ*, 上 *shàng* and neither 裡 *lǐ* nor 上 *shàng*. Our results show that Mandarin speakers were elicited triple more ON relation than than IN relation.

5.1.4 Discussion

In this section, we have adopted the tool TRPS (Topological Relations Picture Series) to elicit data from both native English speakers and Mandarin speakers, and we had a preliminary finding on how the two spatial relations, containment and support were elicited from the 71 TRPS. In the group of Mandarin speakers, 49 pictures out of 71 TRPS were consistently described by using the spatial term 上 *shàng* and 12 pictures out of 71 TRPS were consistently described by using the Mandarin spatial term 裡 *lǐ*. Among the native English speakers, 40 pictures out of 71 TRPS were consistently described by using the spatial term *on*, and 15 pictures out of 71 TRPS were constantly described by using the spatial term *in*. Furthermore, after comparing the two language groups we found that there are 37 pictures that were described as English *on* and Mandarin 上 *shàng*.
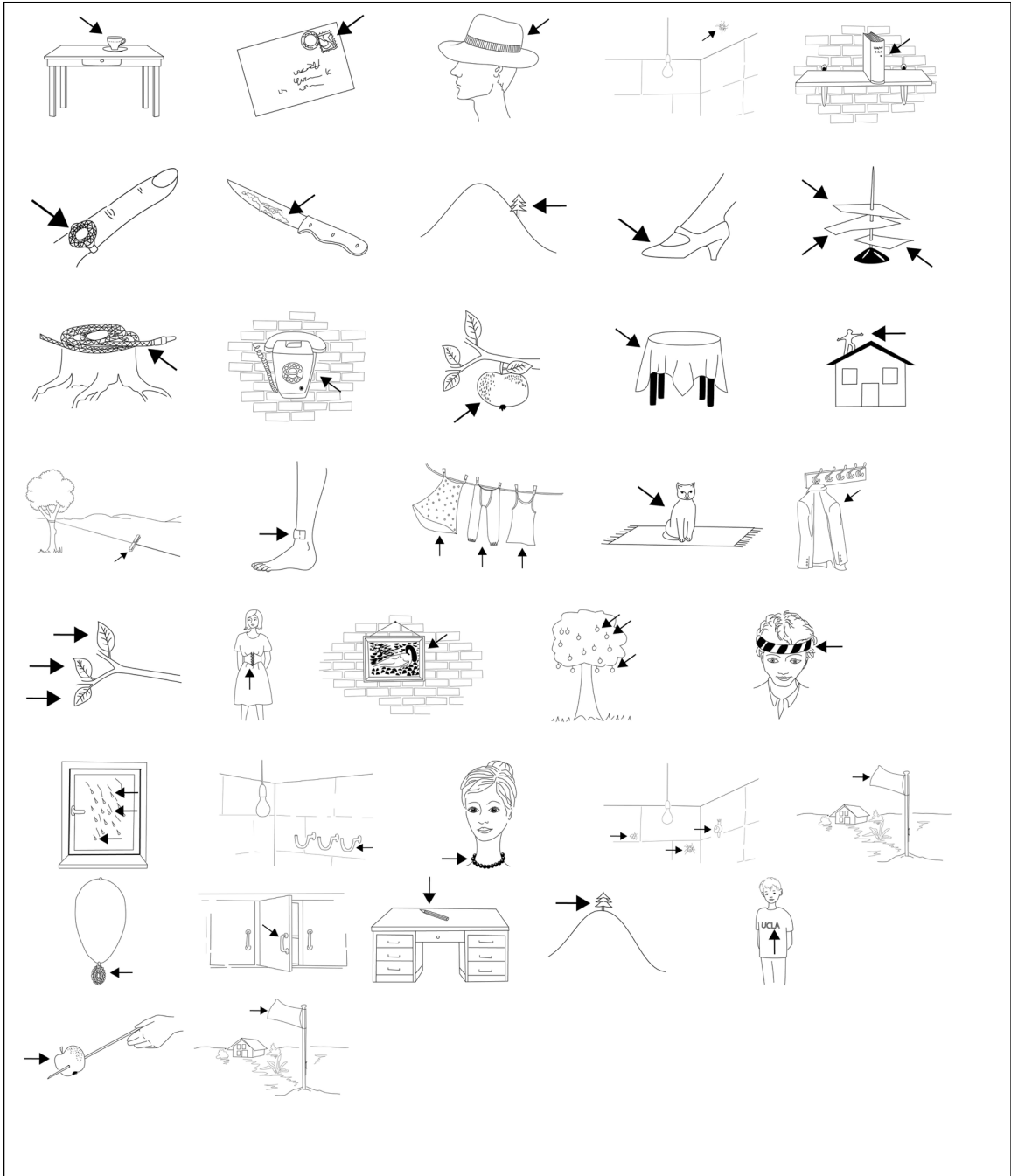
Figure 5.2 Thirty seven pictures that were depicted in English *on* and Mandarin 上 *shàng*

The results match with our discussion in Chapter 4 on the similarities and

differences in use of English *on* and Mandarin 上 *shàng*. Pictures that were described as

English *on* and Mandarin 上 *shàng* capture the spatial relation that the object with an

arrow pointed X is in the contact spatial relationship with the rest part of the picture Y.

As discussed in 4.3.1, both *on* and 上 *shàng* are associated with the spatial relation that

the TR is in contact with the LM. And the functional elements that are associated with the

proto-scene for *on* and 上 *shàng* are "support" and "adhere/attach".

In addition, there were 10 pictures that were described as English *in* and Mandarin

裡 *lǐ* .
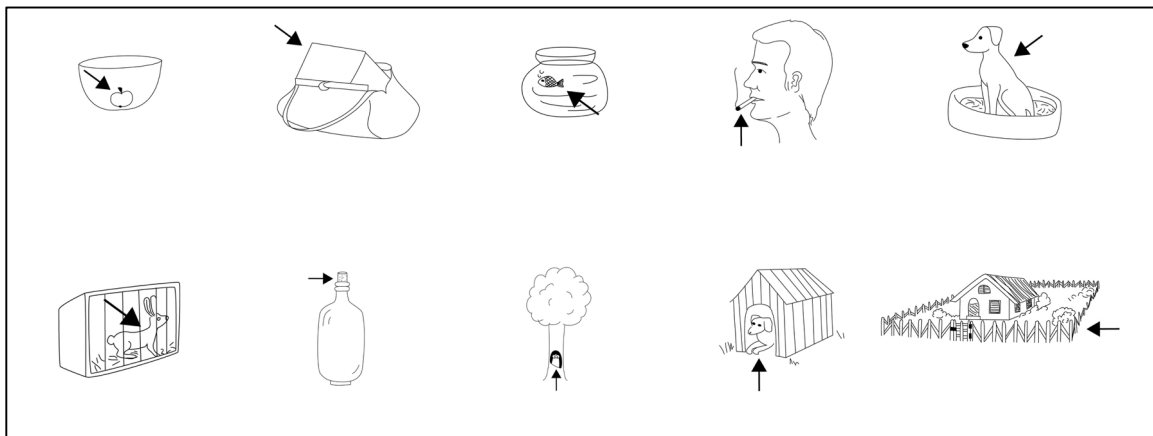
Figure 5.3 Ten pictures that were described English *in* and Mandarin 裡 *lǐ*

As shown above, the spatial relation between the object with an arrow pointed X

and the rest part of the picture Y can be initially generalized as that the object where an

arrow is pointed, is in a fully or partially enclosed by Y. Again, the preliminary result

also matches our analysis for the similarities between English *in* and Mandarin 裡 *lǐ*. As

discussed in 4.3.2, both *in* and 裡 *lǐ* constitute the spatial relation in that the TR is located

within the LM that has an interior, a boundary, and an exterior (or an inside space in

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Mandarin's case). The functional consequence that associated with the proto-scenes for *in* and 裡 *lǐ* is that the TR is contained by the LM. The results of this small set of data confirm our analysis on the similarities that are associated with the proto-scenes for English on/in and Mandarin 上 *shàng*/裡 *lǐ*, and their additional functional elements.

5.2   Experiment 1: Mandarin L1 English L2

Based on previous studies and our analysis on spatial encodings in English on/in versus Mandarin 上 *shàng*/裡 *lǐ*, Experiment 1 was designed to test our research questions. First, do these cross-linguistic similarities and differences in usage of the spatial terms influence the mapping process among English L2 learners who speak Mandarin as L1? Second, whether learners' L1 plays a role in the spatial conceptualization on two spatial concepts—containment and support in the L2?

5.2.1   Participants

In this experiment, two groups of participants were recruited from the University of Hawaiʻi at Mānoa: native speakers of Mandarin who learned English as their L2, (hereafter English L2 group) ($n = 25$) and native speakers of English (hereafter English L1 group) ($n = 20$) which serves as a control group. Participants of the English L2 group are international students from China and Taiwan. Their ages ranged from 18 to 29 years. Given that the participants in English L2 group might have different learning profiles, a language background survey was used to measure each learner's prior learning experiences. Most of the participants in this group (23/25) had taken the TOEFL ibt test,

with scores ranging from 62 – 108, (M = 87.9, SD = 14.4). The duration of their previous English studies ranges from 4 – 22 years. The duration of their residence in the United Stated ranges from 1 – 96 months (M = 15.8). As for the L1 English group, their ages ranged from 19 to 35 years and their language backgrounds were controlled: (i) English is their dominant language, (ii) they do not speak Asian languages. However, 6 out of 20 English L1 speakers had taken Japanese classes ranging from 5 to 48 months. They all claimed that they only have limited knowledge of Japanese. Due to the special populations in Hawaii, we found it is difficult to recruit participants whose second languages are not Asian languages, especially Japanese. Since Japanese immigrants form one of the major populations in Hawaii, this could explain why 1/3 of the participants recruited had the experience of learning Japanese.

5.2.2 Materials

The design of the present study is a modified replication of Zhang et al.'s (2011) study. Based on their findings, the similarities and differences in use of IN and ON in English and Mandarin groups, we designed our task as a word choice task. In Zhang et al,'s (2011) study, 116 pictures were used, of which 65 pictures were from the original 71 TRPS, together with 51 pictures developed by Zhang et al. (2011: 421). The stimuli pictures used in present study are the results of the four groups of pictures that were consistently described as IN or ON in Mandarin and English. In all, there are 71 pictures (22 IN–IN, 35 ON–ON, 13 ON–IN, and 1 IN–ON) used as stimuli in this study (see Table 5.3). We added 45 pictures as fillers, including 30 pictures that depict the spatial relations other than IN or ON (e.g. UNDER, NEAR, etc.), together with 15 pictures that

were undefined in either IN-dominant or ON-dominant group; as a result, 116 pictures in total were used in our study. Of the 116 pictures, each picture has a simple sentence that describes the picture. All the sentences we adopted for our experiment were collected from five native English speakers who were asked to depict the TRPS pictures with the instructions to "use a simple sentence to depict where the object that is pointed by an arrow is located in reference with the rest part of the picture". The purpose of data collection from the native English speakers is to provide natural descriptions for each picture.

Our stimuli were further divided into "congruent" and "non-congruent". Here the term "congruent" refers to those pictures that were consistently described as IN or ON by Mandarin and English speakers; on the other hand, "non-congruent" refers to those pictures that were consistently described as ON by Mandarin speakers and IN by English speakers and vise versa (Zhang et al.'s 2011: 424). The materials used in the present study are summarized in table 5.3.

Table 5.3

Two types of stimuli: congruent and non-congruent with four groups of pictures and their quantities

Type	Picture group	Number
Congruent	IN-IN	22
	ON-ON	35
Non-congruent	ON-IN	13
	IN-ON	1
Other		45
Total		116

The experiment was designed via the E-prime 2.0 software (Psychology Software Tools, Pittsburgh, PA). 71 Stimuli together with 45 fillers were presented randomly on the computer screen. A more detailed description of the experiment is discussed in the next section.

5.2.3   Procedures

A word choice task was conducted in this study. Participants were tested individually, sitting in front of a PC in a laboratory. On the computer screen, they were shown a picture. Following the disappearance of the picture, a simple sentence would appear which described the picture. All the sentences contain blanks in the grammatically correct location for a preposition. Finally, following the disappearance of the sentence, the picture, which is shown at the beginning, reappears together with two choices of prepositions. Participants are instructed to respond as quickly as possible when they see a picture with two choices of prepositions. Their task is to choose a preposition which best depicts the picture. The instructions are as follows:

> "First you will see a picture shown on the screen for 2 seconds. Next, you will see a sentence, which describes the pictures shown on the screen for 3 seconds. Finally, you will see a picture shown on the screen together with two choices of preposition. Now your task is to choose one from the prepositions which best describe the picture."

Mandarin speakers were also given verbal instruction in Mandarin by the experimenter in addition to the English instruction displayed, to ensure that they had no issues understanding the task. A practice trial (6 pictures) was conducted prior to the test

trial (116 pictures). After the completion of the experiments, a short, informal interview is given to each participant regarding the pictures to which he/she found difficult to respond, in order to ascertain whether judgments are based on the spatial relationships displayed, rather than on other factors.

5.2.4   Data Analysis

In total, there were 5220 responses to TRPS pictures (45 speakers in two languages groups X 116 pictures). The data were analyzed into two parts: accuracy rate and reaction time. Data were compiled by E-prime 2.0 software and analyzed by the program E-merge. For accuracy rate, we have input the answer of each picture stimulus in E-Prime. The answer of each picture stimulus was adopted from the results in Zhang et al.'s (2011) studies. Further, in order to justify the answer of each TRPS picture, we also collected data from five native English speakers who were asked to describe TRPS pictures with a short sentence. They were directed to look at each picture and think of the question "where the object pointed by a yellow arrow was located?". The answer of each picture was set in E-prime— if the response key matches the answer key, participants receive 1, whereas if the response key does not match the answer key, participants receive 0. Reaction time was set in milliseconds. The measurement began when participants was presented a picture together with two choices of prepositions on a screen, and ended when participants responded by pressing the key of up-arrow or down-arrow.

5.2.5   Results

Accuracy (Acc) and reaction time (RT) are mainly examined in the experiment between two groups: English L1 and English L2 speakers. Our results are summarized in the following table.

Table 5.4

Mean accuracy, reaction times and Standard Deviations for two types of stimuli by English L1 and English L2

	Congruent				Non-congruent			
Group	Acc		RT		Acc		RT	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
English L1	0.94	1.6	927.7	242.9	0.86	1.6	910.6	392.2
English L2	0.89	3.5	1744.5	882.3	0.48	2.4	2018.6	995.6

We expected to see significant differences in overall performance, specifically accuracy rates and reaction time, in L1 and L2 groups. As predicted, the overall accuracy rates in terms of two different types of stimuli, congruent and non-congruent, are lower in English L2 group than the monolingual group. Furthermore, within the same group in English L2, we also expected to see their accuracy rates and reaction time show differences subject to different types of stimuli. As can be seen in Table 1, the mean accuracy rate and reaction time are significantly different between these two types of stimuli. Our results also aligned with the findings in Zhang et al. (2011), in that those pictures ($n = 57$) consistently described by using the spatial term IN or ON (congruent IN–IN and ON–ON) in both language groups, native speakers of English and Mandarin result in a higher accuracy rate, while pictures ($n = 14$) consistently described as an ON

spatial relation by Mandarin speakers and IN by English speakers and vice versa (non-congruent ON-IN and IN-ON) result in a lower accuracy rate. The same holds true in RTs for different language groups conditioned to congruent and non-congruent types. The overall RTs of two types of stimuli in English L2 group are longer than our English L1 group. Moreover, in the English L2 group, participants need longer time to respond to non-congruent stimuli than to congruent stimuli. The results in Table 5.4 are presented in are presented in Figure 5.4 and Figure 5.5.
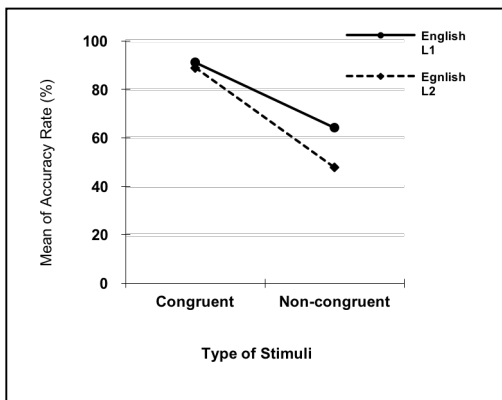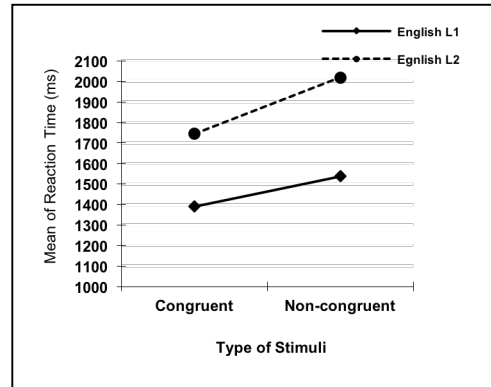

Figure 5.4 Mean accuracy rate   *Figure 5.5* Mean reaction time

The means of accuracy rates in both groups are very close in congruent type of stimuli, while both lines decrease and diverge in non-congruent type of stimuli, as shown in Figure 5.4. For the mean reaction time shown in Figure 5.5, it is clearly to see that there exist significant differences in between the two groups per type of stimuli. The slopes between congruent and non-congruent types are quite large; however, the slope in between non-congruent types is even larger. In order to ascertain whether the observed differences between means for accuracy rates and RTs between these two groups are statistically significant, an independent t-test for English L1 and L2 groups in congruent

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Acc, congruent RT, non-congruent Acc and non-congruent RT was performed. The results are summarized in the following table

Table 5.5

Independent T-test of the mean differences on accuracy and reaction times between two groups per type of stimuli

	t	*df*	*sig.* (2-tailed)
Congruent			
Acc	-3.661	35.313	0.001
RT	4.421	28.441	0.000
Non-congruent			
Acc	-9.231	42.323	0.000
RT	5.092	32.661	0.000

As shown in Table 5.5, the mean differences on accuracy and reaction times for congruent and non-congruent stimuli in between English L1 and English L2 groups are statistically significant. The results show that the mapping processes for English L2 speakers are generally longer when compared to native speakers, whereas the accuracy rates in L2 group are lower than the L1 group. Further, to confirm our first question on whether the incongruous uses of spatial terms (non-congruent type) affect L2 learners' mapping process, a pairwise comparison between congruent and non-congruent stimuli was performed to confirm whether the differences are significant. The results of the paired T-Test show a significant effect of different types of stimuli on accuracy rate ($t = 59.692$, $df = 24$, $p < .001$) and RT ($t = 8.703$, $df = 24$, $p < .000$). The significances of the results again confirm our research questions, first the cross-linguistic similarity and

difference in use of the two spatial terms IN and ON in L1 and L2 affects the mapping process in L2 speakers. Second, speakers' L1 did play a role in the mapping process, evidence can be drawn from the significant result in the non-congruent type of stimuli.

5.2.6   Discussion

In this experiment, we predicted that two different language groups, English and Mandarin speakers showed significant differences in the accuracy rate and reaction time as well. Furthermore, we also predicted that the results of accuracy rate and reaction time demonstrated significant differences in the two groups of stimuli pictures: congruent and non-congruent stimuli. For the accuracy rate, our prediction was that the overall accuracy rate of the English L1 group would be higher than the English L2 group, whereas as we predicted that the mean reaction time of English L1 group would be faster than English L2 group. However, for different types of stimuli, we predicted that the accuracy rate of congruent type of stimuli was higher than the non-congruent type of stimuli, whereas for the reaction time, we predicted that it would take longer to respond the non-congruent type of stimuli than to respond the congruent type of stimuli.

The results in the present study show significant cross-linguistic influences on the English L2 group. The significant differences in the mean accuracy rates in terms of congruent and non-congruent stimuli in English L2 group can be attributed to conceptual transfer. Jarvis and Pavlenko (2008) identified two types of conceptual transfer—positive conceptual transfer and negative transfer, by presenting supporting evidence in several areas across various conceptual domains, such as gender, color, space, time, etc. Cross-linguistic data showed that conceptual categories were interfered with by the L1. As well,

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data on adult L2 learners that did not use conceptual distinctions successfully, especially

on the target language, were shown to instead depend on L1-mediated concepts formed in

their childhood (Jarvis and Pavlenko, 2008). These L1-mediated concepts can also be

seen in the results shown in the current study. Conceptual transfer comes into play when

speakers express spatial representations in a way that indicates a source-language

influence on how they perceive or categorize these relationships. The result of our studies

also confirmed our analysis and proposal for the mismatch uses in English on/in and

Mandarin 上 *shàng*/裡 *lǐ*.

Recall the discussion in Chapter 4 for the mismatch uses in English on/in and

Mandarin 上 *shàng*/裡 *lǐ*, we proposed that the mismatched usage from different spatial

conceptualizations by English and Mandarin speakers in that English speakers are prone

to pay more attention on the "whole", and thus have the tendency to trigger the

"containment" spatial relation. The relation between the "whole" and "containment" can

be understood via the proto-scene for *in*, in that the TR is located within the LM which

has three salient parts: an interior, a boundary and an exterior. *Whole* includes *part(s)*, as

the LM contains/encloses/includes the TR, and thus "whole" triggers the "containment"

relation. Mandarin speakers, on the other hand, pay more attention on the "part" and

hence, have the tendency to trigger the "higher than" spatial relation. The relation

between the "part" and "higher than" can be understood through the proto-scene for 上

shàng, in that the TR is higher than the LM within potential contact. If an object, *the TR*,

is higher than or on the top of another object, *the LM*, the object (TR) is visually more

salient, as a result, "part" triggers "higher than" relation. Such tendency in spatial

conceptualizations could attributed to the spatial experiences, spatial languages, cultures

from the two languages that prompt the speakers of the two languages to pay more heed on different parts in spatial scenes, and which led to different results of the uses of the two spatial terms IN and ON.

All in all, this could explain why the accuracy rate is significantly higher in congruent stimuli than non-congruent stimuli and why the RT is shorter in congruent stimuli than in non-congruent stimuli. In the congruent type, both languages, Mandarin and English, share the same conceptual categories on the spatial relations IN (containment) and ON (support). As a result, the L1 of English L2 group contributes to a positive conceptual transfer. On the other hand, in the non-congruent type, both languages have different spatial categories on the two topological relations IN and ON, which therefore results in a negative conceptual transfer. Owing to the mediation of the L1 in the two spatial categories IN and ON, as predicted, it is more difficult for English L2 learners to score higher in the non-congruent types when there is a native conceptual transfer. It can also be explained that English L2 speakers need more time to respond to the non-congruent stimuli for the same reason.

5.3   Experiment 2: English L1 Mandarin L2

As our results shown in Experiment 1, cross-linguistic similarity and difference is a factor that influence how learners of English whose L1 is Mandarin in the uses of the spatial term IN and ON in the target language. We have confirmed that the there is such a factor, especially on mismatched usage of the two spatial terms, and as a result, in Experiment 2, we would like to examine how the language acquisition process affects the

mapping of spatial relationships into language in L2, specifically how the accuracy results of both congruent and non-congruent stimuli are affected by proficiency level.

5.3.1 Participant

In experiment 2, native English Speakers who learned Chinese as their L2 were mainly recruited from the University of Hawai'i at Mānoa while few of the participants were recruited from other Universities in the United States, and Taiwan as well. Two groups of Chinese learners were solicited: high language proficiency learners (n = 15) and low language proficiency learners (n = 19). Their ages are ranged from 18 to 49 years. Participants were current Chinese language learners or had experience learning Chinese, and they were controlled on their second Asian languages, such as Japanese, Korean and or other Chinese dialects as that they don't have the knowledge of these Asian Languages in order to rule out the factor of other Asian languages' influence. All participants were required to fill up a language background survey in order to have references of their Chinese learning. Although in the survey, they were asked on their highest Chinese level, and a self-rating on the four skills of Chinese language, their language proficiencies were determined by our language proficiency test.

5.3.2 Material

In experiment 2, the material for our language proficiency contains 6 short passages of cloze test with 5 questions each, which are extracted from the mock tests for the Test of Chinese as Foreign Languages (TOCFL)[12]. The 6 cloze tests are consisted of 2

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[12] TOCFL is a standardized test developed for non-native speakers of Chinese to test their listening and reading abilities. TOCFL is launched and administrated in Taiwan.

at beginning level, 2 at intermediate level, and 2 at advance level, presented in both

traditional and simplified Chinese characters. Thirty-nine pictures were selected from the

TRPS and Zhang et al.'s study to test the containment and support spatial relations. An

additional 17 line-drawing pictures were developed by the author to use as fillers. In total,

56 pictures were used in the second experiment. For the testing stimuli, we randomly

selected fourteen pictures from the congruent group in the first experiment, and fourteen

pictures from the non-congruent group. In total, there are 28 testing items and the

additional 28 pictures are fillers, as summarized in Table 5.6.

Table 5.6.

Two types of stimuli: congruent and non-congruent with four group of pictures and
quantity

Type	Picture group	Number
Congruent	IN-IN	14
	ON-ON	
Non-congruent	ON-IN	14
	IN-ON	
Other		28
Total		56

5.3.3   Procedures

The experiment was designed using JotForm[13], a web-based form builder. This

experiment consists of four parts: first, language proficiency test, second, pre-knowledge

test, third, the main test and last, picture recognition task. The language proficiency

portion presents 6 cloze tests with 5 questions each and was designed to test overall

proficiency. The pre-knowledge test was designed to control specifically for participants'

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[13] The online survey of Experiment 2 can be accessed via the url
https://form.jotform.com/41100525695146.

knowledge of spatial terms. In this test, basic Chinese spatial terms, 上 *shàng* 'above/up',

下 *xìa* 'below/down', 前 *qián* 'front', 後 *hòu* 'back/behind', 裡/里 *lǐ* 'in(side)' and 旁

páng 'side' were tested. In this test, pictures that depict spatial relations were presented

and participants selected the correct spatial term for the picture from choices. In all, there

were six test items. The next part was the main test. In this section, for each question

participants were shown a picture with a sentence that had a blank for the spatial term.

They selected from five choices of the spatial terms. In total, there were 56 questions in

the main test. Throughout the survey, we provided both traditional and simplified

Chinese characters for the tests. The instructions for the main task were as follows.

"In this task, you will need to answer 56 questions that are related to spatial relations. Each

question will be presented by a simple line drawing picture together with a simple sentence in

Chinese (both traditional and simplified characters) that describes the spatial relation in the

picture. However, each sentence contains a missing spatial term (e.g., 裡/里 , 上 ,下, 旁, 後/后

...etc). You will be provided by 5 choices of the spatial terms for each sentence. Your task is to

choose a spatial term that can best describe the spatial relation in the picture. When you select

the Chinese spatial term, simply focus on the object that the arrow is pointing in relation to the

other part of the picture."

The last part was picture recognition task. The purpose for the last task was to

ascertain the validity of participants' answers in the main test rather than random

selections by the participants. Since our survey was self-conducted by the participants

without experimenters' supervision, the validity of the answers from the participants was

also examined. By examining the validity of the answers in the main test, we designed

the last part of our tasks. In this task, participants need to identify the pictures, which were shown in the main test.

5.3.4   Data analysis

All the data were compiled by JotForm, a web-based form builder, and were exported as an excel file. Our data had four parts, which were corresponding to the four tasks in the survey. The first part was participants' language proficiency. Participants who received more than 16 correct answers were grouped in the high language proficiency group, while participants who received less than 16 correct answers were in the low language proficiency group. When we recruited participants, we targeted at students who were at the beginning and advanced levels. However, to define participants' proficiency levels more accurately, based on the results of our proficiency test, we regrouped our participants.

The second part was the pre-knowledge test. In the pre-knowledge test, six basic Chinese spatial words were tested, including the two target words 上 *shàng* 'above/up' and 裡/里 *lǐ* 'in(side)'. All the participants had at least 83%-100% of the knowledge of the six basic spatial words, but only four of the participants in the low proficiency group had 50% of the knowledge of the six basic spatial words.

Following the pre-knowledge test is our main test. In the main test, accuracy rates of their responses were examined. The answers for congruent and non-congruent type of stimuli were based on the results in Zhang et al.'s (2011) findings on the four groups: IN-IN, ON-ON, IN-ON and ON-IN, used by their English and Mandarin groups, detailed discussion will be presented in the next section.

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The last part of our survey is the picture recognition task. In this task, percentages of the recognition of the pictures shown in the main test are calculated.

5.3.5 Results

The means of the accuracy in low language proficiency group and the high language proficiency group in the main test were compared. Our results can be briefly summarized as shown in table 5.7.

Table5.7

Mean Accuracy for the two groups of language groups

Group	High		Low	
	Mean	SD	Mean	SD
Acc	23.4	3.3	10.8	4.0

We expected to see a significant difference between the two language proficiency groups. We predicted that the overall performance in high Language proficiency group is higher than the low language proficiency group. As predicted, our results showed that the scores of accuracy in the High Language proficiency group are higher than the low Language proficiency group. To better demonstrate the differences between the two different proficiency groups in responding to the two types of stimuli, Figure 5.6 is presented below.
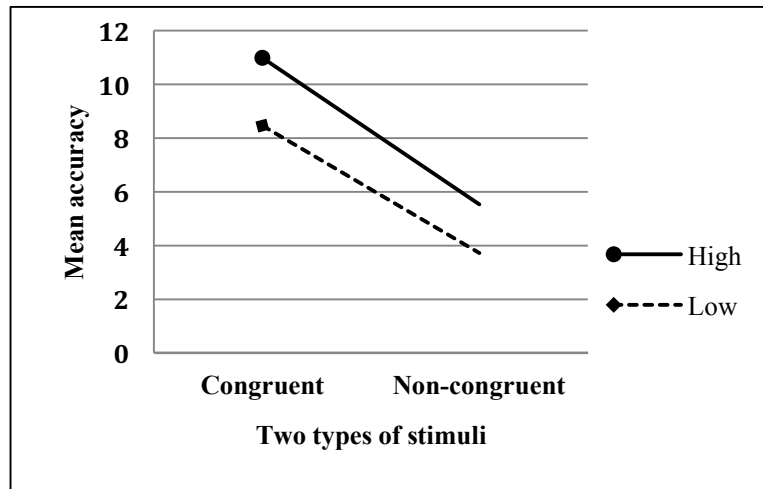
Figure 5.6 Mean accuracy per two types of stimuli in two proficiency groups

We have conducted a statistical methodology, independent T-test, to further confirm our predictions. The statistical results are summarized in the following table.

Table 5.8

Independent T-test of the mean differences on accuracy between two language proficiency groups

	t	*df*	*sig*. (2-tailed)
Acc	9.609	32	0.000

As shown above, the statistical results showed a significant effect on the two language proficiency groups. This confirmed our prediction that language proficiency is a factor on second language learners when using spatial terms. Based on the results shown here, we further predicted that the two language proficiency groups also have different accuracy rates on the two different types of stimuli: congruent and non-congruent (see Table 5.6). Therefore, we further examined the data on two different types of stimuli. We predicted that the overall performances from the learners on the two different types of

stimuli, learners scored higher on the congruent type of stimuli than the non-congruent

type. Moreover, learners in the low language proficiency group scored higher on the

congruent type of stimuli than the non-congruent type, while for the learners in the high

language proficiency group, the accurate rates between the two types of stimuli did not

show significant differences. The reason we predicted there would be a significant

difference between the two types of stimuli in the low proficiency group was that the

beginners of a second language often rely on their L1 knowledge and often seek for the

equivalent translations for the target language (detail see 1.2), as a result, low accuracy

rate on the non-congruent type of stimuli was predicted; on the other hand, advanced

learners are more experienced and have better learning strategies in their second language

learning, such as more awareness and tolerance in the differences between their L1 and

the target language, and thus better performance on the non-congruent type of stimuli.

Our results can be briefly summarized in the following table.

Table 5.9

Mean differences in two language groups per types of stimuli

	Congruent		Non-congruent	
Group	Acc		Acc	
	Mean	SD	Mean	SD
High	11	1.29	5.53	3.06
Low	8.47	2.69	3.73	1.91

As shown above, the overall mean scores of both groups of learners on congruent

type of stimuli are higher than the non-congruent type. As shown in the high language

proficiency group, the mean score is 11 comparing to the mean score 5.53 on the non-

congruent type. For low language proficiency group, the mean score is 8.43 which is also higher than the mean score 3.73 on the non-congruent type.

Table 5.10

Independent t-test for different types of stimuli in two different language proficiency groups

	t	*df*	*sig.* (2-tailed)
High Language Proficiency group			
Acc	7.054	28	0.000
Low Language Proficiency group			
Acc	6.250	36	0.000

An independent t-test was adopted to show whether the two types of stimuli have an effect on the acquisition of second language spatial terms. Our results showed significant differences on two types of stimuli in both high and low proficiency groups. The statistical results further confirmed our predictions that second language learners of Chinese have different learning in acquiring the congruent type of stimuli from non-congruent type of stimuli. However, we did not expect to see a significant difference between the congruent and non-congruent type of stimuli in the high language proficiency group owing to the reasons stated earlier. The results lead us to think why the acquisition of the non-congruent type of stimuli is also very challenging to advance learners. Possible factors will be discussed in the next section.

5.3.6   Discussion

In this experiment, we predicted that two different language proficiency groups, high proficiency and low proficiency in Chinese language, showed significant differences in the accuracy rate. Further, we also predicted that the results of the accuracy rate demonstrated significant differences in the two groups of stimuli pictures: congruent and non-congruent stimuli. Our results again, show significant differences in accuracy rates between the two language proficiency groups: the high and low groups, which confirms our prediction that L2's proficiency level is an effect in the uses of the spatial terms, IN and ON, in the target language. Next, our results also showed significant differences in the two types of stimuli: congruent type and non-congruent type. This, again, confirms that, the two different types of stimuli are factors that influence L2's performance in use of the two spatial terms. Knowing this, we further looked into whether the two proficiency groups have different performances in mapping the spatial terms to the congruent and non-congruent type of stimuli. As stated in previous section, we predicted that learners of Chinese have different learning in acquiring the congruent type of stimuli from non-congruent type of stimuli. We predicted that learners of the high proficiency group would perform slightly better on the congruent type of stimuli than the non-congruent ones. Reasoning as stated earlier, they are more experienced and have more awareness and tolerance in the differences between their L1 and the target language. On the contrary, we expected to see a significant difference between the two types of stimuli in the performance of the low proficiency group, since they often rely on their L1 knowledge and often seek for the equivalent translations for the target language, and thus would lead to a low accuracy rate in the non-congruent type. Our results confirmed one

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of our predictions in the low proficiency group, but not the high proficiency group. Why would the accuracy rate also be low in the non-congruency type of stimuli in high proficiency group? As addressed in Experiment 1's discussion, the reasons may be because the L2's performance on accuracy rates and reaction time are attributed to the negative conceptual transfer (Jarvis & Pavlenko, 2008). Conceptual transfer comes into play when speakers express spatial representations in a way that indicates a source-language influence on how they perceive or categorize these relationships, if the conceptualization maps in learner's L1 and L2, a positive conceptual transfer results; on the contrary, if it does not map, then a negative conceptual transfer results. From the results showed in our studies, we would like to conclude that cross-linguistic differences in spatial conceptualization between learners' L1 and L2 would require longer time in their L2 spatial language acquisition. However, a Cognitive Based teaching approach could help L2 learners success in spatial language acquisition, especially the spatial conceptualizations differ from their L1 and the target language.

CHAPTER 6

CONCLUSION

This study began with the question whether topological spatial relations -

containment and support - exist universally in the physical world. In Chapter 1, I

addressed this issue from a broader scope on how language and space interact with one

another, how human beings decode space, and how spatial relations are encoded into

languages. To determine the answer, I examined the two spatial terms, English *on*/*in* and

Mandarin 上 *shàng*/裡 *lǐ*, which are often associated with the spatial concepts of

containment and support. Cross-linguistic studies have shown that the semantic

categories of English on/in and Mandarin 上 *shàng*/裡 *lǐ* do not fully overlap. Thus my

study covered two parts: first how speakers of English and Mandarin encode the two

spatial relations, and second, whether the similarities and differences of the two spatial

terms affected the acquisition of L2 learners.

In Chapter 2, I reviewed on the syntactic representation as well as semantic

representation of the two spatial concepts, containment and support, in English and

Mandarin. I reviewed the previous studies on the syntactic categorizations of 上 *shàng*/裡

lǐ, and zài…上 *shàng*/裡 *lǐ*, which has been controversial for decades. In the second part

of the Chapter, I discussed the semantic representation for containment and support in

English and Mandarin. Previous studies on the two spatial relations between the two

languages did not provide a systematic way to examine the spatial encodings in the two

languages. And as such, we proposed a new hybrid account: geometric and functional

spatial relation later on in Chapter 4 in order to examine the spatial encodings in the two languages.

In Chapter 3, I presented the theoretical framework of the dissertation. Since previous research did not address the similarities and differences via a comprehensive analysis which was grounded on a theoretical foundation, in this Chapter I adopted an embodied cognition approach, the proto-scene model, that is under the framework of the Polysemy Network by Tyler & Evans (2003) and Evans and Tyler (2004b).

Detailed in Chapter 4, I adopted the proto-scene model and built up the proto-scene for English *on*, and Mandarin 上 *shàng*/裡 *lǐ*. In this Chapter, I compared the similarities and differences of the proto-scene for on/上 *shàng* and in/*lǐ* and provided a plausible solution for the puzzle for the alternative uses of English *on*/裡 *lǐ* and Mandarin 上 *shàng*/裡 *lǐ*. At the end of this Chapter, I have also proposed an important view for examining the issue of the mismatched uses in English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ,* and my proposal would be more plausible with empirical evidence such as eye tracking analysis.

Chapter 5 presented evidence from empirical studies for our analysis via the proto-scene model for English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ*. In this Chapter, I have conducted two experiments to examine the cross-linguistic similarities and differences of the two spatial terms of the L2 groups. The results of the two studies suggested that cross-linguistic differences played a role in the L2 spatial language acquisition. Furthermore, the results also confirmed my proposal for the mismatched uses in English *on*/*in* and Mandarin 上 *shàng*/裡 *lǐ* which derives from different focus attentions on the spatial scenes by the speakers of the two languages.

The dissertation began with a question on how language and space fundamentally interact, and studied two of the most deceptively complex topological spatial relations, containment and support, as a test ground. Although the present study only focuses on the two topological spatial relations, the study presented a compressive approach grounded in cognitive linguistics which can be verified by empirical studies. The study has limitations on the experimental design, and working to overcome these limitations in order to design a more scientific experiment is our next step. More importantly, how the results of our studies can inform back to L2 spatial teaching is our final attainment for doing this study.
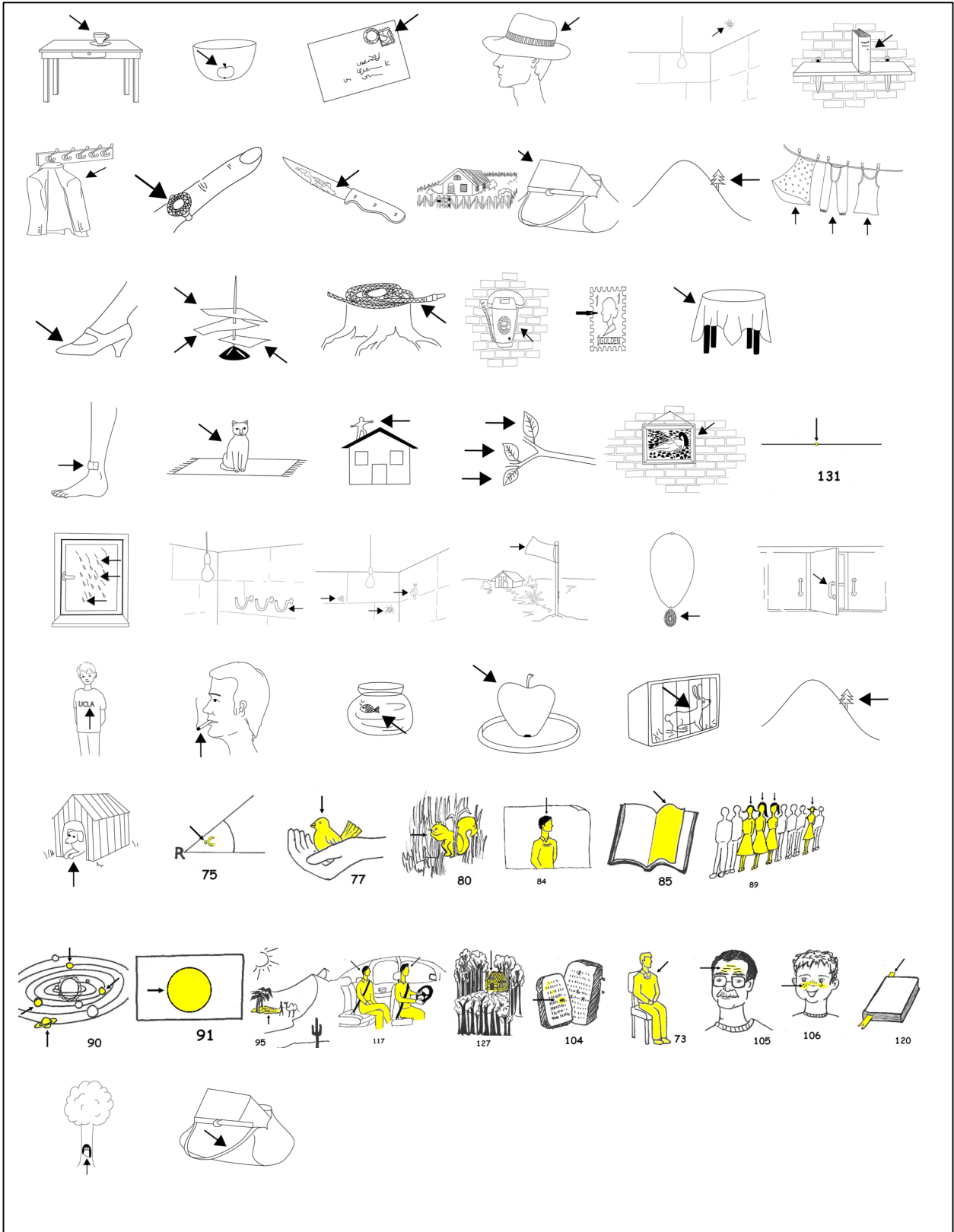
71 Topological Relations Picture Series
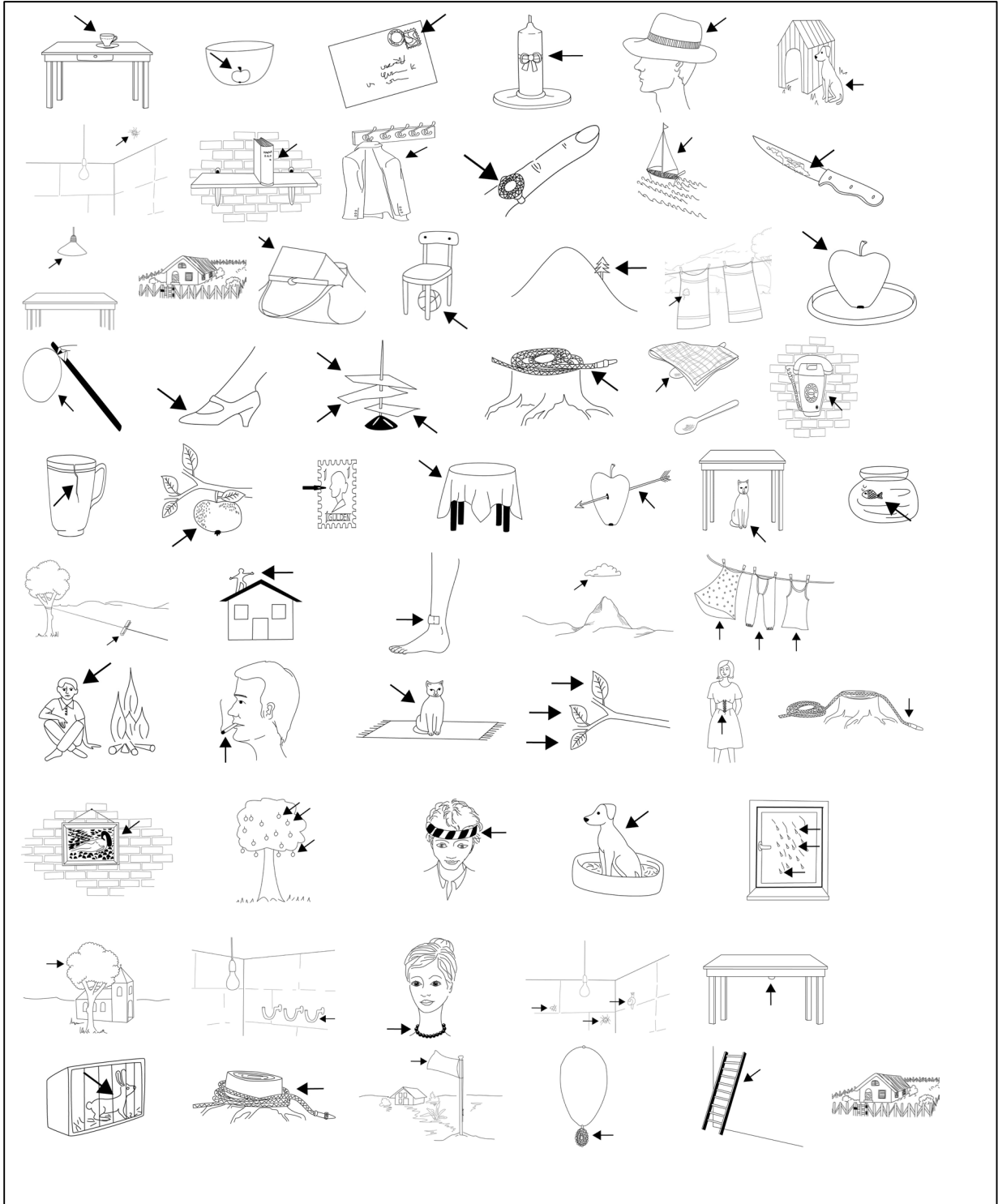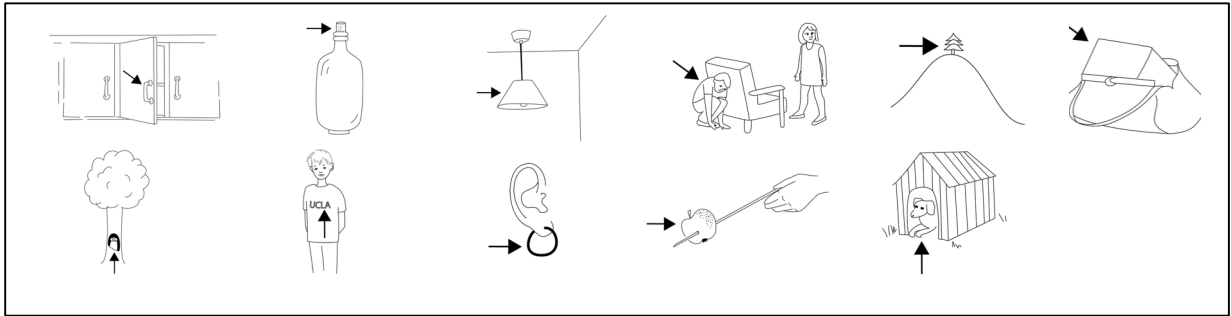
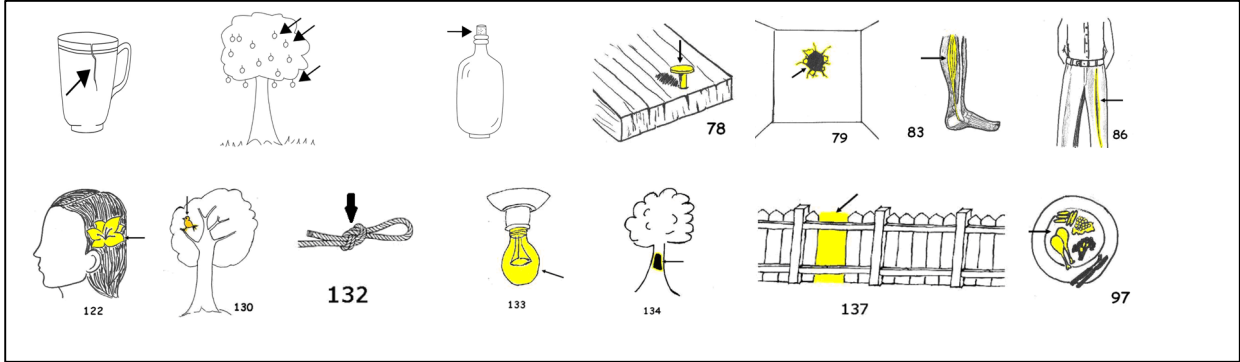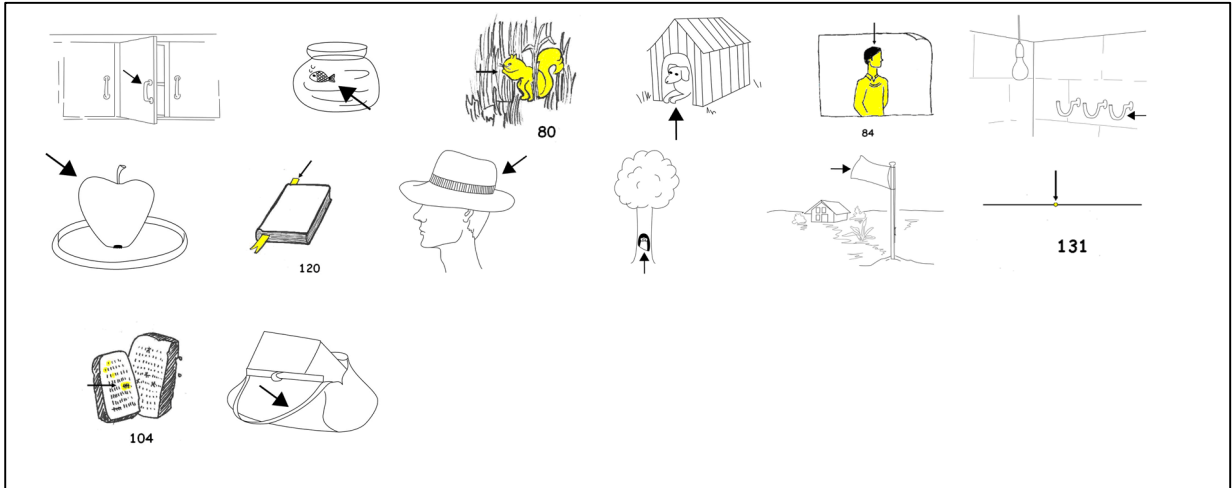Congruent type of stimuli for Experiment 1

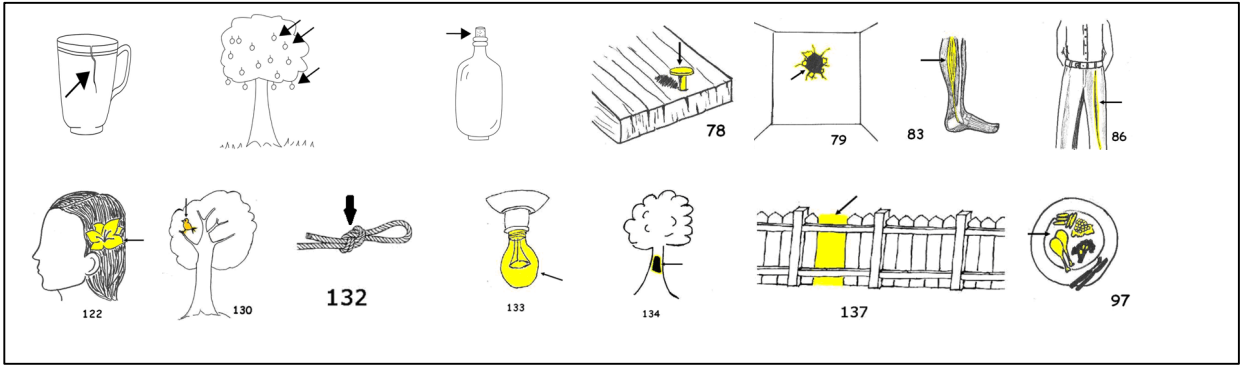# APPENDIXE C

Non-congruent type of stimuli for Experiment 1

APPENDIXE D

Congruent type of stimuli for Experiment 2

Non-congruent type of stimuli for Experiment 2

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