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指導教授：萬依萍 博士
Advisor: Dr. I-Ping Wan

台灣以中文爲母語的小孩的誘發過度泛化現象
Priming Overextensions in Taiwan Mandarin Children

研究生：陳采君 撰
Student: Tsai-Chun Chen

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Priming Overextensions in Taiwan Mandarin Children

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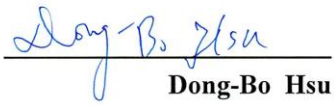
Advisor



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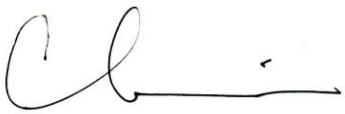
Committee Member

Approved: 

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寫論文的這一年多的時間，有快樂也有悲傷，我從二下就開始寫了，真正口試完眨眼已過了一年多的時間，這樣的漫長過程中，想感謝的人很多，因為有這些人存在在我身邊，才能在我失意時給我力量，在我努力時給我幫助，直到一步一步達成目標。

首先，想感謝我的指導教授萬依萍老師，在我一開始遍尋不著題目的時候，給我很好的建議，讓我終於可以定下來好好做一個題目，也因為他開的研究方法課程，讓我可以在二下就有機會預先處理論文，並且有更多的機會跟老師meeting討論。雖然二下的時候就已經開始寫論文，但到三年級要提論文計畫的時候還是發現自己論文很多問題，讓萬老師費了很多心神替我一次又一次的提點出問題所在，要是沒有老師的指教，我的論文計畫決不會那麼順利就通過，也因為老師一次又一次的指出我論文的問題所在，才能讓我真正了解怎麼樣才是一篇好的論文，也讓我了解到真正的學術研究是怎麼一回事，這一年多慢慢的成長，老師的指教真的是不可或缺的因素。

再來，想要謝謝參與我口試的口委們。提論文計畫書的時候口委是黃瓊之老師跟張顯達老師，最後的論文口試的口委則是徐東伯老師跟黃瓊之老師。首先，先謝謝各位老師們願意抽時間來參與我的口試，再來想要謝謝老師們提供的意見，張顯達老師在我提論文計畫書的時候，給了我很多的方向去思考，幫助我可以在未來更清楚地知道自己的論文應該怎樣修正才會更好；黃老師更是一直在旁邊給了我實用的意見，讓我知道我論文不足的部分是什麼；徐老師更是在最後的口試時讓我能從更宏觀的角度去了解自己的論文還有哪些問題是需要改進的。口委們的意見都很寶貴，因為擁有這些意見，才能讓我更順利地前進。

再來想謝謝提供我受試者的每一位朋友，有些園所是認識的幫忙提供或者介紹的，有些則是完全不認識的園所，經由接洽而願意讓我進去收實驗，除了園所

以外，也謝謝私底下提供自己的小孩子、孫子、姪子讓我做實驗的每位朋友，沒有你們的幫助，實驗絕對完成不了，我也無法收到那麼多個受試者。另外在這裡，我想特別謝謝教會的林財川老師，提供我統計上的協助，花私下的時間費心又費神地了解我的實驗方式跟內容以及統計方法，沒有老師專業的指教，我的統計無法順利跑出來，感謝林老師的統計教學，這真的是我論文非常重要的一部分。

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研究所別: 語言學研究所

論文名稱: 台灣以中文為母語的小孩的誘發過度泛化現象

Priming Overextensions in Taiwan Mandarin Children

指導教授: 萬依萍

研究生: 陳采君

論文提要內容:（共一冊，兩萬兩千七百字，分五章）

本篇研究的目的是要去比較中文跟英文小孩的誘發過度泛化現象的不同之處。誘發過度泛化現象指的是小孩子因為受到之前誘發過的字的影響進而造成對物品過度泛化現象的情況而稱之。Gershkoff-Stowe et al. (2006) 認為 Dell (1986) 提出的擴散激活機制 (spreading activation mechanisms) 可用來解釋小孩的三種泛化錯誤類型: 類別錯誤 (category errors) 、語用錯誤 (pragmatic errors) 跟提取錯誤 (retrieval errors)，此三種泛化錯誤的基底機制應該都是同樣的。另外，他們也認為最近激活跟形狀的類似對小孩的命名應該都扮演了很重要的角色。年紀較大的小孩也應該會擁有比較成熟的心理詞彙所以會比起年紀較小的小孩比較不容易受到之前提取過的字的影響。因為中文跟英文心理詞彙的不同，我們想去檢視是否一樣的理論也可套用在中文小孩身上。實驗方法沿用了 Gershkoff-Stowe et al. (2006)的相同實驗法，做了與他相同的兩個實驗。第一個實驗是熟悉物與不熟悉物的命名，兩歲小孩要做六次的試驗，然後我們是用三張圖片做為誘發圖片，

然後請小孩去命名一個真實的物品。第二個實驗是虛構物品命名，我們在這個實驗裡比較兩歲小孩跟四歲小孩的不同表現。實驗過程跟實驗一是一樣的，只是實驗二是看虛構物品不是真實物品，且有八個試驗機會而不是六個。結果顯示有一個跟英文大致上類似的結果。然而我們仍有發現一些不同之處。第一，我們發現熟悉物在中文裡比起英文似乎有更強的力量。第二個則是兩個語言不同的構詞法可能會對於比較成熟的心理詞彙造成不一樣的誘發方式。

Abstract

This purpose of this study is to compare the difference of priming overextension phenomena between Mandarin Chinese children and English children. Priming overextension means that children overextend some words due to the effects of the previously primed words. Gershkoff-Stowe et al. (2006) found that spreading activation mechanisms (Dell, 1986) should be the underlying mechanisms of three types of children's overextension errors, i.e., category errors, pragmatic errors, and retrieval errors. Moreover, they thought that recent activation and perceptual similarity both play an important role on children's object naming. Besides, older children should have a more mature mental lexicon and thus less susceptible to previously retrieved words than younger children. Due to the difference of the lexicon networks between Mandarin Chinese and English, we want to examine whether the same theory also could apply to Mandarin children. Two experiments which followed Gershkoff-Stowe et al. (2006) were conducted. The first one was familiar or unfamiliar object naming. 2-year-old Children underwent six trials and were primed by three pictures and then were asked to name a real object. The second experiment was novel object naming. We compared the performances of children aged 2 and aged 4 together. The procedure was the same as the experiment 1 despite the fact that

children in experiment 2 named novel objects rather than real ones and they underwent 8 trials rather than six. And results showed a generally similar finding with English. However, there are still something different between these two languages. First, we found that familiar objects should have stronger strengths in Mandarin than in English. Second, different morphology in two languages may result in different priming way for more mature mental lexicons.

Chapter 1

Introduction

Children's language development has undergone an interesting psycholinguistic process. At around 0;6, children start to babble (Fromkin, Rodman & Hyams, 2003). At first, they may babble some sounds that never appear in their surroundings. Gradually, their babbling becomes stable, and the pattern is much more like their native language no matter when it comes to sounds or sound combinations. About age one, children enters another stage, i.e., the holophrastic stage, in which children use one-word utterances to express more complex meanings (Fromkin, Rodman & Hyams, 2003). And in this stage, children will overextend the meanings of some words so that these words will have different semantic boundaries from adults'. Between age 1;6 and 2;0, they start to say two-word utterances (Clark, 1993). And roughly around the end of the two year old, there is a vocabulary spurt showing up among children (e.g., Bloom, 1973; Nelson, 1973; Halliday, 1975; Goldin-Meadow, Seligman, & Gelman, 1976; Corrigan, 1978; Dore, 1978; Ingram, 1978; Benedict, 1979; McShane, 1980; Gentner, 1983a; Nelson, 1985; Khami, 1986; Dromi, 1987; Gopnik & Meltzoff, 1987; Bates, Bretherton, & Snyder, 1988; Lifter & Bloom, 1989; Fenson et al., 1990; Goldfield & Reznick, 1990). During this period, children have a sharply growth of

lexicon in their production. The vocabulary spurt has been considered to be the evidence that children may have known that language is a symbolic system so that everything around them has a name. Alternatively, maybe the vocabulary spurt suggests that children's articulatory plans have achieved a certain level so that children can realize it in their production (Clark, 1993).

When children begin to use one-word utterances to express the meanings, we can observe that their usages of many words are distinct from adults' usage a lot. There are at least three kinds of phenomena observed in children's early language in this period (Clark, 1993). Those will include situation-bound uses, under-extensions, and overextensions. The first one is situation-bound uses, which means children only use a certain word under a very specific context. For example, children may use 'bye' only in the situation of someone leaving the room. Other examples drawn from many researchers showed that children may use "car" only when they see a car on the street below from the window, but don't use it in other situations (Bloom, 1973; Bowerman, 1978; Braunwald, 1978; Barrett, 1986; Dromi, 1987; Barrett, Harris, & Chasin 1991). The second one is under-extensions, meaning that children use a certain word to refer to only a subset of a larger category in adult usage (Bloom 1973, Reich 1976). For example, children may use shoes to refer to sneakers only (Anglin, 1977; Reich, 1976). And the final one is overextensions, meaning that children will use a word to

refer to not only its actual referents but also other things with perceptual similarity. For example, the word *ball* may be used to refer to all kinds of balls, and also to the round hanging lampshades, doorknobs, and the moon. Since there are various stages of phenomena in children's early language development, overextensions will be the only focus under this study, based on Gershkoff-Stowe, Connell, and Smith's findings (2006).

Traditionally, overextension errors could be categorized into three types. They are category error, pragmatic error, and retrieval error. Category error happens because children have less defining features as adults for a word. And their overextensions often based on perceptual similarity (Clark, 1973). Pragmatic error happens because of children's limited vocabulary (Bloom, 1973; Hoek, Ingram & Gibson, 1986). Children have not acquired certain words yet so that they use other words they have known to substitute them. Retrieval error refers to those errors affected by previously accessed words. Although children could label the object correctly before, they still make an error due to retrieval problems (Gershkoff-Stowe, 2001). In Gershkoff-Stowe, Connell, and Smith's (2006) study, they tried to use adults' spreading activation mechanism to test Dell's (1986) model and to adopt Rapp and Goldrick's (2000) study to explain children's overextensions. Spreading activation consists of three parts: spreading, summation, and decay. One word

receives activation strengths from spreading and summation, so it can be retrieved. And finally these strengths will decay to zero again. Errors will happen when the incorrect word receives more strengths than the correct one.

Gershkoff-Stowe et al. (2006) used this model to explain children's overextension errors. Gershkoff-Stowe et al. (2006) thought actually all of these errors could be explained by Dell's (1986), and Rapp and Goldrick's (2000) spreading activation mechanism. A category error may happen because children activate other similar items with the target objects. Pragmatic errors may appear because the unknown object activates the known words in children's lexicons. Finally, retrieval errors occur because children are affected by another previously activated object. And they used two experiments to argue for their viewpoints: object naming task and novel object naming task. And the findings showed that children's naming errors could be explained by spreading activation mechanism unitarily.

Besides, the arguments about the question whether children's overextensions come from their comprehension or production problems will be also reviewed. In fact, category error suggests comprehension problems while pragmatic error and retrieval reflect production problems. Huttenlocher (1974), Thompson and Chapman (1977), Fremgen and Fay (1980), Rescorla (1980a), Naigles and Gelman (1995), and Gelman, Croft, Fu, Clausner, and Gottfried (1998) all concluded that children often have better

comprehension than their performances, and they all tried to answer whether children's overextension performances really reflect their comprehension problems or not.

When children learn nouns more and more, their attention to shape also increases. Since shape is a crucial cue for children's lexical learning, some factors which may affect children to have this kind of bias will be an interest of this study. This may be related to the visual systems of human beings (Landau, Smith & Jones, 1998). Shape actually is a more direct experience than objects' functions or concepts for children. In addition, shape seems to have some relationship with the quantities of nouns which children have learned. English syntactic cues appear to influence children's attention to shape as well. Count nouns lead children pay more attention to shape while mass nouns lead children to materials.

There have been a lot of debates on children's overextension issue among literature in Germanic languages (e.g., Clark, 1973; Bloom, 1973; Nelson, 1974; Thomson & Chapman, 1977; Landau, Smith & Jones, 1998). Few studies use Chinese to examine whether the theory will still be right when it applies to another different language. English and Chinese are two different languages. English is an alphabetic language. Every word is composed of several letters (e.g., Toyoda & Scrimgeour, 2009). On the other hand, Chinese is a logographic language. Each word often

represents a phonological and semantic unit. Chinese words are mostly compounds whose meaning often can be analyzed from their components (e.g., Mok, 2009). The characteristics of Chinese may give children category hint when they classify the world, which may cause them to have different priming overextension phenomena. In this study, we will base on Gershkoff-Stowe et al's (2006) findings and see whether Taiwan Mandarin children yield the same or different aspects.

In this paper, two experiments related to object naming tasks are conducted. The objects shown to children in experiment 1 are familiar or unfamiliar objects while experiment 2 involves novel objects. In each trail, children are primed by some pictures, which have perceptual similarity with the objects, and then they are asked to name the objects presented to them. If Gershkoff-Stowe et al's (2006) claim is right, i.e., overextensions actually can be explained unitarily by Dell's (1986), and Rapp and Goldrick's (2000) spreading activation mechanism, children will be affected by previously retrieved words no matter the objects presented are familiar, unfamiliar or novel to them. In experiment 1, 2-year-old children's naming of familiar and unfamiliar objects is investigated. And in experiment 2, 2-year-old and 4-year-old's naming toward novel objects are compared. The research questions to be discussed are organized as follows:

(1) Can category error, pragmatic error, and retrieval error be explained by

spreading activation mechanisms and deemed as a retrieval process unitarily?

(2) What is the role of priming and similarity when children label a novel object?

(3) What are the differences of the novel objects' naming between 2-year-old and 4-year-old children?

(4) For the overextension phenomena, are there any differences between Taiwan Mandarin children and English children?

Under this study, and based on Gershkoff-Stowe et al's (2006) study, we might hypothesize the following results:

(1) The underlying mechanisms should be the same among three types of errors.

(2) Priming and similarity should both have an important effect on children's novel object naming.

(3) 4-year-old children should be less vulnerable to previously retrieved words.

(4) Overextension should be a universal phenomenon. However, the difference between English and Chinese may still cause some different results of priming overextension. We assume that Mandarin children might make fewer errors due to the internal meaning which every character brings.

Chapter 2

Literature review

2.0 Introduction

In this chapter, we will introduce three types of errors of overextensions. The first one is a type of category error, the second one is a type of pragmatic error, and the third one is a type of retrieval error, all illustrated in 2.1. The arguments about overextension where the viewpoints among literature on whether children's overextensions come from their comprehension or production problems will then be shown in 2.2. Subsequently, in 2.3 the importance of shape for children will be introduced. And in 2.4, the spreading activation mechanism is used to make an integral account for three types of errors, and we reviewed the experiments and findings in Gershkoff-Stowe et al. (2006). In 2.5, some characteristics of Mandarin Chinese will be shown. Finally, we will make a brief summary in 2.6.

2.1 Three Types of Errors

In this section, three types of errors are introduced separately. Under each error type, the definition and some examples will be used for illustration.

2.1.1 Category Errors

The first kind of error type is called category error. Category error is a kind of overextension that children label two objects with the same name due to their similar perception or concept. Clark (1973) was the first researcher to study children's overextension. She proposed a hypothesis called 'Semantic Feature Hypothesis', which assumed that children may learn just one or two features of a new word at first, and gradually they add new features to that word until the word gets a bundle of features that correspond to adults' meaning. Thus, according to this hypothesis, children will have a broader meaning than adults since their defining features are much less than adults. For example, children at first may think that 'dogs' refer to animals which have four legs. Therefore, 'dogs' may be overextended to refer to many four-legged animals, such as cows, sheep, zebras, llamas, dogs, and anything else. Children may treat all of these animals with similar features as the same thing in their mind.

According to Clark's (1973) hypothesis, children's word learning should be in a top-down order, i.e., they learn the most general features in their early stage and then move on to more specific features. For example, when children learn words about order, such as *before* and *after*, the first feature they acquire is +Time. And then they know these two words are related to order and do not happen at the same

time: –Simultaneous. Next, –Simultaneous implies that the two concepts should have order. *Before* is +Prior, and *after* is –Prior. Thus, the more general features that they acquire should be +Time, then they learn more specific ones, i.e., whether these two words are +Simultaneous or –Simultaneous, and finally ±Prior.

Clark (1973) also noted that children's overextension is based on perceptual similarity between objects and objects. And she further pointed out that the perceptual similarity involves six categories, which are movement, shape, size, sound, taste, and texture respectively. Among these six categories, movement, shape, size, and sound appear to be the more prominent norms to affect children's overextensions. And 'shape' seems to be the most frequent criterion on which children based to do overextensions. However, Clark (1973) still pointed out another fact that children seem not to do overextension based on color criterially. Table 1 is a sample instance of overextension and restructuring (Clark, 1973):

Table 1. A Sample Instance of Overextension and Restructuring (Clark, 1973)

	Word	Semantic domain	Possible criteria feature(s)
Stage I	Bow-wow	Dog(s)	Shape
Stage II	Bow-wow	Dogs, cows, horses, sheep, cats	Shape
Stage III	(a) Bow-wow (b) moo	Dogs, cats, horses, sheep cows	Sound, (horns?)
Stage IV	(a) bow-wow/doggie (b) moo (c) gee-gee	Cats, dogs Cows horses	Sound Size, (tail/mane?)
Stage V	(a)bow-wow/doggie (b)moo (d) gee-gee/horsie (e) baa	Cats, dogs cows horses sheep	Size Sound
Stage VI	(a) doggie (b) moo (c) gee-gee/horsie (d) baa lamb (e) kitty	Dogs Cows Horses Sheep cats	 Shape, sound

Table 1 shows children's change of word domain. According to Clark, at the first stage, children seem to use 'bow-wow' to refer to 'dog' correctly for some unknown reasons. At stage II, 'bow-wow' is overextended to mean many other animals with four legs based on shape similarity. And then at the third stage, children start to broaden their vocabulary. In order to add a new word, children must add some different features to distinguish two words. Thus, they use new features, i.e, sound or

horns to make ‘bow-wow’ and ‘moo’ different. At stage IV, horses are separated from ‘bow-wow’. Due to their intention of separation, children add new features to distinguish ‘gee-gee’ from ‘bow-wow’, and the feature is size. At this time, children may think horses are bigger dogs. And the next stage indicates that children use ‘baa’ to mean sheep. Children may have found that ‘baa’ is different from other four-legged animals since they make different sounds. And finally, at the stage V, children add ‘kitty’ to make ‘bow-wow’ and ‘kitty’ into two totally distinctive lexicons. Children at this stage finally developed a more specific vocabulary system.

In fact, Clark’s (1973) view has been subject to criticisms. The first one is that she thought that children’s overextensions often base on perceptual similarity, especially shape. This kind of shape bias has been in a debate among literature. What feature is the most decisive one when children do overextension is a question that researchers have been trying to answer. A number of researchers agree with Clark’s (1973) view, including Landau, Smith and Jones (1988), Imai, Gentner and Uchida (1994), and Samuelson and Smith (2005), while others do not, such as Rescorla (1980b), and Gelman, Croft, Fu, Clausner, and Gottfried (1998) because they thought that shape should not be the dominant element for overextensions. The second one which is subject to criticisms is Clark’s (1973) ‘Semantic Feature Hypothesis’, while Nelson (1974) has argued against it and proposed ‘Functional Core Hypothesis’. She

thought when children are forming a new concept, what they focus on is the objects' functional relations with people. We will introduce these debates in the following paragraphs elaborately.

As for shape bias debate, Landau, Smith and Jones (1988) agreed with Clark's (1973) view. They believed that children have shape bias, and they thought that although children focus on shape more than other features, such as texture and size, they do not neglect texture and size entirely. Similarly, Samuelson and Smith (2005) also believed that shape is the key cue for children to name an object despite the fact that there are still some other factors involved, such as features or material substance. Imai, Gentner and Uchida (1994) proposed a hypothesis in which they stated that children should undergo a shift from shape to taxonomy. They argued that when children have little knowledge about an object, they will use perceptual similarity, especially shape, to do overextension, while they get more familiar with a certain category and concept, overextension based on taxonomy will increase. Thus, young children depend on shape similarity strongly on word extension firstly and take taxonomic relations into consideration gradually when they grow up.

On the other hand, Rescorla (1980b) argued that children's overextensions should be based on taxonomic relatedness. She tested some children aged between 1;0 and 1;8 and found that overextensions have a tendency towards falling into proper

taxonomic boundaries. For example, children used truck for a lot of vehicles. Besides, Gelman, Croft, Fu, Clausner, and Gottfried (1998) also pointed out that maybe shape is not the dominant element to override others to result in overextensions despite the fact that it is really salient. Other elements such as objects with taxonomic relatedness are also an important factor to affect children's overextensions.

Regarding the 'Semantic Feature Hypothesis' proposed by Clark (1973), this is still not the only explanation for children's overextensions. Nelson (1974) disagreed with Clark's (1973) viewpoint, and proposed another hypothesis, namely, 'Functional Core Hypothesis', in which she stated that children may learn a new concept from their interacting experiences with that object. In Nelson's (1974) study, she argued that when children learn a new concept, they will focus on objects' important functional relations between the object itself and people who act upon it. And perceptual analysis should be derived from the functional core of the object instead of a priori one. Therefore, when children first confront a new object, they may notice various kinds of relations between the object and self or other people, places, actions and so on. And subsequently, they will gradually synthesize all the information they have collected and abstracted a core function about that object so that they understand the true concept of that word. To corroborate her viewpoints, Nelson (1974) mentioned that children's early vocabulary of clothing items are mostly shoes and

other footwear which are objects that children act upon. Moreover, objects like furniture seldom appear in children's early vocabularies because those items are static and children just see them but do not have interactions with them. Thus, Nelson does not agree with Clark's (1973) view. She thought that the dominant feature children notice should be function rather than semantic features.

2.1.2 Pragmatic Errors

The second kind of overextension errors happens when children use certain known words to replace the names of some unknown objects. Thus, some researchers pointed out that this may be a strategy for children to compensate for their insufficient vocabulary, and is called 'pragmatic errors' in the previous literature (Bloom, 1973; Hoek, Ingram & Gibson, 1986). Hoek, Ingram and Gibson (1986) supported the view that children's insufficient vocabulary indeed will affect the phenomena of overextensions. In their study, children overextended known words to unknown words in 33% of comprehension, and 45% of production. Notably, this was just one third of the whole data. Thus, Hoek, Ingram & Gibson (1986) proposed that still other factors may result in children's overextension. And there are at least six factors involved as follows:

(1) Some unknown words would be substituted for other known words by children. This is the pragmatic error in question.

(2) Children would substitute some words acquired earlier for some words acquired later. This is called ‘retrieval errors’, which will be introduced in the next error category.

(3) The fact that children have not acquired the whole knowledge of the words’ criterial features yet would lead to their wrong use of two or more words with similar meanings. And this is so-called the ‘category error’ which has been mentioned before.

(4) Children may in some cases use their preferred word to overextend. This phenomenon which was called ‘Preferred Word Hypothesis’ in Hoek, Ingram and Gibson’s study (1986) means that children may have preference toward certain word, thus using it to overextend to various contexts.

(5) Some words are phonologically difficult for children to pronounce. Thus, children may use some phonologically easier words instead of harder ones.

(6) Children may substitute a word for a more natural class than its meaning in adults’ lexicon. This is the ‘Semantic Naturalness Hypothesis’ that Hoek, Ingram and Gibson (1986) proposed in their study. This hypothesis stated that some words should be part of a more natural semantic class than some other words for some reasons which researchers have not been able to find out. And those words with more natural classes would be less vulnerable to be

overextended.

Accordingly, Hoek, Ingram and Gibson (1986) contended that the factors to cause children's overextensions may not be just one, but should be a combination of those factors.

The phenomenon that children may choose a known word to replace another unknown and novel word is because they have finite resources available to say the objects in the world. Therefore, they use an old and acquired word from a different category to refer to another new object despite the fact that they may have the same cognition of this object as adults. However, many researchers thought that some overextensions actually should be classified as a metaphor (Carlson & Anisfeld, 1969; Bloom, 1973; Thomson & Chapman, 1977; Nelson et al., 1978; Winner, 1979; Billow, 1981; Hudson & Nelson, 1984). When children call apple as ball, they are expressing that apples are like balls (Naigles & Gelman, 1995). This is a different but related phenomenon with children's overextensions. Winner (1988) pointed out that it's hard to distinguish between an overextended error and a metaphor since they are both based on similarity. For instance, in Winner's study (1988), a child may say the "skywriting" as "scar" since the skywriting reminded him/her of the scar on his/her mother. He/she may want to express that the "white line in the sky with its adjacent dots" is very like "the white line on her mother's body with its adjacent stitch marks".

Thus, this is not a kind of overextension error. Instead, it should be a metaphor based on the perceptual similarity between two objects.

Hence, some criteria are needed to distinguish overextensions from metaphors. Winner (1979) explained that the differences between an overextension error and metaphor. An overextension usage is from children's belief that two objects should have the same name and belong to the same category. For example, children may think that string and tail are the same thing due to their similar appearances. This kind of situation should be an overextension error. On the other hand, if children extend one word to another 'on purpose' and they know the correct name of both objects respectively, this should be deemed as a metaphor. Besides, Clark (1983) proposed that as children have acquired the correct name of an object as adults, its wrong and overextended name will be abandoned. Thus, an overextended error fills children's lexical gap while a metaphor does not. Winner (1988) exemplified that as long as a child knows the name of "apple", the overextended name "ball" will be no longer used. On the contrary, metaphorical names are still used even if children have acquired a correct name of that object.

Children's metaphors can be classified into two categories (Winner, 1979; Winner, 1988). The first one is "symbolic play metaphors". This kind of metaphors often happens when children are doing symbolic plays. When playing, they pretend

some objects just like another one through actions. For example, if a child put his leg into a wastebasket and says ‘boot,’ wastebasket becomes a boot because of the child’s pretending action. However, in other situations, wastebasket will not be a boot. Furthermore, for the symbolic play metaphor, the main properties on which children based are the object’s function, or mainly on its function but accompanied with physical similarity at the same time (Winner, 1979; Hudson & Nelson, 1984; Winner, 1988). Thus, the renaming of an object does not necessarily take the features of it into consideration. The features here are neutral for naming.

The second one is “sensory metaphors,” which means that children do metaphors based on perceptual resemblance rather than pretending actions. For this kind of metaphor, children turn their focus from actions to the features of the object itself. Children can do metaphors just based on the properties of the thing solely rather than with the support of pretending actions. Thus, the features of objects here are essential for naming. And the features on which children based are most frequently shape (Winner, 1988). Taken together, children’s early metaphors result from either pretend action or physical similarity. The function and sensory resemblance are very important for children to classify the world (Clark, 1973; Nelson, 1974).

Gershkoff-Stowe et al. (2006) pointed out that the overextension and metaphors together show not only that language has open and flexible properties, but also that

words' boundaries are not unchanged. Instead, they undergo a fast and imaginative alteration.

2.1.3 Retrieval Errors

The third error is the retrieval error. This kind of errors means that children may temporarily have difficulties in accessing certain words which in fact they have known and understood before, but for somewhat reasons, they fail to recall that word and thus perform an error. Gershkoff-Stowe (2001) used horse for example to illustrate what retrieval error is. Figure 1 is provided in the following:

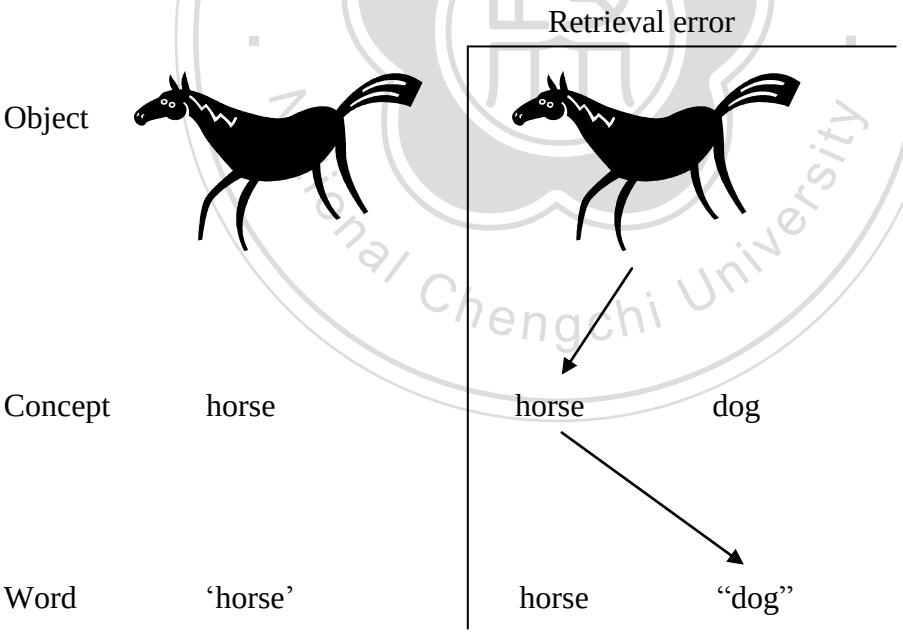

Figure 1. Illustration of Retrieval Error (Gershkoff-Stowe, 2001); arrows indicating the direction where information goes during production.

Figure 1 shows the explanation of retrieval error. Retrieval error happens when a child

first sees an object, in this case, a horse, and although he/she understands the knowledge of that word, he/she still chooses a wrong word ‘dog’ for the correct one ‘horse’. And this kind of errors often show up during the period of vocabulary spurt, i.e., around the end of the two year old, and typically in their 18-to-20-months ages. (Gershkoff-Stowe & Smith, 1997; Dapretto & Bjork, 2000).

Gershkoff-Stowe and Smith (1997) mentioned two possible reasons why vocabulary spurt often accompanies with retrieval errors. First, it’s easier to access a word for adults when the target is in the region with sparse density in one’s lexicon. Namely, if the target word has a lot of similar related words as neighbors, the chance of making errors will enhance (Charles-Luce & Luce, 1990). The same situation can also be applied to children. At first, children’s lexicons are sparsely existing in their memory. However, when their vocabulary starts to grow up sharply, namely, entering the period of vocabulary spurt, their lexicons become denser abruptly. As long as the neighborhood density becomes stronger, it is hard to access a lexicon correctly. Thus, children have to make retrieval process catch up to the speed of the sharp growth of vocabulary. Second, some studies have shown that the frequency of the use of target words (Forster & Chambers, 1973) and the age of acquisition (Walley, 1993) are very important to affect lexical access for adults. Therefore, word retrieval will benefit from repetitive practice through speaking and hearing words. Dapretto and Bjork

(2000) assumed that every act of retrieval will fortify the links involved in retrieving a certain lexicon, therefore making every entry in the vocabulary less vulnerable to being interfered. Based on this assumption, it is logical that a child will have difficulty to retrieve words during the period of vocabulary spurt since he/she does not have enough practicing experiences for every new word rapidly adding to his/her lexicon.

Furthermore, Gershkoff-Stowe and Smith (1997), Dell (1986) and Gershkoff-Stowe (2001) also pointed out that the incorrect retrieval from neighboring related words often involves those words with either phonological similarity or semantic/perceptual similarity. And the result showed that errors involving semantic/perceptual (conceptual) similarity happen more frequently than phonological similarity, which corresponded with previous research where they contended that naming is semantically intervening but not phonologically (Vitkovitch, Humphreys & Lloyd-Jones, 1993). In addition, not only conceptual similarity but also the rate of speaking will affect children to make errors. Errors will have higher chances to happen when two objects are from the same semantic category and the naming time between two utterances is short.

Researchers (Dapretto & Bjork, 2000; Gershkoff-Stowe, 2001) also found that children's retrieval errors may happen because of the disturbance of previous word which they just articulated. Take an example in Gershkoff-Stowe's study (2001). A

child may see a duck on a picture and call it duck, but subsequently, he/she may confront another picture, in this case, a shoe which is a known word for this child and was correctly articulated in the past, but now he/she may fail to name it correctly and call it duck due to the effect of the previous retrieved word ‘duck’. Similarly, Naigles and Gelman (1995) used preferential-looking paradigm to look into the phenomena of children’s overextensions. The finding in their study showed that the cause of children’s overextensions may come from the effect of another word they said before, which has a higher frequency for use for them. Thus, the word’s higher frequency in use to children may make children access that word easier than the other correct one which is used less for children. For example, children in Naigles and Gelman’s (1995) study used dog to name cow. Since frequency has a strong effect on word accessing (Forster, 1990), it is reasonable to expect that children will make more errors when they are producing many new words since most of those words are used less frequently by children (Gershkoff-Stowe, 2001). This kind of errors which children make affected by previously spoken words is the so-called perseveration errors. Stemberger (1989) observed that children under age of 3 make perseveration errors in a high rate compared with adults. And he ascribed this kind of phenomenon to the factor that children may need more time to decay the previously retrieved word. According to Gershkoff-Stowe and Smith (1997), this kind of perseveration errors

will decline when children grow up because of their more practice of retrieving words.

Taken together, the researchers mentioned in the previous paragraph (Naigles & Gelman, 1995; Dapretto & Bjork, 2000; Gershkoff-Stowe, 2001) all agreed that children's retrieval errors come from the influence of the previous accessed word. And importantly, retrieval errors reflect the fact that the occurrence of overextensions may be because children have temporary difficulties to access the correct word in their vocabulary (i.e., a production problem), rather than their incorrect understanding of that word (Huttenlocher, 1974; Thompson & Chapman, 1977; Fremgen & Fay, 1980; Rescorla, 1980a; Naigles & Gelman, 1995).

2.2 Comprehension and Production Problems

The three error types mentioned in the previous sections actually reflect the diverging viewpoints of researchers about children's comprehension or production problems. In category error, the Semantic Feature Hypothesis which is proposed by Clark (1973) suggests that children's overextensions are from the fact that their comprehension is different from adults'. Thus, their performance errors reflect their comprehension problems. For example, when a child calls 'cow' as 'dog', he/she thinks that they both refer to the same thing. In their lexicon, dogs and cows may have the same defining boundary which results in their errors. In pragmatic error,

researchers (Bloom, 1973; Hoek, Ingram & Gibson, 1986) maintain that children use a known word to replace another unknown word because of their limited vocabulary, which means that this is a strategy for children to compensate for their lexical gaps and this strategy can make communication more effective. Thus, this viewpoint implies that children's errors should be just a production error without comprehension problems. In retrieval error, researchers (Huttenlocher, 1974; Thomson & Chapman, 1977) contend that children make an error although they know the correct word, they still choose a wrong word due to retrieval problems. This kind of viewpoint still implies that children make a performance error without comprehension problems.

Due to the discrepancy of three viewpoints, many researchers have tried to understand whether children's overextension errors result from comprehension or just production problems (Huttenlocher, 1974; Thompson & Chapman, 1977; Fremgen & Fay, 1980; Rescorla, 1980a; Naigles & Gelman, 1995; Gelman, Croft, Fu, Clausner & Gottfried, 1998).

Gelman, Croft, Fu, Clausner and Gottfried (1998), Naigles and Gelman (1995), Rescorla (1980a), and Thompson and Chapman (1977) all reported similar results about this issue. Their studies show that children's comprehension and production are often in an inconsistent situation. Sometimes their comprehension is correct but they still make errors in their production; sometimes both of their comprehension and

production have problems. Namely, children overextend certain concepts in both comprehension and production. And, children often have a better performance in their comprehension than their production. Most of time, they have no problems in comprehension but perform an error in production. Rescorla (1980a) displays some examples of this kind of inconsistency. In her study, a child can respond to *Mommy* correctly, but calls both of his/her parents *Daddy* in production. She claimed that the word and children involved affect the diverse relations between comprehension and production.

Naigles and Gelman (1995) think that this kind of inconsistency between children's comprehension and production should be retrieval errors. Although they cannot eliminate the possibility of pragmatic error, they assume that the possibility of retrieval error is higher than the possibility of the other one. Similarly, Thomson and Chapman (1977) also agree with the third view, i.e., retrieval error, and disagree with Clark's (1973) view because it cannot explain that some errors just appear in production. They also disagree with the second view (limited vocabulary) because it cannot explain why some words are overextended both in comprehension and production. However, Fremgen and Fay (1980) think that the inconsistency in comprehension and production as literature has shown is due to problems of methodology. They used another method and argued that children 'always' perform

errors just in their production without comprehension problems. Children know the correct referent although they make an error when producing it. Therefore, Fremgen and Fay (1980) contended that the reasons to cause children's overextensions should come from two: limited vocabulary and retrieval error. When children do not know the correct word of an object, they will make an error due to their insufficient vocabulary. On the other hand, when children know the correct word of the object, their overextension errors will be attributed to retrieval difficulty. And other researchers like Gershkoff-Stowe and Smith (1997) stated that overextensions should not be an integral phenomenon. Instead, it should sometimes reflect a category error, sometimes a pragmatic error, and sometimes a retrieval error.

Taken together, all the researchers mentioned above agree that children have better competences than their performances. Hence, we cannot consider children's overextension phenomenon based on production data alone since production does not necessarily reflect children's true competences.

2.3 Shape bias

In the literature, shape is a very important factor to influence children's naming and lexical acquisition. It is also a major cue for children's overextensions. Thus, some viewpoints about shape bias among literature will be introduced here.

Tomikawa and Dodd (1982) indicated that 2- and 3-year-old children will learn

the names of objects with similar shape easier than the names of objects with functions in common. Similarly, Landau, Smith and Jones (1998) also pointed out that shape will dominate children's naming while functions are weaker cues. But with their growing up, the importance of function will increase. According to Landau, Smith and Jones (1998), the reasons for the importance of shape in object naming may be attributed to three factors. First, the visual system of human beings is sensitive to the shape of 3-dimensional objects. Second, perception of shape is a very intuitive behavior and need not additional experiences about that thing. Third, shape is a good predictor of the object kind. Similarly, Smith and Heise (1992) also proposed that although both conceptual and perceptual structures are essential for children's category learning, perceptual similarity is still more prominent than conceptual structure at the beginning. Children's developmental direction is from perception to concept. Perceptual structure plays an important role in children's category development.

Although function is not that prominent as shape for young children, it still plays an important role in object recognition. Actually, both function and shape are related to people's psychological judgments of shape sameness between two objects (Gershkoff-Stowe & Smith, 2004). For example, Biederman (1987) mentioned that objects are recognized by 'geons' (geometric icons). Thus, that different chairs can be

thought to have the same shape is because they share the same component structure, which is often relevant to the way that people use them. Therefore, to define shape, function of the object is also important.

Perceptual similarity is dynamic rather than static (Smith & Heise, 1992). Perceptual similarity is changed with people's attention to objects' different attributes. This is a kind of psychological process. People shift their attention to certain perceptual features between two objects, which results in the variability of perceptual similarities. And with development, children will change their attention from overall similarity to single dimension when comparing objects (Smith, 1989).

Many studies have shown that shape also contribute to children's noun learning (Landau, Smith & Jones, 1988; Baldwin, 1989; Jones, Smith & Landau, 1991; Soja, Carey & Spelke, 1991; Baldwin, 1992; Smith, Jones & Landau, 1992; Imai, Gentner & Uchida, 1994; Samuelson & Smith, 1999). They found that children would extend the name of a novel thing to other solid things with the same shape. The relation between shape and noun learning can be observed from the following two points, which were found in Gershkoff-Stowe and Smith's study (2004). Firstly, the nouns that children acquire at the very beginning are often some items with similar shapes. Secondly, children's attention to objects' shapes in experimental tasks seems to enhance with the quantities of nouns that they've learned. Shape and the quantities of

nouns display a corresponding increase. However, sometimes children's lexical learning may come from other strategy, like 'fast mapping' (Carey, 1983). For example, that children can response to 'bus' correctly when asked may be attributed to the fact that they know the other two items are not bus (e.g, train and pig), but not because they truly know that the item is the so-called 'bus' (McDonough, 2002).

In addition, shape bias also seems to have relations with syntactic cues (Smith, 2005). In English, count nouns and mass nouns can be differentiated by syntax. For example, count nouns are often preceded by 'a' or 'an' and often refer to discrete items, such as 'an apple' or 'a ball'. On the other hand, mass nouns are accompanied with 'some' or 'much' and often cannot be counted, such as 'some water'. Count-noun syntax will lead children's attention to objects' shapes while mass-noun syntax will lead children's attention to objects' materials in the noun generalization experiments. And this kind of mass-count syntactic difference is existent in English but not in all languages.

2.4 The Study in Gershkoff-Stowe, Connell, and Smith (2006)

In our study, we want to examine whether the assumptions in Gershkoff-Stowe et al. (2006) could be applied into Mandarin Chinese as well. The following are the rationale in their study.

Gershkoff-Stowe et al. (2006) thought that overextensions could be deemed as a

retrieval process. They used the model proposed by Dell (1986) and also followed by Rapp and Goldrick (2000) to explain their assumptions. Dell (1986) and Rapp and Goldrick (2000) tested the adults' spreading activation mechanism in their studies. Spreading activation consists of three parts: spreading, summation and decay. When the activation level of one node goes beyond zero, it will "spread" some parts of its activation level to other nodes which are linked to it. After "spreading", the activation will move to its terminal node, and then adds its activation level to the present node, which is called "summation". And finally, "decay" is needed to make all the activation levels down until they reach zero again. With this mechanism, the occurrence of an error could be explained. An error happens because it receives more activation than a correct one and is finally chosen and tagged.

Naming an object involves three steps (Johnson, Pavio & Clark, 1996). First, seeing an object must make other similar things activated. Second, people have to retrieve an appropriate word for that item from their lexicons. And finally, the articulatory mechanisms must be executed for a response.

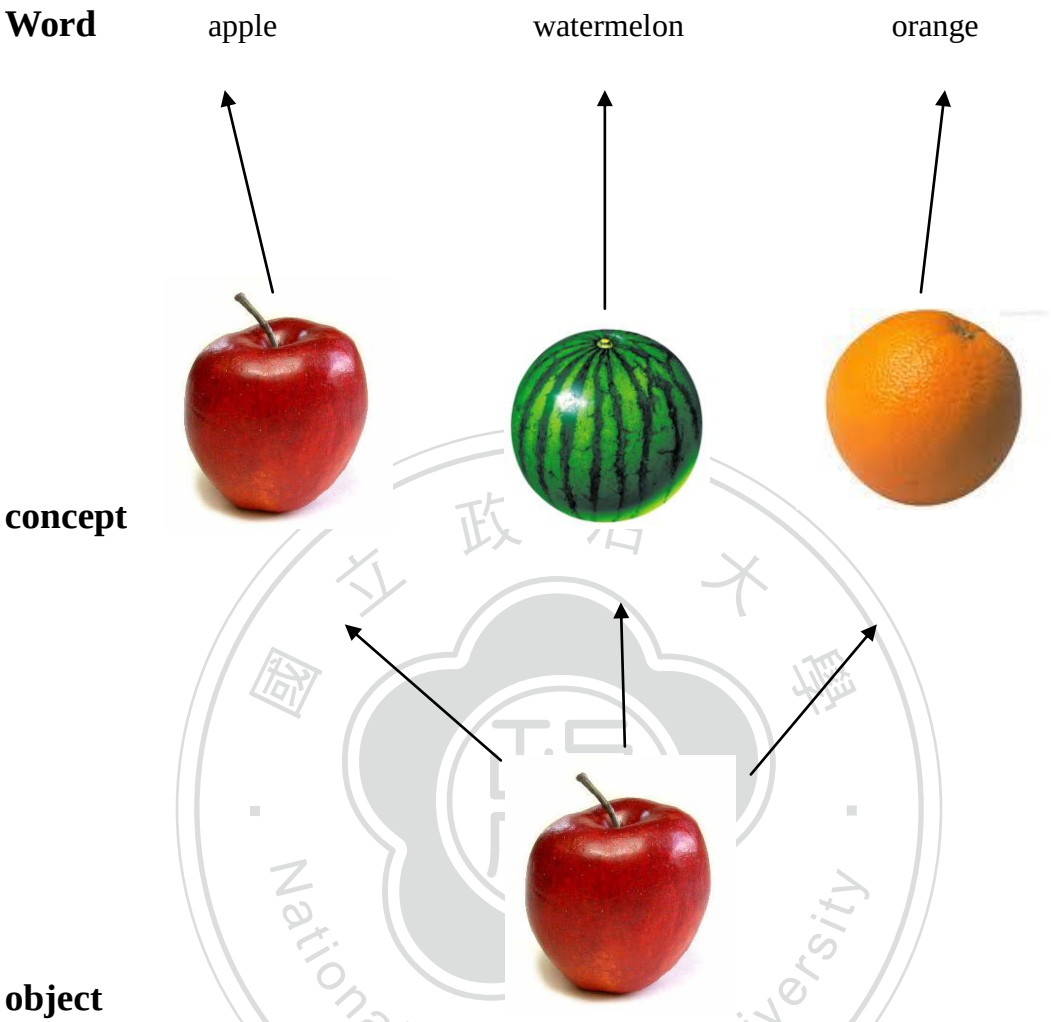

Figure 2. The Process of Labeling a Seen Object

For example, as illustrated in the figure 2 (Gershkoff-Stowe et al., 2006), when people see an object first, e.g., an apple, other related concepts would be activated, such as orange and watermelon, which are both from the same category. And then all the concepts which have been activated will activate their specific words from the lexicon. At last, among the three words, the word which receives most activation will win so

that is produced finally.

As we have mentioned previously, there are two factors to affect children to make retrieval errors during the vocabulary spurt period: lexical density and the frequency of the use of the target words. Besides, semantic/perceptual and phonological similarity between two words often results in incorrect retrieval. Actually, the reason for the occurrences of all of these phenomena is related to the activation strengths. When the activation strength is strong, retrieval process is less vulnerable to making errors. Gershkoff-Stowe et al. (2006) mentioned that three factors affect activation strengths. First, activation strengths would be stronger when the perceived thing is semantically/perceptually similar to the image in our concept (Huttenlocher & Kubicek, 1983; Martin, Weisberg & Saffran, 1989). For example, a typical bird, like sparrow will activate both the concept and the word "bird" easier than an untypical one, like an ostrich or a chicken. Second, activation strengths will become stronger through repetitive practice (Dapretto & Bjork, 2000). Thus, a high frequency word will receive stronger activation than a low one. That is why adults' word retrieval is less susceptible to be interfered. Finally, the third factor is context. The fact that context will affect activation strengths is based on two reasons. The first one is that activation is not a phenomenon which happens and disappears simultaneously. Rather, it will last for a period of time (Cohen & Dehaene, 1998). The

second one is that activation does not only activate a concept or a word. Instead, it also spreads to other related things at the same time (Dell, Burger & Svec, 1997). Accordingly, the activation strength is decided by not only the object which is perceived but also the lingering activation from the previously uttered word. Lingering activation will affect a certain word or concept which is activated and add more activation levels to it so that it would become a stronger competitor. The fact that children are susceptible to making retrieval errors from the effect of context is because they have sparse lexicons and less practice in their very young life, which will cause that many words or concepts are weaker competitors (Gershkoff-Stowe & Smith, 1997). Therefore, young children in the period of vocabulary spurt have many naming errors and overextension phenomena.

Gershkoff-Stowe et al. (2006) thought that all three explanations resulting in children's overextension should jointly involve in the process in children's word selections. A category error may happen when children see an object and activate another similar item. For example, upon seeing a dog may activate the concepts of a cat. Moreover, pragmatic errors may appear when children see an unknown object and activate another name in their lexicons to substitute for it. Finally, retrieval errors result from the fact that children would be affected by contexts. Young children's utterances would be interfered by previously activated object. Thus, children's word

access could be explained unitarily.

In Gershkoff-Stowe et al's study (2006), they conducted two experiments. The first one is object naming task, and the second one is novel object naming task.

In the first experiment, they proceeded six trials to 18 2-year-old children. In each trial, children were primed by three pictures and after priming, they would be shown one 3-dimensional test object and asked to name it. Of three priming pictures, one is the target prime and the other two are fillers. Target priming pictures have perceptual similarity with the test objects while fillers do not have any similarity with the test objects. Target priming pictures were divided into two sets. The purpose of this was to check that target primes would indeed affect children's naming. And the test objects were also divided into two sets. One is familiar set; the other is unfamiliar set. They used this to check that no matter which conditions children were involved in, children would be affected by the target primes. With regard to the order of three priming pictures, their showing sequences were not fixed. Gershkoff-Stowe et al. (2006) pointed out two reasons. First, the target priming pictures were arranged to appear equally in the first, second, and third position in case that children simply repeated the previous word just named. Second, in this way, the possibility that children may find out the similarity between the target priming picture and the test object would decrease. Although this may have the effect of reducing the influences

of the target primes, previous researchers have pointed out that the rate of decay of a previously retrieved lexicon for young children is very low (Stemberger, 1989). As for the stimuli in Gershkoff-Stowe et al's study (2006), they used adult similarity judgments to rate the similarity between 12 test objects and 24 priming pictures. The rating was from 1 to 10. Scale one means low similarity and 10 means high similarity. And after the object naming task had been conducted to children, each child would do the word comprehension task to examine whether they knew the objects' names which they had seen before. And the result showed that children have better comprehension in the familiar test object condition. And Gershkoff-Stowe et al. (2006) also compared children's comprehension performances with their production performances. In comprehension, children's correctness proportions were 0.63 in familiar test object condition and 0.24 in unfamiliar test object condition. In production, children's correctness proportions were 0.24 in familiar test object condition and 0.00 in unfamiliar one. Children's comprehension was better than production. As for the object naming task, Gershkoff-Stowe et al. (2006) made a classification to analyze their data. The answers that children gave were classified into "Correct", "Omission", "Extraneous", "Control", "Target", and "Filler" types. And among the six types, the last four could be deemed as children's error type together. The results in their study are shown in the Table 2:

Table 2. Children's Naming Results in Gershkoff-Stowe et al's study (2006:472)

	Correct	Omission	Extraneous	Control	Target	Filler
Familiar	24%	26%	35%	4%	9%	2%
Unfamiliar	0%	48%	33%	4%	13%	2%

Children replied the correct answers in the familiar condition more often than the unfamiliar one (24% vs. 0%). Children also had higher chances to omit the answers in the unfamiliar condition (48%) than in the familiar condition (26%). And of the children's error naming type, children gave extraneous answers most often both in the familiar (35%) and unfamiliar conditions (33%). And the different tasks in which children participated did not have different impact on children's target error naming. Besides, no matter which conditions that children participated in, they were affected by the target primes. Therefore, Gershkoff-Stowe el al. (2006) thought that the underlying mechanism among three kinds of errors should be the same.

In the experiment 2 (i.e., novel object naming task), the performances of novel object naming between 2-year-old and 4-year-old children were compared. According to Gershkoff-Stowe et al. (2006), experiment 2 is based on the theory that word retrieval is a process of competition. When children start to access a word from their lexicons, several related words are activated and compete. And the one which receives most strength will win and be spoken out finally. Gershkoff-Stowe (2001) mentioned that two factors would affect activation. The first one is lingering activation. That is,

children will be affected by previously retrieved words or concepts. The second one is that a present object may activate other related perceptually similar items from one's vocabulary. In their experiment 2, these two factors were put together to compare further children's word retrieval between 2- and 4-year-old children. And they assumed that it is more difficult for older children to be influenced by the previously retrieved words. This belief came from the theory mentioned before that activation strength affects children's word selection, and this strength comes from the frequency of a word to be used (Forster & Chambers, 1973) and lexical density (Charles-Luce & Luce, 1990). Repetitive practice could enhance the activation strength of a word (Dapretto & Bjork, 2000). Accordingly, older children could have better performances for inhibition of other competitors when they retrieved a lexicon and be less susceptible to be influenced by previously activated words.

Novel object naming task had eight trials. In each trial, children were also primed by three pictures (one target prime and two fillers) and then shown a novel test object. Children's task was to label the objects that they saw. The target priming pictures were divided into three groups: high similarity, low similarity, and unrelated group to test the effects of similarity on children's naming. Children at each age level were participated into one of three groups at random. Unrelated groups served as a control group to compare with the other two groups to examine children's naming when they

were not primed by pictures with perceptual similarity to the test objects. The test objects and target priming pictures were chosen from children's spontaneous overextension naming in the experiments of Landau, Smith and Jones (1988) and Samuelson and Smith (2005). Children sometimes gave an English name for the novel objects in their studies. And the novel objects which had been gave a name were used for the high and low similarity priming pictures and the test objects in Gershkoff-Stowe et al's (2006) study. They selected pictures as high similarity, low similarity, or unrelated primes by their intuitions. To check whether their intuitions were right, adult similarity judgments were conducted. In the experiment 2, all the procedures were the same as the experiment 1. The differences were that experiment 2 had 8 trials and children did not do the word comprehension task since all the objects were nonce.

And they classified the data into four types: omission, extraneous, target, and filler. Target naming was further classified into three subcategories: high similarity, low similarity, and unrelated target naming. Besides, they reported another naming type "perseverative naming" which did not show up in the experiment 1. Their findings showed that children's naming would be affected by recent activation and perceptual similarity. Sometimes, they are combined together to influence children's naming. Therefore, different degree of similarity will affect children to different

extent. The naming of high similarity targets appeared most frequently. Besides, Children in the low similarity and unrelated condition produced more extraneous naming than in high similarity condition. Older children made more extraneous naming than younger ones. Finally, although children in both age groups were influenced by the recent activation and perceptual similarity, younger children were susceptible to those influences easier. Thus, they made significantly more perseverative naming than older children.

2.5 Characteristics of Mandarin Chinese

Mok (2009) mentioned that the most prevalent form of words in Chinese is bisyllabic. Of bisyllabic words, some are bimorphemic compound words, some are affixations and some are monomorphemic words. Bimorphemic compound words are the most common kind of the three.

Chinese is a logographic language while English is an alphabetic language. The words in Chinese are composed by characters, and English words are composed by letters (Toyoda & Scrimgeour, 2009). In Chinese, characters are often deemed as the basic unit (Mok, 2009). Generally speaking, each character represents a syllabic morpheme, which often brings a complete semantic meaning and phonological sound at the same time. However, there still exist some exceptions in Chinese. Some characters do not act as a morpheme. Rather, they need to be combined with other

characters to form a bisyllabic monomorphemic words to have an integral meaning. For example, *gan1ga4* means ‘embarrassed’ in English. However, neither *gan1* nor *ga4* constitutes a semantic unit. They are just a phonological unit in Chinese. They have to be combined with each other so that they can express the meaning of ‘embarrassed’. On the other hand, English letters represent sounds (Toyoda & Scrimgeour, 2009). A group of letters forms a word.

Since compounds are the most popular morphological methods in Chinese, the components of compounds are important. Mok (2009) mentioned that compounds can be divided into three kinds according to their meaning transparency. The first one is fully transparent, which means that the meaning of the compound is totally equal to the components that constitute that compound, such as *lan2tian1* ‘blue sky’. The second one is fully opaque, which means that from the components of the compound, we cannot figure out its meaning successfully, such as *hua1sheng1* ‘peanut’ or *gan1ga4* ‘embarrassed’. The last type is partially opaque, which means the meaning of the compound is just related to one of its component, such as *ka3che1* ‘truck’. Besides, Huang (1998) argued that basically there should be headless in Chinese compounds. Lexical categories cannot be determined by the rightmost constituent or the leftmost one totally.

Because of the different morphology between English and Chinese, we suspect

that this difference may result in different lexicon network, which may make priming overextension have different impact on children. After all, English words mostly carry phonological information while Chinese words are often more than that. Thus, the category hint in Chinese should be more than English, which may cause children less vulnerable to making errors.

2.6 Summary

In the literature review section, we reviewed three types of errors. The first one is category errors. Category errors happen when children still do not find identical features as adults to define a concept. They just use one or two features so that they will overextend several things at the same time. The second one is pragmatic errors. Pragmatic errors mean that children use some known words to replace some unknown words. This happens because children still do not have sufficient vocabulary in their very young age. Therefore, they use some other related words which are similar with target words for children to make a substitution. Besides, we also introduce another distinct but related phenomenon: metaphors. Metaphors happen when children want to express the similarity between two objects. Since the features they base on to make metaphors are often perceptual similarity, it is hard to distinguish metaphors from overextensions. The criterion to distinguish them is that children will abandon the overextending usage when they have acquired the correct word while the usage of

metaphors will be retained. Finally, the third one is retrieval errors. Retrieval errors occur when children have acquired a certain word but they use another word to name that object due to some retrieval problems. The reasons often come from the effect of previously retrieved words or children's insufficient practice for that word. Besides, the issue whether children's overextensions come from their comprehension or production problems is also reviewed. Generally, researchers all think that children's performance errors do not necessarily reflect that they also have errors in their comprehension. In fact, children often have better comprehension than their production. And then we reviewed the shape bias. Shape is very crucial in children's lexical development. It is more effective than objects' function or concepts for children's category learning. It also has relation with the quantities of nouns which children have acquired. Besides, English syntactic cues seem to direct children's attention to objects' shape. And Gershkoff-Stowe et al.'s (2006) study is reviewed. Gershkoff-Stowe et al. (2006) thought that the underlying mechanism of these three types of errors may be the same. They may be all related to the spreading activation mechanism and can be explained unitarily. And they conducted two experiments in their study. They found that the underlying mechanisms of three error types should be the same. Besides, recent activation and perceptual similarity would affect children's naming. Older children were less susceptible to previously retrieved words than

younger children. Finally, the characteristics of Chinese are introduced. The characters in Chinese often represent not only phonological units but also semantic units. The meaning of a compound often can be understood through its components.

Under the study, we will base on Gershkoff-Stowe et al. (2006) work, follow the similar experimental design and procedure, and adopt the similar coding system to test whether Taiwan Mandarin children will yield the similar results or not.

Chapter 3

Methodology

3.1 Experiment 1

The experiment design generally followed the work in Gershkoff-Stowe et al. (2006).

In experiment 1, we first show three pictures to children, including one target priming picture, and two fillers. And they will be shown a 3-dimensional test object, and asked “What is this?” as shown in figure 3.

Picture naming

target prime

filler

filler

Object naming

lollipop

Figure 3. The Demonstration of Object Naming Task

In figure 3, we can clearly see the stimuli that children will see during one of the trial in the experiment. In the picture naming phase, *yan3jing4* ‘glasses’ and *wa4zi5* ‘socks’ are two fillers that are not related to the test object. And the target priming picture is *qiu2pai1* ‘racket’, which is similar with the test object *bang4bang4tang2* ‘lollipop’ in the way that they both have one big circle and one stick under that circle.

Target priming pictures are perceptually similar to the test objects in order to examine whether this picture will affect children’s word selection. Thus, experiment 1 is designed to have two sets: set A and set B. The fillers in both sets were the same, but the target priming pictures were different. Both of the target priming pictures in set A and B are perceptually similar to test object. Experiment is designed this way for confirming that priming will affect children’s word selection. If this is true, the error naming in the first and second set will differ. For example, in the figure 3, the target priming picture is *qiu2pai1* ‘racket’. And we will have another target priming picture in the other set *jing4zi5* ‘mirror’ which also shared the criterial perceptual features with the test object. In this way, if the answers children offer in the two sets differ, namely, children give *qiu2pai1* ‘racket’ in one set, and *jing4zi5* ‘mirror’ in the other, we can corroborate that priming task indeed will affect children’s word selection.

Test objects in this experiment were composed of two categories. One was familiar items and the other was unfamiliar ones. The purpose of experiment 1 was to

examine if priming has the same effect for children on those familiar items with known names and unfamiliar items with unknown names. If this is true, this could imply that retrieval errors, which involve known lexicons, have the same underlying mechanism with pragmatic and category errors which involve unknown lexicons.

3.1.1 Procedure

Every child would undergo six trials in the experiment 1. Each trial was composed of two phases. The first phase is picture naming as priming, during which children would see one target priming picture, and then two fillers one by one as mentioned above. And the experimenter would ask children *zhe4shi4she2me5* 'what is this' after showing each picture to them. If children offer an answer, the next pictures would show to them until three pictures in a trial have shown up. If not, the experimenter would tell them the name of the picture and ask children to repeat it. The second phase is object naming, during which the experimenter would present children with a test object and ask them to label it. If children do not reply, then the experimenter would ask the question again and wait for the answer for around ten seconds. If children still keep silent, we would proceed to the next trial. After children completed all the six trials, they were rewarded by some candies for their cooperation in the experiment. All the processes in the experiment were recorded and we also wrote down the responses which children gave in order to prepare for the subsequent

analysis.

About the order of three priming pictures, their showing sequences were not fixed, and were arranged to appear equally in the first, second, and third position.

3.1.2 Subjects

Twenty two children participated in this experiment. Their age ranged from 2;0 to 2;11 (mean=2;5). They were all normal children with no development delay or brain damages and their first languages were all Mandarin Chinese. They were recruited from six kindergartens, one church and several personal contacts in Taipei.

3.1.3 Materials

The stimuli in the experiment 1 included 12 test objects, and 24 priming pictures. Test objects were all 3-dimensional and realistic items or toys in the true world. Twenty four priming pictures consisted of 12 fillers and 12 target priming pictures. Every picture was realistic again and colorful, and presented on card to every children. The contents of 12 fillers were as follows: spoon, broom, fork, bottle, banana, truck, dog, plane, faucet, remote control, glasses and socks. They were all perceptually different from the test objects so that they served as fillers rather than target primes. The pictures of twelve fillers shown to children were shown in the appendix.

The target priming pictures were designed to have two sets: set A and set B. Pictures in both sets had similar shape with the test objects according to adults'

judgments which would be shown in the next section. Experiment had two conditions. Half of the children would participate in Familiar Test Object Condition, and half would be in Unfamiliar Test Object Condition. Thus, of the 12 test objects, 6 were familiar things to children, and the other 6 were unfamiliar to them. In each trial, three priming pictures, including two fillers and one target prime, were paired with one test object, either familiar or unfamiliar depending on which conditions that children were assigned to. The test objects and target primes used in the experiment one are shown in the following table.

Table 3. The Stimuli in the Experiment 1

Test objects		**Prime**	
Familiar	**Unfamiliar**	**Set A**	**Set B**
蛋糕 *Dan4kao1*	削鉛筆機 *xiao1qian1bi3ji1*	盒子 *He2zi5*	鼓 *Gu3*
‘cake’	‘pencil sharpener’	‘box’	‘drum’
籃子 *Lan2zi5*	元寶 *Yuan2bao3*	木瓜 *Mu4gua1*	船 *Chuan2*
‘basket’	‘odd-shaped gold’	‘papaya’	‘Boat’
鈴鐺 *Ling2dang1*	掛飾 *Gua4shi4*	球 *Qiu2*	蘋果 *Pin2guo3*
‘bell’	‘hanging ornament’	‘Ball’	‘apple’
甜甜圈 *Tian2tian2qɯan1*	髮帶 *Fa3dai4*	飛盤 *Fei1pan2*	輪子 *Lun2zi5*
‘donut’	‘hair band’	‘Frisbee’	‘wheel’
芭樂 *Ba1le4*	量角器 *Liang2jiao3qi4*	扇子 *shan4zi5*	月亮 *Yue4liang4*
‘guava’	‘protractor’	‘fan’	‘moon’
棒棒糖 *Bang4bang4tang2*	魚網 *Yu2wang3*	球拍 *qiu2pai1*	鏡子 *Jing4zi5*
‘lollipop’	‘fish net’	‘racket’	‘mirror’

Under each condition, there were totally six trials presented to each child. Children would be shown two fillers, and one target prime either from set A or set B

in one trial. For example, in the Familiar Test Object Condition, a child would be primed either by *he2zi5* 'box' or *gu3* 'drum', and two fillers, and finally shown a test object *dan4kao1* 'cake'. On the other hand, if children participate in the Unfamiliar Test Object Condition, they would be primed by *he2zi5* 'box' or *gu3* 'drum', and two fillers, and finally shown a test object *xiao1qian1bi3ji1* 'pencil sharpener'. Besides, in both conditions, children were further divided into two parts. One was assigned to Set A, and the other was to set B to examine whether priming task would indeed affect children's word selections. Likewise, for the unfamiliar condition, the situation was the same. Namely, children assigned to this condition half was shown a target prime from set A, and half was from set B. And all of them were shown two fillers, and finally saw an unfamiliar test object. To sum up, in this experiment, each child was presented with 12 fillers, 6 target primes either from set A or set B, and 6 test objects (familiar or unfamiliar). The pictures were grouped into six triads, and each included two fillers and one target prime.

3.1.4 Coding

All the answers which children gave were classified for the subsequent analysis. And the classification followed Gershkoff-Stowe et al's (2006) study. The answer types were categorized as follows:

(1) Correct answers:

Correct answers include all the specifically correct and some unspecific but still correct answers. Specifically correct answers were those responses corresponding to most adults' expectations. And unspecific but still correct answers refer to some inexact naming. Sometimes children used a general name to include the object they saw. For example, when children see *tian2tian2quan1* 'donut', both *tian2tian2quan1* 'donut' and *mian4bao1* 'bread' should be counted as the correct answer type although the former one are more specifically correct. Other correct responses included some naming which was not a direct name for that object. Instead, children just used some words to modify the objects they saw. For example, a child named *Ling2dang1* 'bell' as *ding1ding1dang1* 'jingles'. This is not an overextension error because children just used other conceptually related ways to label the objects so that this would be counted as 'correct' type as well.

(2) Omission:

"Omission" means that children did not give any answer. They just omitted it.

(3) Erroneous answers:

A. Extraneous:

"Extraneous" means the response which children gave was not related to the

pictures in the priming task in a trial. Children's labeling was not based on previously primed items. Rather, they may be based on other cues, such as function, shape, color or so on.

B. Control:

"Control" means the response that children gave did not show up in the priming task but show up in the other set of priming task. For example, if one child in prime set A named *gua4shi4* 'hanging ornament' as *qiu2* 'ball', this should be a "control" error because he/she did not be primed by *qiu2* 'ball'. *Qiu2* 'ball' actually should be the target prime in set B.

C. Target:

"Target" means that the erroneous naming came from the target prime. For example, *ling2dang1* 'bell' was named as *qiu2* 'ball' since the target prime in the priming task was *qiu2* 'ball'.

D. Filler:

"Filler" refers to the response which was affected by the fillers rather than target prime.

3.1.5 Adults' similarity judgments

Before the object naming task experiment was conducted to children, 10 adults had participated for similarity judgments among 12 test objects and 24 prime pictures

which were composed of 12 fillers and 12 target primes. Similarity scales ranged from 1 to 10. Scale 1 means that two things were low similarity while 10 means high similarity. Adults were asked to grade the similarity using the 10 points scale. Five of ten were assigned to familiar condition judgments and the other five were assigned to unfamiliar condition judgments. The result showed that in the familiar condition, the mean of adults' rating for the similarity of target primes and objects was 8.08, and the similarity of fillers and objects was 1.31. According to ANOVA, for the shape similarity to the objects, target primes and fillers were significantly different, $F(1,118)$=1129.01, p<0.001. On the other hand, in the unfamiliar condition, the similarity rating of target primes and objects was 8.38, and the similarity of fillers and objects was 1.33. The similarity of target primes to the objects and fillers to the objects in unfamiliar condition also reached significance, $F(1,118)$=909.20, p<0.001. And for the comparing of two conditions (familiar vs. unfamiliar), it did not differ significantly, $F(1,238)$=0.11, p=0.74>0.05.

3.1.6 Word comprehension

After children have finished the naming tasks in the experiment 1, they would continue the word comprehension task. In this task, they had to index which object the experimenter was asking. For example, the experimenter would ask children *na3yi2ge5shi4dan4gao1* 'Which one is the cake?', and children had to point out

which one is the cake. For the comprehension task, children had to choose one answer from three objects, in which one was the target answer, and the other two were the distracters. And all the target objects in this task were the test objects which were presented to children in the previous experiment. All of the objects shown to children in word comprehension task are presented in the appendix.

3.2 Experiment 2

In the experiment 2, the effects of previously retrieved words and perceptual similarity on children's naming were compared between 2- and 4-year-old children. The design of experiment 2 followed again the study in Gershkoff-Stowe et al. (2006), but we modified the priming pictures. There were three groups in this experiment. One was pictures with high similarity to test objects, another was pictures with low similarity, and the other one was unrelated pictures to the test objects. The third group acted as a control group to compare and contrast with the first and second groups to see the effects on children's naming when there is no perceptual similarity between test objects and priming. We expect that children who participated in this condition will produce more extraneous answers since they are not primed by related concepts. And high and low similarity priming were used to examine how the priming and similarity affect children's naming behaviors.

In this experiment, novel objects were used. The novel objects which we used in this experiment were from the study of Gershkoff-Stowe et al. (2006). And for the target names in high-similarity and low-similarity conditions were decided from adults' imagination and judgments, which would be illustrated in the section 3.2.3.

The purpose of using novel objects in this experiment was to test the differences of word choosing between 2- and 4-year-old children. We expected 4-year-old children would be less susceptible to previously retrieved words since it's reasonable that 4-year-old children have more mature vocabulary and concept base than younger children, they may have better performances toward naming.

3.2.1 Procedure

Children at each age level were evenly distributed to three sets. All the procedures in this experiment were the same as the experiment 1. The only difference between these two experiments was that the experiment 2 had eight trials rather than six. And after the end of the experiment, there was no comprehension test for objects since there is no real name for the novel objects in this experiment.

3.2.2 Subjects

Twenty two 2-year-old (mean=2;5) and 25 4-year-old ranged from 3;11 to 4;11 (mean=4;4) children participated in this experiment. They were all normal Chinese-speaking children and had no brain damage before. Two-year-old children

were the same as the experiment 1. And 4-year-children were recruited from six kindergartens in Taipei.

3.2.3 Materials

The novel test objects followed the study of Gershkoff-Stowe et al. (2006). And all of the priming pictures were modified. They were decided from adults' imagination and similarity judgments.

Ten adults participated in the imagination task. Eight novel objects were shown to them. And they were asked to write down what they thought of based on shape similarity when they saw these novel items. Each adult was asked to write down two to three items they could think of and these items must have some perceptual similarity with those novel objects presented to them. After 10 adults had completed, we collected all the answers they had provided. After that, the corresponding pictures of those objects were found. By comparing with the target object, we thought of some unrelated items by our intuition for ready to be 16 fillers and unrelated targets in the experiment 2. And all the unrelated and related items were judged by other 10 adults for their similarity to target objects. These 10 adults did not participate in the imagination task before. In the adult judgment task, adults were shown a sheet full with many pictures. They were asked to grade the similarity between the target objects and the pictures we had chosen. The scale was ranged from 1 to 10. Scale 1

represented the lowest similarity and 10 represented the highest. These 10 adults were asked to mark a point which would show the similarity between the target object and the judged item. After grading, the total points of each item were counted. The one which receives most points was the item used in the high similarity condition, the one receiving lower points was the item used in the low similarity condition, and the ones receiving least points were the items used in the unrelated control and fillers. The mean rating of high similarity items was 6.73 (*S.D*=2.64). The mean rating of low similarity items was 4.35 (*S.D*=2.28), and the mean of unrelated items was 1.09 (*S.D*=0.28). Finally, the mean of fillers was 1.26 (*S.D*=0.28). And the similarity of target primes in three conditions to the novel objects reached significant difference, $F(2, 237)=156.50$, $p<0.001$. And all the test items used in experiment 2 were shown in appendix.

Target priming pictures were divided into three sets. One is high similarity set, another is low similarity set, and the other is unrelated control set. Every priming set included three pictures, i.e., one target prime and two unrelated fillers. And the 16 fillers are shown in the appendix.

3.2.4 Coding

In the experiment 2, we adopted the same coding as Gershkoff-Stowe et al. (2006) for data analysis. The classification was similar to experiment 1. Children's responses

were coded as the following four types: omission, extraneous, prime target, and filler. The meaning of each type has explained in the coding section in experiment 1. What's different is that in experiment 2, prime target was divided into three kinds, i.e., high, low, and unrelated. If children in the high similarity condition gave the responses of the high target, the answers would be coded into the 'high' kind. However, if children in the high similarity condition did not give its target prime, rather, they gave the target prime in the low or unrelated similarity conditions, the answer would be counted into 'low' or 'unrelated' kind. In the other two conditions, the coding of target primes was the like. Besides, another type of error would be reported separately, i.e., perseverative naming. This kind of naming refers to the naming which was perseverated from previous naming. But there was no perceptual similarity between these two objects at all.

Chapter 4

Result and Discussion

In this chapter, we would display the results of our two experiments and make a discussion. 4.1 to 4.3 are the results of experiment 1. In 4.1, we compare children's performances of comprehension and production. In 4.2, we describe children's responses of object naming. And in 4.3, the priming effects in experiment 1 are examined. 4.4 to 4.6 are the results of experiment 2. 4.4 show the comparison and contrast of the novel object naming between children aged 2 and 4. In 4.5, we examine the priming effects in this experiment. And in 4.6, the results of children's perseverative naming are discussed. Finally, in 4.7, a brief summary for the chapter 4 is presented.

4.1 Children's Word Comprehension and Production in Experiment 1

We have checked whether familiar test objects are better known to children in the word comprehension task. Children performed better in the familiar condition and worse in the unfamiliar one. And the comparison of correct percentage between children's comprehension and production performances is shown in the following figure.

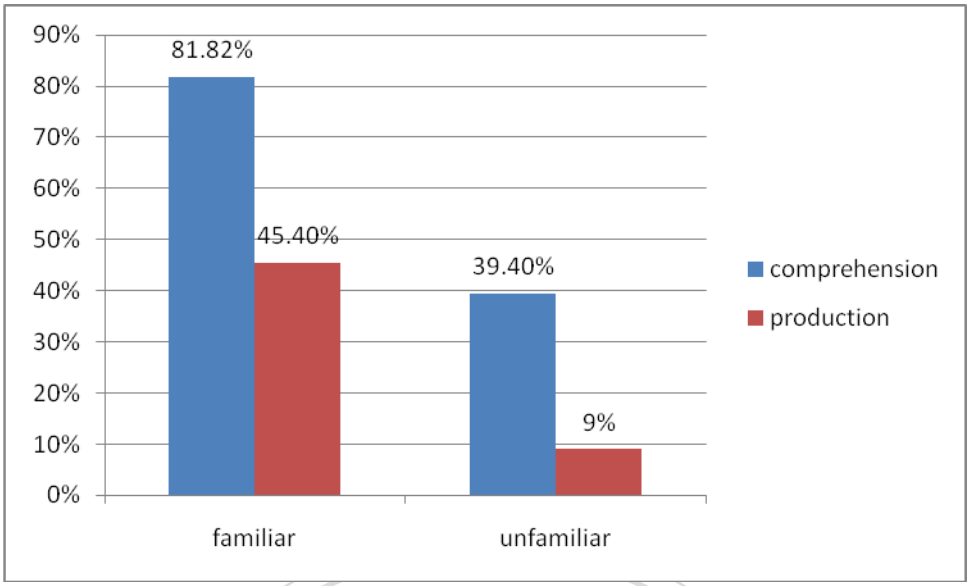

Figure 4. The Comparison Correct Percentage between Children's Comprehension and Production Performances

From this figure, we can observe that in the comprehension task, children gave correct responses up to 81.82% in the familiar condition, while only 39.4% was correct in the unfamiliar condition. As for production performances, children also performed better in the familiar condition, they had 45.4% correct responses. In the unfamiliar condition, their percentage of correct responses was lower (9%). Based on ANOVA test, children's correct responses had significant relations with both familiarity and comprehension. They had significant better performances in the familiar condition, $F(1,31)=12.38$, $p=0.0014<0.05$. And their comprehension was significantly better than their production as well, $F(1,31)=17.22$, $p=0.0002<0.05$. There was no interaction effect of these two factors, $F(1,30)=0.08$, $p=0.7856>0.05$. According to this data, we could corroborate that familiar test objects are better known for children and

children's comprehension is better than their productions. Their performance errors do not necessarily reflect their comprehension errors. The result is consistent with previous literature (Huttenlocher, 1974; Thompson & Chapman, 1977; Fremgen & Fay, 1980; Rescorla, 1980a; Naigles & Gelman, 1995; Gelman, Croft, Fu, Clausner, & Gottfried, 1998).

4.2 Object Naming in Experiment 1

After children were primed by three pictures, they named the target objects. And their naming results are shown in the Table 4:

Table 4. Children's Naming Results in the Object Naming Task

		Familiar		Unfamiliar	
		Frequency	**Total**	**Frequency**	**Total**
Correct		45.4%	45.4%	9%	9%
Omission		16.7%	16.7%	24.2%	24.2%
Erroneous	**Extraneous**	22.7%	37.8%	36.4%	66.7%
	Control	3%		7.6%	
	Target	7.6%		21.2%	
	Filler	4.5%		1.5%	

In the correct answer type, the percentage is much higher in the familiar condition (45.4%) than in the unfamiliar one (9%). And for the omission answer type, children kept silence more often in the unfamiliar condition (24.2%) than in the familiar one (16.7). There is an explanation for the fact. When children confronted some objects with unknown names, they could not find a proper word to label the objects so that they did not give a response and just kept silence.

Extraneous naming happens much more often in the unfamiliar condition (66.7%) than the familiar condition (37.8%) in Mandarin children. The cues for children to give extraneous naming in the object naming task were shape, texture, function and color. For example, children named *bang4bang4tang2* 'lollipop' as *gua1niu2* 'snail'. This is the naming based on shape similarity. The shape similarity between those two was that they both had one circle with spiral on it. Other overextension naming example based on shape was like that children named *liang2jiao3qi4* 'protractor' as *xi1gua1* 'watermelon'. For the naming based on the texture, children named *fa3dai4* 'hair band' as *nei4ku4* 'underpants' or *wei2jin1* 'scarf'. They were both made of cloth. Notably, children's overextension naming based on the texture all appeared in the *fa3dai4* 'hair band' item. Since *fa3dai4* 'hair band' is not a hard and firm object, this kind of feature may lead children's attention to the texture rather than shape. Children sometimes may overextend based on function as well. For example, children named *lan2zi5* 'basket' as *he2zi5* 'box' or *pan2zi5* 'plate', which may come from the same function of these items, i.e., they all can load things. Moreover, the example of naming based on color is that *yuan2bao3* 'odd-shaped gold' was named as *yue4liang4* 'moon'. However, besides color, this overextension may be still based on shape at the same time. This result was consistent with previous findings found in Clark's (1993) study. Clark (1973) proposed that children seem not to do overextension based on

color. We also did not find overextension case based on color criterially in Mandarin Chinese. If children overextend a certain object which has the same color with the target, color seems not to be the only feature on which children based. Rather, color often combines with other features at the same time. In addition to the naming with clear cues, sometimes children may give some naming which does not have apparent relations to the target objects. For example, a child named *yu2wang3* 'fish net' as *bao3ling2qiu2* 'bowling ball'.

For the control naming type, we can observe from table 4 that control errors seldom appear both in the familiar and unfamiliar condition (3% in the familiar condition and 7.6% in the unfamiliar one). When children were not primed, the possibilities for children's naming being affected were both low in two conditions.

In the target types, the percentage in the familiar condition was lower (7.6%) than in the unfamiliar condition (21.2%). It seems that Chinese children were easier to make errors on those things that they felt unfamiliar.

Finally, children gave filler answers 4.5% of the time in the familiar condition and 1.5% in the unfamiliar condition. Both of them are not high since fillers have no perceptual similarity with the target objects.

As a whole, erroneous naming (extraneous, control, target, and filler) happens more often in unfamiliar condition than in familiar one (66.7% vs. 37.8%). This result

could imply that concept and word have strong influences on children's word selection. Unfamiliar words seem to be affected easier and thus have a higher frequency of errors. This may be related to the assumptions that through repetitive practice, words could gain stronger linking among object, concept, and word. Unfamiliar words were used less than familiar ones. Thus, the naming of unfamiliar words would be interfered easier. This finding was consistent with Gershkoff-Stowe et al. (2006) as well, which may imply that this should be a universal phenomenon.

4.3 Priming Effects in Experiment 1

According to Gershkoff-Stowe et al. (2006), the design was to compare children's naming when they were primed (children in the set A provided A target prime answers) versus when they were not primed (children in the set A provided B target prime (control) answers). To understand whether there are the same priming effects in Mandarin Children as in English children, (2) × (2) ANOVA test were adopted to examine the effects of tasks (set A/set B) and conditions (familiar/unfamiliar) on children's object erroneous naming. In the four error types, 'extraneous' and 'filler' are not affected by different tasks and conditions. However, there is a main effect of condition on children's 'target' error type. The ANOVA result is shown in the table 5.

Table 5. The Effects of Conditions and Tasks on Children's 'Target' Error Type

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Task (set A/ set B)	1	2.42	2.42	3.87	0.0647
Condition (Familiar/Unfamiliar)	1	3.68	3.68	5.88	0.0260
Task×Condition	1	9.22	9.22	14.73	0.0012

From this table, we could know that different tasks should not be a main effect for children to make 'target' error type (*SS*=2.42, *MS*=2.42, *F*(1,18)=3.87, *p*=0.0647>0.05). This fact means that no matter which target prime pictures that children saw in a condition, both tasks (set A and set B) have the same effects on children's 'target' error naming. The shape similarity with the objects should have the same effects on children's naming. However, different conditions (familiar or unfamiliar) seem to have significantly different effects on children's 'target' error naming (*SS*=3.68, *MS*=3.68, *F*(1,18)=5.88, *p*=0.0260<0.05), and there was an interaction effect (*SS*=9.22, *MS*=9.22, *F*(1,18)=14.73, *p*=0.0012<0.05). Children in the unfamiliar condition were susceptible to be influenced by perceptually similar target prime pictures easier. This result was not consistent with Gershkoff-Stowe et al's (2006) study. Their findings showed that familiarity should not cause children to have different reactions to target priming pictures. Thus, they concluded that the underlying mechanisms among category errors, pragmatic errors, and retrieval errors should be the same. Nevertheless, in Mandarin children, the situation appears to be another case. Children made less overextension errors from the effect of target prime

pictures previously shown to them in familiar condition. On the contrary, it is much easier for children to make 'target' error naming in the unfamiliar condition. This should be explained by two reasons. The first one is because of activation strengths. Activation strengths will be stronger when the use frequency of a word is higher (Dapretto & Bjork, 2000). It is reasonable that familiar words have higher frequency of retrieval and practice in children's daily life. Thus, stronger strengths may make children have fewer possibilities to be affected by previously primed perceptually similar target pictures. The second reason may come from different types of languages. Since Mandarin Chinese and English are two different languages and thus have different morphology, this may be the reason to lead to different results. Chinese words/compounds are often composed of two syllabic morphemes, which bring phonological and semantic information at the same time while English words are composed of letters, which often bring just phonological information (Mok, 2009; Toyoda & Scrimgeour, 2009). And studies have shown that activation strengths would be stronger when the perceived thing is semantically/perceptually similar to the image in our concept (Huttenlocher & Kubicek, 1983; Martin, Weisberg & Saffran, 1989). Thus, concept (semantic/perceptual) relations will fortify the strengths in people's mental lexicon. Thus, the characteristics of Mandarin Chinese morphology may cause words/compounds to be less vulnerable to be influenced than English because words

in Mandarin mostly own information more than just phonology, which may let Chinese vocabularies have stronger strengths than English naturally. It is more difficult for Chinese words to be overextended because of its natural stronger strengths. Especially when the words are familiar, the strengths are double. Therefore, conditions (familiar/unfamiliar) become a significant factor to affect children's 'target' error naming.

Although familiarity becomes a significant factor to influence children's error naming in Mandarin children, we do not want to neglect the effects of spreading activation mechanism on children's naming (Dell, 1986). In fact, it still could be used to explain children's three types of overextension errors because we could not deny the fact that even in the familiar condition, the frequency of 'target' error naming (7.6%) was more than 'filler' (4.5%) or 'control' (3%). This means that the strengths of perceptually similar target prime pictures are still stronger than the other two. Similarity indeed makes the target primes become a more powerful competitor to intervene children's word retrieval despite the fact that the power of this interference is not that strong as in English. Thus, we still want to agree that the underlying mechanisms among three types of overextension errors should be the same.

Regarding to the last kind of erroneous naming, i.e., 'control', the results of ANOVA test are displayed in the table 6.

Table 6. The Effects of Conditions and Tasks on Children's 'Control' Error Type

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Task (set A/ set B)	1	1.96	1.96	12.62	0.0023
Condition (Familiar/Unfamiliar)	1	0.73	0.73	4.68	0.0443
Task×Condition	1	0.87	0.87	5.61	0.0292

In this table, we could observe that both Task (*SS*=1.96, *MS*=1.96, *F*(1,18)=12.62, *p*=0.0023<0.05) and Condition (*SS*=0.73, *MS*=0.73, *F*(1,18)=4.68, *p*=0.0443<0.05) had main effects on children's 'control' naming. And there was an interaction effect of Task and Condition (*SS*=0.87, *MS*=0.87, *F*(1,18)=5.61, *p*=0.0292<0.05).

In fact, almost all the 'control' naming data came from the same trail: trail 3 in experiment 1. Children mostly still replied *qiu2* 'ball' when they were primed by *pin2guo3* 'apple'. In other trails, the 'control' naming scarcely happened. This fact leads to the result that Task became a significant factor to influence children's 'control' naming. Gershkoff-Stowe et al. (2006) mentioned that when labeling an object, several related concepts will be activated at the same time, and the one which receives the strongest strength will win and be retrieved successfully. It appears that *qiu2* 'ball' is a strong competitor to affect children's naming when they saw a round thing. This suggests that *qiu2* 'ball' in Mandarin should have stronger activation strengths among the competitors with round shape so that it has possibilities to overpower the target prime pictures in some cases. Besides, condition also plays a significant role in children's 'control' naming as well. This is reasonable since

familiarity will make the strengths become stronger so that the possibilities of other erroneous retrieval will decrease accordingly.

In this experiment, some facts were revealed. First, shape similarity indeed will fortify the strengths of the word to intervene children's word retrieval even though this kind of effect was lower for the familiar objects in Mandarin Chinese children. Second, priming is a necessary factor to make children to give 'target' error naming especially in the unfamiliar condition because the strengths for the unfamiliar objects should be weaker in children's mental lexicon. Third, word retrieval errors should not be totally affected by previously accessed words. Rather, concepts and words in our long term memory should play an important role. This is why there were many extraneous errors and why 'control' error naming data almost completely came from children's labeling *qiu2* 'ball' to substitute for the things with round shape. From the data in our experiment, three types of error still could be explained by Dell's (1986) spreading activation model. Our finding is generally consistent with Gershkoff-Stowe et al's (2006) study.

4.4 Novel Object Naming in Experiment 2

Children's novel objects' naming results are shown in the table 7. The boldfaced numerals were the frequency of responses that happened due to the effects of target prime pictures in the corresponding condition where children participated (e.g.,

labeling novel objects as high-similarity target prime in the high similarity condition).

Table 7. Children's Novel Objects' Naming Results

			Prime target			
	omission	extraneous	high	low	unrelated	filler
				2-year-old		
High	17.4%	55.1%	**26.1%**	0%	0%	1.4%
Low	26.8%	50%	10.7%	**10.7%**	0%	1.8%
Unrelated	30.4%	58.9%	8.9%	0%	**1.8%**	0%
				4-year-old		
High	32.8%	20.3%	**40.6%**	0%	0%	6.3%
Low	43.8%	37.5%	14.1%	**4.7%**	0%	0%
Unrelated	25.6%	62.8%	7.7%	3.8%	**0%**	0%

In this table, we could compare and contrast children's naming results between different ages in different conditions. In the high similarity condition, the responses that 2-year-old children gave most frequently were 'extraneous' one (55.1%) while for the 4-year-old children, the responses were high-similarity target prime (40.6%). The responses of high-similarity target prime for the younger children were 26.1% of the time. And in this condition, both low- and unrelated-similarity target prime did not appear at all in the two different age groups. In the 'omission' type, it happened more frequently for the 4-year-old children (32.8%) than 2-year-old ones (17.4%). 'Extraneous' naming occurred 20.3% of the time for the 4-year-old children. And both age groups seldom gave 'filler' responses (1.4% for the 2-year-old children and 6.3% for the 4-year-old children).

In the low condition, 2-year-old children were susceptible to the effects of the

target prime easier than 4-year-old children (age 2: 10.7%; age 4: 4.7%). And no matter for which age, they both produced the target names of the high-similarity condition (age 2: 10.7%; age 4: 14.1%). No children produced unrelated target primes for both age groups in the low-similarity condition. And the frequency of answering of 'filler' was low both in 2-year-old (1.8%) and 4-year-old children (0%). For children aged 2 in the low-similarity condition, the frequency of 'omission' and 'extraneous' was 26.8% and 50% respectively, while for children aged 4, the frequency was 43.8% and 37.5%.

In the unrelated condition, the possibilities of replying the unrelated target primes were very low both for children in two age groups (age 2: 1.8%; age 4: 0%). Sometimes, they may give the target prime responses of high- or low-similarity conditions. For children aged 2, the frequency of answering high similarity targets was 8.9% while 0% for the low similarity targets. For children aged 4, the frequency of answering high similarity targets was 7.7% while 3.8% for the low similarity targets. No 'filler' answers were produced when children labeled the novel objects in both age groups. Two-year-old children gave no responses 30.4% of the time while 4-year-old children gave no responses 25.6% of the time. Finally, the frequency of extraneous naming was close in both age groups (age 2: 58.6% vs. age 4: 62.8%).

As a whole, we could observe that target priming pictures would affect children

on novel objects' labeling because there are perceptual similarity between them. And different levels of shape similarity have different levels of activation strengths on children's word retrieval no matter for children aged 2 or aged 4. Thus, we could find that with the decrease of shape similarity, the frequency of target prime responses was also getting lower. For example, for children aged 2, the frequency of target prime responses was from 26.1% to 10.7%, and finally to 1.8%. And for children aged 4, the situation was similar. The frequency was from 40.6% to 4.7%, and finally to 0%. From this data, we could corroborate the effect of shape on children's word retrievals. The priming from high-similarity concepts will strengthen the activation strength more than priming from low-similarity or even unrelated concepts. Besides, we used (2) age × (3) similarity AVOVA test to check the main effects on the frequency of children's 'target' naming. And the results are shown in the table 8.

Table 8. The Effects of Age and Similarity on Children's Target Naming

Source	DF	Type I SS	Mean Square	F Value	Pr > F
age	1	0.01	0.01	0.01	0.9413
similarity	2	64.64	32.32	27.09	<.0001

From this table, we could know that only similarity was significant to target frequency (*SS*=64.64, *MS*=32.32, *F*(2, 43)=27.09, *p*<0.0001). Age did not approach significance (*SS*=0.01, *MS*=0.01, *F*(1, 43)=0.01, *p*=0.9413>0.05). And there was no interaction effect. Thus, we could corroborate that different levels of similarity should affect the frequency of children's 'target' naming. High similarity indeed makes children

produced primed targets much easier than low similarity and unrelated similarity conditions. However, age seems not to make significant differences. That is to say, Mandarin children aged 2 and 4 both had the same performances on ‘target’ naming. This is not consistent with Gershkoff-Stowe et al’s (2006) study. They had main effects of similarity and age at the same time. Two-year-old children were susceptible to the primed targets easier than 4-year-old children.

Although children in both age groups seem to be affected by primed targets, we still could observe some different influences between these two age groups. In the high similarity condition, the priming effect in older children appears to be stronger than younger children since they had 40.6% reply of targets while younger children only had 26.1%. However, in the low similarity condition, younger children seems to be affected by low-similarity targets (10.7%) easier than older children (4.7%). Similarly, in the unrelated condition, the frequency of replying the name of unrelated targets in younger children was a little higher (1.8%) than the frequency in older children (0%). Older children appear to be affected easier only by high perceptually similar pictures than younger children while for those low or no perceptually similar pictures, they do not be affected that much. This phenomenon may be able to be explained by spreading activation mechanism as well (Dell, 1986). For children who speak Chinese, their mental lexicon’s networks should develop from simple to

complicate. Since older children should have more complicated and complete networks, the concepts which are activated from one related node are likely to have more powerful strengths than the node in a more simple and incomplete networks in younger children's mental lexicon. Because of the immaturity of younger children's mental lexicon, the link between node and node should be weaker so that although the priming effect still exists in the high similarity condition, it cannot be that strong as for older children. Similarly, in the situation of low and unrelated similarity condition, since the linkage of nodes in older children's lexicon should be more mature, older children would not be affected by those conceptually farther primed targets. On the contrary, as the immaturity of younger children's mental lexicon, they would be affected by shape similarity or priming effects easier than the older ones. Thus, they had higher probabilities to reply the primed targets in the low and unrelated similarity conditions. Accordingly, as a whole, children in both age groups had no significant differences towards frequency of answering primed targets because both of them would be affected by shape similarity. However, with different levels of shape similarity, children still have different responses to them. This finding seems not to agree with our hypothesis where we assumed that 2-year-old children should be vulnerable to primed targets easier than 4-year-old children because there appears to be no differences between these two age groups from the ANOVA test. In fact, this

result should be attributed to the fact that high similarity would fortify the strength of a node easier in a more mature mental lexicon than a more immature one, which results in the fact that both age groups have similar reactions towards the primed targets while it is not the same case in English. This finding may suggest that the way of words' processing or linkage between nodes and nodes in mental lexicon are different between Mandarin Chinese and English children. In addition, notably, our result does not mean that 4-year-old children are more susceptible to previously retrieved words because we did not observe the phenomenon that they are affected by low or no perceptually similar primed targets in the same way. Actually, from observing the responses of older children to the low similarity or unrelated primed targets, we still want to say that older children should be less susceptible to previously retrieved words.

To understand whether children will produce more extraneous naming when the degree of similarity decreases, a (2) age × (3) similarity ANOVA test was used to examine the effects of these two factors on children's extraneous naming. And the ANOVA results are displayed in the table 9.

Table 9. The Effects of Age and Similarity on the Frequency of Extraneous Naming

Source	DF	Type I SS	Mean Square	F Value	Pr > F
age	1	13.15	13.15	2.33	0.1342
similarity	2	37.03	18.51	3.28	0.0472

From this table, we could know that only similarity was a main effect on children's

extraneous naming (*SS*=37.03, *MS*=18.51, *F*(2, 43)=3.28, *p*=0.0472<0.05), but age did not reach significance again (*SS*=13.15, *MS*=13.15, *F*(1, 43)=2.33, *p*=0.1342>0.05). And there was no interaction effect. Generally speaking, different ages did not make the frequency of extraneous naming differ significantly. However, in Gershkoff-Stowe et al. (2006), they still found main effects of age and similarity. In Mandarin Chinese data, children gave extraneous answers most frequently in the unrelated condition for both two age groups as we have predicted (age 2: 58.9%; age 4: 62.8%). And with the decrease of similarity, the frequency of extraneous naming was getting higher especially for older children (high: 20.3%; low: 37.5%; unrelated: 62.8%). The reason should be the same as we have mentioned before. That is, since older children have a more mature mental lexicon, the linkage between nodes and nodes should develop better than younger children's. Thus, they presented a more beautiful pattern for extraneous naming (i.e., less powerful priming effects result in more extraneous naming). On the contrary, due to a more scattered and loose linkage in younger children's mental lexicon, their pattern of extraneous naming (high: 55.1%; low: 50%; unrelated: 58.9%) was not that beautiful as older ones'. Despite of this, the extraneous naming still happened most frequently in the unrelated condition. Due to the possible different way of processing and word retrievals between Mandarin and English, Mandarin children in two age groups did not have significantly different extraneous

naming. Older children in English seem to be less susceptible to the effect of previously retrieved words because of their mature mental lexicon. This fact causes them to activate more extraneous naming. However, more mature mental lexicon in Mandarin Chinese children seems to make them have more elaborate lexical networks so that this contrarily make the effects of conceptually related prime become even stronger. Accordingly, there was no age effect on children's extraneous naming in Mandarin Chinese children.

4.5 Priming Effects in Experiment 2

The design of experiment 2 according to Gershkoff-Stowe et al. (2006) was to test whether there is priming effects on children's labeling or not. They want to compare the frequency of target naming when children were primed versus when they were not primed. That is to say, we want to know when children participated in the high similarity condition, whether the frequency of producing high similarity targets will be more than the frequency of producing low similarity or unrelated targets. Likewise, we want to know when children participated in the low similarity condition, whether the frequency of producing low similarity targets will be more than the frequency of producing high similarity or unrelated targets. We adopted a (2) age × (2) high/low similarity target × (3) similarity condition ANOVA test to examine the priming effects. And the results showed that for the frequency of high and low target

naming, only 'target' should be a significant factor to influence children's naming (for the frequency of high target naming: $F(1, 43)=27.76$, $p<0.0001$; for the frequency of low target naming: $F(1,43)=9.37$, $p=0.0038<0.05$). This is consistent with Gershkoff-Stowe et al's (2006) finding. But, age did not reach significance again in Mandarin Chinese children. In fact, this result reflected the same phenomenon that we had found in the previous discussion. That is, different way of processing or word retrieval from English may be the key point to lead to different results. The different morphology between Mandarin Chinese and English should make the networks of the mental lexicon become different so that Mandarin Chinese children and English children may have different way of processing.

4.6 Perseverative Naming in Experiment 2

In the experiment 2, because every object shown to children was novel object which did not have a name, children sometimes perseverated the naming that they had produced in the previous trials. For example, they may produce *mao4zi5* 'hat' in the trial 2, but still used this labeling to label other objects in other trials despite the fact that there were no shape similarity between the two novel objects at all. And the frequency of perseverative naming in 2- and 4-year-old children is shown in the figure 5.

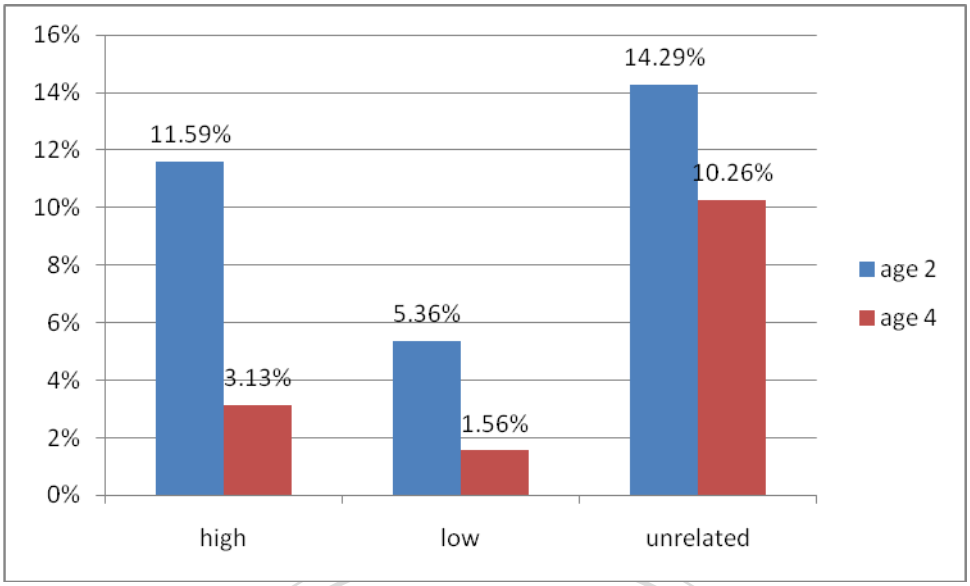

Fig 5. The Frequency of Perseverative Naming in 2- and 4-year-old Children

In this figure, we could find that both younger and older children present the similar pattern for the perseverative naming. That is, both of them produced perseverative naming most frequently in the unrelated condition (age 2: 14.29%; age 4: 10.26%). And the next more frequent one is high similarity condition (age 2: 11.59%; age 4: 3.13%), and then finally the least frequent one is low similarity condition (age 2: 5.36%; age 4: 1.56%). This suggests that both recent activation and shape similarity have influences on children's word access. In the high similarity condition, the strengths of word's retrieval should be the strongest one because each word has the strengths from shape similarity and recent activation at the same time. Thus, it is harder for children to resist the influence from a more powerful word especially for younger children. Younger children have more immature mental lexicon so that they will be affected by previously retrieved words even easier than older ones.

Accordingly, the frequency of perseverative naming was higher in high similarity condition than low similarity one. With regard to the perseverative naming in the unrelated condition, it happened most frequently in both two age groups. This may be because words only have strengths from recent activation in the unrelated condition. There was no other cue for children to name the novel objects. The strengths of recent activation may become more powerful in this kind of situation. With the lack of cues from shape similarity but with the strengths from recent activation, it is most likely for children to perseverate their naming from previously retrieved words. As a whole, from figure 5, we also could observe that younger children always had a higher probability to make perseverative naming than the older children. This implies that older children indeed are less susceptible to the previously retrieved words because of their more mature mental lexicon.

Although there was some differences from observing the frequency of perseverative naming between children in the two age groups, the (2) age × (3) similarity condition ANOVA test seems to show that neither age (SS=2.10, MS=2.10, $F(1, 43)=1.32$, $p=0.2570>0.05$) nor condition (SS=4.33, MS=2.16, $F(2, 43)=1.36$, $p=0.2677>0.05$) reached significance as shown in table 10. And there was no interaction effect.

Table 10. The Effects of Age and Condition on Children's Perseverative Naming

Source	DF	Type I SS	Mean Square	F Value	Pr > F
Age	1	2.10	2.10	1.32	0.2570
Condition	2	4.33	2.16	1.36	0.2677

This data showed that children aged 2 and aged 4 had similar performances in the three conditions. This may be explained by the fact that both younger and older children made very little perseverative naming in the three conditions. However, in the study of Gershkoff-Stowe et al. (2006), they found a significant age effect. The differences may be from different morphology between Mandarin Chinese and English. As mentioned before, Chinese words/compounds should carry stronger power than English words naturally. This may cause children to make perseverative naming in a very low frequency both for younger and older children because each word should have stronger strength so that it will not be interfered that easy as English's word is.

4.7 Summary

In this chapter, we compared children's performances of comprehension and production and displayed the results of their object naming and novel object naming. Besides, the priming effects in the two experiments were examined. And finally, the perseverative naming in Mandarin Chinese children were shown and discussed.

And the results in experiment 1 showed that children had better comprehension than their production. Incorrect naming does not necessarily reflect that they have

problems in their comprehension. In the object naming task, we found that children's erroneous naming happened more often in the unfamiliar condition than in the familiar one. This may suggest that unfamiliar words have weaker linking to concept, word, and object since children have fewer practices for them. The priming effect in experiment 1 showed that there are something different between English and Chinese. That is, familiarity seems to be a main effect on children's target error naming. This should be attributed to the activation strengths or different morphology between English and Chinese. But, despite of this fact, the spreading activation mechanism still could be used to explain children's three types of errors. We do not deny the existence of it because even in the familiar condition, the strengths of perceptually similar target prime pictures are still stronger than perceptually unrelated pictures for children.

In the experiment 2, regarding to children's novel object naming, only similarity would affect children's target and extraneous naming while age did not have this kind of effect. And, in addition, it was still the same case when it comes to the priming effects in this experiment. Age is not a main effect in Mandarin Chinese children should be attributed to the fact that due to the different morphology between English and Chinese, the way of processing and word retrieval should be different as well. Finally, the perseverative naming showed that recent activation and shape similarity should both play an important role on children's naming.

Chapter 5

Conclusion

In this study, we conducted the same experiment with Gershkoff-Stowe et al's (2006) study to Mandarin Chinese children to examine whether the assumption in their study is still right when it applies to another language. According to our data, we have the following findings and conclusions. First, the fact that children have better comprehension than their production seems to be a universal phenomenon. Second, fewer practices would indeed affect children's naming. Children will make more errors when labeling an unknown or unfamiliar object. Third, familiarity should affect Mandarin children on their frequency of correct object labeling while this should not affect English children. This may be due to different morphology between these two different languages. Despite of this fact, we are not going to deny that the underlying mechanisms of three types of errors should be the same. We just can say that familiar words for Mandarin children have more powerful strengths than familiar words for English children. Fourth, shape similarity is an important factor to influence children's naming. High similarity will fortify the word's strengths more than low similarity or unrelated objects. Fifth, older Mandarin children seem not to have significantly different performances when compared with younger children. The reason for this may be because the networks of mental lexicon in Mandarin are different from in

English. Different way of word processing and word retrieval may result in different priming effects. Finally, besides shape similarity, recent activation also plays an important role on children's word retrievals.

Taken together, spreading activation mechanism should be applied to a variety of languages. Word retrieval is a process of competition. Shape similarity and recent activation will fortify the strengths of concepts both in English and Chinese speakers. However, different morphology in different languages may cause different way of priming effects. Thus, we still could observe some differences between English and Chinese. In Chinese children, more mature lexicon seems to make the priming effects become even stronger when they are primed by some highly conceptual related concepts while in English, more mature mental lexicon seems to make the priming effects weaker. Nevertheless, evidence still shows that older Mandarin children are less susceptible to previously retrieved words. We can observe this from the data where older children was not affected by low similarity or unrelated targets that much as younger children and where they have lower frequency of making perseverative naming than younger children. Although different morphology may lead to different way of priming effects on children, the fact that more mature mental lexicon would make children be less vulnerable to previously retrieved words should be universal.

Further research could be aimed at the characteristics of Chinese morphology to

examine the phenomena of children's overextension. Especially, issue involving whether "those transparent compounds have stronger strengths than those opaque compounds so that children will make less overextension errors among those transparent words" would be another related topic that deserves investigating.

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Appendix

Twelve Fillers in the Experiment 1

湯匙 “spoon”	掃把”broom”	叉子 “fork”	瓶子“bottle”
			
香蕉 “banana”	卡車 “truck”	狗 “dog”	飛機 “plane”
			
水龍頭 “faucet”	遙控器 “remote control”	眼鏡 “glasses”	襪子 “socks”
			

The Stimuli in the Experiment 1

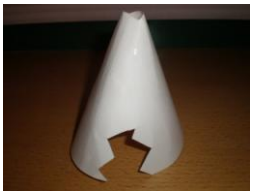
Test objects		Prime	
Familiar	Unfamiliar	Set A	Set B
蛋糕 “Cake” 	削鉛筆機 “Pencil sharpener” 	盒子 “box” 	鼓 “Drum” 
籃子 “basket”	元寶 “odd-shaped	木瓜 “papaya”	船 “Boat”

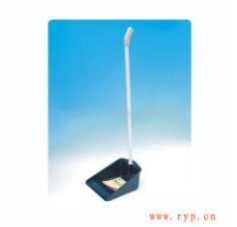
	gold” 		
鈴鐺“bell  ”	掛飾“hanging ornament” 	球“Ball” 	蘋果“apple” 
甜甜圈“donut” 	髮帶(hair band) 	飛盤“Frisbee” 	輪子“wheel” 
芭樂“guava” 	量角器“protractor” 	扇子“fan” 	月亮”moon” 
棒棒糖”lollipop” 	魚網“fish net” 	球拍“racket” 	鏡子“mirror” 

The Items Used in Word Comprehension Test

1			
2			
3			
4			
5			
6			

Target Names of Novel Objects in Experiment 2

Target names				
	High similarity	Low similarity	unrelated	Novel object
1	花 “flower” 	貝殼 “shell” 	鑰匙 “key” 	
2	帽子 “cap” 	裙子 “skirt” 	車“car” 	
3	愛心 “love” 	葉子 “leaves” 	蠟筆 “crayon” 	
4	盤子 “plate” 	鉛筆盒 “pencil box” 	鳥 “bird” 	
5	燈 “lamp” 	柱子 “pillar” 	筷子 “chopsticks” 	
6	蝙蝠 “bat”	閃電 “lightning”	畚箕“dusk basket”	

				
7	鯨魚“whale” 	沙發“couch” 	娃娃“doll” 	
8	領帶“tie” 	老虎鉗“vise” 	枕頭“pillow” 	

The Fillers Used in Experiment 2

1		
2		
3		

4		
5		
6		
7		
8