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詞彙特指性與詞彙習得之探討

Lexical Specificity and Lexical Acquisition

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本論文係 陳素玫 君（學號 R95142004）在國立臺灣大學語言學研究所完成之碩士學位論文，於民國九十八年六月二十三日承下列考試委員審查通過及口試及格，特此證明

口試委員：

張顯達 （簽名）

（指導教授）

曹峰銘

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摘要

本研究旨在探索詞彙語意上的特指性是否影響動詞習得。Tardif (2006)曾指出中文動詞比起英文動詞，因其語意特指性較高而較易習得。中文的動詞是否較特指尚無定論，本研究要檢驗的則是，以一般新詞學習歷程而言，特指性較高的動詞是否較易習得；主要關注當語言對於不同動作給予命名上的對比（即給予特指性高的詞彙），是否因此促進詞彙學習；另外，本研究也檢視學習不同語意特質詞彙的幼兒，是否發展出不同延伸新詞到其他情境上（extension）的策略。

本研究藉由對於相同視覺刺激的給予不同命名方式，來操控新詞的語意特指性。本研究採用快速對應作業（fast-mapping task），受試者需要將聽到的新詞與看到的動作作對應。在訓練階段，受試者會看到實驗者現場示範數次新動作，並從指導語中聽到新詞，實驗組別分為特指組與泛指組。不同組別之間，語言刺激的次數及動作示範次數皆相同；兩組主要的分別在於對動作之命名的差異性。在特指組中，兩個不同的動作，會被對應到兩個新詞；而在泛指組中，這兩個動作會被對應到同一個新詞。訓練與測試分為四個階段，第一階段兩組幼兒都聽到同一詞彙對應到同一動作；第二階段進行兩組幼兒的前測，作為比較的控制組；第三階段兩組幼兒都看到另一個類似的動作，泛指組幼兒會聽到與第一階段相同的新詞去指稱，而特指組幼兒則聽到另一個不同的新詞去指稱該動作；第四階段為後測，檢驗第三階段兩組別中不同的命名方式是否對幼兒表現造成影響。測驗包含理解測驗與說話測驗，以影片方式進行；理解測驗要求受試者選出與命名相配合的影片，說話測驗則要求受試者回答該段影片的主角做了什麼。

本研究受試者包含六十名平均年齡約四歲半的幼兒。結果顯示，即使特指組幼兒在訓練階段聽到比泛指組幼兒聽到較多新詞，但不見得能夠因此在適當情境說出較多的詞彙；說話測驗的結果顯示，特指組幼兒對原詞彙的表現，在後測階段的表現比前測階段顯著退步，而泛指組幼兒則表現穩定。雖然特指組幼兒對語意已有初步認識，但大多無法區辨兩個新詞的語意範圍。另一方面，本研究也發現泛指組的訓練促進了新詞延伸，而特指組則不然，同時，施測順序以及幼兒詞彙量對於新詞延伸策略亦有影響，若幼兒先受過特指性高動詞的訓練或擁有較大詞彙量，延伸新詞的比例較低。另外，我們也探討了詞彙量、音韻工作記憶的個別差異及施測順序，如何影響幼兒在本實驗的理解作業的表現，我們發現在泛指組中詞彙量較高的幼兒表現顯著優於詞彙量較低的幼兒，音韻工作記憶的個別差異並未造成表現上顯著的差別。總結來說，本研究支持幼兒對詞彙語意的習得是一個動態的過程，幼兒對語意的假設，不斷受到語言經驗的影響及型塑。

關鍵詞：語意特指性，語意分類，詞彙習得，詞彙發展，動詞習得，快速對應

Abstract

This present study aims to explore the impact of specificity on Mandarin-speaking children's verb learning process. Tardif (2006) proposed that the typologically higher specificity of Mandarin verbs contributes to the ease of learning and thus leads to higher proportion of Mandarin verbs in early vocabulary. It remains unclear whether Mandarin verbs are more typologically specific, while this study examined the role of specificity in the general mechanism of lexical acquisition. This study aims to explore whether providing children with an additional label to mark a semantic distinction facilitates word learning. In addition, it was also examined whether different labeling patterns would contribute to different strategies for extending novel words.

This study manipulated specificity of novel words by providing different labeling patterns for the same visual stimuli. Specificity was thus defined as the presence of labels marking the distinction between two different actions in contrast with a single label for both actions. The experimental conditions included the General Condition and the Specific Condition. In the General Condition, two actions were mapped onto one word whereas in the Specific Condition these actions were mapped onto two words. The main experiment for testing specificity effect can be divided into four phases: (1) the baseline training, (2) the pre-conditioning-training test, (3) the reinforcing conditioning training, and (4) the post-conditioning-training test. In the first phase, all the participants were shown an action labeled by a novel word. In the second phase, they were tested with the aid of video clips. Then came the third phase in which the children were shown with a different but similar action that was labeled by either the same label (in the General Condition) or a different label (in the Specific Condition). Finally, in the fourth phase, the participants were tested for their production and comprehension of the novel words.

Children's production, understanding about semantic distinctions, and the pattern of extending uses of novel words were examined. Sixty 4.5-year-old Mandarin-speaking children participated in this study. Results indicated that children under the Specific Condition were not significantly more likely to produce an additional target word although they heard more words in the training session. They performed poorer on the baseline verb in the post-test than in the pre-test whereas this retrogress was not found in the General Condition. Although children had a robust understanding about specific words, most of them failed to make correct distinction between these specific words. As for extending uses of novel words, results revealed that the training of a general word facilitated extension, yet the training of specific words did not. Additionally, an influence of vocabulary size and order effects were found in the extension task: Children with larger vocabulary and children exposed with a prior training of specific verbs were much less likely to extend novel words to other novel actions. Also, we examined how individual differences affected children's performance in this particular novel word learning task. Results showed that children with larger vocabulary performed significantly better in the comprehension task than children with smaller vocabulary when learning a general word whereas the difference did not exist when children were presented with specific words. Taken all together, our results supported the view that word learning is a dynamic process in which the semantic boundaries are shaped by children's language experience.

Key words: semantic specificity, semantic category, lexical acquisition, lexical development, verb learning, fast mapping

Table of Contents

List of Tables

List of Figures

Chapter 1. Introduction

1.1 Background

1.1.1 Lexical specificity in meaning

Semantic specificity of a word[1] can be defined as the amount of information that the word encodes or the degree to which the word encodes (Gentner, 1981; Tardif, 2006a, 2006b). It is also known as "semantic weight" (Barde, Schwartz, & Boronat, 2006), "semantic complexity", or "semantic richness"(Gordon & Dell, 2003). Also, some researchers have defined semantic complexity as the number of semantic features that a word has (Breedin, Saffran, & Schwartz, 1998).

An influential body of studies has provided cross-linguistic evidence that languages differ in how they encode meanings into words (Choi & Bowerman, 1991; Talmy, 1985) For example, Talmy (1985) provided evidence for a variety of patterns of lexicalization across languages on the basis of findings from motion verbs, which were analyzed into small semantic components. Similarly, Tardif (2006a, 2006b) also argued that Mandarin encodes more information into verbs when compared to English.

The notion of specificity in previous studies mentioned above is based on the

[1] In this study, the terms, "semantic specificity", "lexical specificity", and "specificity", were applied to refer to the narrowness or limitedness of meaning that a particular word has.

lexicalization or packaging of word meaning; some researchers, however, interpret the mapping between a word and its meaning on the basis of the notion of categorization or semantic partitioning (Bowerman, 2005; Choi, McDonough, Bowerman, & Mandler, 1999). That is, this alternative framework involving "categorization" is also adopted to interpret the contrast between specificity and generality of word meaning. The degree of specificity is thus linked to "category size" (Bowerman 2005, p.225): Higher specificity of a word implies a smaller category.

It has also been suggested that different languages draw different semantic boundaries on the outside world, even for natural boundaries. Take color terms for example. English has two distinct terms for *green* and *blue* yet some other languages have a single term to cover those colors which are referred to by two terms in English. On the other hand, Russian has two separate words for *light blue* and *dark blue* while this distinction does not reflect in English (Berlin, 1969).

Cross-linguistic evidence has already shown that even based on the same ability to perceive the world, typological differences exist in the pattern of lexicalization or semantic partitioning, yet when involving the process of acquisition, this issue would be even more complex. This study was originated from the argumentation that Mandarin verbs are friendlier for children in that they are more typologically specific (Tardif, 2006a, 2006b). The argument that the ease of Mandarin verb acquisition comes from

their high specificity is based on the assumption that specific verbs are easier to be acquired and the assumption that Mandarin verbs are specific. This study aims to test the first assumption, which involves the general mechanism of lexical acquisition. Nevertheless, though the second one is not the main focus of this study, it will be also discussed later for an overall review.

Whether specificity facilitates word learning remains unclear, and some researchers have argued otherwise that general verbs may be easier and specific verbs could be harder. Clark (1973), for instance, proposed a "semantic feature hypothesis", suggesting children begin with general features and then narrow down the referent of a word gradually by adding more specific semantic features to the word. If children acquire semantic features gradually as argued by Clark, high specificity may impede a full understanding of word meaning in an early stage of word learning. In addition, extremely high specificity may confuse children in that more semantic distinctions should be detected and learned to master this semantic complexity. For example, when using a verb denoting carrying actions, children acquiring Tzeltal and Chinese need to make distinctions between positions of the object being carried corresponding to the agents' parts (Brown, 2001; Tardif, 2006a). Moreover, high specificity may obstruct children's understanding about the meaning of a word since cues of perceptual differences may not be available for children to analyze the meaning of a new word.

Also, empirical evidence has showed that many general words, such as *go*, *make,* and *put,* appear in the early vocabulary. Ninio (1999) reported that Hebrew children use these verbs, “want”, “make”, “put”, “bring”, or “give”, frequently before using other verbs and argued that early uses of general-purpose verbs might provide bases for initial syntactic and semantic generalization. Taken as a whole, many issues should be clarified to employ the notion of typological differences in specificity or lexicalization to explain the path of lexical acquisition. The following section will provide an overview for challenges to acquisition issues involving the notion of specificity.

1.1.2 Challenges to applying specificity hypotheses to acquisition issues

To argue that higher specificity implies higher perceptual salience and thus facilitates verb learning, it needs to be explained how the effect operates cross-linguistically and within a certain language. Cross-linguistically, it has been observed that in some languages like Mandarin and Korean (Choi & Gopnik, 1995; Tardif, 1996), early vocabulary consists of higher proportion of verbs than languages like English. Many efforts have been made to investigate the reasons why some verbs are acquired earlier while others are not in a particular language (Ma, Golinkoff, Hirsh-Pasek, McDonough, & Tardif, 2009; Naigles & Hoff-Ginsberg, 1998). To employ the notion of specificity to provide accounts for issues like why verbs in some languages seem easier when compared to verbs in other languages or why some verbs

seem easier than others, two basic assumptions should be put into test. First, to explore the role of specificity on language acquisition in terms of cross-linguistic differences, one should demonstrate that verbs in this language are more specific before arguing that verbs in this language are easier to learn as Tardif (2006a, 2006b) has made attempts to argue that Mandarin verbs have higher specificity thus they are not as difficult as English ones. Second, the assumption that specific verbs are easier to acquire should be tested. Some counterexamples for the rationale are still waiting to be clarified.

1.1.2.1 Specificity in terms of cross-linguistic evidence

Though some researchers have proposed that verbs in some languages, such as Mandarin and Tzeltal, have typologically higher specificity than verbs in other languages (Brown, 2001; Tardif, 2006a, 2006b), it seems hard to define whether verbs in a particular language have higher specificity. Some studies have provided some counterexamples for Tardif's typological observation on Chinese. Chu (2008), for instance, argued that English has finer distinctions between motion verbs. Similarly, Chen (2005) illustrated this by the fact that Mandarin Chinese has two main walking verbs (*zǒu* 'walk' and *mài* 'march') whereas English has a variety of walking verbs such as *walk*, *march*, *plod*, *step*, *stride*, *tiptoe*, and *tramp.* In addition, Gao and Cheng (2003) contrasted "verbs of contact by impact" by comparing bilingual dictionary entries and suggested that English has many "hit verbs", which do not necessarily have equivalents

in Chinese such as *bang*, *bash*, *batter*, *beat*, *dash*, *drum*, *hammer*, *hit*, *kick*, *knock*, *lash*, *pound*, *rap*, *slap*, *smack*, *smash*, *strike*, *tamp*, *tap*, *thump*, *thwack*, and *whack,* whereas Chinese speakers tend to use adverbs that refer to the manner or degree or use nouns that refer to instrument to narrow down an action referent (e.g., *qīng-dǎ* 'hit tenderly', *yòng-lì-dì-dǎ* 'hit hard', *yòng chuí-zǐ qiāo* 'hit with a hammer', *měng-liè-qiāo-dǎ* 'hit severely').

An alternative account is that typological differences involving specificity may display in semantic domains instead of a whole word class. In other words, Chinese may have higher specificity for a particular semantic domain than English and the opposite is true for another semantic domain. Observational findings supported that there might be an asymmetrical pattern for typological specificity. For instance, as for hit verbs, English speakers tend to use more hit verbs while Mandarin speakers tend to use general verbs like *dǎ* 'hit' (Gao and Cheng 2003). On the other hand, concerning carrying verbs, Mandarin has more specific verbs than English (Tardif 2006).

Moreover, the debate on the typological pattern of specificity may be related to the discrepancy between actual language uses and the language system. One can always find extremely specific words in a particular language but it also matters whether most speakers understand and use it. Though existing in a language, some jargons or archaisms may be used and known by only a small group of people. For example,

Chinese has a number of cooking terms such as *wén* ‘cook with little heat.’ Yet it remains unclear how verbs with low frequency in input affect the process of lexical acquisition.

This study does not aim to solve these issues on typological pattern of specificity although this study was motivated by the observation of the differences in learning patterns between English-speaking and Mandarin-speaking children. Instead, this study aims to independently examine the effect of specificity on language acquisition by experimental manipulation. That is, the study explored the role of lexical specificity in a general learning mechanism though the complexity of this issue was recognized.

1.1.2.2 Specificity within a certain language

Empirical evidence from some languages has shown that specificity is not always a facilitative factor for word learning. For instance, the Mandarin verb *tiào* ‘jump’ is more specific than *dòng* ‘move’ and the age of acquisition (sometimes abbreviated as AoA in literatures) of *tiào* is earlier than *dòng*, which confirms Tardif’s prediction that verbs with high specificity are acquired earlier. However, the two verbs, *qiáo* ‘glance’ and *dèng* ‘stare’ are more specific than *kàn* ‘look’ but the AoA of *kàn* is 18 months whereas AoA of *qiáo* ‘glance’ is later than 27 months (Chen & Cheung 2007). Counterexamples like these have challenged the hypothesis that specificity in verb meaning facilitates word learning.

In addition, specificity of words for adults might not be consistent with that for children. For instance, some early words are very general such as *dǎ* 'hit' with an early AoA (17 months) in Mandarin (Chen 2008). Advocates of the specificity hypothesis may argue that children grasp only a part of verb meaning and use it in limited contexts. In other words, children may treat general words as specific words (underextension), which is the opposition of the prediction of the light verb hypothesis or the semantic feature hypothesis proposed by Clark (1973)[2]. This discrepancy of findings may result from different methods to assess performance of word learning (e.g., comprehension and production). The following section will discuss different assessing methods about lexical development and how this study assessed children's performance in the mapping task.

1.1.3 Probe into the effect of specificity: Vocabulary size, time or understanding about word meaning?

If specificity has a real effect on word learning, it should be described within a general framework of language acquisition on which aspect specificity has an influence. Researchers have emphasized either the number of lexical items produced, the time that a word was acquired (i.e., age of acquisition), or the understanding about word meaning.

[2] Clark (1973) suggested that since children only grasp general semantic features of a word in the beginning, they *overextend* the word. In this sense, children seem to treat the specific word as a general one.

Specificity in verb meaning might affect the number of lexical items produced. When speakers are asked to describe a variety of events, a language with higher specific verbs would provide more word choices. In Tardif's example (2006a, 2006b), Mandarin speakers can make use of many *carrying* words whereas English speakers use the general word *carry*. Therefore, a larger number of verb types in input would contribute to a larger number of verb types in early vocabulary.

In addition, it has been presented that age of acquisition may be affected by perceptual availability such as imageability or specificity. One of these studies was conducted by Ma et al. (2009) who argued that rated imageability of a word significantly correlated with age of acquisition, stating that the higher imageable a word is, the earlier it is acquired. They further argued that higher specificity of verbs contributes to higher imageability in that once particular manners and particular objects in an action are specified, a word would be more likely to arouse a relatively exact image.

The understanding about semantic boundaries or semantic features is also an important aspect in the field of lexical acquisition. Clark (1973), for instance, pointed out that children often overextended a word in an inappropriate way since they did not grasp all the features in an earlier stage. On the other hand, Bowerman (2005) argued that two-year-olds are already able to follow language-specific patterns of semantic

categories for verbs in a target language.

Recognizing that various methods can be adopted to assess the process of language development, this study assessed 4-year-old children's performance by an experimental training task testing lexical outcome and understanding. In other words, the focus of this study is on how specificity contributes to the number of target word produced and how it affects the understanding about word meaning.

1.2 Purpose, design and research questions

1.2.1 Factor examined: Specificity

This study aims to explore the effect of specificity on lexical learning through manipulating the labeling pattern of actions. Specificity was thus defined as the presence of labels marking the distinction between two different actions in contrast with a single label for both actions. Variations among all actions presented were controlled yet these actions were named with either the same label or different labels.

This design is based on the assumption that children's perceptual capability is constant cross-linguistically or cross-culturally whereas semantic boundaries in a language are not totally constrained by perceptual capability. Thus, in this study, a different degree of specificity is considered a consequence of a different pattern of semantic partitioning in an input language. In our experiments, children who were assigned to "the Specific Condition" heard two novel labels for two actions while those

under “the General Condition” were provided with only one word for these actions. Thus, the word provided in the training session in the General Condition was supposed to be more general since it could apply to a wider context than the two words in the Specific Condition, each of which was bounded to a particular kind of action and thus more specific. A semantic boundary was supposed to be drawn between the two similar actions shown in the Specific Condition while the difference between the two actions was irrelevant in terms of labeling in the General Condition. This design thus allowed us to explore the effect of specificity on learning of verbs referring to caused-motion events in a control context. It was investigated if the learning outcome of a semantically specific verb which was presented in limited contexts was better when compared with verbs without this encoding as measured in comprehension and production tasks.

Tardif’s typological specific account predicts that when learning specific verbs children perform better than they do with general verbs even though they are confronted with a more difficult learning task: They have to detect how the two labels differ in the semantic properties each encodes. Specifically, it was explored whether performance for the original verb changed after an additional verb was presented to label another action for the condition in which specific words were presented, or after the additional action exemplar labeled by the same word for the other condition in which a general word was presented.

1.2.2 Specificity vs. frequency

To compare learning outcome of different labeling patterns (i.e., different number of words for the same visual stimuli), one can either control the total frequency of exemplars for visual stimuli or the input frequency of each label. In other words, there is an alternative design that controls the frequency of each general and specific label. However, in a design like this, children assigned to the Specific Condition would be exposed to a greater amount of visual stimuli and linguistic stimuli than those in the General Condition, which might not reflect the learning process in the real world[3]. Therefore, we turned to control the frequency of visual stimuli and made a compromise of the frequency for each word across conditions: The frequency of each word in the Specific Condition was lower than the word to be learned in the General Condition. This discrepancy in frequency can also be observed in language input since general verbs are usually used in a wider context.

1.2.3 Related issues: Extending uses of novel words

In addition, this study also tested Brown's (2007) hypothesis that children under different input patterns develop different strategies for extending uses of a word to other contexts. Through analyzing how children extended uses of novel words, this study explored if children under different training conditions would develop different

[3] See Section 2.4 for a review on the relationship between specificity and frequency and see Section 3.1.3 for further justification for our experimental design.

assumptions about the broadness of word meaning. If Brown's hypothesis is also a correct description of the general mechanism of lexical acquisition, the prediction might be that children learning specific verbs (i.e., trained under the Specific Condition) would be less likely to extend the novel label to an variant that was never shown in the training sessions, while children acquiring a general word (i.e. trained under the General Condition) would be more likely to extend the novel label.

1.2.4 Other factors involving linguistic experience

In addition, each participant's vocabulary knowledge and phonological working memory were also tested for further analyses although they were not designed as independent variables. We explored if children with larger vocabulary performed differently in this fast-mapping task or whether phonological working memory made a difference in learning patterns.

1.2.5 Research questions

In sum, the present study aims to explore the research questions as the followings:

(i) Does providing labels for contrasts between actions facilitate word learning in production and comprehension?

(ii) Are children learning specific words less likely to extend the use of novel words?

1.3 Significance

Despite the contribution made on the effect of specificity on the sentence recall, sentence processing especially in aphasia patients (Barde et al., 2006; Breedin et al., 1998; Gentner, 1981; Gordon & Dell, 2003), there are surprisingly few studies examining the effect of specificity on verb learning (Ma & Wong, 2008). The scarcity of studies experimentally examining the effect of specificity may be due to the difficulty in defining the notion, *specificity*. Unlike other semantic properties such as imageability (Bird, Franklin, & Howard, 2001; Ma et al., 2009) and concreteness (Gilhooly & Logie, 1980; Pavio, Yuille, & Madigan, 1968), which have been explained explicitly, there seems no general measure, method or criteria available to define or measure specificity. Specificity involves multiple factors, such as the load of information encoded in a word, the variation among referents or contexts a word can apply to, and the argument structures that a word implies. Also, the concept of specificity is different from that of polysemy which might be measured by the number of senses but not the number of semantic features. Additionally, the degree of specificity is often a relative concept. It has been suggested that similar to nouns, verbs have semantic hierarchies (Fellbaum, 1990): A word is more general to its subordinate and more specific to its superordinate. Thus, it might be hard to determine the degree of specificity of words across different domains.

By altering labeling patterns for the same visual stimuli, this training study manipulating specificity of novel words provided evidence that cannot be obtained from rating studies or observational studies. This present study not only filled the research gap of the role of specificity in the general learning mechanism but also presented a procedure to test specificity in a controlled context.

1.4 Organization

This thesis includes five major parts. Chapter 1 provides an introduction of the background and the purpose of this study as well as research questions. Chapter 2 reviews the literature of the theories and studies related to lexical specificity in meaning and its role in acquisition. In Chapter 3, the experimental design and tasks administered are described in terms of materials, procedure, and scoring. Chapter 4 reports the results from both the comprehension task and the production task. The last chapter includes a general discussion on the research questions we have raised, and the potential for further research.

Chapter 2. Literature Review

2.1 Is Chinese a verb-friendly language?

Many efforts have been made to explore whether children's vocabulary reveals noun bias and what factors affect the proportion of nouns or verbs in early vocabulary (Bloom, Tinker, & Margulis, 1993; Gentner, 1982; Goldfield, 1993, 2000; Gopnik & Choi, 1995; Tardif, 1996, 2006a; Tardif, Gelman, & Xu, 1999; Tardif, Shatz, & Naigles, 1997). One of these studies was conducted by Gentner (1982), who suggested that children's early vocabulary was predominantly made up of nouns rather than verbs on the basis of a review of studies on early vocabulary in six languages: English, German, Turkish, Japanese, Kaluli, and Mandarin Chinese. To explain this tendency, she proposed the "nature partitions hypothesis", which assumed that a preexisting conceptual distinction between "concrete concepts such as persons or things" and "predicative concepts of activity, change of state, or causal relations" contributes to the distinction between nouns and predicates across languages. In addition, she argued that the category related to nouns is "conceptually simpler" and "more basic" than that corresponding to verbs. In short, she argued that nouns are universally acquired before verbs since they are more "perceptually accessible" (1982, pp. 301-302).

However, an influential body of research provides evidence that nouns seem not

universally dominant in early vocabulary (Choi & Gopnik, 1995; Ogura, Dale, Yamashita, Murase, & Mahieu, 2006; Tardif, 1996; Tardif et al., 1997). For instance, Tardif's (1996) findings from nine 22-month Mandarin-speaking children in Beijing revealed that more verbs than nouns were produced. Also, Choi and Gopnik (1995) found equal proportions of nouns and verbs in Korean-speaking toddlers' vocabulary and more nouns than verbs in English speaking children's vocabulary on the basis of the comparison between nine Korean speaking toddlers and nine English-speaking toddlers.

2.2 Why do verbs in languages like Chinese not show a delay?

Previous studies have provided evidence of language-specific properties in languages like Chinese to account for the reason why verbs in some languages can be acquired earlier or for different patterns of composition in early vocabulary (Ma et al., 2009). Some researchers emphasize the role of linguistic cues, such as syntactic properties (Tardif, 1996) and frequency count (Sandhofer, Smith, & Luo, 2000), some argue for social, pragmatic, or cultural factors (Lavin, Hall, & Waxman, 2006; Ogura et al., 2006; Tardif, 1996) whereas others emphasize the salience of perceptual cues or perceptual availableness makes a difference in the ease of word learning (Ma et al., 2009; Tardif, 2006a, 2006b)

2.2.1 Syntactic properties that make verbs more salient in input

One of these studies was conducted by Tardif (1996), who proposed that typological properties of Mandarin contribute to the distinct composition of early vocabulary. She argued that the simpler inflection morphology of verbs in Mandarin facilitates verb acquisition. In addition, she argued that another reason for the ease of Mandarin verbs might be that Mandarin verbs occur in a salient position more often than English verbs since Mandarin permits the omission of a subject, which allows verbs to appear in the beginning of the utterance.

2.2.2 Frequency

Additionally, caregivers' speech was considered contributing to toddlers' vocabulary. Tardif et al.'s (1997) finding supported that Mandarin-speaking caregivers in Beijing used more verb type types than nouns and tended to elicit verbs when talking to their children while English-speaking caregivers tended to use more nouns and tended to elicit nouns. It was found that Mandarin-speaking parents used more verb types than noun types and more verb tokens than noun tokens whereas English-speaking and Italian-speaking parents used approximately equal verb types and noun types. Sandhofer et al. (2000) also found that Mandarin verbs had a more extremely "steep" distribution (many tokens of few types) in Mandarin-speaking caregivers' speech than English verbs whereas nouns had a flat distribution (many types with modest frequency).

Based on the assumption that words with higher frequency would be acquired earlier, it could be predicted that Mandarin verbs are more privileged in lexical acquisition.

2.2.3 Social learning, cultural factor, or pragmatic context

Another hypothesis proposed by Tardif (1996) involves cultural factors. She suggested that American English-speaking middle-class parents tend to play naming games with children, which may lead them to "center their conversation with infants around objects" (p. 502). On the other hand, Mandarin-speaking parents elicit more verbs than English ones. For example, Mandarin-speaking parents would ask children "*yào bú yào hē?*"('[do you] want to drink'), which elicits the verb, *yào* '[I] want' or *bú yào*'[I] do not want', while English-speaking parents would produce "more juice?" which elicits non-predicate responses, e.g., *yes* or *no*. On the other hand, Fernald and Morikawa (1993) found that Japanese parents emphasized more on social routines even in the context of playing toys while English-speaking parents emphasized more on labeling objects. English-acquiring infants produced more nouns than Japanese-acquiring infants did. In addition, Ogura et al. (2006) reported that context may play a role in the proportion of verbs in child speech: In a book-reading context, more nouns were elicited across different developmental stages, while in a toy context more verbs were produced than nouns in the syntactic stage.

2.2.4 Perceptual Salience

In addition, some researchers have suggested that the ease of word learning comes from perceptual salience. Ma et al. (2009), for example, attributed the relative ease of Mandarin verbs to *imageability,* which is defined as the ease with which a word gives rise to a mental image (Pavio et al., 1968). By analyzing CCDI (Chinese Communicative Development Inventories, Tardif, Fletcher, Zhang, & Liang, 2002) data of Beijing children and imageability ratings of Beijing adults, Ma et al. (2009) suggested that the imageability is a reliable predictor for age of acquisition of early verbs: The more imageable a verb is, the earlier it is acquired. Though it has been demonstrated that imageability is correlated with *rated* age of acquisition on a scale of 0 to 13 years (Bird et al., 2001), few experimental studies have been conducted to examine imageability in a controlled context probably because imageability is hard to be manipulated as a variable. Words with low imageability can hardly be presented and tested in an experimental context.

2.3 Specific hypothesis and lexical acquisition

Similar to Ma et al. (2009), Tardif (2006a) has made observation that perceptual availability contributes to a higher proportion of verbs in Mandarin. She hypothesized that typologically Chinese verbs are more specific and thus easier to acquire when compared to English ones. The observation that specificity varies across language is not

a new one. Brown (2001) has proposed a verb specificity hypothesis on the basis of findings from Tzeltal verbs. In the following paragraphs, a brief review on studies concerning specificity will be provided before the acquisition issues are discussed.

2.3.1 Previous studies on specificity and processing

Some psycholinguistic studies have examined that the effect of semantic specificity (i.e., semantic complexity or semantic weight) of verbs on some processing aspects such as memory for sentences (Gentner, 1981) and lexical retrieval (Breedin et al., 1998; Gordon & Dell, 2003). Two models have been involved: the Componential Model and the Connectionist Model. The Componential Model (Kintsch, 1974) predicts that semantically specific verbs require more processing resources since relatively more features need to be processed than general ones. That is, this model suggests that semantic features have their cost in processing time. On the other hand, the Connectionist Model, emphasizing the role of the structure of semantic representation, predicts that specific verbs would be processed faster since additional features imply more connections among components and a more complex network between components, which would facilitate processing or memory.

Different levels of specificity

Unlike other studies which only acknowledge the difference between general verbs and specific verbs or between light verbs and heavy verbs (Barde et al., 2006; Gentner,

1981; Gordon & Dell, 2003), Breedin et al. (1998)[4] compared performance for semantic complexity of verbs at two levels: light verbs vs. heavy verbs (*go* vs. *walk*) and general verbs vs. specific verbs (e.g., *clean* vs. *wipe*)[5]. This distinction allows us to be aware that there are actually at least three levels of specificity and thus a word can be general or specific at different levels of comparison. For example, in Breedin et al.'s (1998) study, *mix* was used as a stimulus at both comparisons, it was a "heavy verb" when compared to *make* as a light verb whereas it was a "general verb" when compared with *stir* as a specific verb. As for another example *carry*, which was used at the level of comparison between general and specific verbs for two times, was categorized as "general" when compared to *deliver* but also defined as "specific" when compared to *hold*. Their results showed that aphasic patients had more difficulty in retrieving "semantically simple verbs" than "semantically complex verbs".

Specificity involving syntactic properties

On the other hand, some studies provide a definition of *specificity* or *semantic complexity* or *semantic richness* involving morphological or syntactic properties, or link

[4] "Light verbs" in Breedin et al.'s (1998) study are similar to semantic primitives like *make*, *come, bring* and so on.

[5] The variable "specificity" manipulated in this study is more similar to the later level in Breedin et al.'s (1998) study (general verbs vs. specific verbs) in that the so-called general words in this study are not so general to be primitives in a language whereas light verbs in the former level refer to primitives.

semantic specificity to syntactic properties[6]. For instance, Gordon & Dell (2003) proposed a connectionist verb-production model and argued for the implication of "division of the labor" to the dissociation between semantically heavy and semantically light verbs as well as that between nouns and verbs. This model suggested that syntactic and semantic inputs share "responsibility (or 'division of labor') for lexical activation according to their predictive power" (2003, p. 1). They argued that semantically light verbs rely more on the syntactic cues and less on the semantic cues when compared to semantically heavy verbs, just as verbs have "more complex grammatical representations" while nouns have "richer semantic representations" (2003, p. 31). In other words, they suggested that this "division of the labor" between semantics and syntax can provide an account not only for the dissociation between verbs and nouns in aphasic patients but also for the dissociation between semantically heavy verbs and semantically light verbs. Their results from sentence production and single-word naming simulation revealed that anomic patients had more difficulty in retrieving heavy verbs whereas aphasics with agrammatism were more impaired in retrieving light verbs. Similarly, Barde et al. (2006) reported that agrammatic aphasics had higher difficulty in

[6] Mobayyen & de Almeida (2005) used similar term "semantic complexity" in their study, yet their focus fell in a different area. They seemed to use argument structure to define the semantic complexity in their sentence recall tests. Causatives (e.g., *grow*/ *fertilize*) were used as stimuli for semantically complex verbs, while perception verbs were used for semantically simplex verbs (e.g., *smell/ re-smell)*. They reported that participants performed better in recalling when sentences included semantically complex verbs than when sentences included semantically simplex verbs.

light verbs in a story completion test and argued that it is the syntactic deficit that contributes to the difficulty of light verbs.

Assessing difficulty or ease resulting from specificity

Additionally, previous studies have provided various explanations for the difficulty of light verbs or the ease of heavy verbs on the basis of results from different tasks. As mentioned above, Gordon & Dell (2003) suggested that the greater difficulty of light verbs compared to heavy verbs is attributable to the greater dependency on syntactic cues. On the other hand, Gentner (1981) argued for a connectionist account, which suggested that more semantic components of heavy verbs provide more connections in the network of verb meaning, and thus provide stronger "memory traces" whereas light verbs have less connections. In addition, Breedin et al. (1998) mentioned another possibility that the difficulty of retrieving light or general verbs is due to the relative wideness of contexts that light verbs can apply to, which leads to instable representations of verb meaning: Light verbs can generate a variety of meanings and should be limited by the context where it occurs.

Both evidence for the relationship between specificity and processing and studies on how aphasic patients perform with specific verbs or general verbs provide us with some insights about verb learning. Understanding the memory load caused by lexical specificity or the stableness of mental representation would allow us to re-examine the

argumentations concerning verb acquisition. However, evidence provided by studies on adults for either approach seems not valid evidence for language acquisition. There might be some discrepancy between results from adult processing and child language acquisition because people may have different responses or develop different strategies when faced with familiar and unfamiliar materials (Gentner, 1981). Additionally, children would have an different understanding or assumption about word meaning from adults' since it requires time to develop full understanding about word meaning after children produce certain words (Clark, 1993).

Taken as a whole, it is still in debate whether specific verbs are easier to process or learn since there are different points of view to explain the phenomena of verb specificity. Specificity can be determined by the number of semantic features or the amount of information that is encoded in a word. That is, the more semantic features one word has, the higher specificity it has. Therefore, specific verbs are also called as "heavy" (Gentner, 1981) or "semantically rich" (Gordon & Dell, 2003, p. 1) or "semantically complex" verbs (Breedin et al., 1998, p. 2). If semantic features are separately processed suggested by "Componential Model" or "Complexity Hypothesis" or are gradually learned as argued by Clark (1973), it would be predicted that a word with more features would require more resources for processing and learning. On the other hand, if specificity is viewed in terms of the contexts to which a word can be

applied, the direction would contrast to the earlier one: fewer contexts that a word can apply to imply higher specificity. In other words, a highly specific verb would be restricted to a limited number of contexts by its internal meaning. Thus, in the process of retrieval of a semantic complex word, one did not have to select the possible meaning since this word has a more "uniform representation" (Breedin et al., 1998, p. 21). In other words, if a verb is more specific, its perceptual characteristics would be more stable. In contrast, connectionists view specificity in terms of a network of meanings. Higher specificity implies not only more semantic features but also more connections and thus facilitates the processing of sentences.

These studies mentioned above provide us with various accounts for ease or difficulty of specificity through examining the general mechanism involved in processing specific verbs and general verbs. The following section will provide a review on studies concerning typological differences in specificity and the role of specificity in lexical development.

2.3.2 Typological pattern in specificity and lexical development

Some studies have discussed the notion of specificity in a cross-linguistic context. One of these was conducted by Tardif (2006a, 2006b), who suggested that languages differ in the tendency of specificity of nouns and verbs and argued that Chinese verbs have typologically higher specificity whereas nouns are less specific. She noticed that

Chinese speakers tend to use more specific and distinct verbs to indicate distinct actions while English speakers tend to use general-purpose verbs, occurring with prepositions or nouns that are used to specify referents. For example, in English, *carry* could refer to various ways of transporting objects with one's body, such as *carry a backpack*, *carry a baby*, and *carry a serving dish*. On the other hand, in Chinese, different verbs are used for different ways in which objects are carried, e.g. , *bēi* 'carry on the back', *pěng* 'carry upon hands', *bào* 'carry with arms', *duān* 'carry as if serving food', *līn* 'carry with one hand', and *ná* 'grasp/take'. Additionally, she also pointed out that specific verbs are available in English though English speakers tend to use general words. However, she did not further explain how frequency interacts with language-specific properties.

Additionally, similar evidence was also shown in some Mayan languages such as Tzeltal and Tzotzil (Brown, 2001; Haviland, 1992). Through examining verbs in Tzeltal, Brown (2001) proposed the "verb specificity hypothesis", suggesting that the pattern of specificity in different word classes varies across languages. Specifically, different word classes in a particular language fall in different positions on the continuum of specificity. In the end of higher specificity English has common nouns whereas Tzeltal has transitive and positional verb roots. Tzeltal, for instance, has a variety of eating verbs, which distinguish between the kinds of food that an agent eats. In contrast to English, common nouns in Tzeltal are more general than transitive and positional verb roots. In

addition, Haviland (1992) reported that Tzotzil verbs often encode what body parts engage in an action. Like Mandarin and Tzeltal, Tzotzil has different verb roots for carrying something on the back (*kuch*) and carrying something in arms (*pet*).

Though making similar observation of typological patterns of verb specificity, Tardif and Brown have made different interpretations and predictions on how these typological properties affect the mechanism of word learning (Brown, 2001, 2007; Tardif, 2006a). In addition, Bowerman (2005) viewed the typological differences in specificity in terms of different patterns of boundaries between categories. The following section will provide a brief review and discussion on their hypotheses and approaches to the relationship between specificity and lexical development.

The implication of the specificity hypothesis in the acquisition of lexicon

Though being based on similar observation that specificity pattern of syntactic category is different across languages, Brown (2007) and Tardif's (2006a, 2006b) arguments toward the learning mechanism are different from each other. Generally speaking, Tardif attempted to explain the ease of learning Mandarin verbs, while Brown put more emphasis on the difference in mapping patterns.

Approach 1*: Specificity as a predictor of the ease of learning*

To put it more specifically, Tardif not only pointed out that Mandarin verbs are specific and but further linked this to the fact that the proportion of Mandarin verbs in

early vocabulary is much higher than that of English verbs. In other words, she seemed to argue that specific verbs are easier to learn because of perceptual availableness. Though not explicitly expressed, the contrast between English nouns and Mandarin nouns was also mentioned to support her proposal. She pointed out English nouns are specific, while Mandarin often has a root word for a group of nouns. For instance, English has two distinct words, *rooster* and *hum* whereas the equivalents in Mandarin, *mǔjī* 'rooster' and *gōngjī* 'hum', share a word root *jī* 'chicken'. However, the role of specificity of English nouns or the generality of Mandarin nouns remains unclear. An alternative account is that the morphology of Mandarin nouns might provide a cue that allows children to observe the similarity between objects that share the same root. In addition, little is known about how specificity influences noun learning since basic levels vary across languages. To sum up, though making attempts to employ the notion of specificity to account for the ease of word learning across word classes, Tardif (2006a, 2006b) did not provide explanations for the role of specificity in noun learning.

Approach 2*: Different degree of specificity implying different extending strategy*

On the other hand, although Brown (2001, 2007) contrasted the semantic specificity of early transitive verbs in Tzeltal children with the generality of early verbs in English children, she did not employ the specificity of early Tzeltal verbs to explain the ease of verb learning as Tardif did to explain the ease of Mandarin verbs. Though

recognizing that the light verb hypothesis (Casenhiser & Goldberg, 2005; Clark, 1973; Goldberg, 2006)[7], which is based on the observation from English verbs, fails to explain the process of Tzeltal learning, Brown (2007) did not propose an opposite hypothesis of the light verb hypothesis. Instead, to solve the paradox that English early verbs are general and early Tzeltal verbs or Mandarin verbs are specific, she argued it is not that a specific verb is easier nor that generality facilitates word learning; it may be that typological differences in verb specificity contribute to different word extending or learning strategies. Specifically, children who are exposed to a language with highly specific verbs -- such as Tzeltal-- would avoid generation or extension after acquiring a verb until positive evidence is available. In contrast, children acquiring a language with many general-purpose verbs -- like English -- would suppose that verbs are "tricky" ones then they tend to use verbs that are general enough and let nouns narrow down the referents of events (2007, p. 181). This argument seems similar to Choi and Bowerman's (Bowerman, 1996; Choi & Bowerman, 1991), who pointed out that children as young as two-year-old are sensitive to language-specific semantic distinctions.

Taken all together, Tardif (2006a, 2006b) made an opposite argument of the light

[7] Clark did not predict what kind of word would be acquired earlier but predicted some general features would be mastered first. Based on the assumption that general features are acquired earlier and other features are mastered later to narrow down the meaning of a word, it would be predicted that children acquiring Mandarin would have an incomplete understanding meaning of specific verbs.

verb hypothesis while Brown (2007) made attempts to conciliate prediction by light verb hypothesis and counterexamples found in languages like Tzeltal and Chinese. The light verb hypothesis predicts that light verbs are easier to learn because of fewer semantic features to be mastered and because of higher frequency. Tardif (2006a, p. 491) mentioned that exploring verb semantics in English and Mandarin would be "informative as to why Mandarin appears to *break* the rule." In her reasoning, Tardif made attempts to illustrate that it is not that nouns are easier than verbs nor that verbs are more difficult; rather, it is that specificity makes the difference. In the case of Mandarin, nouns used in daily life are more general whereas verbs are specific, and thus early vocabulary in Mandarin-speaking children consists of more verbs and less nouns than that in English-speaking ones. In contrast, to explain Tzeltal children's better performance in learning verbs, Brown (2007) provided a different account that did not violate the assumption that nouns are easier to learn. Instead, she argued that Tzeltal verbs incorporate information of nouns and are more like nouns -- or more "nouny" in her term -- and thus more privileged than verbs in other languages. She suggested that semantic specificity of Tzeltal verbs "is indeed a possibly crucial ingredient in Tzeltal children's early transitive verb learning" because it provides "concreteness", which makes verbs more "nouny", and "redundancy", which indicates that information was carried both in the verb and Object NP (Brown, 2007, p.172). Arguing that Tzeltal verbs

are more nouny and thus easier to learn is still based on the assumption that nouns are easier; therefore Tzeltal children's early production of specific verbs cannot be regarded as counterexamples that "break the rule" that nouns is easier to learn than verbs as Tardif argued. Brown, instead, suggested that different pattern of specificity would contribute to different preferences for mapping strategies.

Additionally, Brown's argument that children's assumption about word meaning reflects the typological pattern of specificity in the input language is similar to Bowerman and colleagues' approaches that suggested that toddlers are sensitive to the language-specific pattern of encoding patterns for spatial words or to the semantic partitioning of spatial words (Bowerman, 1996; Choi & Bowerman, 1991; Choi, McDonough, Bowerman, & Mandler, 1999). In the following paragraphs, it will be discussed how specificity can be understood in terms of semantic partitioning or categorization as well as lexicalization.

Approach 3*: Specificity in terms of conflation pattern vs. semantic category*

As motioned above, specificity has been defined as how much information is encoded in a word as Brown found that Tzeltal transitive verbs often encode object, which facilitates the omission of an object argument. Though not using the term *verb specificity*, Choi and Bowerman (1991) have also made similar observation on cross-linguistic differences among how a word encodes information and how it affects

word learning. They argued that the pattern of information encoded in motion words varies across languages, and analyzed the pattern of lexicalization of motion events in English and Korean in terms of Talmy's framework (1985) in which a motion event is analyzed into semantic components, such as MOTION, FIGURE, GROUND, and PATH. They found that English and Korean have different conflation patterns for motion events. In English, motion verbs often encode MANNER or CAUSE while PATH is usually conflated in prepositions. In addition, English does not mark distinction between caused motions and spontaneous motions in its verb conflations. On the other hand, Korean motion verbs encode PATH in transitive sentences expressing caused events, while in intransitives motion verbs expressing spontaneous events Korean "encodes PATH, and optionally MANNER and CAUSE with separate constituents" (Choi & Bowerman, 1991, p. 88). From observations in how children ranging from 14 to 24 months talk about motion events, they found that English-speaking children and Korea-speaking children as young as 17-month to 20-month are sensitive to language-specific patterns in lexical conflation. Children acquiring English use path particles like *up, down, in,* or *on* for both spontaneous and caused motion events whereas children acquiring Korean "keep words for spontaneous and caused motion strictly separately" (p. 83).

This typological difference in encoding patterns can also be understood as a difference in patterns of semantic partitioning or categorization. Although languages are

supposed to mark perceptually salient distinctions and constrained by human's perceptual capability to some degree, semantic boundaries between categories are found to vary across languages (Bowerman & Choi, 2001; Malt, Sloman, Gennari, Shi, & Wang, 1999). In their later studies, Bowerman and colleagues (Bowerman, 1996; Choi et al., 1999) put more emphasis on the notion of "semantic categories" than "the pattern of lexicalization" when discussing language-specific patterns of spatial verbs or particles. Choi et al. (1999) reported that Korean spatial verbs make distinction between *tight-fit* relation versus *loose-fit* relation whereas English does not mark this distinction but distinguishes between the relation of support (put *on*) and containment (put *in*). The Korean word, *kkita* 'fit tightly/ interlock' only can be used for *tight-fit* relations regardless of *support* or *containment* relation while the distinction regarding *tight-fit* relation is "indifferent" to English. In their experimental studies, they found children as young as 18-month to 23-month are sensitive to language-specific semantic boundaries for the spatial words. In other words, young children can observe the language-specific regularity of lexical distribution for categorization.

More recently, Bowerman (2005) explored cross-linguistic differences in verb meaning in terms of object categories from evidence in a variety of verbs such as dressing verbs, carrying verbs and consumption verbs, and also examined how the differences influence lexical development through findings from opening, cutting, and

breaking verbs. While some researchers (e.g., Tardif 2006a, 2006b; Brown, 2001; and Ma et al., 2009) suggested that carrying verbs in different languages, such as Mandarin or Tzeltal, differ in specificity, Bowerman (2005, p. 209) tried to explain different ways how object classes ("covert object categories" in her term) "are woven into" verb meaning (p. 209). She argued that while some object categories have names, some object categories seem not consciously noticed by speakers but displayed in how verbs or other word classes are used. Based on evidence from dressing verbs, carrying verbs, and consumption verbs, cross-linguistic differences were shown in how "[verbs] impose restrictions on the kinds of object involved in the event" (2005, p. 214). Dressing verbs and carrying verbs display covet categories for body parts, while consumption verbs show categories for things people consume. Take dressing verbs for example. English speakers use the verb *put on* regardless of body parts involved or types of clothing items. However, Tswana, a Bantu language of Botswana, has distinct verbs for putting clothing on extremities (head, hands, arms, feet: *gòrwálà*) and the central region of the body (*gòàpàrà*) (Schaefer, 1985, as reported in Bowerman 2005). On the other hand, Korean has specialized verbs for putting clothing on the head (*ssuta*), feet (*sinta*), and wrist or waist (*chata*). As for Japanese dressing verbs, distinctions are made between the head (*kabura*), the upper torso (*kiru*), and the lower torso down through the feet (*haku*). In addition, Yoruba, a Niger-Congo language of Nigeria, only makes distinction between

putting clothing on the head (*dē*) and other religions of the body (*wō*) (Schaefer, 1985, as reported in Bowerman 2005). In her argument, Bowerman linked this discrepancy in dressing verbs, carrying verbs or verbs of consumption among different languages to different patterns of categorization of objects. Specifically, a verb with higher specificity, in this framework, is interpreted as "a small (differentiated, concrete) [event] category involving objects or specific types" as opposite to a "big (global, abstract) event category" (2005, p. 225), which is referred to by a *general* verb in the specificity hypothesis. Regarding lexical development, Bowerman (2005) reported that children are able to produce appropriate verbs on the basis of how their target languages partition events (or covert object categories) by the age of two. She further argued that "category size", which is identified as specificity mentioned by Tardif (2006b, 2006b) or Brown (2001), does not determine the ease of learning. This conclusion seems similar to Brown's proposal that either specificity or generality dose not necessarily lead to ease of verb learning but contributes to the difference in the tendency of mapping strategies.

Specificity or category size in lexical learning: Experimental evidence

Some studies have examined the effect of variation among exemplars for a category, a relationship, or a label on conceptual development and language development. One of them was conduced by Casasola (2005), habituating 10-month-olds and 14-month-olds to two or six examples for the *support* relation.

Through examining whether children generalized this relation to a novel object, she found that the spatial category was formed in 14-month-olds who were habituated to few (i.e., two) exemplars, yet children habituated to more (i.e. six) exemplars did not form the abstract category. Less variation between objects might help children to attend more to the similarity in relationship. In addition, some studies manipulate specificity through providing children with different degrees of variation among exemplars for a certain novel word. In Ma and Wong's (2008) study, English-speaking three-year-olds were presented with either a "narrow" verb that was mapped onto two actions with less variation, or a "broad" verb that was mapped onto two actions with more variation. Their results showed that children presented with exemplars with less variation performed better when required to choose the target action from two video clips. It was also found that children who were exposed to a narrow verb were less likely to extend the novel word to an action carried out with a different *manner* than children who were exposed to a broad verb, yet the difference was not significant in agent extension or object extension. Ma and Wong (2008, p. 329) thus concluded that "meaning specificity facilitates verb fast-mapping, but hinders verb extension to new manner variations."

However, though Ma and Wong's (2008) findings shed light on the effect of the broadness of variation in exemplars on verb learning, it remains unclear how the contrast between specific words or the semantic boundary between categories affects

children's understanding about verb meaning[8]. In addition, although some efforts have been made to explore the effect of labeling patterns on the structuring of categories or generalization through providing children with different number of labels for the same visual stimuli (e.g., Landau & Shipley, 2001), most experimental studies focus on the process of noun learning while few studies have explored the role of labeling in forming a semantic category of a verb.

2.4 The interaction between specificity and frequency

Some researchers emphasize the role of frequency rather than perceptual availableness when exploring factors that may involved in early vocabulary development. For example, Chen and Cheung's (2007) findings from CCDI (Chinese Communicative Development Inventories, Tardif et al., 2002) of forty-eight two-year-olds supported that early words might not necessarily be specific but rather frequent. Item analyses showed that many early verbs were the ones that appeared frequently in daily routines. Verbs like *shuìjiào* 'sleep' and *ná* 'grasp/take' and nouns

[8] In Ma and Wong's (2008) design, specificity was tangled in the two dimensions: body part and direction (or path). For both the broad verb and the narrow verb referring to moving a ball, two exemplars were displayed. As for the narrow verb, the two actions differed only in the body parts involved: one arm or two arms. On the other hand, concerning the broad verb, the two actions varied in body parts involved and directions: The first was carried out with one arm in the direction of *up and down*, which was identical to the narrow verb, while the second was carried out with two arms in the direction of a *circle*. Therefore, all participants did not have to distinguish the contrast between words with similar meanings. In their test trials, children were only required to distinguish the target action from an "out-of-category exemplar".

like *chē* ‘car’, which are supposed to be general in Tardif’s argument, are acquired early. Also, results from ninety-six two-year-olds in Chen’s study (2008) showed that frequency is significantly correlated with AoA whereas rated imageability is not. These findings also supported the notion of “frequency trajectory” proposed by Zevin and Seidenberg (2002) who argued that the words children master in an earlier stage are those that they heard more frequently in an early stage.

Additionally, Casenhiser and Goldberg (2005) reported that high frequency of occurrence of a particular verb could facilitate construction learning since children need a frequent word as a template to acquire the meaning of a novel construction. It has been noticed that general verbs and specific verbs differ in their frequency. General verbs are more frequent since they can be applied to more contexts. Similarly, Gordon and Dell (2003, p. 7) have argued, “[light verbs] are specified by fewer semantic features than are heavy verbs; they are also less constrained by semantic context and, consequently, occur more frequently than heavy verbs.”

Taken as a whole, frequency seems not only a factor that plays a role in lexical development as specificity does; it should be also involved in the interaction with specificity. Therefore, studies exploring the role of specificity in word learning should take the role of input frequency into consideration.

Chapter 3. Experimental Designs and Experimental Tasks

This study explored the role of specificity on word learning. Specifically, this study aims to examine whether it is easier for children to learn a verb with high specificity when compared to a general verb. In addition, whether differences in specificity lead to different strategies for extending novel word was also examined.

In the present study, the degree of specificity of novel words to be learned was considered a consequence of the absence or presence of an additional label for an additional action. A fast-mapping procedure was adopted in this study. As shown in Table 3.1, the main experiment for testing specificity can be divided into four phases: (1) *the baseline training,* (2) *the pre-conditioning-training test*[9], (3) *the reinforcing conditioning training*, and (4) *the post-conditioning-training test*[10]. In the first phase, the baseline training, all the participants were shown an action labeled by a novel word. In the second phase, all the participants were tested for the comprehensive and productive ability of the novel verb presented in the baseline training, and thus results from this phase served as controls. Then came the third phase, reinforcing conditioning training in which children were shown with a different but similar action that was

[9] This test session will be abbreviated as *pre-test* in the following sections.

[10] This test session will be abbreviated as *post-test* in the following sections.

labeled by either the same label in the baseline training (in the General Condition) or a different label (in the Specific Condition). Finally, in the fourth phase, the post-conditioning-training test, the participants were tested for their production and comprehension of the novel words.

Table 3.1: Experimental design: Stimuli in each training and test phase

		General Condition	Specific Condition
Phase 1	Baseline training	Action 1 Label 1	Action 1 Label 1
Phase 2	***Pre*-reinforcing-training test**	**Comprehension** Action 1 Label 1 **Production** (stimuli) (target) Action 1 Label 1 Action 3[a] -	**Comprehension** Action 1 Label 1 **Production** (stimuli) (target) Action 1 Label 1 Action 3[a] -
Phase 3	Reinforcing conditioning training	*(different action same label)* Action 2 Label 1 Action 1	*(different action different label)* Action 2 Label 2 Action 1 Label 1
Phase 4	***Post*-reinforcing-training test**	**Comprehension** Action 1 Label 1 Action 2 Label 1 **Production** (stimuli) (target) Action 1 Label 1 Action 2 Label 1 Action 3[a] -	**Comprehension** Action 1 Label 1 Action 2 Label 2 **Production** (stimuli) (target) Action 1 Label 1 Action 2 Label 2 Action 3[a] -

[a] Action 3 was a variant of Action 1 and Action 2 and differed from them in the body part involved. It was not presented in the training session. This trial was designed to explore children's extending the use of the novel words.

Other tasks administered in this study

In addition to the above tasks, several other tasks were included: (i) the Peabody

Picture Vocabulary Test-Revised (Lu & Liu, 1994) and (ii) the non-word repetition task. The Peabody Picture Vocabulary Test-Revised (often abbreviated as PPVT-R) was employed to test children's comprehensive vocabulary, and the non-word repetition task (adapted from Li's study, 2007) was used to test children's phonological working memory.

3.1 Experimental Design

3.1.1 Variables

Variables in this study include the semantic specificity of words to be learned (*general* versus *specific*) and the test condition (*pre-conditioning-training test* versus *post- experimental-training test*). For visual stimuli, two sets of novel actions involving breaking and carrying events were designed. These two types of actions were selected because previous studies have shown that many languages differed in specificity or semantic categories of carrying verbs and breaking verbs (e.g., Bowerman, 2005; Brown, 2001; Tardif, 2006a). Also, the two types of actions differ in some factors such as punctuality, affectedness, and kinesis. The differences might help to balance the unknown effect of perceptual factors on learning outcome.

Children's performance in both the pre-test session and the post-test session for each condition was compared so as to explore the effect of conditioning training. In the production task, through comparison between the pre-test session and the post-test

session, we could explore if children can use an additional label to encode another action in the Specific Condition or if children learning a general label performed better after exposure of visual stimuli with more variation and higher frequency for a particular label. As for the comprehension task, we examined if children could properly identify the subtle semantic boundary as encoded in the novel word(s) presented in the reinforcing conditioning training.

We also made comparisons between the General Condition and Specific Condition in their performance in production and performance on extension tasks to probe into the effect of specificity. Specifically, this study examined whether children under the Specific Condition in which more words were presented to describe the same set of visual stimuli were more likely to learn an additional word than the General Condition. Also, we explored whether children under the Specific Condition would be more likely to develop a one-to-one mapping strategy and avoid extending the novel words to other contexts when compared to the General Condition.

3.1.2 Counterbalancing

In the reinforcing conditioning training, in the Specific Condition, two similar actions with slightly differences would be mapped onto two different novel verbs whereas in the General Condition they would be mapped onto one novel verb. A participant who was assigned to the Specific Condition when presented with the

carrying actions would be assigned to the General Condition when shown the breaking actions (i.e., Order 2 and Order 3 in Appendix 1), and vice versa. Therefore, the total number of novel words to be learned throughout the experiment for each participant was controlled. Each participant would hear three novel words, two of which were baseline verbs, and the other of which was an additional word in the Specific Condition. The novel word for the baseline carrying action was *mū* and that for baseline breaking action was *dē*. In addition, the word for the additional word for carrying actions or breaking actions was *fō*. All of these words are gap words, consisting of non-occurring syllables, in Mandarin.

3.1.3 Confounding factor: Input frequency

In our study, we manipulated the existence of the contrast provided by novel labels but controlled exemplars of actions across conditions. However, conducting an experiment on mapping between actions and different number of label, we should make a compromise between controlling the total number of exemplars for actions as well as the total input frequency and controlling the input frequency for each label. On the one hand, if we control the total number of exemplars of actions and the total number of exposures of labels as shown in Table 3.2 (a), this would result in the discrepancy in the frequency for each label across conditions (e.g., Label 1 in the General Condition was presented for 18 times whereas Label 1 in the Specific Condition for 9 times). On the

other hand, if we control the input frequency for each label as shown in Table 3.2 (b), discrepancy in the total number for actions and labels across the two conditions would occur: The participants under the Specific Condition would be presented with a larger amount of visual stimuli as well as linguistic stimuli when compared to those under the General Condition.

On the basis of the assumption that language conventions vary in semantic boundaries while perceptual capacity is constant (Bowerman, 2005; Majid, Bowerman, van Staden, & Boster, 2007) and the observation that frequency of a semantically general verb is usually higher since it can applied to a wider context[11] (Casenhiser & Goldberg, 2005; Gordon & Dell, 2003), this study controlled the total number of actions and total number of labels shown and left frequency of each word different: The input frequency of an individual label in the General Condition would be higher than that in the Specific Condition. Therefore, when comparing the performance on Label 1 in one condition to that in the other condition, input frequency would inevitably be a confounding factor though we aim to examine the effect of specificity. In this sense, children under the Specific Condition would encounter a more difficult task since they

[11] Crosslinguistically, the example of *carry* used in Tardif's (2006) study can serve to illustrate the relationship between specificity and frequency. Since Mandarin has more types of *carrying* verb roots than English, the frequency of *carry* in English should be relatively high when compared to specific verbs in Mandarin when speakers of both languages are asked to describe a variety of carrying events. Also, within a language, there are usually some general words used frequently since they can be used in a variety of contexts (Casenhiser & Goldberg, 2005; Gordon & Dell, 2003).

were presented with fewer exposures for each individual label and they had to distinguish between two similar verbs. Better performance observed in the Specific Condition would be strong evidence for Tardif's account that specificity facilitates word learning; nevertheless, two possible accounts would be aroused if better performance was found in the General Condition: (i) frequency facilitates word learning and (ii) specificity impedes word learning.

Table 3.2: Different designs for mapping in the conditioning training session

(a) Controlling total number of exposure of actions and total number of labels

General				**Specific**			
Exposure		**Input**		**Exposure**		**Input**	
Action 1	3	Label 1	18	Action 1	3	Label 1	9
Action 2	3			Action 2	3	Label 2	9
Total	6	Total	18	Total	6	Total	18

(b) Controlling the number of frequency for each verb

General				**Specific**			
Exposure		**Input**		**Exposure**		**Input**	
Action 1	3	Label 1	18	Action 1	6	Label 1	18
Action 2	3			Action 2	6	Label 2	18
Total	6	Total	18	Total	12	Total	36

3.1.4 Production task

As shown in Table 3.3, the production test session consists of five trials. For both conditions, two trials were administered before the conditioning training (pre-test) and three trials after the conditioning training (post-test). Pre-test trials in the two conditions

were identical whereas some differences lied in post-test trials across the conditions. One of pre-test trials and two of post-trials were designed to test the participants' responses to the actions they had seen in the training sessions; on the other hand, in training sessions, children had not been shown the action appeared in one of pre-test trials (Trial 2) and one of post-test trials (Trial 5) since these trials were designed to examine extending uses of the novel words. As shown in Table 3.3, the video clips in Trial 2 and Trial 5 showed Action 3, which was similar to Action 1 and Action 2 but differed from them in the body part involved. The characters in the video clips of the production task were different from the puppet used in the demonstration for the training sessions yet the same across trials of the production task.

Table 3.3: Trials of the production task

		General		Specific	
	Test condition	**Action**	**Target Label**	**Video**	**Target Label**
(1) [a]	Pre-test	Action 1	Label 1	Action 1	Label 1
(2)	Pre-test	Action 3 [b]	-	Action 3 [b]	-
(3)	Post-test	Action 1	Label 1	Action 1	Label 1
(4)	Post-test	Action 2	Label 1	Action 2	Label 2
(5)	Post-test	Action 3 [b]	-	Action 3 [b]	-

[a] The number in this table is listed for discussion but does not mean the order of stimuli.

[b] Action 3 was similar to Action 1 and 2 but not displayed in the training session. This trial was designed to explore children's extending uses of the novel words.

3.1.5 Comprehension task

As shown in Table 3.4, the comprehension task consists of five trials. For both conditions, one trial was administered before the conditioning training session (i.e., in

the pre-test session) and four trials after the training (post-test). Pre-test trials in the two conditions were identical while there were some differences in post-test trials between the two conditions. In the Specific condition, it was also examined whether children could make the distinction between Action 1 and Action 2, which were mapped onto different verbs. To put it more specifically, in the Specific Condition, Trial 2 and Trial 4 were designed to test whether children could distinguish the target action from others they had never been shown in the training session. These two trials could thus serve for the comparison with performance in the General Condition. On the other hand, Trial 3 and Trial 5 were designed to test whether children could make distinction between the two actions, which were matched to different novel verbs in that Action 1 and Action 2 served as choices in each of the two trials. The reason that the materials in Trial 3 and Trial 5 in the Specific Condition were not adopted for the General Condition is that the two actions serving as choices in these two trials in the Specific Condition could be referred to by the same label under the General Condition, and thus it would be inappropriate to ask children which of the two actions this label referred to. The characters in the video clips of the test session were different from that in the demonstration of the training session. In addition, the characters in the video clips of post-test trials (from Trial 2 to Trial 5) differed from one another. This difference in the characters among trials was designed to avoid strategies that might be developed

because of the repetition of the same question. On the other hand, the characters in Trial 1 and Trial 2 were identical since they were designed for comparison between the pre-test and the post-test.

Table 3.4: Trials of the comprehension task

		General		Specific	
	Test condition	**Target Action**	**Label**	**Target Action**	**Target Label**
(1)	Pre-test	Action 1	Label 1	Action 1	Label 1
(2)	Post-test	Action 1	Label 1	Action 1	Label 1
(3)	Post-test	Action 1	Label 1	Action 1[a]	Label 1
(4)	Post-test	Action 2	Label 1	Action 2	Label 2
(5)	Post-test	Action 2	Label 1	Action 2 [a]	Label 2

[a] In these two trials, participants should distinguish the target action from the other that was also labeled so as to make the correct choice.

3.1.6 Levels of analyses

To explore the effect of the conditioning training, three levels of analyses were conducted: (1) comparison of the performance in the post-test session between two conditions (*general* versus *specific*), (2) comparison between the performance on pre-tests and post-tests for each condition, and (3) comparison between the performance level and the chance level. Comparison of the performance in post-test between two conditions would allow us to examine whether specificity facilitated word learning. For each condition, the performance in pre-tests was employed as a baseline level for comparison with the performance in post-test. In the General Condition, the comparison would allow us to demonstrate whether a different action coming with the same label

confused children about the meaning of label, or whether the accumulated frequency of the label and less variation among visual exemplars facilitated word learning. On the other hand, the conditioning training in the Specific Condition was designed to explore whether one-word-to-one-action mapping was facilitative or whether subtle semantic distinctions confused children. Additionally, there were some differences in post-test trials between the two conditions since the conditional training in the two conditions provided children with labels encoded different information. Therefore, the comparison between the performance level and the chance level would be helpful if the differences in the test trials make it inappropriate to directly compare results from two conditions.

3.2 Participants

Sixty-four four-year-olds were recruited from six kindergartens in Taipei City and Taipei County. However, three dropped out in the middle of the testing due to family factor and one did not finish all the tasks owing to his healthy condition. Children who finished all the tasks include sixty four-year-olds (30 boys and 30 girls). The average age was 4;7;20 with a range of 4;3;0 to 4;10;23. These children were Mandarin native speakers with normal language development and without reported cognitive or perceptual impairments.

3.3 Materials

In the training session, the participants were shown several actions labeled by with novel words, and then they were asked to act out a label provided by the experimenter[12]. There were two conditions of training trials for each set of novel words: the General Condition and the Specific Condition (see Table 3.5). Across these conditions, the total number of exemplars was controlled and the visual stimuli were identical. The major difference between conditions lied in the labels provided for the novel actions. As shown in Table 3.5, two types of actions were demonstrated by using hand puppets. One type of action was carried out by a black dog breaking a piece of "candy" with his nose or with ear (see Figure 3.1 and see Appendix 2 (a) for detailed demonstration) while the other type of action was carried out by an elephant carrying a "circle" with his nose or ear (see Figure 3.3 and see Appendix 2 (b) for detailed demonstration). The so-called candy used in the demonstration for the breaking actions was actually styrofoam that was colored by pigment (see Figure 3.2). Every piece of styrofoam was cut into two or three smaller pieces. Magnets were then glued to the pieces of styrofoam, and this allowed the conjunction after broken into several pieces. The circles used in the demonstration of the carrying actions were made of steel wire with different colors[13].

[12] The requirement to act out the label in the training session was designed to enhance the performance. With this procedure, the participants would be more familiar with the actions they were shown.

[13] The differences of colors were designed to create variations among the patients in the actions shown.

Both the comprehension task and the production task were administered with the aid of video clips. A forced-choice task was adopted in comprehension tests, including five trials. Also, production tests include five trials.

Table 3.5: Two groups of actions

Actions	Sub-action	Features encoded
Break something (with a part of head)	baseline	With ear
	additional	With nose
Carry something (with a part of head)	baseline	With nose
	additional	With ear

Figure 3.1: Demonstration in the training phase of the breaking action

Figure 3.2: Styrofoam used in the breaking action

Figure 3.3: Demonstration in the training phase of the carrying action

3.4 Procedure

3.4.1 Vocabulary size: Peabody Picture Vocabulary Test-Revised

The Peabody Picture Vocabulary Test-Revised (Lu & Liu, 1994) was administered to all the participants in a week. This test was designed to test children's comprehensive vocabulary size. Each trial consisted of four pictures on a page, and children were asked to point to the picture that a particular word refers to. Thus, children could easily make a response without producing any words. The scoring followed the procedure mentioned in Lu & Liu (1994). Results from PPVT-R were summarized in Table 3.6.

3.4.2 Phonological working memory: Non-word repetition task

The non-word repetition task was adopted to test participants' ability of phonological working memory. When required to repeat a non-word, children have to rely solely on their phonological working memory since lexical knowledge cannot be used to support their recall performance. On the basis of this argumentation, non-word repetition has been widely adopted as an indicator of phonological working memory

(Alloway et al., 2005; Gathercole & Baddeley, 1990; Li, 2007).

The participants were told that they were going to play an imitation game in which they had to imitate what they heard from the headphone that they were going to wear. The stimuli were mainly adapted from Li's study (2007), including two sets: the nonce-word set and the gap-word set, both of which consisted of four types of syllable length. In Li's (2007) design, the nonce-word set consisted of meaningless words consisting of real syllables in Mandarin whereas the gap-word set was created with non-words consisting of non-occurring syllables in Mandarin.

In the first type of syllable length, the participants were required to repeat one set of two syllables. In each trial of the second part, they were required to repeat two sets of two syllables with an interval between two sets. In each trial of the third part, they were required to repeat three sets of two syllables. In the fourth part, which was not administered in Li's (2007) study, the participants had to recall two sets of three syllables in each trial. In other words, the number of syllables that the participants had to recall in the third part and fourth part was the same while the major difference lied in the pattern they were organized. All the participants were required to repeat the nonce-word set before the gap-word set. The task was administered with presentation of pre-recorded stimuli for it ensured stimuli were identically presented for all the participants.

All responses were recorded and coded for further analyses. A participant would get one point if correctly recalling one syllable. Each participant got a score that was calculated by summing up all the correct syllables repeated. Results on the non-word repetition task were summarized in Table 3.6.

Table 3.6: The characteristics of participants

Sex	Male	Female
No. of participants	30	30
Number of children reporting input of Taiwanese Min	31	
Age		
Mean	4;7;20	
Standard deviation	69.23(days)	
Range	4;3;0~4:10;23	
PPVT-R score		
Mean	42.02	
Standard deviation	10.06	
Range	13~70	
Non-word repetition score		
Mean	90.17	
Standard deviation	25.54	
Range	28~153	

3.4.3 Training phase

The experimenter sat in the right of the participants during the experiment. The training session began with introducing of the puppet and the patient of a novel action. The children were told that the puppets' hands were hurt, but they were still good at

completing some actions. Each time the experimenter performed the novel action, she labeled the action by introducing the novel word in a fossilized construction for three times[14]. For instance, the participants would hear instructions for a breaking action as following: "*Wā! Hái-yǒu yī-gè yǒu diǎn-diǎn de tang-guǒ yē*! *Xiǎo-hēi yào* ***dē*** *tang-guǒ wō*! *Nǐ kà! Tā gāng-gāng* ***dē*** *tang-guǒ*! *Xiǎo-hēi shì-bú-shì hěn lì-hàin ya*！ *Xiǎo-hēi* ***dē*** *tang-guǒ yē!*" (**"**哇，還有一個有點點的糖果耶，你看，小黑要 ***dē*** 糖果喔，你看，他剛剛 ***dē*** 糖果，小黑是不是很厲害呀！小黑 ***dē*** 糖果耶！") 'Wow! Another candy with spots! Look! He is going to *dē* candy! Look! He just *dē* candy. Isn't Little Black cool? Little Black *dē* candy' (see Appendix 5 for complete instructions). As can be seen, aspect markers were deliberately omitted. All exemplars for the novel words were produced in a transitive construction. The frequency of the exposures of visual stimuli and linguistic input in the training sessions were summarized in Table 3.7. After introduced with the action several times, the participants were invited to act out the action that the novel word labeled[15]. The participants would be assisted in performing the action if not acting out the action that matched the novel word.

[14] Though there is much research pointing out that syntactic cues are important for verb learning, this study controlled this factor by deliberately simplifying the sentence frames.

[15] Because of the instructions for inviting children to act out the action, the frequency of the label would be more than three times for an action as shown in Table 3.7.

Table 3.7: The frequency of visual and linguistic stimuli

General Condition				Specific Condition			
Action	Exposure to visual stimuli	Label	Frequency	Action	Exposure to visual stimuli	Label	Frequency
Action 1	6	Label 1	20	Action 1	6	Label 1	20
Pre-conditioning-training test				Pre-conditioning-training test			
Action 2	3	Label 1	22	Action 2	3	Label 2	11
Action 1	3			Action 1	3	Label 1	11
Post-conditioning-training test				Post-conditioning-training test			

3.4.3.1 The breaking action

In the beginning, the experimenter picked up a piece of styrofoam with her left hand. The dog, which was manipulated by the experimenter's right hand, then broke the piece of styrofoam into several parts with his ear (the baseline action) or nose by knocking on the joint that were seamed with magnet (see Appendix 2 for a detailed procedure).

3.4.3.2 The carrying action

In the beginning, the circles were hung on several "branches" of a box separately as shown in Figure 3.4. The first action for carrying was done as following. The elephant, which was manipulated by the experimenter's right hand, lifted the circle on his nose, walked from the box to a tree, and then lay down the circle (see Appendix 1 and Appendix 2 for a detailed procedure). The second action was the same with first one except that the body part used was the ear rather than the nose.

Figure 3.4: Circles hung on several "branches" separately (in the carrying action)

3.4.4 Test Phase

3.4.4.1 Production test

There were five trials in the production task. In each of the five trials, a participant was shown a video clip in which a puppet performed an action (see Figure 3.5 for example and Appendix 3 for more details of the trials in the production task). In the end of each trial, the narrator of the video required the participant to answer what an action is by asking "Look! What is Little Pig doing?" ("*kàn-kàn Xiǎo-zhū zhuō shénp-me ya?"*) If the participant did not attempt to answer or said "I don't know" the experimenter would ask the question again and encourage the participant to answer it. If this participant still did not make any attempt to answer the question after asked twice by the experimenter, the experimenter would move on to next trial. All the responses were recorded and then coded for the main verbs and the body parts specified.

Figure 3.5: Example for the video clips used in the production task

3.4.4.2 Comprehension test

The comprehension test is a forced-choice task. There were five trials in this session. In each trial, the participants were shown three video clips, which one-by-one appeared in different positions on the screen of 12-inch notebook computer. These video clips were played with the aid of the software, GOM media player. As shown in Figure 3.6, in each test trial, the characters, background, and properties in all the three clips were identical. The difference lied in the actions the character performed. One of three clips in a trial displayed a particular character performing the target action, which was labeled in the training session, while the other two clips displayed the same character performing actions different from the target action (see Appendix 3 for detailed stimuli). Before each trial ended, three pictures captured from the three original video clips would be simultaneously displayed on the screen as shown in Figure 3.6, with a narrator requiring the participants to choose the video clip that matched the meaning of a particular novel word from the three pictures by asking a question like “which one is

'Stitch *mū* circle'?" ("*nǎ-yī-ge shì shǐdìqí mū quān-quān?*"). If a participant did not make any attempts to respond, the experimenter would repeat the question that was produced by the narrator in the video and require the participant to make a choice. The participants were trained to point to the clip on the computer screen in practice trials so that responses would be unambiguous. The responses in each trial of the comprehension task were coded for the position of the video clip that a participant pointed to. The accuracy would be analyzed by the rate of responses that matched the target clip.

Prior to the main test, two practice trials were administered to make sure children were familiar with this forced-choice task which required them to observe three clips with actions sequentially and to choose one of them in the end of the trial. In addition, a test trial began with a display of a real puppet that appeared in the video if the character was introduced for the first time. This procedure was adopted to increase participants' familiarity with the puppet and its body parts. That is, this step was added to lower the possibility that children had learned the word but failed to respond correctly just because they had difficulty observing and identifying the particular body part involved shown in the video clips.

Figure 3.6: Example for the video clips used in the comprehension task

Chapter 4. Results on Specificity Effect

Children's performance in the production task and the comprehension task was reported separately. Inferential statistic analyses were carried out to determine whether specificity facilitated word learning and in what aspect specificity affected word learning. This chapter provides three levels of inferential statistic analyses: (1) comparison between the performance in pre-tests and post-tests for each condition, (2) comparison of the performance between the General Condition and the Specific Condition, and (3) comparison between the performance level and the chance level. For the comprehension data, analyses were conducted at the first two levels listed above. On the other hand, for the production data, analyses were conducted at the first level and the third level.

The first level for analysis, the comparison between pre-tests and post-tests allowed us to analyze changes in each participant's performance on the baseline verb, which was shown in the baseline training for both conditions. Since children's performance in the pre-tests was treated as their own controls, we could explore how the conditional training affected children's responses. As for the second level, the comparison between the General Condition and the Specific Condition, allowed us to explore whether there were differences in children's performance resulting from

specificity defined by labeling patterns. The third level, comparison between the performance and the chance level, which was only made for test trials of the comprehension task in which forced-choice task was adopted, could help us examine the possibility that children had a correct understanding about the word boundaries instead of guessing answers.

Additionally, extending uses of the target words were also examined. Brown (2007) has argued that typological differences in verb specificity might contribute to different word learning strategies. This study did not directly deal with this issue of cross-linguistic differences in word learning strategies, but instead aims to test whether this hypothesis could apply to explain how children deal with meanings of forms. Specifically, this study explored whether this hypothesis is also a correct proposal for explaining learning mechanism: If it is true that children dynamically build word meanings by observing the pattern of lexicalization, input with different patterns for form-function mapping would contribute to different assumptions about what meaning is encoded.

4.1 Production task

4.1.1 Performance in each trial testing novel word

Before discussing results from inferential statistic analyses, this section provides a

general description for the trials that were designed to test the performance on the target words. Results were summarized in Table 4.1. The accuracy in Trial 1, Trial 3 and in Trail 4 in the production task (see Table 3.3 on p. 47) was coded for further analysis. If the target word was produced for the certain action shown in the video of the trial, the response would be coded as "target word". On the other hand, other responses or no responses would be coded as "others".[16]

Overall, the performance on learning a general word was more stable across the pre-test session and the post-test session when compared to the performance on learning specific words. Results from the General Condition showed that about 70% of responses were target words in each trial. On the other hand, results from the Specific Condition showed that the proportion of target responses dropped in the post-tests for both the test with the baseline label, i.e., Label 1, and the other test with Label 2. It seemed that the contrast marked by an additional label (Label 2) was not learned and this contrast also impeded the performance of the baseline label. Nevertheless, it was also found that participants under the Specific Condition still had better performance in the post-test with Label 1 than that with Label 2 (Label 1: 52% vs. Label 2: 33%).

In addition, the performance on mapping Action 2 onto Label 1 in the General Condition could be compared to the performance on mapping Action 2 onto Label 2 in

[16] It should be noted that these two trials were designed to test the production for the *baseline* verb, and thus the response of the other specific verb in the Specific Condition would be coded as "others".

the Specific Condition. Results showed that children under the General Condition perform much better than those in the Specific Condition (General: 70% vs. Specific: 33%). It seemed that mapping a similar action onto the same label is easier than mapping it onto a different label.

Table 4.1: The number and proportion of target responses in the production task

		General					Specific				
Session	Stimuli	Target	*break* *n=30*	*carry* *n=30*	Total *n=60*		Target	*break* *n=30*	*carry* *n=30*	Total *n=60*	
Pre-test	Action 1	Label 1	23	17	40	(67%)	Label 1	23	23	46	(77%)
Post-test	Action 1	Label 1	22	20	42	(70%)	Label 1	13	18	31	(52%)
Post-test	Action 2	Label 1	24	18	42	(70%)	Label 2	9	11	20	(33%)

Change from pre-test to post-test

To explore whether children's responses in the pre-test session significantly differed from those in the post-test, performance of each child was analyzed through McNemar tests. In this section, for the Specific Condition, it was explored whether the additional label would facilitate or impede the performance on the baseline label. For the General Condition, it was examined whether the additional kind of exemplar for the same label facilitated the performance of the label in the test trial with the baseline action.

Table 4.2 summarized the frequency of responses for the pre-test and the post-test on the baseline verb. Most children under the General Condition did not change their response after being exposed to a novel action that was also labeled by the baseline verb.

The proportion of target responses in the pre-test and the post-test was similar. On the other hand, the McNemar tests showed that in the Specific Condition the proportion of children responding with target words in the pre-test significantly differed from the proportion in the post-test ($p < .0005$): Forty-six out of 60 children responded with target words in the pre-test while only 31 out of 60 in the post-test did so. This difference is attributable to the fact that 16 children produced the target word in the pre-test successfully but failed to respond with the target word in the post-test whereas only one child changed their response from the target word to others.

Taken as a whole, showing another similar action and mapping it onto the same word did not affect the performance on producing the baseline verb, as shown in results from the General Condition; in contrast, exposing children with a different word that labeled a similar action seemed to affect the production of the baseline verb, as shown in results from the Specific Condition. One possibility might be that some of the children in the Specific Condition were confused by the two newly-learned words. They produced the other word, which was supposed to label the other action rather than the action shown in the test trial. In addition, the lower frequency of the baseline verb in the Specific Condition could be a competing account for the poorer performance in the Specific Condition when compared to General condition. However, this possibility seems not plausible since the frequency of another specific verb was actually lower than

baseline verb in the Specific Condition. If frequency alone could account for the learning process in this task, children should have been more likely to produce the baseline verb instead of changing their responses from the baseline verb to the other verb, which was presented with lower frequency.

Table 4.2: Performance on the baseline verb in the production task (pre-test and post-test)

			Pre-test		
			Target word	Others	Total
General	**Post-test**	Target word	37	5	42
		Others	3	15	18
		Total	40	20	60
McNemar test: p =.727					
Specific	**Post-test**	Target word	30	1	31
		Others	16	13	29
		Total	46	14	60
McNemar test: p < .0005					

4.1.2 Number of target words produced

All participants' performance in the production test session was coded for further analyses on number of target words produced. As shown in Table 4.3, to examine the effect of specificity on lexical gain, each participant's performance in the pre-test session and the post-test session was classified as: "no target word produced" (including "no response" and "non-target-word response"), "one target word produced", and "two target words produced". Only trials testing the actions shown in the training session but not trials testing patterns of extension were counted.

Table 4.3: The number of children producing no, one or two target words in the test sessions

(a) Results of performance on the General Condition

No. of words Produced	Pre-test				Post-test				Overall			
	break *n=30*	*carry* *n=30*	Total *n=60*		*break* *n=30*	*carry* *n=30*	Total *n=60*		*break* *n=30*	*carry* *n=30*	Total *n=60*	
0	7	13	20	(33%)	5	10	15	(25%)	5	8	13	(22%)
1	23	17	40	(67%)	25	20	45	(75%)	25	22	47	(78%)
2	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*	*NA*
Total	30	30	60	(100%)	30	30	60	(100%)	30	30	60	(100%)

(a) Results of performance on the Specific Condition

No. of words Produced	Pre-test				Post-test				Overall			
	break *n=30*	*carry* *n=30*	Total *n=60*		*break* *n=30*	*carry* *n=30*	Total *n=60*		*break* *n=30*	*carry* *n=30*	Total *n=60*	
0	7	7	14	(23%)	13	10	23	(38%)	5	7	12	(20%)
1	23	23	46	(77%)	12	11	23	(38%)	15	12	27	(45%)
2	*NA*	*NA*	*NA*	*NA*	5	9	14	(24%)	10	11	21	(35%)
Total	30	30	60	(100%)	30	30	60	(100%)	30	30	60	(100%)

Overall, more than half of children produced at least one novel word in post-test trials (General 75%; Specific: 62%). In both conditions, about 20% failed to produce any target words throughout the test session (Overall percentage: General 22%; Specific: 20%).

Interestingly, results from the Specific Condition showed that children who produced two target words in all trials did not necessarily produce two words in the post-test trials in which there were supposed to be two target words. This is because they produced one target word in the pre-test session yet produced the other for all the

post-test trials in which there should be two target words. In other words, they overextended the second novel word to the action that was supposed to be referred to by the baseline word. As can be seen in Table 4.3, in the Specific Condition, 35% produced two target words in all trials but only 24% produced two target words in the post-test trials. This is because some children stop using the baseline word even in the trial that required them to use to correctly respond although they had learned to produce the second novel word in an appropriate context after being exposed to the different label referring to a different action. Intriguingly, the baseline word should be more privileged in the design since it was presented more frequently than the other word and was also the last word participants would hear in the training session of a set of words. The possible account would be that the newly-learned word was attention-attracting.

Additional label learned?

This section examined whether children under the Specific Condition would be more likely to learn an additional label as predicted by Tardif's proposal (2006a) through examining the performance across the reinforcing conditioning training. Each participant's performance was classified into "gain" and "no gain" for further analyses according to the change from pre-test to post-test in the number of target word produced. The category "gain" refers to an increase in the number of the target words produced in the post-test trials when compared to that in the pre-test trials. "No gain" refers to the

situation that the number of distinct target words produced in the post-test session did not increase compared to the number in the pre-test session. Thus, the category "gain" would include the pattern that "no word to one word or two words" and "one word to two words" while other patterns such as "one or two words to no word" and "one word to one word" would be included in the category "no gain"

For the same visual stimuli, the General Condition provided children with one novel word to label the actions whereas the Specific Condition provided two novel words for the two actions respectively. If children in the Specific Condition had learned both target words and used them in the appropriate contexts, they would be supposed to produce more verbs in the post-test trials when compared to in the pre-test trials. On the other hand, children under the General condition would produced more target words in post-test than pre-test only when they did not learned the word in the beginning but they learned it after the conditioning training (i.e., the number of word they produced increased from zero to one).

Overall, as summarized in Table 4.4, there was no significant difference between the Specific condition and the General Condition in the change of number of target words produced. Tardif's proposal was not supported in that children under the Specific Condition were not significantly more likely to learn a new verb than the General Condition (General: 10% vs. Specific: 22%, $\chi^2_{(1)} = 3.064$ $p = .080$).

Table 4.4: The pattern of lexical gain from pre-test to post-test

	Condition					
	General		Specific		Total	
Gain	6	10%	13	22%	19	16%
No gain	54	90%	47	78%	101	84%
Total	60	100%	60	100%	120	100%

$\chi^2_{(1)} = 3.064$ $p = .080$

4.1.3 The pattern of extension of the novel word

4.1.3.1 Results from McNemar tests for each condition

McNemar tests were conducted to explore whether children performed differently in the extension task after the reinforcing conditioning training. As shown in Table 4.5, results showed that the proportion of extension under the General Condition changed after the conditioning training while that under the Specific Condition did not change. In the post-test, children under the General Condition were significantly more likely to extend uses of novel words to new actions when compared to the pre-test ($p < .05$). Ten children did not extend the novel word in the pre-test but start doing so after the conditioning training whereas only two children extended the novel word in the pre-test but stop doing so after conditioning training. Consequently, the proportion of extending uses had increased after the conditioning training. On the other hand, results from the Specific Condition showed that the proportion of extending uses in the pre-test and that in the post-test was similar. This result suggested that after exposure to an action labeled by a word, showing an additional action for the same label would facilitate the

extension of this label whereas providing an additional action that was labeled by another label would not.

Table 4.5: The number and proportion of responses of novel words in the extension task

			Pre-test		
			Novel word	Others	Total
General	**Post-test**	Novel word	21	10	31
		Others	2	27	29
		Total	23	37	60
McNemar test: $p < .05$					
Specific	**Post-test**	Novel word	21	4	25
		Others	5	30	35
		Total	26	34	60
McNemar test: $p = 1$					

4.1.3.2 Order effect in the extension task

In this section, it was explored whether children performed differently when presented with stimuli in a different order. Specifically, this section explored whether the presence of a prior training session for specific verbs influenced the performance on a general verb and whether the presence of the training for a general verb had an effect on the performance on specific verbs.

The difference of orders for presenting stimuli was consequences of counterbalancing as shown in Appendix 1. Each participant was exposed to two type of actions (i.e., breaking and carrying) and assigned to different conditions (i.e., *general* versus *specific*) when learning different types of actions. When learning a general verb,

half of children were exposed to the general verb as the first word in the experiment while the other half of children had been exposed to specific verbs before they learned this general verb. As shown in Table 4.6 (a), these two orders of presenting stimuli were categorized as "first" and "second." Similarly, when learning specific verbs, half of children learned the specific verbs as the first set of stimuli while the other half of children had been presented a general verb earlier. Thus, as shown in Table 4.6 (b), for the Specific Condition, "first" refers to the situation in which the specific verbs were presented without any prior training of another general verb whereas "second" indicates that children had been trained for another general verb before they learned these specific verbs.

Results showed possible order effect that contributes to children's assumption or expectation about the experimental task. First, an effect of learning specific verbs on learning a *general* verb was found. Overall, when learning a general verb, children who had been exposed to specific verbs were less likely to extend this general word. As shown in Table 4.6 (a), results from the General Condition showed that among the 30 participants who had been provided with a prior training of specific verbs (i.e., trained in the order, "second", in Table 4.6), only nine (30%) extended the novel word in the pre-test whereas 14 children (47%) extended this word among 30 participants who learned the general verb as their first verb in this experiment setting (i.e., trained in the

order “first”). This result implied that the training and test sessions for specific verbs had an impact on the next task for the general verb. After being exposed to the training of specific verbs, children might predict that the words to be learned would be also specific. The assumption that “I am learning specific words” might remain when they were doing the next task of another set of novel actions and might make them more reluctant to extend the word even though for the next task they were assigned to the General Condition, in which they were supposed to be more likely to do so.

A contrast effect, the effect of learning a general verb on learning *specific* verbs, could be observed. In this case, children who learned the specific verbs after learning a general verb were more likely to extend these words (trained in the order “second”: 50%) when compared to children who learned the specific words first were less likely to extend the novel words (trained in the order “first”: 37%). This might be because the training of a general verb had a remaining effect on the next task of learning specific verbs. The prior training of a general verb increased the possibility of extending uses in the task for specific verbs.

Table 4.6: Responses of novel words in the extension task and the order of presentation of stimuli

(a) Results of performance on the General Condition

		Order of presentation [a]		
		First (*n*=30)	Second (*n*=30)	Total (*n=60)*
Session	**Pre-test**	14 (47%)	9 (30%)	23 (38%)
	Post-test	20 (67%)	11 (37%)	31 (52%)
	Total (*n*=60)	34 (57%)	20 (33%)	54 (45%)

[a] "First" represents the situation in which the general word to be learned was presented as the first set (i.e., there was no other training of specific words prior to this training) whereas "second" stands for the situation in which the word to be learned was presented as the second set (i.e., there was another training session for *specific* words prior to the presentation of the word).

(b) Results of performance on the Specific Condition

		Order of presentation [b]		
		First (*n*=30)	Second (*n*=30)	Total (*n=60)*
Session	**Pre-test**	11 (37%)	15 (50%)	26 (43%)
	Post-test	10 (33%)	15 (50%)	25 (42%)
	Total (*n*=60)	21 (35%)	30 (50%)	51 (43%)

[b] As for this table, "first" stands for the situation in which the specific words to be learned was presented as first set where as "second" refers to the situation in which the specific words to be learned was presented as the second set of stimuli (i.e., there was another training session for a general word prior to the presentation of the words).

In addition, this finding not only suggested that there were order effects resulting from the experiment setting, but also implied that the process of lexical learning is a dynamic process of building the word meaning. In this sense, if a prior training session has effect on children's assumption of word meaning, vocabulary knowledge might also have a relatively long-term effect. Therefore, in the following section, analyzes were conducted to explore whether vocabulary size had an effect on children's extending uses of the novel words.

4.1.3.3 Performance of children with different vocabulary sizes

To explore whether vocabulary size affected children's assumption about verb meaning, two groups of children who had different vocabulary size should be selected. The group for larger vocabulary was defined as having a *z* score equal to or bigger than 0.5 whereas the group for smaller vocabulary having a *z* score equal to or smaller than -0.5. The mean of PPVT-R score of all the sixty participants was 42.02 (with a minimum of 13 and a maximum of 70) and the standard deviation is 10.06. Thus, children with a PPVT-R score lower than or equal to 37 were selected for the analysis on smaller vocabulary while children with a score higher than or equal to 47 were selected to the group of larger vocabulary. The number of children with different vocabulary size was summarized in Table 4.7.

Table 4.7: The number of children with different vocabulary sizes measured by PPVT-R

Criteria	*n*	*percent*
Smaller (PPVT≦37)	20	34%
38 < PPVT<46 (excluded for analysis)	23	38%
Larger (PPVT≧47)	17	28%
Total	60	100%

Overall, results showed that children with larger vocabulary were less likely to extend the novel words. This tendency was even more extreme in the pre-test before which the reinforcing conditioning training was administered. As shown in Table 4.8,

21 out of 40 children who had a smaller vocabulary extended the words (53%) while only eight out of 34 children who had a larger vocabulary extended the words (24%).

There might be two possible accounts for the difference of performance in children with different vocabulary sizes. One possibility is that children with larger vocabulary would have more words to refer to an event than children with smaller vocabulary. For instance, in the pre-test trials of the breaking event, other responses of children with larger vocabulary included *qiē* 'cut/slice'(for three times), *nòng* 'do/trifle with'(for two times) and *tiào* 'jump' (for one time) in addition to two children who did not make any response whereas responses of children with smaller vocabulary included *pā* 'lie prone' and *qiē* 'cut/slice' for one time respectively. The other possible account is that children with larger vocabulary were more influenced by language-specific properties. This reasoning would support Brown's hypothesis in that children with more linguistic experience have a more similar pattern for extension to that of adults. Nevertheless, this argument would require more examination since it remains unclear whether Mandarin verbs are really more specific.

Table 4.8: *Crosstabulation of responses to the extension task and the group of vocabulary size*

		Vocabulary size					
		Larger		Smaller		Total	
Pre	Novel words	8	24%	21	53%	29	39%
	Others	26	76%	19	48%	45	61%
	Total	34	100%	40	100%	74	100%
$\chi_{(1)}^2$= 6.473,	p = .011						
Post	Novel words	11	32%	23	58%	34	46%
n=17	Others	23	68%	17	43%	40	54%
	Total	34	100%	40	100%	74	100%
$\chi_{(1)}^2$=.4.676,	p = .031						

4.2 Comprehension task

4.2.1 Comparison against chance level

In the beginning, we conducted binominal tests for each trial to examine whether children performed significantly better than the chance level. The chance level was set at 0.333 since there were three choices in each trial of this comprehension task. Results showed that children performed significantly better than the chance level in most trials while the performance in Trial 5 is only nearly significant (p = .067 in both the conditions). The results indicated that participants had a robust understanding about novel words in both the General Condition and the Specific Condition.

Table 4.9: Accuracy and the binominal tests in the comprehension task

(a) Results of performance in the General Condition

Test Condition	Pre	Post			
Trial	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Target	Action 1	Action 1	Action 1	Action 2	Action 2
Label	Label 1	Label 1	Label 1	Label 1	Label 1
N	29	31	28	36	26
%	48.33*	51.67**	46.67*	60.00**	43.33
P	0.0112	0.0025	0.0216	0.0000	0.0673

(b) Results of performance in the Specific Condition

Test Condition	Pre	Post			
Trial	Trial 1	Trial 2	Trial 3 [a]	Trial 4	Trial 5 [a]
Target	Action 1	Action 1	Action 1	Action 2	Action 2
Label	Label 1	Label 1	Label 1	Label 2	Label 2
n	32	35	27	38	26
%	53.33*	58.33**	45.00*	63.33**	43.33
p	0.0011	0.0001	0.0392	0.0000	0.0673

Chance level: 0.333

* Significant at the 0.05 level (2-tailed).
** Significant at the 0.01 level (2-tailed).

[a] In these two trials in the Specific Condition, participants should distinguish the target action from the other that was also labeled so as to make the correct choice.

4.2.2 Performance on the baseline verb: From pre-tests to post-tests

Similar to analysis for tests on the baseline verb in the production task, the comparison between the pre-tests and the post-tests for the baseline verb in the comprehension task was made to explore the role of labeling patterns provided in the conditioning training in learning process. As shown in Table 4.10, McNemar tests showed that there was no significant difference in accuracy between the pre-test and the post-test for both conditions (General: p =.839; Specific: p =.678) .

Table 4.10: Performance on the baseline verb in the comprehension task (pre-test and post-test)

			Pre-test		
			Match	Mismatch	Total
General	**Post-test**	Match	18	11	29
		Mismatch	13	18	31
		Total	31	29	60
McNemar test: p =.839					
Specific	**Post-test**	Match	15	10	25
		Mismatch	13	22	35
McNemar test: p =.678		Total	28	32	60

4.2.3 The role of individual differences in the comprehension task

4.2.3.1 Vocabulary size

In this section, we explored how individual differences in vocabulary size and working memory affected performance in this particular fast-mapping task. At first, we examined the relationship between vocabulary size and the performance in the comprehension task. The criteria for groups of vocabulary were the same with those presented in Table 4.7.

To compare between the performance of children with larger vocabulary and the performance of those with smaller vocabulary for each condition, independent *t* tests were conducted. Also, we examined whether the aid or other possible impacts provided by vocabulary knowledge on the understanding of the meaning of a general verb differed from those on the understanding of the meaning of two specific verbs.

In this section, independent *t* tests were conducted to analyze only the effect of vocabulary size instead of two-way ANOVA to explore the effect of vocabulary size and conditions of labeling patterns since the test trials of comprehension tasks employed in the General Condition and the Specific Condition were not identical. This difference between the two conditions is that only when learning specific words did participants have to distinguish the two similar actions that they had been shown in the two trials, Trial 3 and Trial 5.

In addition, for this analysis, a comprehension score was calculated. If responding correctly in a particular trial, a participant would get one point. The full score was five since there were five trials in the comprehension task.

Results from children with difference vocabulary sizes were summarized in Table 4.11 and Figure 4.1. Overall, children with larger vocabulary got higher comprehension scores than children with smaller vocabulary did. However, the effect seemed not consistent across the General Condition and the Specific Condition. In the case of the Specific Condition, vocabulary size seemed to have no significant effect on the performance in the comprehension task though the mean score of children with larger vocabulary was slightly higher than children with smaller vocabulary ($t_{(35)}$ =-1.133, p=.265). On the other hand, in the case of the General Condition, the mean score of children with larger vocabulary was significantly higher than children with smaller

vocabulary ($t_{(35)}$=-3.292, p < .005). In short, vocabulary size did not make difference for the Specific Condition, yet it did when children learned the words under the General Condition.

Table 4.11: Comprehension scores of children with larger vocabulary and smaller vocabulary

		Comprehensive vocabulary size	
		Larger	**Smaller**
General	*n*	17	20
	Mean	2.941	1.650
	SD	1.249	1.137
		$t_{(35)}$=-3.292**, p < .005	
Specific	*n*	17	20
	Mean	2.824	2.300
	SD	1.468	1.342
		$t_{(35)}$ =-1.133, p=.265	

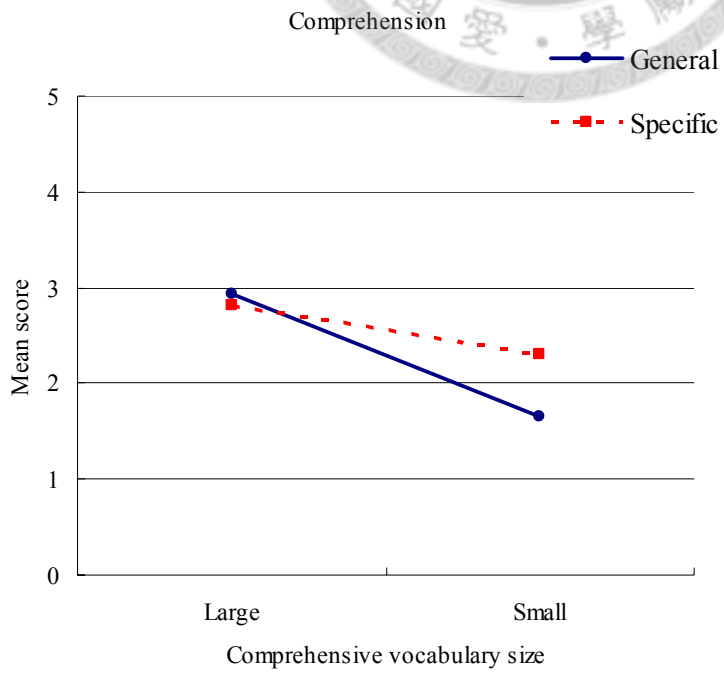

Figure 4.1: The mean scores of groups with different vocabulary sizes for each condition

4.2.3.2 Phonological working memory

In this section, it was examined whether children with different sizes of phonological working memory performed differently in the comprehension task for learning a general word or specific words. For further analyses, we selected two groups by the following procedure. The group of *larger phonological working memory* consisted of children with a *z* score equal to or higher than 0.5 whereas the group of *smaller phonological working memory* a *z* score equal to or lower than -0.5. As shown in Table 3.6, the mean of the non-word repetition score of all the sixty children was 90.17 (with a minimum of 28 and a maximum of 153) and the standard deviation is 25.54. Thus, as shown in Table 4.12, the group with larger phonological working memory consisted of children with a non-word repetition score equal to or higher than 103 whereas the one of children with smaller phonological working memory was composed of children with a score equal to or lower than 77.

Table 4.12: The number of children with larger and smaller phonological working memory size

Criteria	*n*	*percent*
Smaller (Non-word repetition≦77)	21	35%
77 < PPVT<103 (excluded for analysis)	17	28%
Larger (Non-word repetition ≧103)	22	37%
Total	30	100%

To compare between the performance of children with larger phonological working memory and the performance of those with smaller phonological working memory for each condition, independent *t* tests were conducted. The results were summarized in Table 4.13. Overall, children with large phonological working memory seemed to get slightly higher comprehension scores than children with phonological working memory as shown in Figure 4.2, yet this difference was not significant.

Table 4.13: Comprehension scores of children with larger and smaller phonological working memory size measure by a non-word repetition task

		Phonological working memory size	
		Larger	**Smaller**
General	*n*	22	21
	Mean	2.455	1.905
	SD	1.654	1.091
$t_{(41)}$= -1.292, *p*=.204			
Specific	*n*	22	21
	Mean	2.636	2.286
	SD	1.432	1.347
$t_{(41)}$ =-.826, *p*=.414			

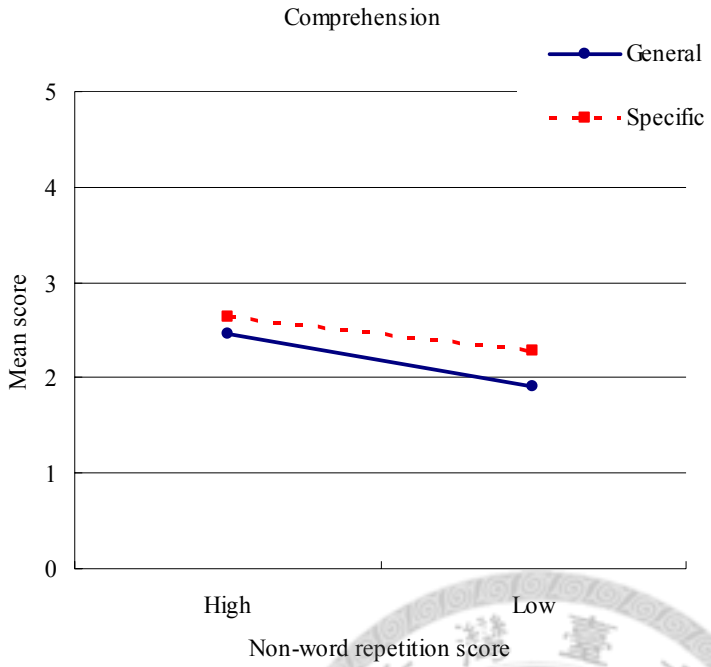

Figure 4.2: The mean scores of groups with different non-word repetition scores for each condition

4.2.3.3 Correlation between age, PPVT, non-word repetition, and comprehension

To clarify the correlations among all the measures and the comprehension score, a correlation analyses were conducted on the scores of all the measures of the sixty children. The results were showed in the correlation matrix in Table 4.14.

The correlations between the comprehension task and all the other measures on subject variables were inspected. Overall, results revealed a significant correlation between the PPVT-R score and the comprehension score[17]($r = .327$, $p < .05$); in contrast, the correlation between the non-word repetition score and the comprehension score was

[17] Each participant's comprehension score was calculated by summing up the *breaking* score and the *carrying* score.

not significant (r = .186, p = .156). In addition, there was no significant correlation between these subject variables: age, the PPVT-R score and the non-word repetition score.

Table 4.14: Correlation matrix for subject variables and dependent variables

	1	2	3	4
1. age	1	.041	-.028	.155
2. PPVT-R		1	.216	.327*
3. Non-word repetition			1	.186
4. Comprehension score				1

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed).

4.2.3.4 Regression analyses

Table 4.16 summarized the results from hierarchical multiple regression analyses on children's performance on the comprehension task using the comprehension score as the dependent variable and the PPVT-R score, the non-word repetition score and age as the independent variables. In the first round of the multiple analyses, the non-word repetition score was entered as the first step, followed by PPVT-R score, and age. In the second round, the entry sequence of the PPVT-R score and the non-word repetition score was reversed. In each analysis, the additional contributor, age, was entered after the two variables. The results showed that PPVT score directly contributed to the performance on the comprehension whereas neither of age and the non-word repetition score was a reliable predictor for the comprehension score.

Table 4.15: The hierarchical multiple regression analyses with comprehension score as the dependent variable

Independent Variables	R^2	$\triangle R^2$	$\triangle F$	p	$\triangle F\ p$
Non-word repetition	.034	.034	2.069	.156	.156
PPVT-R	.121	.087	5.616	.025	.021
Age	.143	.022	1.407	.034	.241
PPVT-R	.107	.107	6.965	.011	.011
Non-word repetition	.121	.014	.897	.025	.347
Age	.143	.022	1.407	.034	.241

	Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
	B	Std. Error	β	t	Sig.	Tolerance	VIF
(Constant)	-6.929	7.069		-.980	.331		
PPVT	.067	.029	.294	2.319	.024	.951	1.051
Nonce word and	.011	.011	.126	.994	.324	.952	1.050
Gap word age	.005	.004	.147	1.186	.241	.997	1.003

4.2.4 Order effect in the comprehension tasks

It was also examined whether the presence of prior training of verbs with a different degree of specificity affected the performance in the comprehension task. The criteria for the categories "first" and "second" in Table 4.16 were identical to that in Table 4.6. The category "first" indicates that no prior training sessions were

administered. On the other hand, for the General Condition, *second* indicates that a prior training session of specific words was administered before the stimuli for the general verb were presented; for the Specific Condition, "second" means that there was a prior training session of a general verb before stimuli for the specific verbs.

Table 4.16 summarized results from different orders for presenting stimuli in the comprehension task. No significant difference between orders of presentation was found for learning the general verb ($t_{(58)}$= -.764, p = .448). In contrast, when learning specific verbs, children who had been trained for a general verb before learning these specific verbs (i.e., the order, "second") got significantly lower comprehension scores than those who learned the specific verbs first ($t_{(58)}$ = -4. 029**, p < .0005).

In short, this result showed an asymmetrical order effect in this fast-mapping task. Specifically, the training of general word would have a persistent effect on the specific word which was going to be learned while the training of specific words did not have a symmetrical effect on the general words which was going to be learned. After being exposed to a general word, children might have an assumption that the words that they were going to learn were also general. This assumption may obstruct the full understanding about the specific words. For instance, after learning carrying verbs under the General Condition, children would predict that in the next session they were going to learn a general label that could cover a variety of actions. However, they were

actually going to learn specific words for breaking actions, and then they developed an incorrect understanding about semantic boundaries. The same is true for the case of learning carrying specific words: The experience of learning general breaking verbs may obstruct the full understanding about semantic distinctions between carrying specific words.

Interestingly, when children learned a general word, a prior training session of specific words might not have an effect on the performance on the general word. The possible account might involve the interaction between the effect from experimental setting and the experience from linguistic input in daily life. For instance, if these children acquiring Mandarin had encountered with specific verbs more frequently in daily life as argued by Tardif (2006a, 2006b), once they found the task seemed to demand them to learn general words, they might develop a strategy of learning general word to fit the expectation they thought the experiment required them to do. On the other hand, if children first learned the specific words, which were similar to their experience in daily life, they would not develop an experimental demanding strategy. However, this explanation needs more investigation since it remains unclear that whether Mandarin verbs are really typologically specific and we did not make comparisons between specificity of real verbs in Mandarin and that of the novel words.

Table 4.16: Comprehension scores of groups with different orders of presentation of stimuli

		Order of presentation [a]	
		First	**Second**
General	*n*	30	30
	Mean	2.367	2.633
	SD	1.299	1.401
$t_{(58)}$= -.764, p = .448			
Specific	*n*	30	30
	Mean	3.300	1.967
	SD	1.368	1.189
$t_{(58)}$ =-4. 029**, p < .0005			

[a] "First" represents the situation in which the word(s) to be learned was presented as the first set whereas "second" stands for the situation in which the word(s) to be learned was presented as the second set (see Table 4.6 for a detailed description).

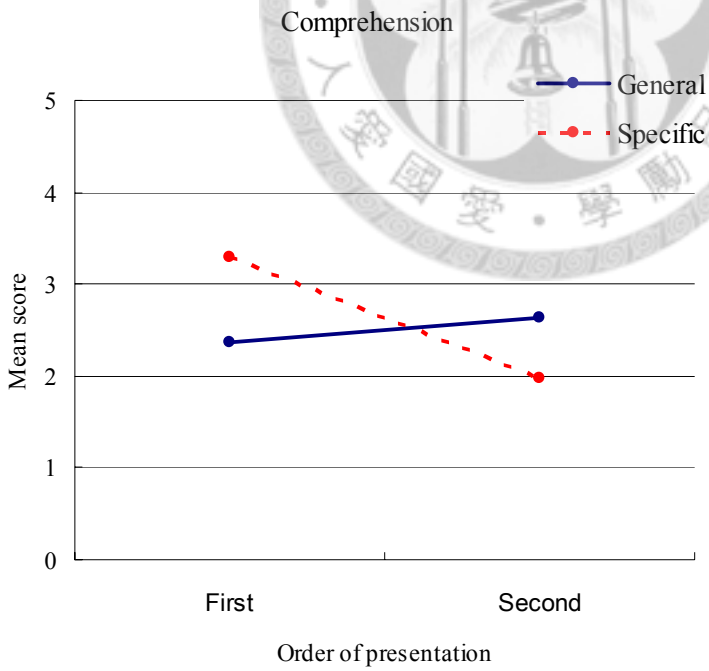

Figure 4.3: The mean scores of groups with different non-word repetition scores for each condition

4.3 Summary of results

Taken all together, findings from this experimental study showed when learning specific verbs, children did not benefit from the richer semantic information encoded. Also, results from the production task supported that children might be confused by semantic distinctions when learning specific words. Children overextended the specific word to the context in which the other word was supposed to be used. The comparison between the pre-test and the post-test for the baseline verb showed that when provided with an additional verb for another action in the conditioning training (i.e. trained under the Specific Condition), participants performed poorer in the post-test than in the pre-test whereas this retrogress in performance was not found in the General Condition. In addition, we found that children under the General Condition were significantly more likely to extend the use of novel word in the post-test than in the pre-test while this change was not found in the Specific Condition. It was also found that order in which the stimuli were presented and children's comprehensive vocabulary size measured by PPVT-R score seemed to have an impact on the tendency of performance on the extension task and performance on the comprehension task. The order effects and the impact of vocabulary size implied a dynamic process of building word meaning.

Chapter 5. General Discussion and Conclusion

5.1 Does providing labels for contrasts between actions facilitate word learning in production and comprehension?

This study not only provided evidence on the mechanism of word learning but also provided some insights into cross-linguistic pattern of language acquisition in that two labeling patterns were offered for the same visual stimuli. This design was based on the view that semantic categories are often language-specific rather than reflect shared nonlinguistic cognitive ability (Bowerman & Choi, 2001; Malt et al., 1999). Nevertheless, it is still not sufficient to provide an explicit account for research questions like whether Mandarin verbs were specific or whether Mandarin children were more prepared to learn verbs.

Going back to our first research question, we found that specificity is not always facilitative. Results revealed that when learning specific verbs children did not benefit from the richness of semantic information. Instead, the additional label to mark the contrast actually confused children and contributed to poorer performance with the baseline verb in the post-test. Nevertheless, there were still a few participants under the Specific Condition successfully producing the target words though the word frequency for each verb was relatively low than that in the General Condition.

Also, it was found that in the beginning children learning specific words might have an incomplete understanding about the semantic boundaries of the target verbs. When an additional specific word was provided, children did not draw clear-cut semantic distinctions marked by the different labels though they might make attempt to produce it. Children often overextended a specific word and used it to an action that was supposed to be referred to by the other novel word. This overextension of specific words contributes to the poorer performance in the post-test session than in the pre-test session. In addition, it was found that some children under the Specific Condition performed poorer in the post-test than in the pre-test, suggesting a possible confusion by the greater amount of semantic information.

In contrast, this retrogress in performance on the baseline verb was not found in the comprehension trials in both the General Condition and Specific Condition. On the other hand, most children had a robust understanding about word meaning when learning a general word or two specific words, and they could produce at least one word after exposure to an additional label for the contrast.

Gap between results on different tasks

Different learning patterns were found from results on different tasks. As for accuracy in the production task, a significant drop in the post-task was found in the Specific Condition, yet the performance in the post-test in the General Condition was

similar to that in the pre-test. However, as for the number of target words produced and the performance on the comprehension task, similar patterns in the Specific Condition and the General Condition were found.

This implication could be applied to provide an account about different conclusions about the relationship between specificity and word meaning drawn from different studies. Studies from productive vocabulary inventories (e.g., CCDI) might reveal a higher proportion of verbs in early vocabulary of Mandarin-acquiring children (Ma et al., 2009; Tardif, 2006a) and arrive at a conclusion that Mandarin verbs are easier to learn than verbs in other languages. However, results from vocabulary inventories or productive data may not be informative about children's understanding of word meaning. On the other hand, if we focus on the difficulty from complexity of the meaning of a word, we might neglect the fact that children might be able to produce the word though it is sometimes produced in an inappropriate context. According to Clark (1993, p. 32), "Children do not start out already knowing the meanings of the words they are attempting to pronounce and use... children's earliest mappings of meanings onto forms diverge from adult usage in a variety of ways." Results in this study conformed Clark's view that children's production of a certain word may not guarantee a full understanding of its meaning. Therefore, when describing that a cue would lead to the ease of word learning, one should clarify the aspect it affects.

Difficulty in forming semantic boundaries

In addition, the difficulty of distinguishing between meanings of two similar action verbs is an important issue aroused here. Many studies have recognized this difficulty of "semantically complex" words, one of which was conducted by Clark (1973) who argued that the difficulty comes from not mastering specific features yet. Also, many researchers have made efforts to explore why children have difficulty distinguishing words sharing much information. For instance, Bowerman & Choi (2001) found children sometimes generalize spatial words too narrowly and sometimes generalize too broadly although they are sensitive to semantic boundaries in their input language. They further concluded that nonlinguistic spatial conceptualization sometimes interacts with children's semantic structure although not shaping it directly. However, though findings from this study suggested that children have difficulty in distinguishing between specific words, it remains unclear what contributes to this difficulty.

5.2 Are children learning specific words less likely to extend the use of novel words?

This study also examined whether children under different conditions of labeling patterns developed different strategies for extending words as Brown (2007) argued when discussing cross-linguistic differences in specificity of early words. Results in this study revealed a significant difference in performance on the extension task between the

General Condition and the Specific Condition. It was found the training of a general word seemed to facilitate extending uses of novel words whereas the training of specific words did not. This finding supported Brown's (2007) proposal that different degrees of specificity in input contribute to different extending strategies.

Also, our results showed that the order of presentation of stimuli and children's vocabulary knowledge might make a difference in their mapping or extension strategies. The first finding is that if children got prior input for specific labels, they were more reluctant to extend the word even when they were presented with a general word at that time. One possibility is that the training of specific verbs would give children the impression that every fine distinct action would have a name. That is, the prior training session facilitates a one-to-one mapping strategy. Thus, when these participants were shown a different --even slightly-- action they might suppose that there should be another name for it. Another finding is that when children learned a specific word, they were more likely to extend the word to other contexts if they had been shown another set of a general word.

However, the effect of prior training seemed not asymmetrical across action types presented in the training sessions. The effect of prior training of specific words on extending uses of a general word was only observed in the extension task for the general carrying label but not the general breaking label; in contrast, the effect of prior training

of a general word on the extending of specific words only exist in the extension task for the specific breaking labels but not the specific carrying labels. This asymmetrical order effect might have something to do with *pre-emption* (Clark, 1990). Mandarin has existing words for the stimulus for the extension test of carrying verbs whereas there seem no appropriate words to refer to the stimulus for breaking verbs[18]. The reason that the facilitative effect of a prior training of a general word did not exist in the specific carrying verbs might be that children tended to use their own words to refer to the action instead of using the newly learned novel word.

This finding suggested that it is likely that the learning mechanism of meaning involves the interaction between knowledge about existing words and perceptual cues. Therefore, we also conducted analyses to see if there was an effect of prior vocabulary knowledge. Results showed that children with larger vocabulary were more reluctant to extend the words. Two competing accounts have been proposed. One possibility is that children with larger vocabulary had more word choices to respond and thus did not use the newly-learned words, while the other is that children with larger vocabulary were more influenced by language experiences. The latter account is based on the assumption that experience of acquiring Mandarin inhibits extension of newly-learned words,

[18] For these trials testing extending uses of the specific carrying words (Trial 2 and Trial 5 in the production task), children used words like *ná* 'grasp/take' and *dài* 'bring', which actually encode the body part involved or which are appropriate to label the action used as the stimulus in the extending task for the carrying action (see No. 4 in Appendix 4 (b)).

supporting Brown's hypothesis that typological specificity of verbs affects children's willingness to extending verbs.

Taken as a whole, Brown's (2007) proposal that different patterns of specificity lead to different tendencies in extending words was supported by the differences between the General Condition and Specific Condition found in the results from the fast-mapping procedure. Also, effect of order of presenting stimuli as well as an impact of prior vocabulary knowledge supported that Brown has a point in the mechanism of lexical learning: Language input did have effect on extension of a newly-learned word. Nevertheless, further research is needed to clarify how children's extending uses were affected by linguistic experiences.

5.3 Word learning as a dynamic process

Order effects and the effect of comprehensive vocabulary size not only existed in the extension of words but also were found in performance on the comprehension task. We have proposed that order effect resulting from the experimental setting seemed to provide implications about word learning in the real life though more research would be needed to argue for the relationship between the performance in experimental settings and that in the process of language acquisition. These effects supported that word learning is a dynamic process in which the semantic boundaries between words and assumptions about word meaning are always shifting and shaped by language

experience. Specifically, findings from this study supported Bowerman's view that language-specific semantic partitions are available to children (Bowerman, 1996) though it takes time to develop a semantic structure of lexical boundaries similar to adults'.

However, although this study that found vocabulary size might make a difference in children's performance, further studies would be required to clarify this issue since vocabulary size was not designed as a variable in the experiment, and thus the sample size of children in both groups with larger and smaller vocabulary was small, which might lead to little power of statistical tests.

5.4 Future study

5.4.1 Syntactic factors

This study does not aim to solve why specificity is easy or hard, instead it aims to explore how it affects word learning and in what aspect it affects on the basis of findings from the fast-mapping task. Thus, this study controlled other factors that involved in language uses such as syntactic factors. As mentioned in 2.3.1, previous studies have shown that specificity involving the different degrees of reliance on syntactic cues (Gordon & Dell, 2003) and verbs that differ in specificity may have different tendencies in their argument structure (Brown, 2007). In the experiments conducted in this study, the general verbs and the specific verbs for stimuli had exactly

the same argument structure and syntactic behavior throughout the experiments. This design thus not only allowed us to focus on the semantic factor but leave room for further research on the interaction between syntactic factors and specificity.

5.4.2 The role of individual difference

In addition, this study found that children with larger vocabulary got significantly higher comprehension scores than children with smaller vocabulary when learning a general action word. It is an interesting issue what kind of ability that experienced children would have to facilitate performance on the comprehension task. This issue requires further investigation since we did not specifically manipulate this variable in this study.

5.4.3 Specificity on a continuum

It has been recognized that specificity is a relative idea and can be examined in different levels (Breedin et al., 1998). One may argue that there is a basic level where specificity works to facilitate word learning in that the verbs at this level are easier to be imaged and thus toddlers can easily detect semantic contrasts whereas verbs at other levels are less important or the contrasts are too subtle to be observed. In other words, specificity effect may only apply to some particular level in a semantic structure. Nevertheless, due to the complexity of this issue involved, we did not manipulate specificity at different levels here. Instead, the differences in specificity between two

conditions provided in this study is similar to the difference between general verbs and specific verbs in Breedin et al.'s (1998) study rather than between light verbs (e.g., *make*, *go*, and *do*) and specific verbs. Thus, there is still room for further analysis on how the effect of specificity works on word learning at different levels in a semantic hierarchy.

5.4.4 The role of frequency

Input frequency as a possible confounding factor in this study should be tested in further research. Lower Input frequency for an individual word in the Specific Condition would contribute to the difficulty in learning the specific words in the fast-mapping procedure. Our results showed when learning the specific words, children had difficulty in producing target words in appropriate contexts. Consequently, it is likely that children learning specific words might be hindered by low frequency rather than by semantic specificity. In addition, the briefness of the training sessions might hinder children's understanding about semantic boundaries. To clarify the possibilities, frequency alone should be manipulated as a variable in future studies. Exploring the possible effect of input frequency would shed light on the role of specificity in the lexical development.

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Appendices

Appendix 1: Counterbalancing of the two actions shown in the training session

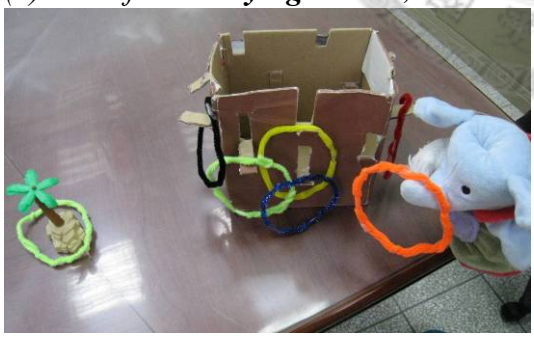
	Order 1		Order 2		Order 3		Order 4	
Sequence	Condition	*n* [a]	Condition	*n*	Condition	*n*	Condition	*n*
1st action	Carry General	1	Carry Specific	2	Break General	1	Break Specific	2
2nd action	Break Specific	2	Break General	1	Carry Specific	2	Carry General	1
No. of participants	15		15		15		15	

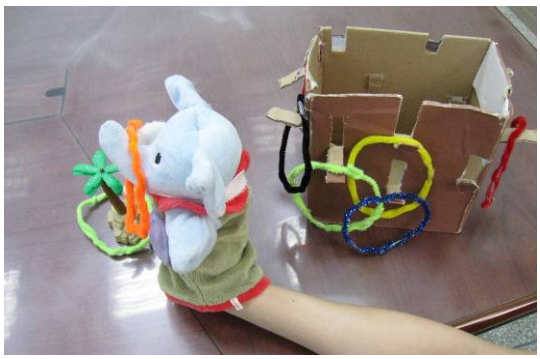
[a] *n* represents the number of words to be learned.

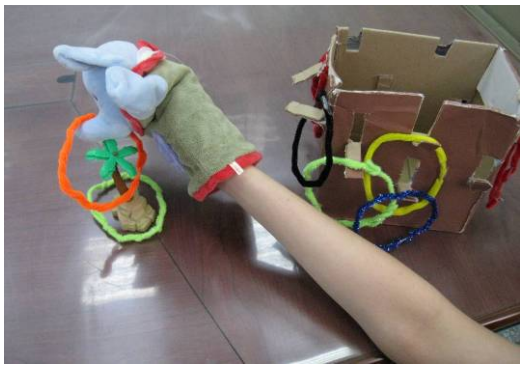
Appendix 2. Actions adopted in the training sessions

*(a)One of the **breaking** actions, the other of which was carried out with the puppet's ear*

*(b) One of the **carrying** actions, the other of which was carried out with the puppet's ear*





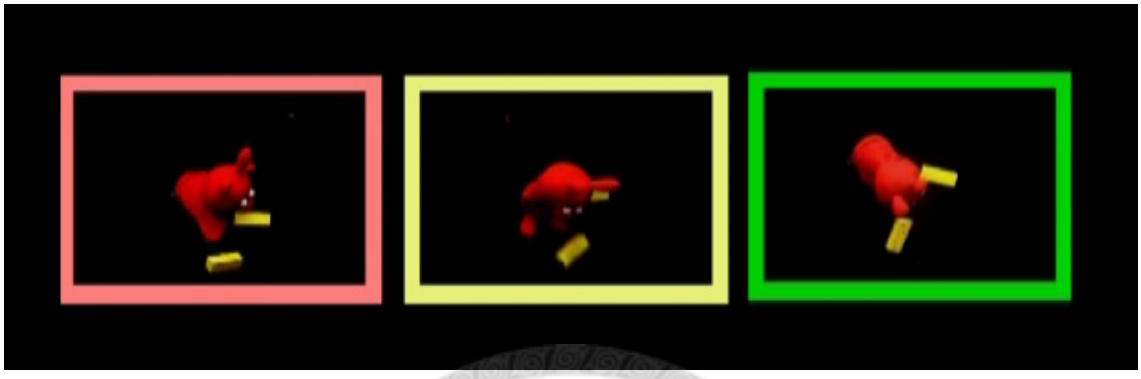


Appendix 3. Video clips in test trials in the comprehension task

(a)The breaking action

No.1

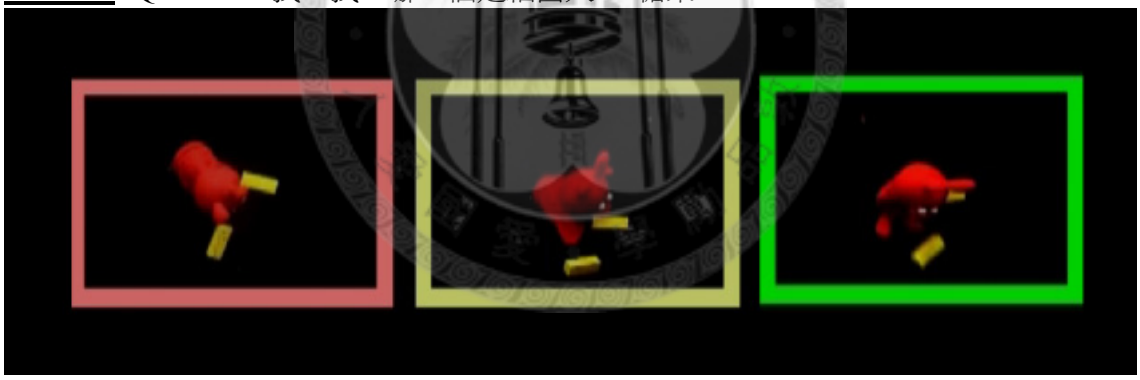
General: Question: 找一找，哪一個是細菌人 *dē* 糖果?



Specific: Same video/ Same question

No.2

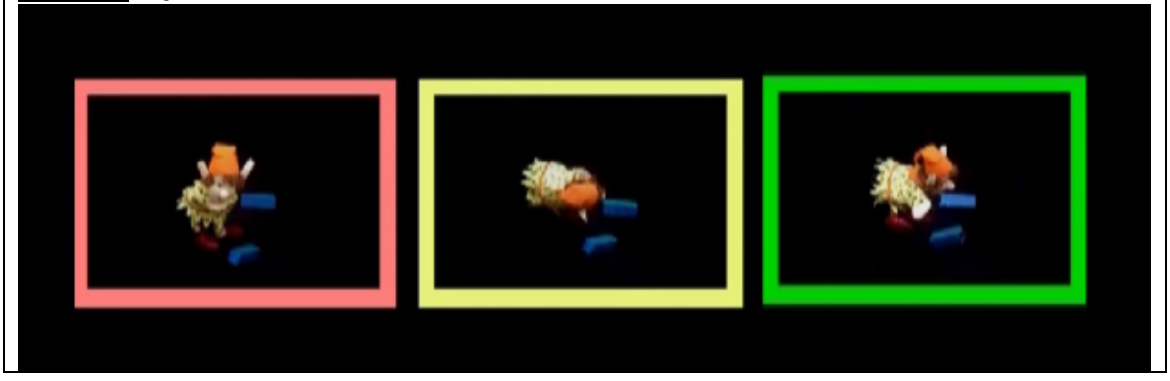
General: Question: 找一找，哪一個是細菌人 *dē* 糖果?



Specific: Same video/ Same question

No.3

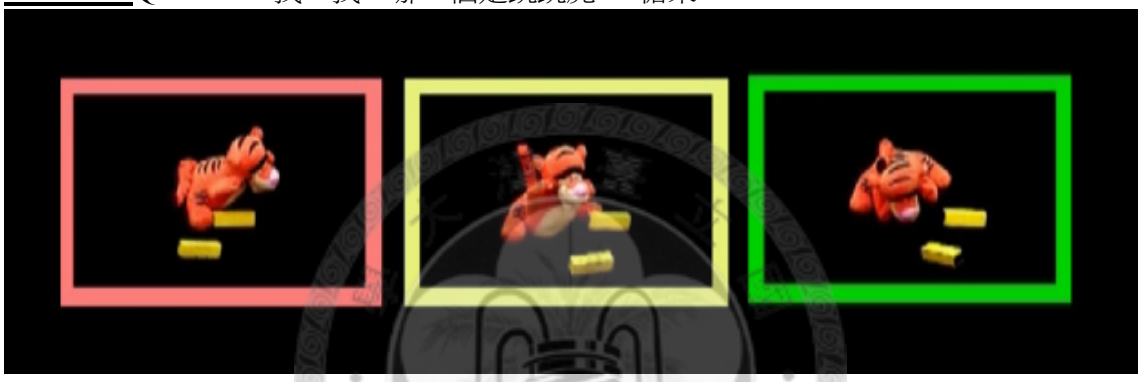
General: Question:找一找，哪一個是小矮人 *dē* 糖果?



(No.3) <u>Specific</u>: Different video/Same question

No.4

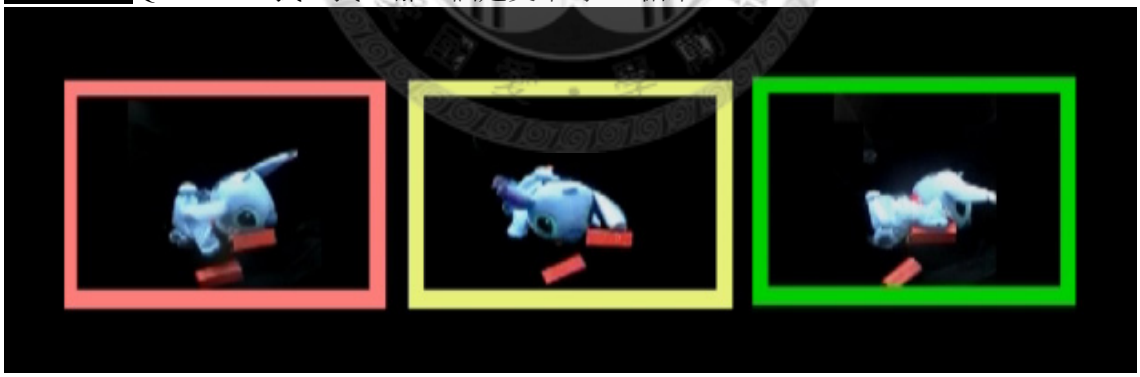
<u>General:</u> Question: 找一找，哪一個是跳跳虎 *dē* 糖果?



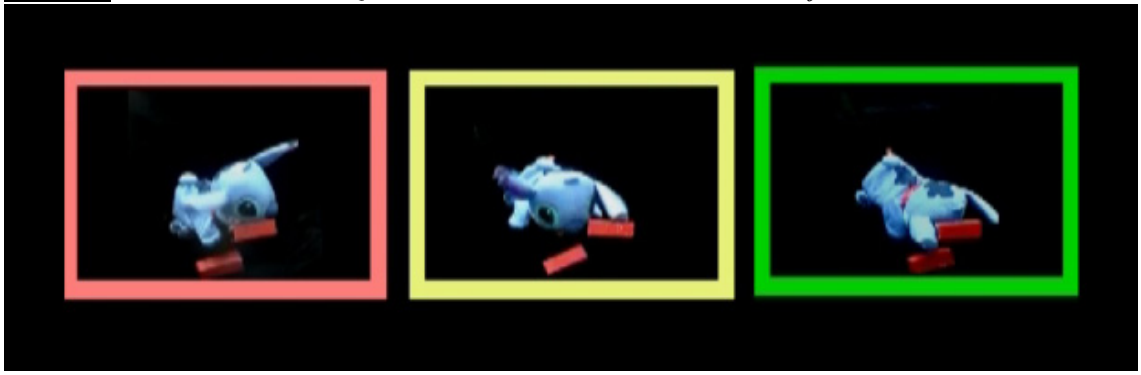
<u>Specific</u>: Same video/ Question:找一找，哪一個是跳跳虎 *fō* 糖果?

No. 5

<u>General:</u> Question: 找一找，哪一個是史蒂奇 *dē* 糖果?



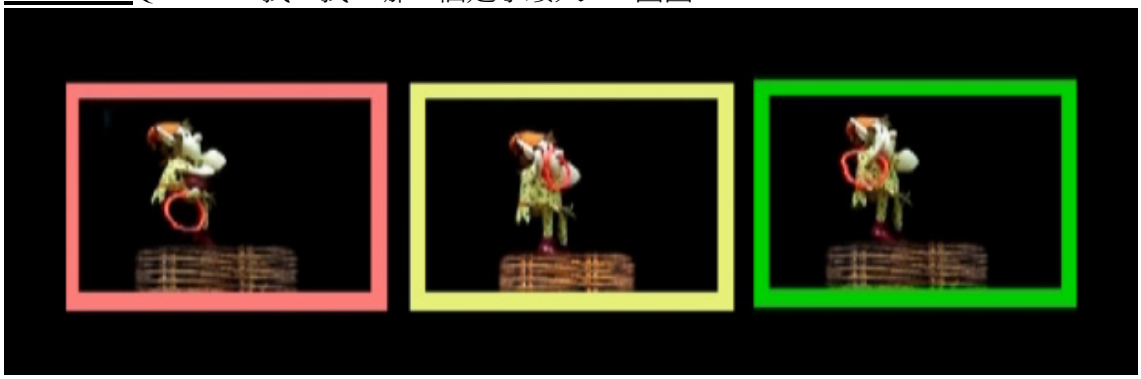
<u>Specific</u>: Different video/ Question: 找一找，哪一個是史蒂奇 *fō* 圈圈



(b)The carrying action

No.1

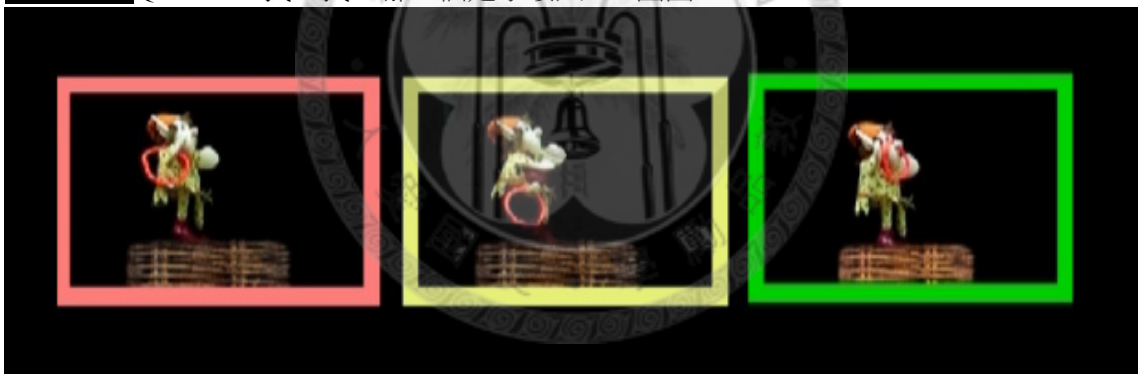
General: Question: 找一找，哪一個是小矮人 *mū* 圈圈?



Specific: Same video/ Same question

No.2

General: Question: 找一找，哪一個是小矮人 *mū* 圈圈?

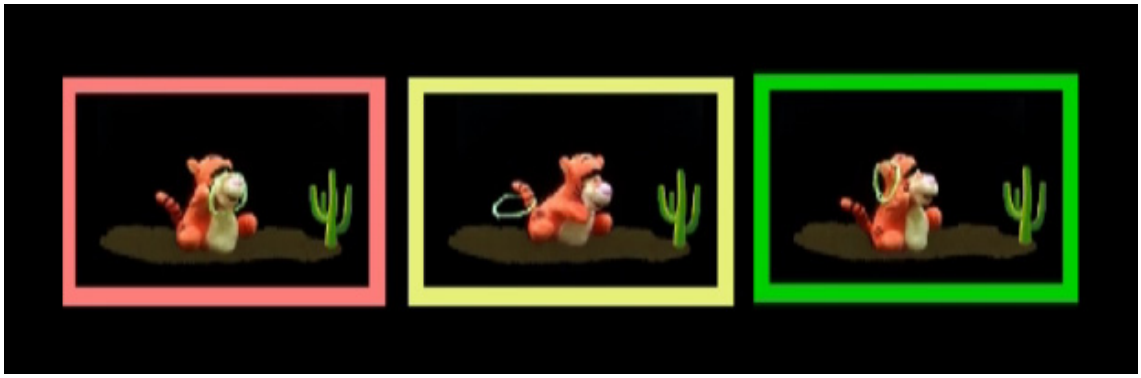


Specific: Same video/ Same question

No.3

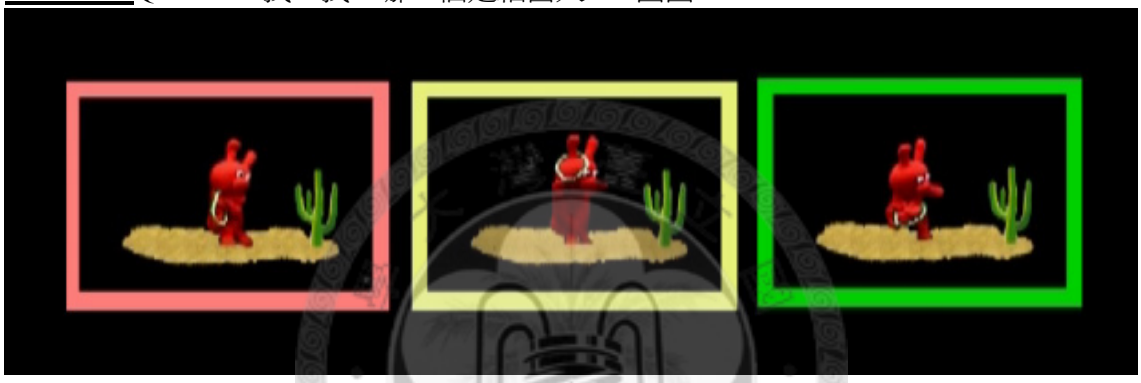
General: Question: 找一找，哪一個是跳跳虎 *mū* 圈圈?

(No.3) Specific: Different video/ Same question



No.4

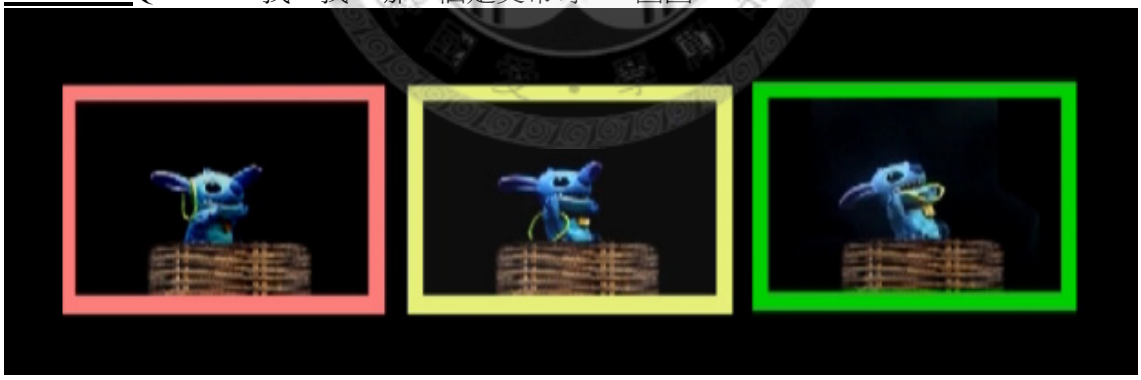
General: Question: 找一找，哪一個是細菌人 *mū* 圈圈?



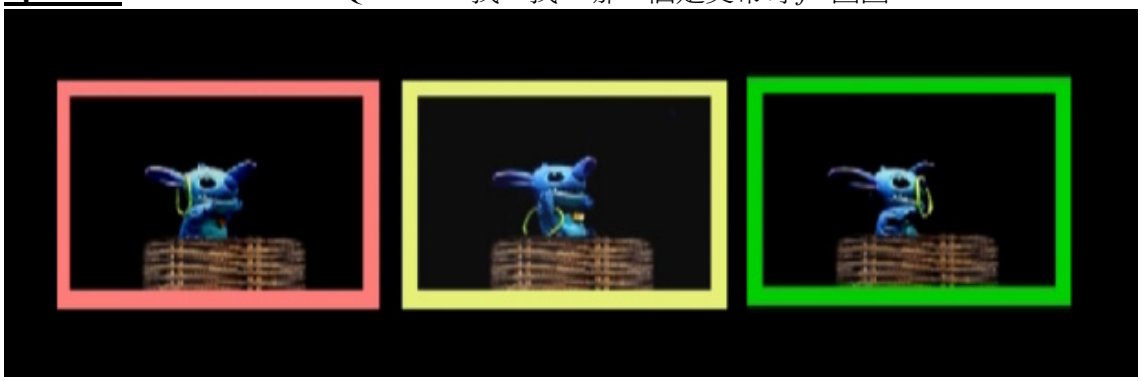
Specific: Same video/ Question: 找一找，哪一個是細菌人 *fō* 圈圈?

No. 5

General: Question: 找一找，哪一個是史蒂奇 *mū* 圈圈?



Specific: Different video/ Question: 找一找，哪一個是史蒂奇 *fō* 圈圈?



Appendix 4. Video clips in test trials in the production task

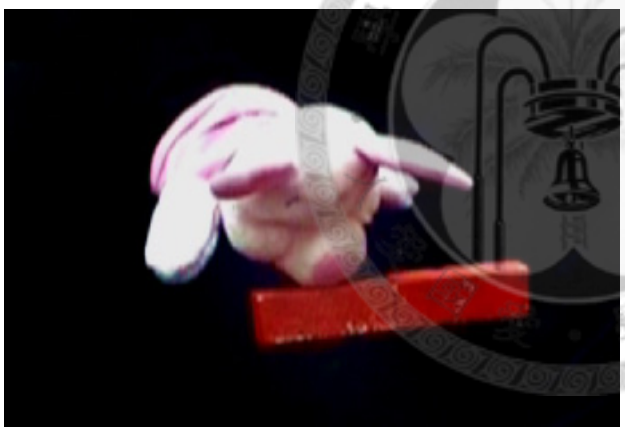
Question: 看看小豬做什麼呀！

(a)The breaking action

No. 1(pre-test), 3 (post-test)

No. 4 (post-test)**<u>General</u>:** testing the performance on the baseline word (*dē*)

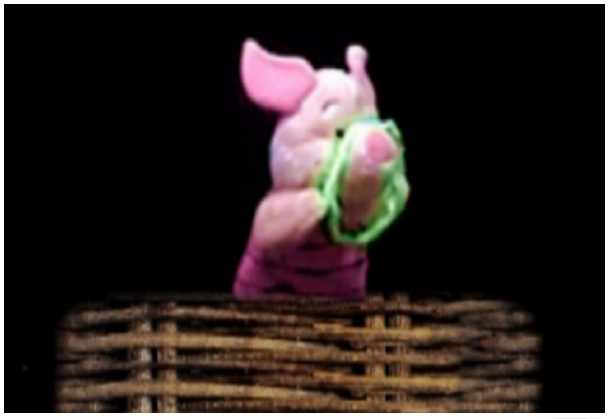
<u>Specific</u>: testing the performance on the additional word (*fō*)



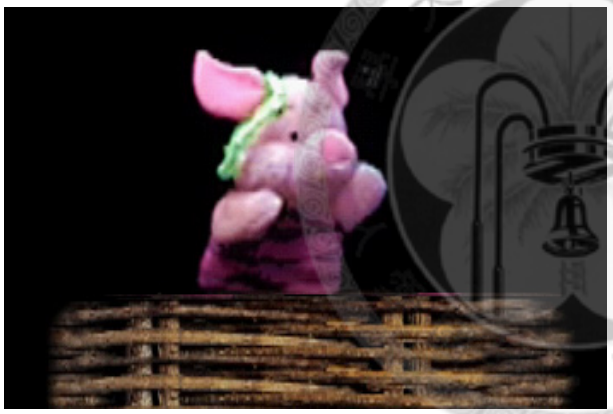
No. 2 (pre-test), 5 (post-test)

(b)The carrying action

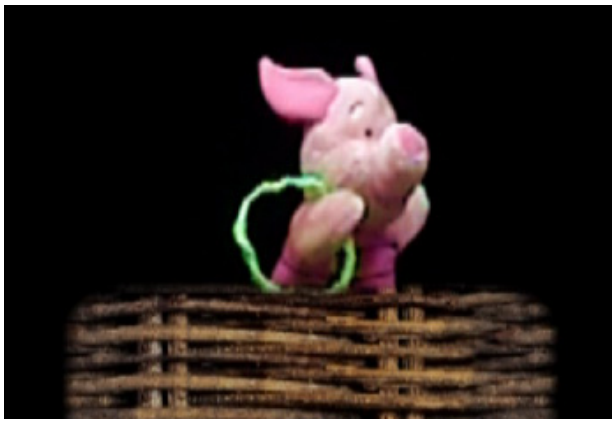
No. 1(pre-test), 3 (post-test): testing the performance on the baseline word



No. 4 (post-test)**General:** testing the performance on the baseline word (*mū*)
Specific: testing the performance on the additional word (*fō*)



No. 2 (pre-test), 5 (post-test): testing the extending uses of the novel words



*Stimuli for the test trials in the production task were the same between the Specific Condition and the General Condition)

Appendix 5. Instructions in the training sessions

Instructions when introducing the hand puppet and carrying the target action for the first time

The breaking action

你看喔，這個是小黑，這個是外星魚，外星魚最喜歡吃的東西是糖果，是像這種糖果喔。今天小黑要餵糖果給外星魚吃，可是他的手受傷了，不過他很厲害喔，他還是可以 *dē* 糖果喔！你看，小黑要 *dē* 糖果喔！你看，他剛剛 *dē* 糖果耶！

The carrying action

你看喔，這個是大象寶寶，他的手受傷了，不過他很厲害喔，他還是可以 *mū* 圈圈，像這種圈圈喔！你看，他要 *mū* 圈圈喔！就像這樣，大象寶寶 *mū* 圈圈走走走耶！

Instructions when carrying out the actions

The breaking action

小黑回頭一看，哇，還有一個有**[點點/星星/愛心/小花/條紋]**的糖果耶，你看，小黑要 *dē* 糖果喔！你看，他剛剛 *dē* 糖果，小黑是不是很厲害呀！小黑 *dē* 糖果耶！[a]

The carrying action

大象寶寶回頭一看，哇！還有一個**[紅/黃/藍/綠/橘]**色的圈圈耶，他就走回去，你看，他要 *mū* 圈圈喔！就像這樣，大象寶寶 *mū* 圈圈，你看，大象寶寶 *mū* 圈圈走走走耶！

[a] *fō* would be used for the second type of action if the participant was assigned into the Specific Condition

Instructions to invite children to carry out the action

The breaking action

好，現在你來當小黑，小黑來 *dē* 糖果好不好？很好，小黑 *dē* 糖果耶！

The carrying action

好，現在你來當大象寶寶，大象寶寶來 *mū* 圈圈好不好？很好，大象寶寶 *mū* 圈圈耶!