

Language and thought : classifier effect in early and late bilinguals

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Language and Thought:
Classifier Effect in Early and Late Bilinguals

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ABSTRACT

Classifiers have been found to influence the conceptual organization of speakers of Mandarin Chinese, which can also be termed the classifier effect. As such, studies have deemed classifier categories to be conceptual categories and not arbitrary systems. Hence, it is argued that classifier system is a distinguished grammatical form of word class in Mandarin Chinese that serves a semantic function in categorizing objects. This in turn, draws a direct link of interest to the theory of linguistic relativity (i.e. Sapir-Whorf hypothesis), as this meant that speakers of classifier languages could possibly categorize objects and think about the world differently as compared to speakers of non-classifier languages. Support has been found for linguistic relativity with studies showing that Chinese speakers used implicit knowledge of classifier categories and group objects that shared the same classifiers to be more similar to each other. On the other hand, this view has also been opposed by studies that provided evidence that classifier relations are not as dominant and salient as taxonomic relations. Therefore, claiming that the effect of classifier categories is limited.

Following what previous studies have found, this current study is interested in determining the degree of classifier effect, albeit expected to be smaller than that of taxonomic relations. Also, this study extends to the area of bilingualism, looking at Chinese and English early and late bilinguals. Singapore and People's Republic of China (PRC) participants were recruited, making up the early bilingual and late bilingual groups respectively. Prime-target noun pairs bounded by three different conditions, functional or thematic related, classifier related and unrelated conditions were used as the stimuli. A rating of relatedness task, and recall of nouns task based on the prime-target noun pairs formed the basis of these experiments. It was found that for both tasks, only functionally or thematically related prime-target noun pairs exhibited a

significant difference in the responses of the participants, compared to the other two conditions. For the rating of relatedness, results showed that PRC participants exhibited a classifier effect as they rated classifier related noun pairs to be more similar than the unrelated noun pairs. However, classifier effect was not found for the recall task for the PRC participants. In comparison, results for the Singaporean participants were similar for both tasks and no classifier effects were found. Implications from the results suggest that classifier effect is present, but in a weak manner.

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1. INTRODUCTION

The classifier categories in Mandarin Chinese make up a comprehensive system that serves to denote quantities of nouns, and its usage is obligatory. Beyond this grammatical function, it appears that the usage of classifiers in Chinese is built on a system of categorization of the nouns that they are commonly attached to. For instance, 条 *tiao* is usually used for nouns that are of a certain shape, such as being long and slender. Hence, the classifier system has been claimed to possess a semantic function that influences the categorization of conceptual categories within its speakers. Interestingly, it seems to be intuitive within a native speaker of a classifier language on which classifier to use when given novel objects to categorize (Allan, 1977:290). This shows that there is an underlying principle in the usage of classifiers and that it is not an arbitrary system. Studies have thus, been interested to look at whether classifiers can be a determining factor in influencing the categorization of objects.

What motivated this study is the interest in examining the question on how language plays a part in influencing thought. According to Tai (1994), the classifier system offers a great platform to examine interactions between cognition and language, and between culture and language. Hence, by determining the semantic functions of classifiers and the degree of influence it can exert on the categorization of objects within individuals, it can possibly provide insight on answering questions pertaining to the Sapir-Whorf hypothesis, or linguistic relativity.

Previous studies (e.g. Saalbach and Imai, 2005; Gao and Malt, 2009) that looked at linguistic relativity in relation to classifier effect have shown that taxonomic relations are more salient and generally used more frequently and dominantly in cognitive functions (e.g. in terms of organizing thought processes). For the purpose of this study, prime and target nouns pairs will be created and they are based on three different conditions: (i) functionally or thematically related, (ii) classifier related and (iii) unrelated. Subjects will be tasked to perform a rating of relatedness on the prime-target noun pairs, followed by a recall task of the target nouns. Following what has been found in previous research, it is hypothesized that:

- (1) Functional or thematic related prime-target noun pairs will be rated as more similar, and recalled better, compared to the classifier related and unrelated conditions.

Although taxonomic relations has been found to be the governing factor in conceptual organization, still, studies have been done that show support for the presence of classifier effects (e.g. Kuo and Sera, 2009). Also, by extending the study into looking at early and late bilinguals, we will be able to see if

classifier effects will be great enough to possibly still create an effect when two language systems are present within an individual. Thus, it is further hypothesized that:

- (2) If classifier effect exists, classifier related noun pairs will be rated as more similar and recalled better than unrelated noun pairs.
- (3) PRC participants (late bilinguals) will rate the classifier related noun-pairs to be more similar and recall of the classifier related target nouns will be better, compared to the Singaporean participants (early bilinguals)

2. LITERATURE REVIEW

2.1 Semantic Analysis of Chinese Classifiers

There are a considerable number of classifier languages being spoken around the world and among them, some similar and consistent features that mark them as classifier languages can be observed. For instance, a common characteristic among classifier languages is that nouns are often grouped based on certain characteristics and in order to determine which classifier to use would be based on those characteristics. There are generally four types of classifier languages: (i) numeral classifier languages, (ii) concordial classifier languages, (iii) predicate classifier languages and (iv) intra-locative classifier languages as identified by Allan (1977:286). Chinese belongs to the group of numeral classifier languages as nouns typically have to be preceded by a classifier in order to denote quantity. Take a look at the following examples:

- | | | | |
|-----|-------------|------------|------------|
| (1) | 三 | 颗 | 豆 |
| | <i>san</i> | <i>ke</i> | <i>dou</i> |
| | NUMBER | CLASSIFIER | bean |
| | Three beans | | |
| | | | |
| (2) | *三 | 豆 | |
| | <i>san</i> | <i>dou</i> | |
| | NUMBER | bean | |
| | Three bean | | |

Considering expression (1), it can be seen that the classifier must precede the noun that it is referring to and without which, it becomes ungrammatical as in (2). Hence, Chinese can be said to be a language with a prevalent usage of classifiers, making it a language that is rich in classifier terms.

Beyond forming a grammatical category in Chinese and serving its syntactic role, it is also of interest in the area of cognitive studies to examine whether classifiers possess semantic functions, since different classifiers can be used with a single noun to point out critical characteristics of the referent (Allan, 1977:290). This would thus, imply that classifiers are meaningful units and possibly, a device in categorizing nouns. This idea has also found support from Tai (1994:481), who claimed that classifiers do serve the function of categorizing objects that they are referring to, based on its salient perceptual properties. Most studies have thus, attempted to analyze Chinese classifiers from a semantic point of view. Sun (1989) suggested that Chinese classifiers can be divided into two main groups with

different semantic functions, quantity and shape. Mensural classifiers are the ones that denote quantity of nouns it is being used to refer to (e.g. 斤 *jin*, 里 *li*), and shape classifiers are those that denote characteristics of the referent noun on the basis of size, thickness and some other physical properties (e.g. 根 *gen*, 片 *pian*). Tai (1994) identified the following cognitive categories governing the classifier system of Chinese, which consisted of animacy, shape, size, consistency and attributes referring to parts of the objects. Gao (1998) in his study then, identified three distinct categories namely, classifiers with clear defining features (e.g. 辆 *liang*, 本 *ben*), classifiers which denote a prototypical structure of the object it is referring to (e.g. 颗 *ke*, 条 *tiao*) and lastly, classifiers with no clear-cut usage or are arbitrary (e.g. 尊 *zun*, 桩 *zhuang*). A more recent study by Song (2009) pointed out several semantic structures of classifier categories, looking specifically in the area of body parts. For instance, 颗 *ke* originates from the head to mean “small head”.

Because Chinese classifiers make up a complex system and the usage is not standard in some instances, there have been no consistent and definite categories being drawn. Nonetheless, there are still some core classifier categories that have been identified. Also, before defining the classifier categories that will be used as the focus of this study, it is also imperative to address the fuzzy boundaries between measure words and classifiers. While some studies used them conjunctively and included classifiers to be a subcategory of measure words on the basis of Chao’s (1968) definition and classification of classifiers (e.g. Sun, 1989; Zhang and Schmitt, 1998; Gao, 1998), others are careful to make a distinction (e.g. Tai, 1994; Song, 2009). For the purpose of this study, these two terms will be treated separately following what has been defined by Song (2009:38-41), in that measure words are terms that focuses on quantity whereas classifiers are those that considers the intrinsic properties of the objects. For instance, the measure word, 里 *li* is generally used as a standard measure for distance, indicating miles. On the other hand, classifier terms such as 根 *gen* is used for objects with the inherent property of being long and slender. Hence, it is necessary that measure words are excluded from the analysis since this study is interested in examining the semantic functions of classifiers, and measure words do not necessary evoke a mental representation like classifiers do.

Following what has been identified from the previous studies, the list of classifiers generated for this study should be governed by prototypical or more salient features like shape, and also possess a restricted usage. See Table 1 for the list of 13 classifiers generated with their dominant semantic features.

Table 1 Classifiers and their Semantic features

Classifier	Semantic feature	Examples of typical objects
条 <i>tiao</i>	Long, slender, strip-like	Rope, braid, necklace
粒 <i>li</i>	Small and rounded	Pearl, sand, bean
朵 <i>duo</i>	No definite shape	Cloud, mushroom
把 <i>ba</i>	Able to be grasped or held	Umbrella, gun, scissors
张 <i>zhang</i>	Flat surface	Desk, paper, card
块 <i>kuai</i>	Objects of regular shape, medium sized	Biscuit, stone, wood
架 <i>jia</i>	Frame-like	Airplane, piano, camera
枚 <i>mei</i>	Rounded piece	Coin, stamp, ring
支 <i>zhi</i>	Rod or stick-like shape	Pen, twig, branch
座 <i>zuo</i>	Seat or platform like	Hill, building
颗 <i>ke</i>	Bead-like shape or small objects	Tooth, star, bullet
顶 <i>ding</i>	Top of the head	Hat, crown
根 <i>gen</i>	Root-like and long shape	Cigarette, grass, candle

2.2 Classifier Effect in Conceptual Organization and Linguistic Relativity

As discussed in the earlier section, classifiers do seem to exhibit its influence in the process of categorization in its speakers. Hence, studies have been done to address the pertinent question of whether is the classifier system a system based on conceptual categories or is it an arbitrary system with no definite rules in its usage. Support for this view came from a study done by Tai (1994), who looked at the use of different classifiers across Chinese dialects. He found that the differing usage of classifiers can be accounted for based on the systematic cognitive categories of classifiers. Hence, he concluded that Chinese classifier system does reflect conceptual structures within Chinese speakers, and that they are cognitively and semantically motivated. Also, in a study done by Gao (1998), who looked specifically at mental representations of Chinese classifiers, found that classifiers belonging to different types of categories gave rise to different mental representations of his participants. Therefore, he argued that classifier categories are conceptual categories, and not arbitrary.

Consequently, if classifier categories are meaningful and speakers of Chinese do organize objects based on these categories, this would be interesting and draws a direct link to the Sapir-Whorf hypothesis, i.e. the concept of linguistic relativity which states that language influences the way one thinks and conceptualized the world. It challenges the theory of Universal Grammar as according to

linguistics relativity, speakers of different languages do not perceive the world in a similar and consistent manner, but that their perceptions are shaped according to the languages that they speak. Hence, classifiers have become a favorable area of study in looking at whether speakers of classifier languages conceptualize and organize their thought differently from non-classifier language speakers.

Previous studies that investigated this area included a study done by Zhang and Schmitt (1998), in which they recruited Chinese and English native speakers as their subjects. They found that the Chinese speakers rated pairs that shared similar classifier relations as more similar in a paired-wise similarity judgment test, in comparison to the English speakers (See also Schmitt and Zhang, 1998). Kuo (2003) then examined the effects of classifiers on categorization, using shape as a measure of classifier effect, in comparison with taxonomic relations. Chinese native speakers from Taiwan and English native speakers from the United States were recruited for her study. Similarly, she found that when participants were asked to judge the similarity between three different objects, made up of a target and the other two choices being shape based and taxonomic relation based, Chinese speakers made more shape choices compared to English speakers. However, it was also found that not only did English speakers classify the objects based on taxonomic relations most of the time, Chinese speakers exhibited a similar trend too. A more recent study done by Kuo and Sera (2009) found similar results as well, but in the case of Chinese-English bilinguals (See Section 2.3 on bilingualism and classifier effect). Thus, it was concluded that linguistic relativity was supported as results showed that language does influence thought, but not to the extent of determining thought. Hence, findings from both studies demonstrated that Chinese speakers made use of their implicit knowledge of classifier categories as a device for categorization.

However, some studies presented conflicting results in opposition of the idea that classifier plays a critical role in the conceptual organization of speakers of its language. For instance, Saalbach and Imai (2005) used a similarity judgment and a property induction task which looked at whether classifier effect would be present when interference of the properties of the objects was present (See also Saalbach and Imai, 2006). They studied responses from three different groups of participants, made up of Chinese, German and Japanese speakers. They found that linguistic relativity was supported but on a relatively weak manner as the results were not consistent across all the experiments, and the Chinese speakers did not exhibit a classifier effect on the property induction task. On the contrary, all participants demonstrated similar performance based on taxonomic relations. Hence, Saalbach and Imai concluded that concept organization does not vary across cultures, as categorization

is mainly based on taxonomic relations. In a later study done by Gao and Malt (2009), they questioned how meaningful are classifier categories and whether by speaking a classifier language, will the speakers' concepts be shaped accordingly. Similar to Saalbach and Imai (2005), they reported mixed findings and therefore, concurred that classifier effect is limited. In addition, they commented that previous studies such as that of Zhang and Schmitt (1998) found strong classifier effects due to the biased selection of stimuli. As opposed to previous studies that focused their testing on similarity judgment tasks, Huang and Chen (2011) adopted a recalling of nouns task. Still, in a different domain of testing, results obtained were similar to that of Saalbach and Imai (2005) in that recalling of nouns based on taxonomic relations had the highest score, compared to classifier related nouns. Hence, they too concluded, that classifier categories might be ad hoc categories that are activated more in oral contexts.

Taking the findings of previous studies into consideration, it seems that taxonomic relation is the more dominant factor in conceptual organization compared to classifier categories. However, this is not to neglect the role that classifier categories can possibly play in the organizing of concepts within an individual. Hence, it is in the interest of this study to examine how pertinent is the effect of classifier categories and what determines and cause the variations of its effect in certain conditions as opposed to others.

2.3 L1 and L2 Activation in Bilinguals

It is believed that the effects of classifier categories can also be examined in the case of bilinguals, especially in the area of their second language usage. If classifier effects exist, then it is expected that depending on whether the classifier language is spoken as L1 or L2, it will possess different activations in varying degrees, thereby causing an interference when trying to categorize objects either in their L1 or L2. According to Bassetti and Cook (2011:160), bilingualism can affect concepts and categorization of objects, since objects are assigned to different categories for different languages. Evidence can be seen from Malt and Sloman (2003) that because of interference from L1 in non-native English speakers, they tend to categorize objects differently from English monolingual native speakers. Likewise, in the study done by Kuo and Sera (2009) as mentioned earlier, bilingualism effects can be observed in that the Chinese-English bilinguals rated shape choices to be more similar to the target object, compared to the English monolinguals and interestingly, the Chinese-English

bilinguals demonstrated a more similar performance to the English monolinguals when compared to the native Chinese speakers.

A study done by Rodriguez-Fornells et al (2005) also provided evidence that suggests that there can be an interference from the second language during a word production task in the first language. In addition, Athanasopoulos and Kasai (2008) also presented evidence from Japanese-English bilinguals. Japanese speakers have been found to categorize objects based on common material whereas English would classify objects more based on shape, given a choice between shape and colour. It was thus, found in this study that the Japanese-English bilinguals made more shape choices compared to the Japanese monolinguals.

Hence, in this study, focus will be on Chinese and English early and late bilinguals, looking specifically at whether there are differences in the responses influenced by classifier effect. According to the findings of the previous studies, it is thus, expected that for the early bilingual participants, responses will show a lesser degree of classifier effect as compared to the late bilinguals, who are native speakers of Chinese. This is because even though both groups are bilinguals of English and Chinese, it is expected that for the late bilinguals, there will be a smaller interference effect from the L2. However, for the early bilinguals, their contact with both English and Chinese came at an early age and thus, stronger interference effect will be expected in examining both their L1 and L2 activation. Therefore, as opposed to most previous studies which examined classifier effects within the monolingual groups, this study is interested in extending the research to bilinguals and determine if classifier effects will still be present, and whether it is affected by the number of languages that an individual speaks.

3. EXPERIMENT

A list of prime-target noun pairs sharing either one of three different relations, being functionally or thematically related, classifier related and unrelated was used as the stimuli. Experiment was carried out in two parts: participants were first asked to perform a rating of relatedness task on the prime-target noun pairs, and after which, a surprise recall test was administered. Both measures were adopted as they were deemed to be appropriate measures in determining conceptual organization within an individual. By observing the offline responses of both tasks, this study aims to see whether there is a difference in the responses elicited based on the relations governing the noun pairs, and in particular, the ones which are classifier related. It is expected that functionally or thematically related noun pairs will have the most number of noun pairs rated as related and being recalled, compared to classifier related and unrelated noun pairs. In addition, if classifier effect exists, and is modulated by the degree of activation between L1 and L2, then native speakers of Chinese (PRC participants), who are late bilinguals with English as their L2, will have more instances of recalling and rating the noun pairs sharing the same classifiers to be more related compared to Singaporeans, who are early bilinguals of English and Chinese.

3.1 Methodology

3.1.1 Participants

A total of sixty students from Nanyang Technological University, Singapore, participated in this experiment. Thirty participants were Singaporeans, and the other thirty participants were from the People's Republic of China (PRC). Singaporean participants consisted of twenty four females and six males, age ranging from 19 to 23 years old (mean=20.9, $SD=1.35$). PRC participants consisted of sixteen females and fourteen males, age ranging from 19 to 28 years old (mean=23, $SD=2.44$). All participants gave written informed consent, and were either volunteers or were paid \$7 as an hourly rate. Participants from Singapore were exposed to English and Mandarin before the age of one or since birth, and hence, they are considered to be early simultaneous bilinguals of both languages. PRC participants were exposed to Mandarin before the age of one or since birth, whereas exposure to English occurred at a much later age. Thus, PRC participants constitute the late bilinguals group, with Mandarin as their L1 and English as their L2. However, it should be noted that six of the PRC participants reported that they were exposed to English before the age of 10. The average age that the

PRC participants arrived in Singapore was 21.6 years ($SD=3.47$). English was reported to be the more dominant language being used by the Singaporean participants when performing mental calculation and holding conversations in both formal and informal domains. Conversely, for the PRC participants, Mandarin was the more dominant language used. See Table 2 below for language background information of participants.

Table 2 Participants' language background information

	Singapore		PRC	
	Mean	<i>SD</i>	Mean	<i>SD</i>
Age of exposure to English	0.37	1.19	12.37	4.81
Age of exposure to Mandarin	0.3	0.99	0.5	1.66
Use of English and Mandarin for mental calculation (5-point scale)	1.3	0.6	4.17	0.65
English and Mandarin daily usage (5-point scale)	2.86	0.97	4.71	0.31

Note: For 5-point scale on usage of English and Mandarin, 1 indicates usage to be always English and 5 indicates usage to be always Mandarin.

Similar to English being reported as the dominant language of use, when asked to rate their proficiency in three separate domains of speaking, reading and writing, Singaporean participants rated themselves to be more proficient in English. On the other hand, PRC participants reported a higher proficiency in Mandarin. See Table 3 below for proficiency information.

Table 3 Participants' self-assessed proficiency in English and Mandarin

	Singapore		PRC	
	Mean	<i>SD</i>	Mean	<i>SD</i>
Self-assessed proficiency in 3 domains (5-point scale)				
English: Speaking	4.61	0.73	3.26	0.86
Reading	4.88	0.32	3.88	0.64
Writing	4.7	0.57	3.39	0.81
Mandarin: Speaking	3.18	1.16	4.72	0.56
Reading	3.98	0.89	4.97	0.18
Writing	3.18	1.16	4.72	0.56

Note: For 5-point scale on degree of proficiency, 1 indicates low and 5 indicates high.

3.1.2 Stimuli

Stimuli were made up of twenty four pairs of nouns, with each pair consisting of a prime and a target. Prime and targets are bounded by either one of three relations, being functionally or thematically related, classifier related and unrelated. Hence, a single prime word has three target words being matched to it. Three lists were created using a Latin Square design. Functionally or thematically related noun pairs consisted of nouns that share functional or thematic relations. This category of noun pairs is generally similar or closely linked in terms of function (e.g. a key is used to open a lock). According to Lin and Murphy (2001), they can also be governed by a causal relation (e.g. electricity making a light bulb glow) or a spatial relation (e.g. paying a bill after having a meal in the restaurant). Classifier related noun pairs are nouns that share the same classifiers as the primes, i.e. the prime and target take on similar Chinese numeral classifier (e.g. 领带 “tie” and 蛇 “snake” both take the classifier 条 *tiao*). For this category of prime-target noun pairs, it was ensured that none of them shared any functional or thematic relations. Similarly, for unrelated prime-target noun pairs, they do not share any functional or thematic relations as well as classifier relations. Likewise, functional or thematic related target nouns did not share the same classifiers as the prime nouns. See Table 4 below for an example of prime-target noun pairs with three differing conditions. Appendix B shows a full list of stimulus items.

Table 4 Three conditions between a prime-target noun pair

Prime	Target	Condition
一枚戒指 one CL ring	一块白银 one CL silver	Functional/ Thematic related: <ul style="list-style-type: none"> A ring can be made from silver Different use of classifier from prime, silver - 块 <i>kuai</i>, ring - 枚 <i>mei</i>
	一枚邮票 one CL stamp	Classifier related: <ul style="list-style-type: none"> Not functionally or thematically related with prime Both ring and stamp share the same classifier, 枚 <i>mei</i>
	一个水壶 one CL kettle	Unrelated <ul style="list-style-type: none"> Not functionally or thematically and classifier related with prime

Since the stimuli were presented in Chinese, all of the noun pairs were made up of two-character words and this was done to ensure that the participants' memory will not be affected by the length of the words and that they were equally memorable. However, the only exception is 指南针 “compass”, which is a three character word. The nouns for the prime and targets were being matched for frequency so as to eliminate any possibility that inaccurate responses were made due to the irregular use of a noun compared to the other. Frequency data were extracted from the *Leeds Collection of Internet Corpora*.¹ A one way analysis of variance (ANOVA) was conducted and showed that frequency of usage of target nouns between the three conditions did not differ significantly from each other ($p = .62$). Paired T-tests showed that the frequency between the prime-target noun pairs between the three conditions did not differ significantly ($p > .05$). Because a Chinese noun is very likely to go with more than one classifier, a pre-test was carried out with two Singaporean and four PRC participants, two from Northern China and another two from Southern China, prior to the actual experiment.² They were tasked to generate possible classifiers according to the list of prime and target nouns. After which, they were asked to judge the acceptability of the usage of the target classifiers if their responses did not match any of the target classifiers. See Appendix C for list of classifiers generated based on prime nouns. See Appendices D and E for list of classifiers generated based on classifier related and functional or thematic related target nouns respectively. In addition, the usage of classifiers can differ for speakers from different regions, and hence, a comparison of classifier usage was not only made between the Singaporean and PRC participants, but also PRC participants from the Northern and Southern parts of China. By doing so, it can be ensured that the use of classifiers for the stimuli was similar across all participants, and this can eliminate any dissimilarity effects.

3.1.3 Procedure

This study was carried out using pen and paper, looking specifically at offline processing responses. Instructions were listed out clearly and explained to the participants before they started the experiment. Participants were either tested individually or as a group. For task 1, which was the rating of relatedness task, they were first given a list of prime-target noun pairs with all three conditions

¹ Leeds Collection of Internet Corpora is an open source development of large internet based corpora. The data used in this study was based on the frequency distribution of words within the internet corpus. For more information, please visit: <http://corpus.leeds.ac.uk/internet.html>

² Generation of classifiers prior to actual experiment for all prime and target nouns was done in collaboration with Luo, Lingyi (2011).

present, and they were instructed to rate them accordingly to whether they viewed each pair to be ‘related’ or ‘unrelated’. Participants were unaware that they had to recall the target nouns later in task 2. The specific instruction for this task 1 is displayed as below:

以下有 24 对字, 请仔细的观察每一对字并把它们列为“有关联”或“无关联”。之后请将你的判断在适当的格子打勾。请注意：这个试验没有正确或错误的答案。

There are 24 pairs of words, please look through every pair carefully and indicate if they are “related” or “unrelated”. Please note that there is no right or wrong answer.

For task 2, a surprise recall test was administered and participants were given a list which consisted of only the prime nouns that they have seen previously in task 1. Their task was then to fill in the target words as quickly and accurately as possible based on their memory of the prime-target noun pairs they have seen earlier.

The specific instruction for this task 2 is displayed as below:

请尽量以最快和最准确的方式将之前试验中所看过的对字填写在排列 II 适当的空格中。可用汉语拼音填写答案, 但尽量使用中文字体。

Please fill in column II according to the word pairs that you have seen in the earlier task. Please complete this task as quickly and accurately as possible. Use of Hanyu Pinyin is allowed, but try your best to fill in the answers using Chinese characters.

3.2 Task 1: Rating of Relatedness

The purpose of the rating task was to generate responses from the participants’ based on their implicit knowledge of categorization. This is a novel way of testing as previous studies were mostly carried out using similarity judgment of pictures between a pair of items (e.g. Saalbach and Imai, 2006; Zhang and Schmitt, 1998; Kuo and Sera, 2009; Song, 2009). By observing how participants rate the noun pairs based on their judgments of how related they are, we will be able to examine which relations are more salient and whether classifier relations can indeed affect categorization.

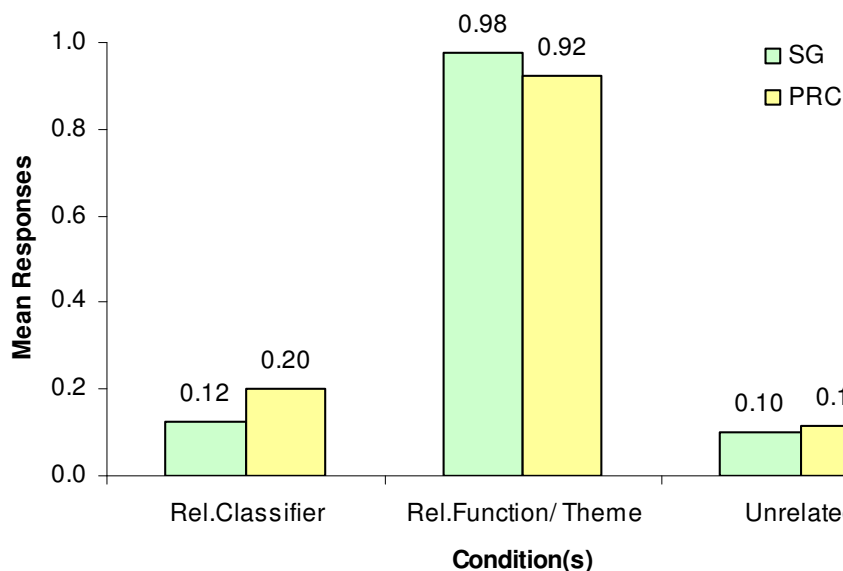
3.2.1 Results and Discussion

Based on the pre-test before the actual experiment as mentioned earlier, stimulus that did not meet the control measures were excluded. For both items no.2 and no.24, they were excluded as they should be functionally or thematically bounded pairs with the primes, without any classifier relations. However, it was found that for item no.2, 米饭 “rice” (prime) and 甜汤 “dessert” (target) can both take on the measure classifier 碗 *wan*, and for item no.24, 卡片 “card” (prime) and 信封 “envelope” (target)

can both take on the classifier 张 *zhang*. For item no.14, the PRC participants rated that it was unacceptable for the prime noun 足球 “football” to take on the classifier 粒 *li*. Hence, out of the 24 original stimuli, 3 of them were excluded, and thus, 21 of the items were analyzed. Each ‘related’ response of the prime-target noun pairs was coded with 1, and ‘unrelated’ response coded with 0. ANOVA was conducted on the responses with the three conditions, functional or thematic related, classifier related and unrelated as a within-subject factor on the rating of relatedness of the prime and target noun pairs. Results showed that for the Singaporean participants, there was a significant difference between the three conditions ($F(1, 29) = 689.69, p < .0001$). A further paired T-test showed that only functionally or thematically related condition was significantly different from classifier related and unrelated conditions at .05 level. This meant that responses for classifier related condition did not differ from unrelated condition.

For the PRC participants, a significant difference was found between the three conditions ($F(1, 29) = 457.08, p < .0001$). As opposed to the results from the Singaporean participants, a further paired T-test showed that all three conditions were significantly different from each other at .05 level. ANOVA was also conducted on the responses of Singaporeans between the items and similarly, there was a significant difference between the three conditions ($F(2, 20) = 223.54, p < .0001$). Paired T-test showed that only functional or thematic related condition was significant different from the other two conditions at .05 level. Classifier related condition did not differ from unrelated condition. For the PRC participants, significant difference was also shown between the three conditions ($F(2, 20) = 125.16, p < .0001$). Similar to the Singaporeans, paired T-test showed that only functional or thematic related conditions was significantly different from the other two conditions at .05 level.

Mean responses with a positive rating for relatedness of the prime-target noun pairs were calculated. For functional or thematic related noun pairs, Singaporeans scored 0.98 ($SD=0.15$) and PRC participants scored 0.92 ($SD=0.27$). For classifier related pairs, Singaporeans had a score of 0.12 ($SD=0.33$) and PRC participants scored 0.2 ($SD=0.4$). Lastly, for unrelated pairs, both Singaporeans and PRC participants scored 0.1 ($SD=0.3$) and 0.11 ($SD=0.32$) respectively. See Figure 1 for comparison of both groups of participants.

Figure 1 Mean responses of Task 1 for Singapore and PRC participants

Results showed that only functional or thematic related condition noun pairs are rated significantly different from the other two conditions. This supports hypothesis 1 that functional or thematic relation is the more determining factor in conceptual organization of individuals. For hypothesis 2, only support as shown from the PRC participants who rated the classifier related noun pairs to be more similar than unrelated noun pairs. Thus, in view of hypothesis 3, it is supported as PRC participants exhibited a difference in the rating of relatedness task across the three different conditions, in comparison to the Singaporean participants.

3.3 Task 2: Recall Test

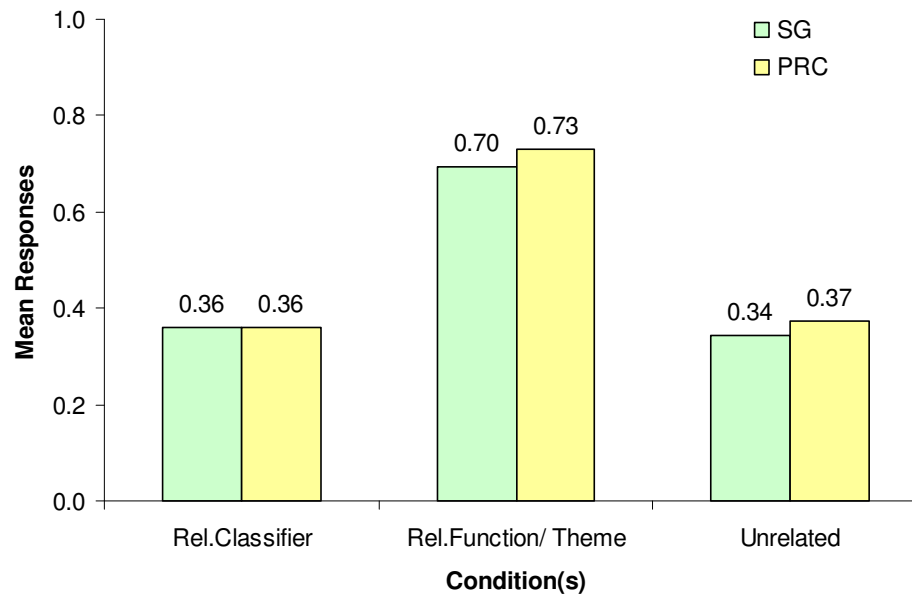
The aim of the recall task was to specifically look at whether both groups of participants were able to recall noun pairs that share classifier relations better than the unrelated noun pairs, with functionally or thematically related noun pairs being the most easily to be recalled. It is expected that when the participants are primed, their semantic memory based on the relations used for categorization of the prime-target noun pairs will be activated, and the strongest conceptual organization would be found in functional or thematic relation. Based on that, similar recall effects should also be observed for classifier related nouns, albeit to a lesser degree. This would show that a classifier relation has a significant role in concept organization of items within individuals, thereby serving a semantic function. Responses from the Singaporean participants and PRC participants will also be compared to

see if there is any aid or interference between the L1 and L2 in both groups of bilinguals in the recall of nouns.

3.3.1 Results and Discussion

Each correctly recalled response of the target noun was coded with 1, and those that were not recalled or incorrectly recalled were coded with 0. An overall ANOVA showed that for the Singaporean participants, there was a significant difference in the responses between the three conditions ($F(1, 29) = 54.67, p < .0001$). A further paired T-test showed that only functionally or thematically related condition was significantly different from classifier related and unrelated conditions at .05 level. Again, classifier related condition did not differ from unrelated condition like task 1. For the PRC participants, similar results was found, with there being a significant difference between the three conditions ($F(1, 29) = 53.58, p < .0001$). Again, paired T-test showed that only functionally or thematically related condition was significantly different from classifier related and unrelated conditions at .05 level. Classifier related condition, thus, did not differ from unrelated condition. Hence, no difference was found in responses of the recall task between the two groups of participants. To determine if there is any significant difference in responses between the items of different conditions, ANOVA was conducted and results showed that there was a significant difference between the three conditions, for both Singaporeans and PRC participants with ($F(2, 20) = 12.41, p < .0001$) and ($F(2, 20) = 11.92, p < .0001$) respectively. Paired T-test showed that only functionally or thematically related condition is significantly different from the other two conditions. This was similar for both groups of participants.

Mean responses for correctly recalled target nouns were also calculated and for functionally or thematically related condition, Singaporeans had a score of 0.7 ($SD=0.44$) and PRC participants scored 0.73 ($SD=0.42$). For classifier related condition, Singaporeans and PRC participants both had similar scores with 0.36 ($SD=0.47$). Lastly, for unrelated condition, Singaporeans scored 0.34 ($SD=0.47$) and PRC participants scored 0.37 ($SD=0.48$). See Figure 2 below for comparison.

Figure 2 Mean responses of Task 2 for Singapore and PRC participants

Results showed that only functional or thematic related condition noun pairs are recalled significantly different from the other two conditions. This supports hypothesis 1 that functional or thematic relation is the more determining factor in conceptual organization of individuals. However, for hypothesis 2, both groups of participants did not show a better recall for classifier related noun pairs in comparison to unrelated noun pairs. Hence, hypothesis 3 is not supported as well since the recall test were not able to produce any distinguished difference in the results of both groups of participants.

4. GENERAL DISCUSSION

From the results, it can be seen that for both groups of participants, functional or thematic related prime-target noun pairs were the ones that are being rated as ‘related’ more than the other two conditions. This is consistent with the findings of previous studies (e.g. Saalbach and Imai, 2005; Huang and Chen, 2011) that taxonomic relations are more salient, and it is the organization device adopted by speakers of all languages at firsthand. Therefore, it does imply that categorization of objects are dominantly governed by functional relations in individuals. However, when looking at the results of the PRC participants with regards to their rating of relatedness task, it was found that they rated significantly more classifier related nouns to be ‘related’ as compared to unrelated nouns. Thus, this proves that classifier effect is present, although at a much smaller level or degree as compared to functional or thematic relations. This is because the mean response rating scores between the two conditions are much more significantly different, as compared to the difference between the classifier related and unrelated condition. It is also interesting to note that as opposed to the PRC participants, Singaporean participants did not exhibit any difference in the rating of classifier related and unrelated conditions in task 1. This suggested that the PRC participants had a greater use of the implicit knowledge of classifier categories, thus, implying that PRC participants, who constitute the late bilinguals, possibly had a lesser interference of English when processing the noun pairs as compared to the Singaporean participants, who are considered the early bilingual group.

For the recall task, no significant effects were found for both groups of participants, except that once again, functional or thematic related target nouns were recalled at a much better level compared to the other two conditions. Contrary to task 1, classifier effect was not found within the PRC participants. This possibly implies that the use of recall as a measure might not be appropriate in this area of study and in relation to memory tasks that have been used in previous studies (e.g. Huang and Chen, 2011; Gao, 1998), they made use of a recall cluster measure. This meant that participants were given a cluster of nouns to memorize, and effects will be shown by looking at the clusters being recalled. Hence, examining recall clusters might be a more indicative measure. To account for the discrepancy of results between the PRC participants in task 1 and 2, it would seem that in rating the relatedness of the prime-target items, the activation of classifier categories in task 1 is strong, but however, the classifier effect is too limited to be extended in the recall task. This finding actually runs

parallel to that of Gao (1998), as his study did not find sufficient support that classifiers can help to aid the organization of memory and produce subsequent retrieval.

Following the debate of linguistic relativity in the case of classifiers, it seems that overall results from this study are not strong enough to argue for the case of classifier effect in conceptual organization. According to Zhang (2011) who acknowledged that Chinese classifiers are semantically motivated but it was pointed out that this system is not rigid, and thus, is open to changes within the language. Zhang (2011:57) further commented that classifiers play multiple roles in Chinese, and this might explain for why they are not as strong a factor in categorization. Also, according to Erbaugh (2002:58), if classifiers are inherently used as a strong device for categorization, then this should be observed in the case of young children. However, it has been found that children generally prefer the use of the general classifier ‘个 *ge*’ when acquiring Chinese during their development period.

One of the shortcomings of this study is that since the experiment was done using only words as stimuli, the experiments had no reliance on pictures as compared to previous studies, and hence, the mental representation that is being evoked in the participants cannot be controlled. This could possibly cause a discrepancy between the target image and the image that was thought of by the participants, and as such, with the difference in mental representation of the noun would involve a change in the classifier that was aimed to be tested. For instance, if the prime word is 蛋糕 “cake”, and the target classifier for this noun is 块 *kuai*, it would be represented as 一块蛋糕 “a piece of cake”. However, if the mental image that is evoked in the participant is “a whole cake”, then the classifier would change to be 个 *ge*. Hence, the use of pictures could possibly control for the mental representations of the nouns and more indicative results might be found with a better control the testing method. Also, one of the limitations is that the choice of stimulus words and the classifiers that they take could be better controlled as Gao (1998) suggested that the defining features of classifiers that could affect the organization of individuals. Additionally, results will be much more balanced and suggestive if a control group consisting of participants who do not speak any classifier languages are included, as they could be compared with Singaporean participants.

5. CONCLUSION

In line with previous studies that found taxonomic relations to be the most dominant and salient relationship in conceptual organization, results for this study also showed that functional or thematically related prime-target noun pairs are rated as most similar. Furthermore, they were recalled significantly better than the other two conditions. Mixed findings were obtained in the case of classifier effect with only the PRC participants, and only in task 1. Nonetheless, it does show the presence of classifier effect, but in a much weaker form, compared to functional or thematic relations. Still, however small the classifier effect may be, it's presence is evident especially if we extend the findings to look at early and late bilinguals since PRC participants had a higher mean response in the rating of the classifier related prime-target noun pairs, as compared to the Singaporean participants. Thus, this shows that there when processing L1 and L2, there can be an interference effect of the L2 on L1 and vice versa, as Singaporean participants are generally being exposed to English more and hence, the way they categorized objects or perceive certain concepts are different from the PRC participants.

Although findings from this study shows that classifier effect is limited, it is still however, evident that it serves as a conceptual category, no doubt not as strong a factor or device which individuals will use to categorize objects if a more dominant relation, like functional or thematic relation is present. Hence, much research is still needed in this area and especially looking in the area of bilingualism. Thus, it is suggested that if classifier effect does play a role in conceptual organization, then it should be present and would function as the same manner within speakers of other classifier languages. Therefore, more future cross-linguistic studies should investigate this area to give a better insight of the semantic functions of classifier categories. In addition, future research in the acquisition of classifiers in monolingual and bilingual children can also shed light on this topic.

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APPENDIX A: Participants' Language Background Questionnaire

Name _____

Age _____

Year of Birth _____

Date _____

I. Language History.

1. Were you born in Singapore? Y/N

If not, please specify the age at which you arrived.

2. Where did you grow up?

Country: _____

3. What is your mother's first language and/or dialect?

4. What is your father's first language and/or dialect?

5. Please list **all** of the languages in which you are competent, either in speaking or in comprehension:

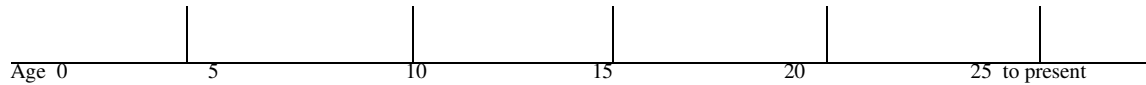
- 1) from **the most proficient** to the least proficient, and
- 2) indicate the age at which you were first exposed to each and the age at which exposure ended.
- 3) Use a solid line **—** if you both spoke and were spoken to in the language. Use a dotted line **....** if you were mainly just spoken to in the language (and you answered in another language).

An example is given below.

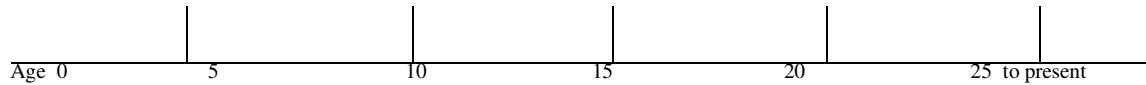
Example

Language 1, English						
Age 0	5	Age 7	10	15	20	25 to present
—					
Language 2, Hokkien						
Age 0	5	Age 7	10	15	20	Age 23
—		—				

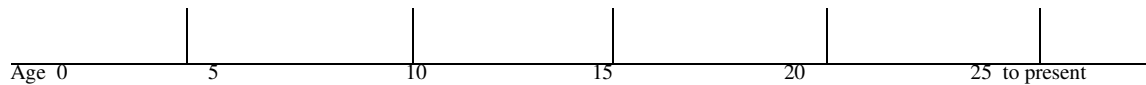
Language 1:



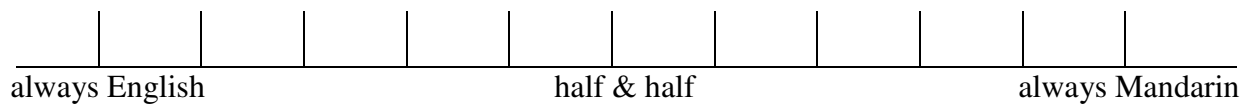
Language 2:



Language 3:



6. How often do you use each language in your every day life?



7. Estimate which language you usually use when having conversation with the following people.

a. Father	Always English	Mostly English	Equal	Mostly Mandarin	Always Mandarin	NA	
b. Mother	Always English	Mostly English	Equal	Mostly Mandarin	Always Mandarin	NA	
c. Siblings	Always English	Mostly English	Equal	Mostly Mandarin	Always Mandarin	NA	
d. Friends	Always English	Mostly English	Equal	Mostly Mandarin	Always Mandarin	NA	
e. Grandparents	Always English	Mostly English	Equal	Mostly Mandarin	Always Mandarin	NA	

8. Which language do you use for mental calculation/arithmetic?

Always English	Mostly English	Equal	Mostly Mandarin	Always in Mandarin
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II. Self-assessed Proficiency

9. I can talk about my work or school without difficulty in

a) English

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
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b) Mandarin Chinese

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
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10. I can talk about my daily life or personal preferences without difficulty in

a) English

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) Mandarin Chinese

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

11. I can talk about abstract topics in

a) English

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) Mandarin Chinese

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

12. My pronunciation (accent) is native-like for

a) English

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) Mandarin Chinese

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

13. I can read a newspaper and understand most of it when it is

a) an **English** newspaper

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) a **Chinese** newspaper

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
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14. I can read and understand most of a simple short article or letter/email in

a) **English**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) **Chinese**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

15. I can write academic research papers without difficulty in

a) **English**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) **Mandarin Chinese**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

16. I can write social and informal business correspondence with conventional openings and closings without difficulty in

a) **English**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) **Mandarin Chinese**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

17. I can write uncomplicated letters, and essays related to work and school experiences in

a) **English**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
-------------------	----------	----------------	-------	----------------

b) **Chinese**

Strongly Disagree	Disagree	Somewhat Agree	Agree	Strongly Agree
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I hereby declare that all the information provided above is accurate to the best of my knowledge.

Signature_____

I understand that this questionnaire may be used anonymously and in confidence at some point in the future to compile group (but not individual) profile statistics for research purposes. I hereby consent to such use of the above information and release it for these purposes only.

Signature_____ Date _____

Thank you!

APPENDIX B: List of Stimulus items

Item no.	Prime			Target						
				Classifier related			Functional/ Thematic related		Unrelated	
1	条 <i>tiao</i>	马路	road	条 <i>tiao</i>	毛巾	towel	汽车	car	老虎	tiger
*2	粒 <i>li</i>	米饭	rice	粒 <i>li</i>	沙子	sand	甜点	dessert	门锁	lock
3	朵 <i>duo</i>	鲜花	flower	朵 <i>duo</i>	白云	cloud	叶子	leaf	书包	bag
4	把 <i>ba</i>	雨伞	umbrella	把 <i>ba</i>	梳子	comb	毛衣	sweater	白兔	rabbit
5	张 <i>zhang</i>	桌子	table	张 <i>zhang</i>	钞票	cash	电灯	lamp	苹果	apple
6	块 <i>kuai</i>	布料	cloth	块 <i>kuai</i>	饼干	biscuit	裙子	skirt	卡车	truck
7	条 <i>tiao</i>	项链	necklace	条 <i>tiao</i>	河流	river	钻石	diamond	课本	textbook
8	架 <i>jia</i>	钢琴	piano	架 <i>jia</i>	飞机	airplane	吉他	guitar	小鸟	bird
9	枚 <i>mei</i>	戒指	ring	枚 <i>mei</i>	邮票	stamp	白银	silver	水壶	kettle
10	支 <i>zhi</i>	手表	watch	支 <i>zhi</i>	树枝	branch	时钟	clock	蛋糕	cake
11	座 <i>zuo</i>	山丘	hill	座 <i>zuo</i>	大厦	building	海洋	sea	镜子	mirror
12	颗 <i>ke</i>	星星	star	颗 <i>ke</i>	子弹	bullet	彩虹	rainbow	香蕉	banana
13	条 <i>tiao</i>	领带	tie	条 <i>tiao</i>	毒蛇	snake	衬衫	shirt	杂志	magazine
*14	粒 <i>li</i>	足球	football	粒 <i>li</i>	糖果	candy	小腿	leg	海报	poster
15	顶 <i>ding</i>	帽子	hat	顶 <i>ding</i>	帐篷	tent	额头	forehead	棋子	chess
16	把 <i>ba</i>	剪刀	scissor	把 <i>ba</i>	烟火	firework	白纸	paper	汽水	soft drink
17	张 <i>zhang</i>	地图	map	张 <i>zhang</i>	椅子	chair	指南针	compass	裤子	pants
18	块 <i>kuai</i>	肥皂	soap	块 <i>kuai</i>	石头	stone	泡沫	bubbles	相机	camera
19	根 <i>gen</i>	野草	weed	根 <i>gen</i>	香烟	cigarette	松树	pine tree	手册	handbook
20	颗 <i>ke</i>	珍珠	pearl	颗 <i>ke</i>	牙齿	tooth	耳环	earring	光碟	disc
21	枚 <i>mei</i>	硬币	coin	枚 <i>mei</i>	炸弹	bomb	黄金	gold	垃圾	garbage
22	把 <i>ba</i>	钥匙	key	把 <i>ba</i>	扇子	fan	铁门	metal door	眼镜	glasses
23	支 <i>zhi</i>	铅笔	pencil	支 <i>zhi</i>	蜡烛	candle	稿纸	manuscript	玫瑰	rose
*24	张 <i>zhang</i>	卡片	card	张 <i>zhang</i>	沙发	sofa	信封	envelope	黄豆	soybean

Note: Items marked with * were excluded from analysis.

APPENDIX C: Classifiers generated for prime nouns

Prime nouns	Target Classifier	Singapore participants	PRC participants (Northern China)	PRC participants (Southern China)
马路 road	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>
米饭 rice	粒 <i>li</i>	粒 <i>li</i> , 碗 <i>wan</i>	粒 <i>li</i> , 碗 <i>wan</i>	粒 <i>li</i> , 碗 <i>wan</i>
鲜花 flower	朵 <i>duo</i>	朵 <i>duo</i> , 束 <i>shu</i>	朵 <i>duo</i> , 捧 <i>feng</i> , 束 <i>shu</i>	朵 <i>duo</i>
雨伞 umbrella	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>
桌子 desk	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i>
布料 cloth	块 <i>kuai</i>	块 <i>kuai</i> , 条 <i>tiao</i> , 批 <i>pi</i>	块 <i>kuai</i> , 尺 <i>chi</i>	块 <i>kuai</i> , 尺 <i>chi</i>
项链 necklace	条 <i>tiao</i>	条 <i>tiao</i> , 串 <i>chuan</i>	条 <i>tiao</i>	条 <i>tiao</i> , 串 <i>chuan</i>
钢琴 piano	架 <i>jia</i>	架 <i>jia</i> , 台 <i>tai</i>	架 <i>jia</i>	架 <i>jia</i> , 台 <i>tai</i>
戒指 ring	枚 <i>mei</i>	枚 <i>mei</i>	枚 <i>mei</i> , 支 <i>zhi</i>	枚 <i>mei</i>
手表 watch	支 <i>zhi</i>	支 <i>zhi</i> , 条 <i>tiao</i>	支 <i>zhi</i> , 块 <i>kuai</i>	支 <i>zhi</i> , 块 <i>kuai</i>
山丘 hill	座 <i>zuo</i>	座 <i>zuo</i>	座 <i>zuo</i>	座 <i>zuo</i>
星星 star	颗 <i>ke</i>	颗 <i>ke</i>	颗 <i>ke</i>	颗 <i>ke</i>
领带 tie	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>
足球 football	粒 <i>li</i>	粒 <i>li</i>	*粒 <i>li</i> , 只 <i>zhi</i> ,	*粒 <i>li</i> , 只 <i>zhi</i> ,
帽子 hat	顶 <i>ding</i>	顶 <i>ding</i>	顶 <i>ding</i>	顶 <i>ding</i> , 只 <i>zhi</i>
剪刀 scissor	把 <i>ba</i>	把 <i>ba</i> , 双 <i>shuang</i>	把 <i>ba</i>	把 <i>ba</i>
地图 map	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i> , 幅 <i>fu</i> ,	张 <i>zhang</i>
野草 weed	根 <i>gen</i>	根 <i>gen</i> , 坨 <i>tuo</i> , 堆 <i>dui</i>	根 <i>gen</i> , 片 <i>pian</i> , 束 <i>shu</i>	根 <i>gen</i> , 片 <i>pian</i>
珍珠 pearl	颗 <i>ke</i>	颗 <i>ke</i> , 粒 <i>li</i> , 串 <i>chuan</i>	颗 <i>ke</i> , 粒 <i>li</i>	颗 <i>ke</i> , 枚 <i>mei</i>
硬币 coin	枚 <i>mei</i>	枚 <i>mei</i>	枚 <i>mei</i>	枚 <i>mei</i>
钥匙 key	把 <i>ba</i>	把 <i>ba</i> , 串 <i>chuan</i>	把 <i>ba</i> , 枚 <i>mei</i>	把 <i>ba</i>
铅笔 pencil	支 <i>zhi</i>	支 <i>zhi</i> , 盒 <i>he</i>	支 <i>zhi</i>	支 <i>zhi</i> , 根 <i>gen</i>
卡片 card	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i> , 枚 <i>mei</i>	张 <i>zhang</i>

Note: Classifier marked with * denotes that the use of this classifier with the prime noun is not acceptable. Items highlighted in red indicate that participants generated classifiers that were unforeseen and they matched those of the classifiers generated for the functional or thematic category, which is not allowed for the purpose of this experiment. Refer to Appendix E for comparison. The generic classifier ‘个’ is excluded from this list.

APPENDIX D: Classifiers generated for target (classifier related) nouns

Classifier related nouns	Target Classifier	Singapore participants	PRC participants (Northern China)	PRC participants (Southern China)
毛巾 towel	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>
沙子 sand	粒 <i>li</i>	粒 <i>li</i>	粒 <i>li</i> , 把 <i>ba</i> , 桶 <i>tong</i>	粒 <i>li</i> , 袋 <i>dai</i> , 堆 <i>dui</i>
白云 cloud	朵 <i>duo</i>	朵 <i>duo</i> , 片 <i>pian</i>	朵 <i>duo</i>	朵 <i>duo</i>
梳子 comb	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>
钞票 banknote/cash	张 <i>zhang</i>	张 <i>zhang</i> , 叠 <i>die</i>	张 <i>zhang</i> , 把 <i>ba</i>	张 <i>zhang</i> , 叠 <i>die</i>
饼干 biscuit	块 <i>kuai</i>	块 <i>kuai</i> , 盒 <i>he</i>	块 <i>kuai</i> , 盒 <i>he</i>	块 <i>kuai</i> , 片 <i>pian</i> , 袋 <i>dai</i> ,
河流 river	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i> , 串 <i>chuan</i>
飞机 helicopter	架 <i>jia</i>	架 <i>jia</i> , 台 <i>tai</i> ,	架 <i>jia</i>	架 <i>jia</i>
邮票 stamp	枚 <i>mei</i>	枚 <i>mei</i> , 张 <i>zhang</i>	枚 <i>mei</i> , 张 <i>zhang</i> , 颗 <i>ke</i>	枚 <i>mei</i> , 张 <i>zhang</i>
树枝 tree branch	支 <i>zhi</i>	支 <i>zhi</i> , 条 <i>tiao</i> ,	支 <i>zhi</i> , 根 <i>gen</i>	支 <i>zhi</i> , 根 <i>gen</i>
大厦 building	座 <i>zuo</i>	座 <i>zuo</i> , 栋 <i>dong</i>	座 <i>zuo</i> , 栋 <i>dong</i>	座 <i>zuo</i>
子弹 bullet	颗 <i>ke</i>	颗 <i>ke</i> , 粒 <i>li</i>	颗 <i>ke</i> , 粒 <i>li</i>	颗 <i>ke</i> , 粒 <i>li</i>
毒蛇 snake	条 <i>tiao</i>	条 <i>tiao</i> , 只 <i>zhi</i>	条 <i>tiao</i> , 只 <i>zhi</i>	条 <i>tiao</i>
糖果 candy	粒 <i>li</i>	粒 <i>li</i> , 盒 <i>he</i>	粒 <i>li</i> , 块 <i>kuai</i> , 颗 <i>ke</i>	粒 <i>li</i> , 颗 <i>ke</i> , 块 <i>kuai</i> , 袋 <i>dai</i>
帐篷 tent	顶 <i>ding</i>	顶 <i>ding</i>	顶 <i>ding</i>	顶 <i>ding</i> , 架 <i>jia</i>
烟火 firework	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i> , 根 <i>gen</i> , 场 <i>chang</i>
椅子 chair	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i> , 把 <i>ba</i>	张 <i>zhang</i> , 把 <i>ba</i>
石头 stone	块 <i>kuai</i>	块 <i>kuai</i> , 粒 <i>li</i>	块 <i>kuai</i> , 颗 <i>ke</i>	块 <i>kuai</i> , 粒 <i>li</i>
香烟 cigarette	根 <i>gen</i>	根 <i>gen</i> , 条 <i>tiao</i> , 支 <i>zhi</i> ,	根 <i>gen</i> , 条 <i>tiao</i> , 支 <i>zhi</i> , 盒 <i>he</i>	根 <i>gen</i> , 条 <i>tiao</i> , 支 <i>zhi</i>
牙齿 tooth	颗 <i>ke</i>	颗 <i>ke</i> , 排 <i>pai</i>	颗 <i>ke</i>	颗 <i>ke</i>
炸弹 bomb	枚 <i>mei</i>	枚 <i>mei</i> , 颗 <i>ke</i> , 粒 <i>li</i>	枚 <i>mei</i> , 颗 <i>ke</i>	枚 <i>mei</i>
扇子 fan	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i> , 枚 <i>mei</i>	把 <i>ba</i>
蜡烛 candle	支 <i>zhi</i>	支 <i>zhi</i> , 根 <i>gen</i> , 条 <i>tiao</i>	支 <i>zhi</i> , 根 <i>gen</i>	支 <i>zhi</i> , 根 <i>gen</i>
沙发 sofa	张 <i>zhang</i>	张 <i>zhang</i> , 台 <i>tai</i>	张 <i>zhang</i>	张 <i>zhang</i> , 座 <i>zuo</i>

Note: The generic classifier ‘个’ is excluded from this list.

APPENDIX E: Classifiers generated for target (functional/ thematic related) nouns

Functional/ Thematic related nouns	Target Classifier	Singapore participants	PRC participants (Northern China)	PRC participants (Southern China)
汽车 car	辆 <i>liang</i>	辆 <i>liang</i> , 台 <i>tai</i>	辆 <i>liang</i> , 部 <i>bu</i>	辆 <i>liang</i>
甜点 dessert	碗 <i>wan</i>	*碗 <i>wan</i>	块 <i>kuai</i> , 盘 <i>pan</i>	*碗 <i>wan</i> , 份 <i>fen</i> , 盘 <i>pan</i>
叶子 leaf	片 <i>pian</i>	片 <i>pian</i>	片 <i>pian</i>	片 <i>pian</i>
毛衣 sweater	件 <i>jian</i>	件 <i>jian</i> , 条 <i>tiao</i>	件 <i>jian</i> , 个 <i>ge</i>	件 <i>jian</i>
电灯 lamp	盏 <i>zhan</i>	盏 <i>zhan</i> , 台 <i>tai</i> , 支 <i>zhi</i>	个 <i>ge</i>	盏 <i>zhan</i>
裙子 skirt	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>	条 <i>tiao</i>
钻石 diamond	颗 <i>ke</i>	颗 <i>ke</i> , 枚 <i>mei</i>	颗 <i>ke</i> , 块 <i>kuai</i>	颗 <i>ke</i> , 粒 <i>li</i>
吉他 guitar	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>	把 <i>ba</i>
白银 silver	块 <i>kuai</i>	块 <i>kuai</i>	锭 <i>ding</i> , 斤 <i>jin</i>	块 <i>kuai</i> , 串 <i>chuan</i> , 堆 <i>dui</i>
时钟 clock	个 <i>ge</i>	个 <i>ge</i>	座 <i>zuo</i> , 个 <i>ge</i>	个 <i>ge</i>
海洋 sea	片 <i>pian</i>	片 <i>pian</i>	片 <i>pian</i>	片 <i>pian</i> , 个 <i>ge</i>
彩虹 rainbow	道 <i>dao</i>	道 <i>dao</i> , 条 <i>tiao</i>	道 <i>dao</i>	道 <i>dao</i> , 条 <i>tiao</i>
衬衫 shirt	件 <i>jian</i>	件 <i>jian</i> , 条 <i>tiao</i>	件 <i>jian</i>	件 <i>jian</i>
小腿 leg	双 <i>shuang</i>	双 <i>shuang</i>	只 <i>zhi</i>	条 <i>tiao</i>
额头 forehead	个 <i>ge</i>	个 <i>ge</i>	个 <i>ge</i>	个 <i>ge</i>
白纸 paper	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i>
指南针 compass	个 <i>ge</i>	只 <i>zhi</i>	个 <i>ge</i>	个 <i>ge</i>
泡沫 bubble	坨 <i>tuo</i>	堆 <i>dui</i> , 团 <i>tuan</i>	堆 <i>dui</i>	个 <i>ge</i>
松树 pine tree	棵 <i>ke</i>	棵 <i>ke</i>	棵 <i>ke</i> , 个 <i>ge</i>	棵 <i>ke</i>
耳环 earring	支 <i>zhi</i>	支 <i>zhi</i> , 双 <i>shuang</i>	支 <i>zhi</i> , 只 <i>zhi</i>	支 <i>zhi</i> , 只 <i>zhi</i> , 对 <i>dui</i> , 副 <i>fu</i>
黄金 gold	块 <i>kuai</i>	块 <i>kuai</i> , 条 <i>tiao</i>	块 <i>kuai</i> , 把 <i>ba</i> , 堆 <i>dui</i>	块 <i>kuai</i> , 把 <i>ba</i> , 串 <i>chuan</i>
铁门 metal door	道 <i>dao</i>	扇 <i>shan</i> , 张 <i>zhang</i>	道 <i>dao</i> , 扇 <i>shan</i> , 张 <i>zhang</i>	扇 <i>shan</i>
稿纸 manuscript	张 <i>zhang</i>	张 <i>zhang</i>	张 <i>zhang</i> , 叠 <i>die</i>	张 <i>zhang</i>
信封 envelope	封 <i>feng</i>	*张 <i>zhang</i>	*张 <i>zhang</i>	个 <i>ge</i>

Note: Classifiers marked with * indicate that they matched those of the prime nouns. Refer to Appendix C for comparison.