

# Lexicalization Degree of Figurative Meaning Affects the Mental Organization of Body-Related Metaphorical Words in Chinese

Aitao Lu (Corresponding author)

Center for Studies of Psychological Application, South China Normal University  
Guangzhou 510631, China  
Tel: 86-20-8486-3366 E-mail: atlupsy@gmail.com

John X. Zhang

Department of psychology, The Chinese University of Hong Kong  
3rd Floor, Sino Building, Shatin, N. T., Hong Kong, China

Lei Mo

Center for Studies of Psychological Application, South China Normal University  
Guangzhou 510631, China

Jijia Zhang

Center for Studies of Psychological Application, South China Normal University  
Guangzhou 510631, China

Yuxiao Dang

Shenzhen Yuanping Special Education School  
Shenzhen 518112, China

Jinwang Yu

Guangdong electromechanical Vocational Technical College  
Guangzhou 510515, China

## Abstract

The purpose of the present study was to examine how body-related Chinese metaphorical words are organized when the degree of lexicalization is taken into consideration. Three experiments were conducted using multidimensional scaling (MDS) and a priming paradigm. The results in Exp. 1 and 2 indicated that the dispersion of metaphorical words was influenced by degree of lexicalization to produce a clear separation between a cluster of highly lexicalized metaphorical words (HM) and a cluster of body-part words (BW) with partially lexicalized metaphorical words (LM) scattering between these two clusters. Semantic priming effect based on a word's literal meaning was then assessed in Exp. 3 by contrasting a picture-word match condition with a picture-word mismatch condition using these three types of words. Significant positive priming effect was found for the BW words but not the LM words, while a reversed inhibitory effect was found for the HM words. Briefly, with the direct evidence from Exp. 1 and 2 showing a unique dispersion in the Euclidean distance map and the indirect evidence from Exp. 3 revealing the existence of literal meanings for the LM but not the HM words, this study showed that metaphorical words are organized based on their degree of lexicalization.

**Keywords:** Metaphor organization, Figurative language, Lexicalization, Multidimensional scaling

## 1. Introduction

Metaphor, as a rhetorical phenomenon, is rather ubiquitous in our daily communication. No matter whether it is as conventional as 'Time is money' or as novel as 'That defense lawyer is a shark', people seem to have little

trouble in comprehending them. If taken literally, metaphoric statements are mostly wrong (Carroll, 1999). The meaning of a metaphor usually goes beyond the literal meaning of words and requires the interpreters to grasp the intended meaning by inferring the mental linkage of different category domains not explicitly stated (Sperber & Wilson, 1986, 1998, 2002).

Recently, the mechanisms involved in metaphor comprehension have aroused more and more interest from linguists, psychologists, neuroscientists, as well as clinical pathologists (e.g., Arzouan, Goldstein, & Faust, 2007; Brownell et al., 2007; Coulson & Petten, 2007; Kita, Condappa, & Mohr, 2007; Rapp et al., 2004; Winner & Gardener, 1999). Particularly in cognitive psychology, a considerable and convincing body of empirical evidence has demonstrated that metaphoric language is quantitatively more difficult to process than literal language, with longer reaction times (e.g., Geiger & Ward, 1999; Gernsbacher et al., 2001) and an extra right hemispheric involvement in metaphor processing (e.g., Coulson & Petten, 2007; Mashal et al., 2005; Rapp et al., 2004; Schmidt, Debusse, & Seger, 2005). Several other investigations have further proposed the view that the increased difficulty in metaphor processing exists only in novel ones but not in those conventional ones which could be comprehended directly like literal statements (e.g., Blasko & Connine, 1993; Geiger & Ward, 1999). For example, 'Time is money' is comprehended not based on the activation of the basic meaning of money, but directly considered as 'Time is important'.

Obviously, one major converging finding in these studies is the role of lexicalization degree of figurative meaning in metaphor comprehension. For example, Geiger and Ward (1999) found that the lexicalized meaning (i.e., figurative meaning) made reliable and dominant contribution to the understanding of conventional metaphors but not novel ones. Similarly, Blasko and Connine (1993) showed that when the visual targets followed immediately after the offset of the auditory metaphor vehicle, the priming effects only occurred in high-familiarity visual metaphor and literal word but not in low-familiarity metaphors. Conventional or high-familiarity metaphors used in the above studies both share the same characteristic -- highly lexicalized figurative meaning. It is therefore possible that the lexicalization degree of figurative meaning plays an important role in metaphor processing (e.g., Geiger & Ward, 1999; Lee & Dapretto, 2006).

However, existing studies concerning the effects of degree of lexicalization in metaphor processing are mainly focused on the comprehension issue, with little attention paid to another equally important topic -- the mental organization of metaphor. The latter topic would be critical for issues such as how metaphors are organized in the mental lexicon. Superficially, metaphor comprehension and organization both attempt to identify the underlying mechanism of metaphor. However, the salient difference of them primarily lies in that the former focuses on the dynamic contribution of literal meanings of metaphor while the latter pays attention to the origin of such dynamics by tracing back to the implicit status of metaphors in our mental mind.

Based on the above findings concerning metaphor comprehension (e.g., Geiger & Ward, 1999; Gernsbacher et al., 2001; Keysar et al., 2000), it may suggest a potential role of lexicalization degree of figurative meaning in metaphor organization. Specifically, the role of lexicalization degree of figurative meaning might go beyond metaphor understanding and extend to metaphor organization. Since recent researches have primarily centered on the issue that how metaphors are processed using sentence expressions, relatively little work has been conducted on those metaphorical words and the exploration of how these metaphorical words are organized mentally is still lacking. Thus, the present study started out to empirically evaluate the potential role of lexicalization degree of figurative meaning in the organization of metaphorical words.

In Chinese vocabulary, there is a unique subcategory of metaphorical words which are conceptualized through body parts. These metaphorical words like "山脚" meaning the foot of mountain and literally referring to the foot, "手册" meaning manuals and literally referring to the hand, "借口" meaning the pretext and literally referring to the mouth, reflect the intricate relation between metaphor, body, and Chinese culture. Different from the words used metaphorically, these metaphorical words could be used independent of the context to express their figurative meaning, while metaphorically-used words like 'grasp' depend on the context to further shape its figurative meaning for understanding.

Moreover, Chinese metaphorical words like "山脚" which contains the character "脚" (i.e., foot) indicating the vehicle part, seem like a profound miniature of an intact metaphorical sentence involving topic and vehicle, rather than a simple extension of their original meanings (i.e., body part). Finally, taking lexicalization degree into consideration, these Chinese metaphorical words could be divided into two main kinds: highly lexicalized metaphorical words, like "山脚" and "场面", whose figurative meanings are no longer relevant to the referent body parts (i.e., foot and face) and seemingly their literal interpretation are deviant, while the other kind are those partially lexicalized metaphorical words, like "手足" and "耳目", whose literal and figurative meanings

are both in usage with the figurative meanings being the dominant one.

To sum up, the aim of the present study was to look into how body-referent metaphorical words like those mentioned above are organized, specifically, at the word level whether metaphorical words are organized based on the degree of lexicalization. Three experiments were carried out. We expect that the degree of lexicalization would moderate the clustering pattern of the Chinese metaphorical words like “山脚”, “场面”, “手足” and “耳目”.

## 2. Experiment 1

In Exp. 1, of particular interest was to discover whether metaphorical words are organized based on the degree of lexicalization of their figurative meanings, which is specified as the relationship with their source domains. An increasing degree of lexicalization of figurative meaning points at a remote connection between the figurative and literal meanings. As predicted by the clustering view of Lakoff and Johnson, such manipulation in the present experiment should predict a certain scatter pattern. Multidimensional Scaling (MDS) approach was applied to explore the latent organization of Chinese metaphorical words (e.g., “山脚” and “场面”). For present purposes, there are two advantages of MDS: one is its ability to generate a visual representation of the latent structure of the data in low dimensional space (Shepard, 1962), the other is MDS can be applied to any kind of data (Bartholomew et al., 2002; Flere et al., 2008).

### 2.1 Method

#### 2.1.1 Participants

Participants were 97 undergraduates (45 males, 52 females), aged between 19 and 24 year, with a mean age of 20.6 ( $SD = .92$ ), who were recruited from a comprehensive university in mainland China and participated for course credit.

#### 2.1.2 Materials

The logic of the current experiment requires that those metaphorical words used be clearly different based on the degree of lexicalization. Such manipulation could ensure a reasonable prediction of the attributive cluster pattern of the words used. Therefore, a 60-item list was constructed, with 20 body-part literal words (BW), 20 body-part metaphorical words whose figurative meanings are highly lexicalized (HM) with deviant literal meanings, and 20 body-part metaphorical words whose figurative meanings are widely used with their relatively low-frequency literal meanings (LM). The application of 20 BWs here served as a referent point to better evaluate the resulting dispersion pattern.

All those 40 metaphorical words as well as the 20 body-related literal words were selected based on the following criteria: one is that all of them include at least one body-part character of “头” (i.e., head), “口” (i.e., mouth), “唇” (i.e., lip), “面” or “脸” (i.e., face), “耳” (i.e., ear), “脑” (i.e., brain), “脚” (i.e., foot), “手” (i.e., hand), and “骨” (i.e., bone); another is that all are familiar and commonly used in our daily communication with familiarity rating higher than 5 based on a pretest study. In the pretest study, 20 undergraduates were required to evaluate the familiarity of 400 words depending on a 6-point Likert scale ranging from (1) “very unfamiliar” to (6) “very familiar”. The other is that in terms of the 40 metaphorical words the Contemporary Chinese Dictionary shows that their figurative meanings are the dominant ones, with half of them have low-frequency literal meanings, and the other half’s literal meanings are deviant.

#### 2.1.3 Procedure

Each participant was seated in a dimly lit room in front of a computer screen. Participants were told that they would first see a fixation ‘+’ on the display for 500 ms and then a word like “山脚”. As soon as the word appeared, they should evaluate its association with the body parts (e.g., “脚”, “头”, “口”, and “面”) basing on a 6-point Likert scale ranging from (1) “very unrelated” to (6) “very related”, and wrote down the corresponding number on a blank sheet of paper. When finishing the evaluation, the participants should press the space bar, and then the next word appeared on the monitor immediately. The presentation order of these words was randomized across participants. The experimental session lasted within 20 min.

### 2.2 Results and Discussion

We performed a two-dimensional MDS, using the ALSCAL program to explore the latent organization among these 60 words. The Euclidean distance maps based on the evaluation data are presented in Fig. 1. The stress value amounted to .053 for a two-dimensional resolution with a  $R^2$  value of .99, indicating a good fit (Cox & Cox, 2001, p. 77). Dissimilarity is represented by distance: stimuli that are close together are conceptually similar.

(Insert Figure 1 about here)

Two main clusters could be clearly observed in Fig. 1, with one located on the left side while the other on the right side. The left one formed a clear cluster that included the twenty items of highly lexicalized body metaphors, namely, “港口”, “石头”, “韵脚”, “街口”, “苦头”, “手册”, “场面”, “街头”, “路口”, “面积”, “借口”, “选手”, “封面”, “书面”, “山脚”, “开头”, “注脚”, “高手”, “阵脚”, and “对手”. Moreover, respondents seem to regard this cluster rather distinctive from other items (especially those body-part words) as the gap between them is quite apparent, which implied that items in this cluster are isolated with little reference to the body parts. In addition, respondents also noted the commonality that these highly lexicalized body metaphor items possessed with each other by the closely cluster pattern observed in Fig. 1.

On the right, there was another cluster, consisting of the items “脚背”, “脚跟”, “嘴角”, “头发”, “脚掌”, “脚趾”, “手指”, “手掌”, “头皮”, “口腔”, “嘴巴”, “右手”, “头颅”, “头骨”, “脸蛋”, “眼眉”, “左手”, “耳朵”, “眼睛”, and “面孔” which was mainly composed of the body-part items. Therefore, we called it the BW cluster. Obviously, items in this cluster dispersed more relative to the left cluster. Interestingly, the LM items were located between these two clusters with part of them closer to BW cluster (viz. “眼里”, “骨肉”, “头目”, “脸皮”, “脸色”, “嘴脸”, “头脑”, “脑筋”, “耳目” and “手足”), even overlapping with each other (viz., “唇舌”, “口齿”, and “手脚”), while the other half closer to HW cluster (viz., “人口”, “口气”, “黑脸”, “眼下”, “眼尖”, “头面”, and “人手”).

Exploring the latent organization of metaphorical words, participants in Exp. 1 showed a unique scatter pattern of these 60 words supporting a potential role of lexicalization in metaphor organization. These findings confirm that metaphors refer to their own resource domains not only for understanding but also for organization; however, it is only true for the LM words but not HM words. Though LM and HM words both have dominant figurative meanings, it seems that the respondents tend to separate them from each other by taking literal meanings into consideration when the LM words are encountered. We argue that our hypothesis is confirmed in Experiment 1.

### 3. Experiment 2

In Exp. 1, participants were explicitly instructed to focus on the relation between metaphorical words and body parts (i.e., their source domains). One may argue that it is not surprising to find a clear discrimination among BWs, LMs, and HMs in the Euclidean distance map (Fig. 1), due to the explicit instruction on the relation between target words and the referent body parts. Specifically, such explicit orientation may confound the findings in Experiment 1 and make it unreliable.

Moreover, the overall dispersion of these three types of words is consistent with our hypothesis, however, it could be seen that the scattering of these 60 words could also be definitely divided into two main parts: one is LMs as a centroid while the other part is HMs as a centroid, which partially evidenced that the requirement in Experiment 1 makes the participant primarily apply the two extreme points to evaluation these words: one is highly related, the other is highly unrelated. Therefore, we carried out Exp. 2 to remove the explicit instructions by requiring the participants to do a free categorization of these 60 words. We expect that the three-cluster dispersion pattern should occur under this new task.

#### 3.1 Method

##### 3.1.1 Participants

Another 128 undergraduates (50 males, 78 females), aged between 19 and 21 year, with a mean age of 20.28 ( $SD = .83$ ), were recruited from the same university with a partial fulfillment of a course.

##### 3.1.2 Materials

Stimulus materials were identical to those used in Exp. 1.

##### 3.1.3 Procedure

The sixty words used in Exp. 1 were randomly-ordered and printed on a paper sheet. Participants were required to sort these words and write down their categorization on a piece of blank paper, without any requirement on the number of categories and the size of each category. However, participants should provide a few words at the bottom of the same paper to describe the differentiating attributes for their sorting groups of stimuli.

##### 3.1.4 Analysis

A total of 38 participants were eliminated from all analyses as their categorizations of these 60 words were seemingly and simply based on what characters the words contained, which was also indicated by their explanation of the categorization. The remaining 90 participants' data were entered in our final analysis. The

number of times each possible pair of stimuli placed in the same group was summed across these 90 participants to yield a co-occurrence similarity matrix of the 60 words. We then conducted a two-dimensional MDS analysis to reveal the latent relation among these 60 words.

### 3.2 Results and Discussion

The Euclidean distance maps based on the free categorization data are presented in Fig. 2. The index of stress value amounted to .046 for a two-dimensional representation with a  $R^2$  value of .99, indicating a good fit (Cox & Cox, 2001, p. 77). Dissimilarity is represented by distance; the further stimuli locate with each other, the more heterogeneous they are.

(Insert Fig. 2 about here)

From Fig. 2, one can easily identify a pattern similar to the one in Fig. 1, namely, three main regions of clusters are observed in the Euclidean distance map. On the far left side of the display locates a region that consisted of sixteen BWs (viz., “头颅”; “嘴巴”; “眼睛”; “右手”; “左手”; “脚趾”; “口腔”; “脚跟”; “头发”; “耳朵”; “手指”; “脚掌”; “手掌”; “头发”; “脸蛋”; “脚背”); thus, this region may be labeled as BW cluster. The second region appears around the y axis involving seventeen LM items (viz., “眼下”; “眼尖”; “脸皮”; “黑脸”; “头脑”; “眼里”; “唇舌”; “手脚”; “人口”; “人手”; “脑筋”; “骨肉”; “嘴脸”; “手足”; “耳目”; “口气”; “头面”); thus, this region may be labeled as LM cluster. Additionally, items involving three LM items (viz., “脸色”; “头目”; “口齿”) as well as four BW items (viz., “面孔”; “眼眉”; “头骨”; “嘴角”) scatter between these two main clusters, serving like a bridge across the gap between these two cluster points. Finally, on the far right side of the display comes a twenty-item region including those twenty HM items, which thus may be called HM cluster. Obviously, the HM cluster is clearly separated from the other two clusters: BW cluster and LM cluster.

On the whole, the cluster pattern in Fig. 2 is quite consistent with that of Fig. 1 with three clusters formed in both of them. Based on such unique and stable scatter pattern of these 60 items, we argue that the horizontal dimension in Figures 1 and 2 represents the degree of lexicalization of their figurative meanings, in another words, the association with body parts (i.e., source domains), though the direction in these two figures seems to be the opposite. Specifically, we propose that the further the metaphorical items located from the body-part cluster on the display, the looser relation exists between them and their source domains, which is demonstrated by the further distance between HMs and BWs, relative to that of LMs and BWs.

## 4. Experiment 3

The logic of the first two experiments was directly targeted on the relation among these 60 words. That is, if there is a dimension in Euclidean distance map showing that LMs get closer to BWs than HMs do, then we argue that that dimension should represent the degree of lexicalization which at least serves as a moderating factor in terms of metaphor organization. However, one may argue that such explicit demonstration of the metaphor organization may not be consistent with the implicit one in our mind. In Exp. 3, we tried to provide another type of evidence, i.e., implicit evidence, to support the conclusions made in Exp. 1 and 2.

The point in metaphor organization exists in the relation between figurative meanings and their source domains (i.e., body parts). That is to say, the strength of links between metaphorical words and their source domains should be a good predictor of the organization of metaphors. Thus, we carried out Exp. 3 by applying a priming paradigm sensitive to the associations between two concepts (e.g., Roggeman, Verguts, & Fias, 2007; Soldan et al., 2008; Raffray, Pickering, & Branigan, 2007). The rationale we adopt is that salient priming effect should be observed if two concepts are closely associated with each other. We predict that only those closer to BWs (i.e., LMs) should be primed by a preceding match body-part picture instead of those not (i.e., HMs), which simultaneously reveals the implicit display of the metaphors in our mind.

Moreover, it is possible for Exp. 2 that presentation of 60 words that all include at least one body-part character in a paper sheet may orient participants to refer to body parts. This may also be why some participants in Exp. 2 did the free categorization based on what characters the words shared with other. The application of priming paradigm may prevent such possibility by adopting other filler materials involving body-unrelated words and pictures, which enabled us to take a closer look at whether the results observed in previous two experiments were reliable or not.

### 4.1 Method

#### 4.1.1 Participants

Another 22 undergraduates (10 males, 12 females), aged between 18 and 20 year, with a mean age of 19.27 ( $SD = .7$ ), were recruited to partially fulfill course requirement.

#### 4.1.2 Materials

In favor of improving Chinese insurance consciousness, spreading insurance knowledge, enlarging insurance needs. The foreign insurance companies propagandize the advanced insurance consciousness and knowledge relying on their rich experiences and abundant capital to make up the insufficiency of propagandizing insurance knowledge system in China. Moreover, the coming of foreign-funded insurance companies will benefit the cultivation of insurance talents in China.

In addition to the 60 test words used in Exp. 1, 44 draw-line pictures were obtained from the picture package 'Snodgrass' of Shu, Cheng and Zhang (1989) which has been standardized and widely used in mainland China (e.g., Zhuang & Zhou, 2003; Zhang & Yang, 2003; Han et al., 2005), with nine (i.e., head, hand, brain, mouth/lip, bone, face, eye, foot, and ear) being the test pictures in the match condition, five (i.e., tree, orange, leaf, pear, and pumpkin) being the test pictures in the mismatch condition, and the rest being filler pictures. Additionally, 60 body-unrelated words were included along with 120 non-words, half of which were formed with and half without any body-part characters.

Each of 60 test words was paired twice: one with a picture from the match condition (e.g., the picture of foot pairing with "山脚"), the other with a picture from the mismatch condition (e.g., the picture of tree pairing with "山脚"). Thus, there were a total of 120 test picture-word pairs. The rest 60 words and 120 non-words were also repeatedly paired with two different filler pictures and made up 120 filler picture-word combinations and 240 filler picture-non-word pairs, respectively.

#### 4.1.3 Design

Each pair of experimental items was divided into two groups so that each group featured one of two picture-word (or picture-non word) combinations (see Fig.3). Match and mismatch test items were distributed evenly across two groups with equal numbers of literal words, highly lexicalized metaphorical words, and partially lexicalized metaphorical words. A within-subject design was used so that each participant verified both two groups of item lists with their presentation order counterbalanced across subjects.

(Insert Fig. 3 about here)

#### 4.1.4 Procedure

Participants were seated in a dimly lit room in front of a computer monitor. They were told that it was a lexical decision task and that whenever two Chinese characters appeared in the monitor they should determine whether it was a real word or not by pressing the 'F' key for 'yes' and the 'J' key for 'no' as quickly as possible. To familiarize them with the experimental procedure, participants were given twenty practice trials before the test session. Errors and response time were indicated as feedback. During each trial, participants would see a fixation '+' on the display for 500ms, and then a picture was presented. After 1000ms, the picture was replaced with two Chinese characters, which remained on the screen until the participant responded. Participants were also reminded that high accuracy should be maintained. The dependent measure was the response time since the onset of the word and response accuracy. If participant failed to respond within 5000ms of the word's onset, the program would regard it as an error.

Half of all filler trials had a comprehension question, like 'is it a turtle in the previous picture' (relating to the filler picture), which appeared after the presentation of word or non-word, with participants answering equal numbers of "yes" and "no" questions (see Fig. 4). Both the practice and test lists were individually randomized for each participant. Participants would take a 2-minute break as soon as they finished every eighty trials.

(Insert Fig. 4 about here)

#### 4.2 Results and Discussion

The reaction times greater than 1500ms or less than 300ms were considered outliers and removed. Altogether, 2% of the data was excluded. Analyses of variance were run on the remaining data by subjects and by items.

(Insert Table 1 about here)

Table 1 shows the mean reaction times for three different word types in match and mismatch picture-word conditions, respectively. 2 (picture-word condition: match, mismatch)  $\times$  3 (word types: BW, LM, and HM) ANOVAs were conducted with both factors being within subject and item. The results demonstrated that people responded slightly more quickly when the priming picture was consistent with the body-part character of the word (i.e., picture-word match condition) than when it was not (i.e., picture-word mismatch condition), but such difference did not achieve the critical level,  $F_1(1, 21) = .43$ ,  $MSE = 989.42$ , and  $F_2(1, 19) = .25$ ,  $MSE = 1407.51$ ,  $p > .05$ . For the main effect of word type, significance was found by subject,  $F_1(2, 42) = 18.05$ ,  $MSE = 1101.32$ ,

$p < .001$ , but marginal by item,  $F_2(2, 38) = 2.96$ ,  $MSE = 6252.05$ ,  $p = .06$ . Subsequent analyses based on the subject means showed that the reaction time for literal words was faster than for partially lexicalized metaphors and highly lexicalized metaphors, respectively ( $ps < .0001$ ).

There was also a significant interaction between word types and picture-word condition,  $F_1(2, 42) = 8.06$ ,  $MSE = 761.38$ ,  $p = .001$ , and  $F_2(2, 38) = 4.36$ ,  $MSE = 1173.03$ ,  $p < .05$ . For literal words, people responded faster in picture-word match condition than picture-word mismatch condition,  $F_1(1, 21) = 8.12$ ,  $MSE = 736.24$ ,  $p = .01$ , and  $F_2(1, 19) = 3.47$ ,  $MSE = 1436.96$ ,  $p = .078$ ; no significant difference was found in partially lexicalized metaphors between these two picture-word conditions,  $F_1(1, 21) = 2.15$ ,  $MSE = 518.41$ , and  $F_2(1, 19) = 1$ ,  $MSE = 920.89$ ; for highly lexicalized metaphors the responses were much more delayed in picture-word match condition than picture-word mismatch condition,  $F_1(1, 21) = 4.46$ ,  $MSE = 1257.54$ ,  $p < .05$ , and  $F_2(1, 19) = 3.35$ ,  $MSE = 1395.71$ ,  $p = .083$ .

(Insert Table 2 about here)

For the error rates (see Table 2), two-way ANOVAs confirmed the effect of word type, significant by subjects,  $F_1(2, 42) = 3.18$ ,  $MSE = .002$ ,  $p = .01$ , although not by items,  $F_1(2, 38) = .46$ ,  $MSE = .04$ . Subsequent analyses showed lower errors in literal words relative to partially lexicalized metaphorical words and highly lexicalized metaphorical words ( $F_1(1, 43) = 10.06$ ,  $MSE = .003$ ,  $p < .01$  and  $F_1(1, 43) = 15.92$ ,  $MSE = .004$ ,  $p < .01$  by subject, respectively). The results also revealed an interaction between picture-word condition and word type, significant by subjects,  $F_1(2, 42) = 5.12$ ,  $MSE = .002$ ,  $p < .05$ , but not by items,  $F_1(2, 38) = 1.66$ ,  $MSE = .003$ . Specifically, non-significant difference in the proportion of errors between picture-word match condition and picture-word mismatch condition was found in literal words ( $F_1(1, 21) = 1.72$ ,  $MSE = .001$ ), nor did in partially lexicalized metaphorical words ( $F_1(1, 21) = .17$ ,  $MSE = .003$ ), while in terms of highly lexicalized metaphorical words error rate was significantly higher in match condition than in mismatch condition ( $F_1(1, 21) = 5.33$ ,  $MSE = .002$ ,  $p < .05$ ).

We argue that the higher error rate of HMs in match condition demonstrated the negative impact of literal meaning activated in the preceding pictures, which, going with the inhibition effect found in their response latency, further reveals the competitive relation between literal meaning and figurative meaning in HMs. While such negative influence was not found in LMs, it may be due to the compatibility between literal and figurative meanings of LMs, which implies the higher positive correlation between LMs and body parts. Thus, both response time or error rate demonstrated that the activation of literal meaning in preceding body-part pictures have different impacts on the following lexical decision of the three-type words. Specifically, the facilitation occurs in both BWs and LMs, but inhibition in HMs, which shows us an implicit display that shorter distance between LMs and BWs, longer distance of HMs and BWs. Consistent with the findings of the two previous experiments, the results in the present experiment support that the relationships between metaphorical words and their source domains are moderated by their lexicalization degree.

## 5. General Discussion

We propose that to better understand how metaphorical words are organized in our mind, it is important to take degree of lexicalization into consideration. Moreover, degree of lexicalization, which has been so far primarily examined in the comprehension of metaphorical sentences, has not been well-studied in the literature concerning the issue of metaphor organization based on those metaphorical words.

Taken together, the results of our three experiments suggest that lexicalization plays an important role in the organization of metaphorical words. Experiment 1 and 2 showed straightforward evidence for the moderating effect of lexicalization degree in metaphor organization. No matter whether there is explicit instruction to make the respondents turn to the references, the dispersion pattern of the 60 words was quite consistent. In terms of the highly lexicalized metaphorical words (HMs), their clear discrimination from the literal items demonstrated that respondents regarded them to be distinct from the body-part words though both of them share the same body-part character (here the characters are also morphemes) which may imply shared phonology as well as meanings (e.g., Melinger, 2003; Roelofs & Baayen, 2002; Zwitserlood, Bolte, & Dhomes, 2002; Chen & Chen, 2004). That is, HMs had little reference to their literal meanings. Furthermore, these two extreme clusters (i.e., HMs cluster and BWs cluster) are directly related to their distinct referent concepts and seem to exist as parallel items in our mental lexicon, but not the subordinates of each other.

With respect to the partially lexicalized metaphorical words (LMs), they scattered between the clusters of BWs and HMs, which seem to act as a bridge connecting these two points together. From such dispersion two implications could be derived. One is that these LMs should have their literal references to some extent, though figurative meaning is the dominant, which was indicated by the shorter distance to BWs (relative to HMs) and

even overlapping with the BWs. The other is LMs seem to be the transition stage from literal words to highly lexicalized metaphorical words. That is, by extending to other fields, the literal words form its figurative meaning which may eventually become the dominant or even the unique meaning with its increasing frequent usage (e.g., Blank, 1999; Traugott, 1990). According to this logic, it is reasonable that the partially lexicalized metaphorical words located between body-part words and highly lexicalized metaphorical words as they are still in this 'evolutional' process.

In Exp. 3, we looked more closely at the activation of literal meanings in HMs and LMs by using body-part pictures as primes. The results showed that in terms of LMs there was no significant difference in the lexical decision time between match and mismatch conditions, while HMs showed significantly inhibition in match condition relative to the mismatch one. Here we claim that there are two possibilities to account for the findings in LMs. One is that as the LMs have dominant figurative meaning as well as probable literal meaning, the appearance of corresponding body-part pictures, which precede LMs, only prime their literal meanings but not the figurative ones. That is, in match condition under the effect of priming picture the literal meaning of the LM is activated while the figurative one is inhibited. In this situation, the respondents make the word judgment based on the literal meanings. However, in mismatch condition (i.e., the preceding pictures have no influence on the latter word decision) the dominant figurative meaning of LMs is activated firstly and quickly, thus, now the respondents make their determination depending on the figurative meaning instead of the literal one.

The second possibility is that the figurative meaning of LMs is related with the corresponding body part to some extent, but such association is not strong enough to significantly facilitate the subsequent lexical decision (that is why we found that the participants respond a little faster in match condition than in mismatch condition). No matter which possibility exist in the current study, we still could get the same conclusion that LMs partially refer to their body-part concepts to a certain extent. Therefore, it is not surprising that there is no significant difference in response time and error rate between match condition and mismatch condition for LMs, which also yielded evidence for the availability of the literal meanings in LMs.

However, regarding to the HMs, the prior presentation of body-part pictures seemed to inhibit the following lexical decision in match condition relative to the mismatch condition. We argue that the priming body-part pictures automatically activate their corresponding literal meanings. If the subsequent words include the same character as the one indicated by the preceding picture, but which now reveal the figurative meaning instead of the literal one, then the previous activated literal meaning of this character would inhibit the activation of the following figurative meaning, which seem to be consistent with the findings in language comprehension that word recognition involves morphological processing (e.g., for alphabetic system, Feldman, Frost, & Pnini, 1995; Libben, 1993; for logographic system, Zhou et al., 1999; Zwitserlood, 1994). Thus, the delayed activation of figurative meaning causes the delayed lexical decision of HMs, which suggests that the understanding of HMs does not involve the emergence of their literal meaning. Therefore, Exp. 3 further confirms the results shown in Experiments 1 and 2 that lexicalization could moderate the references to their literal meanings by revealing the availability of literal meanings in LMs but not HMs.

The above results seem to partially support a major claim of Lakoff and Johnson's theory - that the human body is a potentially universal source domain for metaphors structuring abstract concepts (Lakoff & Johnson, 1980). That is, certain aspects of bodily experience or certain parts of the body are viewed as especially salient and meaningful in the understanding of those abstract concepts (Yu, 2002, 2003, 2004). The current study shows that body parts actually could serve as the referents for the understanding or organization of metaphorical words; however, it is only true for the partially lexicalization metaphorical words but not the highly lexicalization metaphorical words due to their different lexicalization degree. That is to say, though sharing the same characters with body parts, HMs do not definitely subordinate the body-part words. And these unique 'extensions' of body parts seem not to be the 'extensions' any more, which revealed by the sharp discrimination from body-part words (illustrated in Experiments 1 and 2) as well as the inhibition effect in match condition (shown in Experiment 3). Such highly lexicalization of figurative meaning is also demonstrated by other studies concerning metaphor comprehension (e.g., Geiger & Ward, 1999; Lee & Dapretto, 2006).

The findings reported in this paper seem consistent with research suggesting that degree of lexicalization could influence the processing of metaphors in sentence level (e.g., Blasko & Connine, 1993; Geiger & Ward, 1999). Specifically, three basic claims could be derived from the results in the present study. Firstly, we argue that metaphor lexicon may originally have their own source referents, but as their figurative meanings become more and more lexicalized the role of their referents become less and less salient, and then disappear at the end (mainly demonstrated in the results of Experiment 3). That is, there seems to be a tradeoff between metaphor's figurative meaning and literal meaning, because of the frequent usage the figurative one becomes dominant

while the original literal one retreat as secondary (LMs) or even lose its availability (HMs). Secondly, we extend the logic of our first claim that partially lexicalized metaphors might become completely conventional metaphors one day when their literal meanings are no longer in usage. That is, highly lexicalized metaphorical words are the final evolutionary stage of partial lexicalized metaphorical words.

Thirdly, we propose that partially lexicalized metaphors (e.g., “手足”) and highly lexicalized metaphors (e.g., “山脚”) may belong to two distinct types as their sharply discrimination from each other with LMs populating nearer to or even overlapping with their source referents (i.e., body parts), which was consistently illustrated in both two Euclidean distance maps, as illustrated in both Experiments 1 and 2.

It is well-known that meaning of words could be evaluated from different perspectives, thus naturally their representation in a high-dimensional semantic space seems more like vectors involving various valences for different directions. If different vectors are taken, then different organization may be emphasized. Go back to the focus of the present study, our results in three experiments provide converging evidence for the claim that lexicalization of the figurative meaning could be a reliable vector which moderates the specific organization of metaphors. That is, the higher metaphors are lexicalized, the further from the referent it position in the mental lexicon.

## 6. Conclusion

Understanding the role of lexicalization in metaphor organization provides opportunities to further clarify the relationship between metaphors and their references like body parts. The present study found that the overall scatter pattern of those 60 words is reliably consistent, no matter whether there is extra hint to elicit such tendency. However, different dispersion patterns of LMs and HMs were found in the organization of these 60 items when they were plotted in the Euclidean distance map (i.e., MDS analysis), reflecting the organizations of LMs and HMs based on the lexicalization degree of their figurative meaning.

So far, two implications could be derived from the present study. Firstly, research in metaphor organization is far less extensive than comprehension research, with little attention paid to the role of lexicalization degree in the latent organization of metaphors. The present study represents an effort to fill this gap. As metaphor is a fundamental scheme in long-term memory by which people makes sense of their experience, our results may help to understand how we refer our body to conceptualize the outside world. The investigation of body metaphors could serve as a profile allowing fresh insights for the formation of other types of metaphors.

Secondly, Lakoff and Johnson suggested that the mind can be better understood by taking into account the body and the more primitive underpinnings of the mind (e.g., Lakoff & Johnson, 1980; Rohre, 2006). However, current understanding of metaphor seems to primarily focus on the investigation of two main types: conventional (or conceptual) and novel metaphors. Not surprisingly, empirical studies examining body metaphors which named by their referent vehicles of body parts are relatively few. Based the present results, we conclude that body parts are at best minimally involved in Chinese metaphors understanding (in Exp. 3). This conclusion should be framed by the materials we used, as seemingly Chinese culture attaches more importance to the body relative to the western culture. This, for instance, is reflected in the multi-valence of body parts in Chinese (e.g., Yu, 2002). Converging evidence from other types of language materials need to be sought in the future before a more general conclusion can be reached.

## Acknowledgement

The authors thank Zhuo Fang for assistance in the pretest study.

## References

- Arzouan, Y., Goldstein, A., & Faust, M. (2007). Dynamics of hemispheric activity during metaphor comprehension: Electrophysiological measures. *NeuroImage*, 36, 222-231.
- Bartholomew, D. J., Steele, F., Moustaki, I., & Galbraith, J. I. (2002). *The analysis and interpretation of multivariate data for social scientists*. Boca Raton, London: Chapman & Hall/CRC.
- Blank, A. (1999). "Why Do New Meanings Occur? A Cognitive Typology of the Motivations for Lexical Semantic Change", In: A. Blank, P. Koch (Eds.), *Historical Semantics and Cognition*, pp. 61-90. Berlin/New York: Mouton de Gruyter.
- Blasko, D. G. & Connine, C. M. (1993). Effects of familiarity and aptness on metaphor processing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 295-308.
- Brownell, H., Lundgren, K., Cay-Meade, C., Nichols, M., Caddick, K., & Spitzer, J. (2007). Assessing quality of metaphor interpretation by right hemisphere damaged patients. *Brain and Language*, 103, 197-198.

- Carroll, D. (1999). *Psychology of language*, 3<sup>rd</sup> ed., Brooks/Cole, Pacific Grove, pp. 142-146.
- Chen, T. M., & Chen, J. Y. (2006). Morphological encoding in the production of compound words in Mandarin Chinese. *Journal of Memory and Language*, *54*, 491-514.
- Coulson, S., & Petten, C. V. (2007). A special role for the right hemisphere in metaphor comprehension? ERP evidence from hemifield presentation. *Brain Research*, *1146*, 128-145.
- Cox, T. F., & Cox, M. A. A. (2001). Multidimensional scaling (2nd ed.). *Monographs on statistics and applied probability*. Boca Raton, LA: Chapman & Hall/CRC.
- Feldman, L. B., Frost, R., & Pnini, T. (1995). Decomposing words into their constituent morphemes: Evidence from English and Hebrew. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *21*, 947-960.
- Flere, S., Klanisek, R., Lavric, M., & Musil, B. (2008). Testing the Allportian religious orientation schema on Slovenian Catholics by multidimensional scaling. *Personality and Individual Differences*, *44*, 512-520.
- Geiger, O., & Ward, L. M. (1999). Metaphors and the mental lexicon. *Brain and Language*, *68*, 192-198.
- Gernsbacher, M. A., Keysar, B., Robertson, R. R.W., & Werner, N. K. (2001). The role of suppression and enhancement in understanding metaphors. *Journal of Memory and Language*, *45*, 433-450.
- Han, Z. Z., Shu, H., Bi, Y. C., & Bai, X. L. (2005). A case study of Chinese noun specific deficits (in Chinese). *Psychological Science*, *28*, 909-911.
- Keysar, B., Shen, Y., Glucksberg, S., & Horton, W. S. (2000). Conventional language: How metaphor is it? *Journal of Memory and Language*, *43*, 576-593.
- Kita, S., Condappa, O., & Mohr, C. (2007). Metaphor explanation attenuates the right-hand preference for depictive co-speech gestures that imitate actions. *Brain and Language*, *101*, 185-197.
- Lakoff, G., & Johnson, M. (1980). *Metaphors we live by*. Chicago: University of Chicago Press.
- Lee, S. S., & Dapretto, M. (2006). Metaphorical vs. literal word meanings: fMRI evidence against a selective role of the right hemisphere. *NeuroImage*, *29*, 536-544.
- Libben, G. (1993). Are morphological structures computed during word recognition? *Journal of Psycholinguistic Research*, *22*, 535-544.
- Mashal, N., Faust, M., Hendler, T., & Jung-Beeman, M. (2005). An fMRI investigation of the neural correlates underlying the processing of novel metaphoric expressions. *Brain and Language*, *100*, 115-126.
- Melinger, A. (2003). Morphological structure in the lexical representation of prefixed words: Evidence from speech errors. *Language and Cognitive Processes*, *18*, 335-362.
- Raffray, C. N., Pickering, M. J., & Branigan, H. P. (2007). Priming the interpretation of noun-noun combinations. *Journal of Memory and Language*, *57*, 380-395.
- Rapp, A. M., Leube, D. T., Erb, M., Grodd, W., & Kircher, T. T. J. (2004). Neural correlates of metaphor processing. *Cognitive Brain Research*, *20*, 395-402.
- Roelofs, A., & Baayen, H. (2002). Morphology by itself in planning the production of spoken words. *Psychonomic Bulletin & Review*, *9*, 132-138.
- Roggeman, C., Verguts, T., & Fias, W. (2007). Priming reveals differential coding of symbolic and non-symbolic quantities. *Cognition*, *105*, 380-394.
- Rohre, T. (2006). The body in space: Dimensions of Embodiment. *Body, Language, and Mind*, *1*, 339-378.
- Sperber, D., & Wilson, D. (1986). *Relevance: Communication and Cognition*. Blackwell, Oxford.
- Sperber, D., & Wilson, D. (1998). The mapping between the mental and the public lexicon. In: Carruthers, P., Boucher, J. (Eds.), *Language and Thought: Interdisciplinary Themes*. Cambridge University Press, Cambridge, pp. 184-200.
- Seperber, D., & Wilson, D. (2002). Pragmatics, modularity and mindreading. *Mind and Language*, *17*, 3-23.
- Schmidt, G. L., DeBuse, C. J., & Seger, C. A. (2005). Right hemisphere metaphor processing? Characterizing the lateralization of semantic processes. *Brain and Language*, *100*, 127-141.
- Shepard, R. N. (1962). The analysis of proximities: Multidimensional scaling with an unknown distance function. *Psychometrika*, *27*, 125-140.
- Shu, H., Cheng, Y., & Zhang, H. (1989). The naming consistency, familiarity, representation consistency and

visual complexity of 235 pictures (in Chinese). *Acta Psychologica Sinica*, 4, 389-396.

Soldan, A., Zarah, E., Hilton, H. J., & Stern, Y. (2008). Global familiarity of visual stimuli affects repetition-related neural plasticity but not repetition priming. *NeuroImage*, 39, 515-526.

Traugott, E. C. (1990). From Less to More Situated in Language: The Unidirectionality of Semantic Change. In: Adamson, Silvia et al. (Eds.), *Papers from the Fifth International Conference on English Historical Linguistics*, pp. 496-517, Amsterdam: Benjamins.

Winner, E., & Gardner, H. (1999). The comprehension of metaphor in brain-damaged patients. *Brain*, 100, 717-729.

Yu, N. (2002). Body and emotion: Body parts in Chinese expression of emotion [Special issue]. In N. Enfield & A. Wierzbicka (Eds.), "The body in description of emotion: Cross-linguistic studies." *Pragmatics and Cognition*, 10, 333-358.

Yu, N. (2003). Metaphor, body, and culture: The Chinese understanding of gallbladder and courage. *Metaphor and Symbol*, 18, 13-31.

Yu, N. (2004). The eyes for sight and mind. *Journal of Pragmatics*, 36, 663-686.

Zhang, Q. F., & Yang, Y. F. (2003). The determiners of picture-naming latency (in Chinese). *Acta Psychologica Sinica*, 4, 447-454.

Zhou, X. L., Marslen-Wilson, W., Taft, M., & Shu, H. (1999). Morphology, orthography, and phonology in reading Mandarin Chinese compound words. *Language and Cognitive Processes*, 14, 525-565.

Zhuang, J., & Zhou, X. L. (2003). The interaction between semantics and phonology in the speech production of Chinese (in Chinese). *Acta Psychologica Sinica*, 35, 300-308.

Zwitserslood, P. (1994). The role of semantic transparency in the processing and representation of Dutch compounds. *Language and Cognitive Processes*, 9, 341-368.

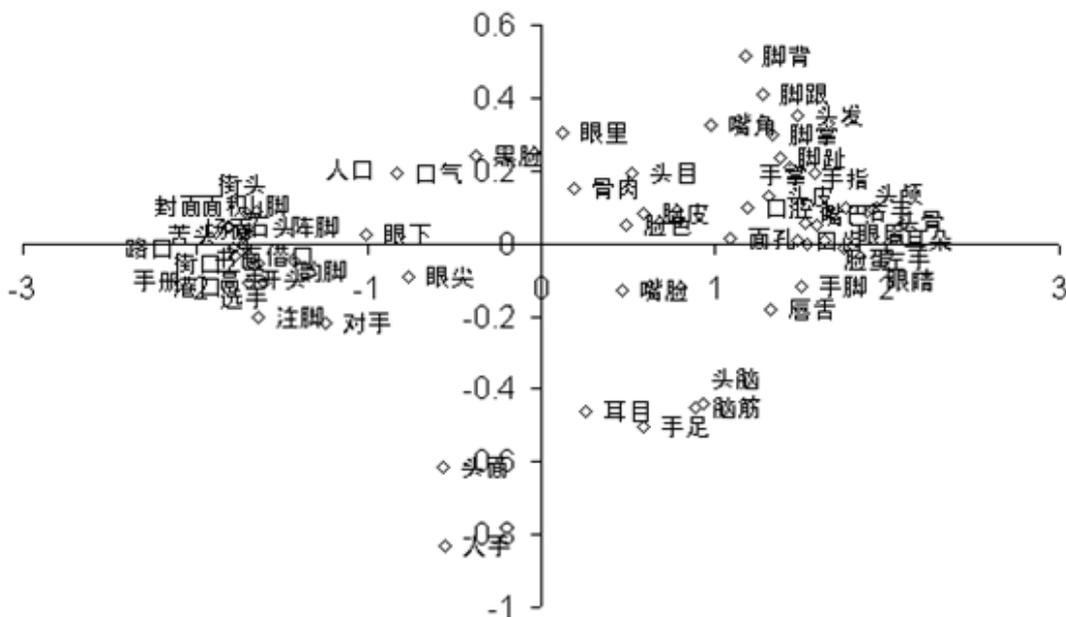
Zwitserslood, P., Bolte, J., & Dohmes, P. (2002). Where and how morphologically complex words interplay with naming pictures? *Brain and Language*, 81, 358-367.

Table 1. Mean response times (ms) with standard deviations in parentheses

Word type	Picture-word relation	
	Match	Mismatch
Literal words	657 ( $\pm$ 66)	680 ( $\pm$ 74)
Partially lexicalized metaphors	704 ( $\pm$ 70)	714 ( $\pm$ 68)
Highly lexicalized metaphors	711 ( $\pm$ 80)	688 ( $\pm$ 70)

Table 2. Proportion of errors with standard deviations in parentheses

Word types	Picture-word relation	
	Match	Mismatch
Literal words	.04 ( $\pm$ .03)	.05 ( $\pm$ .03)
Partially lexicalized metaphors	.08 ( $\pm$ .04)	.07 ( $\pm$ .05)
Highly lexicalized metaphors	.10 ( $\pm$ .06)	.07 ( $\pm$ .06)



**BWs:**

- 头颅: Head
- 嘴巴: Mouth
- 眼睛: Eye
- 右手: Right hand
- 左手: Left hand
- 脚趾: Toe
- 口腔: Oral cavity
- 脚跟: Heel
- 头发: Hair
- 耳朵: Ear
- 手指: Finger
- 脚掌: Sole
- 手掌: Palm
- 头皮: Scalp
- 脸蛋: Cheek
- 脚背: Instep
- 面孔: Face
- 眼眉: Eyebrow
- 头骨: Skull
- 嘴角: Corner of the mouth

**LMs:**

- Literal meaning**
- 脸色: Countenance
  - 口齿: Mouth and tooth
  - 头目: Head and eye
  - 眼下: Below the eye
  - 眼尖: Sharp eye
  - 脸皮: Facial skin
  - 黑脸: Black face
  - 头脑: Head and brain
  - 眼里: In one's eye
  - 脑筋: Bands in the brain
  - 手脚: Hand and foot
  - 人口: Mouth
  - 人手: Hand
  - 唇舌: Lip and tongue
  - 骨肉: Bone and flesh
  - 嘴脸: Mouth and face
  - 手足: Hand and foot
  - 耳目: Eye and ear
  - 口气: Odor of the mouth
  - 头面: Head and face

- Metaphorical meaning**
- Complexion
  - Credit
  - Leader
  - At this stage
  - Eagle-eyed
  - Shamefaced mental state
  - Being offended
  - Subtle mind
  - In one's opinion
  - The ability to think
  - Trick
  - Population
  - Manpower
  - Words
  - Blood relation
  - Look
  - Brotherhood
  - Spy
  - Tone
  - Prominent

**HMs:**

- 高手: Master hand
- 山脚: Foot of the mountain
- 石头: Stone
- 选手: Player
- 苦头: Hardship
- 对手: Opponent
- 阵脚: Front line
- 韵脚: Rhyming word
- 港口: Haven
- 面积: Acreage
- 借口: Pretext
- 助手: Assistant
- 路口: Intersection of roads
- 街头: Street
- 书面: Written format
- 街口: One end of the street
- 封面: Cover
- 开头: Beginning
- 注脚: Footnote
- 场面: Scene

Figure 1. Euclidean distance map for evaluation task

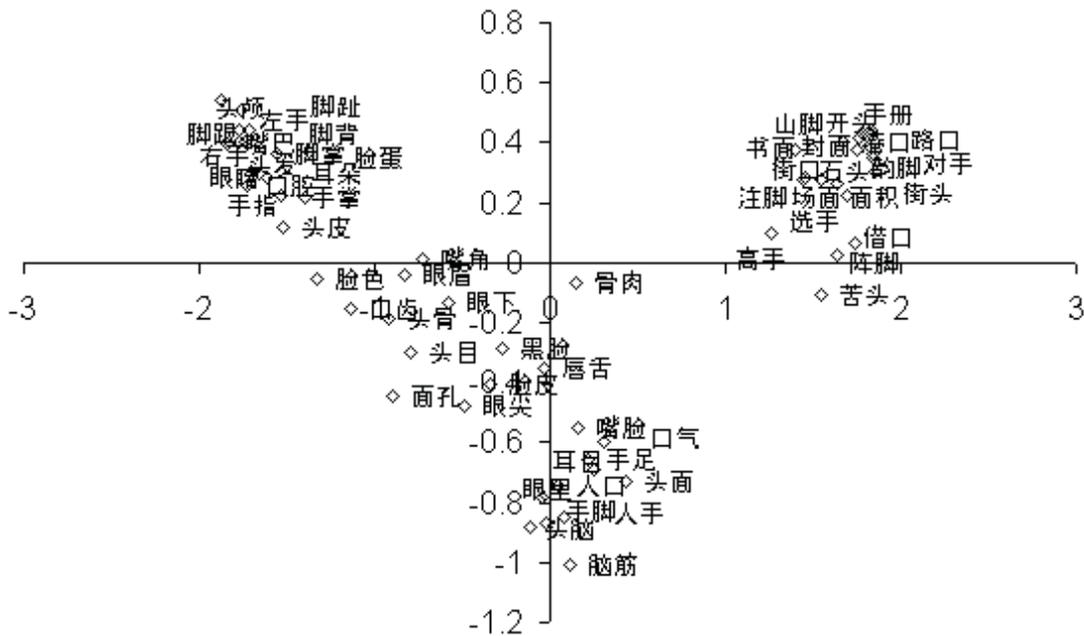


Figure 2. Euclidean distance map for categorization task

Picture-word condition	Picture condition	Test word
Match		山脚 (foot of the mountain)
Mismatch		山脚 (foot of the mountain)

Figure 3. Sample picture and test word stimuli used in the current experiment

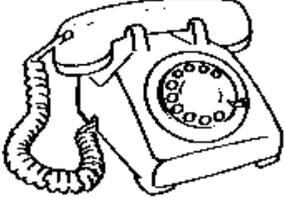
Filler picture	Filler word/ non word	Comprehension question
	Word: 礼仪 (amenity)	刚才出现的图画是一把扇子吗? (Is it a fan in the previous picture?)
	Non-word: 舞蒙	刚才出现的图画是一个盒子吗? (Is it a box in the previous picture?)

Figure 4. Filler picture, word/ non word and comprehension question stimuli. All filler pictures were unrelated to the following words. Comprehension questions followed half of filler trials and required an even distribution of yes/no answers