

## CATEGORIES IN MIND AND CATEGORIES IN LANGUAGE

### *Do Classifier Categories Influence Conceptual Structures?*

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In this chapter, we explore the relation between classifier grammar systems—grammatical systems that categorize objects/entities into over 100 grammatical categories—and how people think about objects. This is of course a question concerning linguistic relativity, or the Whorfian hypothesis (Whorf, 1956). Many researchers have asked whether linguistic categories, be they lexical or grammatical, influence people's concepts and cognitive processes (for reviews see Bowerman & Levinson, 2001; Gentner & Goldin-Meadow, 2003; Gumperz & Levinson, 1996; Hunt & Agnoli, 1991; Lucy, 1992). However, researchers differ in how the impact of language should be evaluated. Thus, we first review different views of how the role of language (linguistic categories) should be evaluated in thought. We then specify our own position concerning this issue, reporting empirical results of two series of studies on the impact of classifier systems. We found some influence of classifiers in some cognitive tasks but not others in Chinese speakers. We found no influence of classifiers in any of the cognitive tasks in Japanese speakers, including the tasks in which Chinese speakers exhibited the influence of classifiers. Based on these results, we attempt to clarify the nature of the influence of classifiers, specifying how large the classifier effect would be relative to other major conceptual relations such as taxonomic or thematic relations, in what cognitive

contexts the language-specific classifier effect is observed (and in what contexts it is not observed), and how the language-specific classifier effect might arise. We argue that it is time for us to go beyond a pro-Whorf or anti-Whorf conclusion. Instead of seeking a cross-linguistic difference in one task for the purpose of establishing evidence for (or against) the linguistic relativity hypothesis, we must investigate the relation between language and thought to reveal complex interactions between the semantic as well as structural nature of the grammatical system and the type of cognitive activities and to evaluate how pervasive and important the influence of a target linguistic categorization system is in a full range of cognitive processes.

#### INFLUENCE OF LANGUAGE ON THOUGHT WITHIN THE REALM OF LANGUAGE USE OR BEYOND

Some researchers (e.g., Lucy, 1992, this volume; Gennari, Sloman, Malt, & Fitch, 2002; Vigliocco, Vinson, Paganelli, & Dworzynski, 2005) emphasize the distinction between two versions of linguistic relativity: In one version, the influence of language is observed within the realm of language use (e.g., paying attention to and encoding a particular aspect of the world to

talk about events and objects); in the other, the influence goes beyond the realm of language use and penetrates into the realm of nonlinguistic cognition. The first version is often referred to as “thinking for speaking” (Slobin, 1987), and is considered a weaker version of linguistic relativity, whereas the second version is stronger and is “true” linguistic relativity (Lucy, 1992).

However, determining the boundary between “linguistic” and “nonlinguistic” cognition is not simple. It appears that almost every researcher in the field has a different idea about it (e.g., Gennari et al., 2002; Imai & Mazuka, 2003, 2007; Lucy, 1992). One way to distinguish “linguistic” and “nonlinguistic” effects may be to determine whether the effect is obtained with or without the explicit invocation of the target linguistic categories. For example, Vigliocco and colleagues (Vigliocco, Vinson, Indefrey, Levelt, & Hellwig, 2004) found that in their semantic substitution paradigm, German speakers tended to produce substitution errors within the same gender category when speakers produced phrases with determiners marked for gender, but that this gender preservation effect disappeared when they produced bare nouns or phrases with determiners not marked for gender (a phrase with an indefinite determiner plus noun).

Another way of distinguishing “linguistic” and “nonlinguistic” effects has been the usage of different kinds of stimulus material, verbal and pictorial, respectively. Underlying this is the assumption that pictures but not the names have direct access to the conceptual (i.e., nonlinguistic) representations of the objects. For example, Vigliocco and colleagues (Vigliocco et al., 2005) determined whether grammatical gender categories would have a direct impact on semantic representation of Italian, using an odd-one-out categorization task. They found that Italian speakers chose two verbally presented objects of the same gender category (in Italian) at a rate higher than English speakers (although this gender effect was found only for animal stimuli but not for artifact stimuli). However, the gender effect was not observed when objects were presented in pictures

instead of words. On the basis of these results, Vigliocco and colleagues (2005) concluded that gender categories in Italian exert their influence at the lexicosemantic level but not at the conceptual level, and hence argued that their results are consistent with the “thinking for speaking” hypothesis but are evidence against the linguistic relativity hypothesis.

In our view, however, the two effects cannot be so simply distinguished just by the use of different types of stimulus material, as pictorial presentation has its own limitations for assessing people’s “nonlinguistic” representations. First, even if the objects were presented in pictures, the participants may have unconsciously named the objects. Second, a picture may invoke a strong visual image of the particular instance of the object depicted in it. Thus, visual similarity among pictures may affect judgments of similarity more strongly than when objects were presented in words without specific visual images. In fact, one possible account for the disappearance of the gender effect with the pictorial stimuli in the study of Vigliocco et al. (2005) is that concrete visual images of objects wiped out the subtle conceptual similarity between objects arising from gender category membership that had shown up in the similarity judgment task with words.

#### EVALUATING THE INFLUENCE OF LANGUAGE IN LIGHT OF MEANINGFULNESS AND MAGNITUDE

What seems to be more important than characterizing the target effect along the dimension of being “linguistic” or “nonlinguistic” is to specify when (i.e., in what cognitive contexts) and how a given linguistic categorization system affects cognitive processes and representations, as well as to specify how large and how meaningful the influence is. Again, take the effect of gender-marking grammar for example. Provided that speakers of a language with a gender-marking grammar rate two objects from the same gender category more similar (even when the grammatical gender was not evoked) compared to speakers of a different language that does not have gender-

marking grammar at a statistically significant level, how should we evaluate this effect in a global picture of human concepts and cognition? Should we interpret this data to suggest that the speakers of the two languages "think differently" and have "different conceptual structures"?

Again, the answer depends on how we define "thought" or "conceptual structures." Here, we would like to operationally define "conceptual structures" as how people organize their knowledge of each object into a coherent body of knowledge so that knowledge of each object is related and can be used to infer properties of other objects. In this light, to make a strong claim that a linguistic categorization system "shapes thought," we may want to see the system serve as a basis for how we relate things in the world. If a given conceptual relation is an important and meaningful one, we would not only use it as a basis of categorization or similarity judgments, but also use it for inductive inference about unseen properties of novel objects. One important function of categories is to promote inductive inferences, as they enlarge the scope of knowledge and allow predictions about novel items (Medin, 1989; Murphy, 2002). Also, strong conceptual relations are expected to be accessed automatically as shown in many studies using the semantic priming method (e.g., Meyer & Schvaneveldt, 1971; Neely, 1977).

Two conceptual relations have been particularly noted to function as connecting knowledge of individual objects. One is, of course, taxonomic relations. Taxonomic categories are denoted by nouns, and include items of the same kind. They are differentiated into levels of varying specificity (e.g., animal, dog, collie) related by class inclusion (e.g., a collie is a dog, a dog is an animal, a collie is an animal). Numerous studies have shown that taxonomic relations organize concepts and provide a basis for categorization, similarity judgments, and inductive reasoning (e.g., Markman, 1989; Osherson, Smith, Wilkie, López, & Shafir, 1990; Gelman & Markman, 1986; Waxman & Gelman, 1986) both in children and adults, and are included in the semantic network that is

automatically activated in fast-speed processing (e.g., Yokosawa & Imai, 1997).

However, recently, researchers have noted that thematic relations are also an integral and important part of the conceptual structure not only for children (e.g., Imai, Gentner & Uchida, 1994; Markman, 1989; Smiley & Brown, 1979) but also for adults (e.g., Lin & Murphy, 2001; Wisniewski & Bassok, 1999; see also Bassok & Medin, 1997). Lin and Murphy (2001, see also Markman, 1989) suggest that many human concepts include knowledge about nontaxonomic relations, with thematic relations being most important among them. They define thematic relations as external relations that arise through objects cooccurring or interacting together in space or time, or objects being linked by functional or causal relationships (e.g., table and chair, morning and newspaper, scissors and paper). Through a series of experiments with varying paradigms, they demonstrated that thematic relations play a role not only in similarity judgments but also in inductive reasoning about properties. They have also shown that the thematic relations are evoked not only in conscious, strategic cognitive processes but also in fast-speed, automatic processes (see also Yokosawa & Imai, 1997). Based on these results, Lin and Murphy (2001) suggested that thematic relations play a prominent role in conceptual structure in well-educated young American adults.

One important point in evaluating the effect of linguistic relativity might be, then, to compare the size of a potential language-specific effect of the classifier categorization system to that of other major conceptual relations such as taxonomic and thematic relations. If the speakers of the language rely on the language-specific conceptual relation in question equally or more strongly than the taxonomic and/or thematic relations, a very strong case is made for the linguistic relativity hypothesis, and it could be concluded that the target linguistic categorization system indeed "structures" or "organizes" the speakers' concepts. On the other hand, even if a statistically significant crosslinguistic difference is found

(e.g., similarity between pairs of objects from the same grammatical classifier category is rated higher by speakers of the language having that grammatical system than by speakers of a language that does not have such a linguistic system), this effect may not be strong enough grounds for a claim that the target linguistic categorization system “structures” (or “shapes,” even) the speakers’ concepts if the effect is much weaker than other conceptual relations.

We therefore suggest that we should be more cautious about advancing a strong and attractive conclusion that language “shapes” thought or language “structures” concepts. To advance such a strong conclusion, the following points should be considered: (1) whether the conceptual relation underlying the target linguistic categories serves as a basis not only for similarity judgments but also for inductive reasoning, (2) whether the conceptual relation is evoked automatically, and (3) whether the effect of the conceptual relation is comparable to that of other major conceptual relations such as taxonomic and thematic relations.

#### DOES A CLASSIFIER CATEGORIZATION SYSTEM INFLUENCE THOUGHT?

In this chapter, we examine the effect of a classifier categorization system on thought, along with the theoretical points we laid out above. In addition to nouns, objects are further categorized by grammar. Different languages have developed a broad variety of nominal classification systems including the classifier grammar system, the count/mass grammar system, and the grammatical gender system (e.g., Aikhenvald, 2000; Senft, 2000). The way language subcategorizes nouns varies across different languages, and it can be characterized as a continuum, with a fully obligatory grammatical classification on one end and a fully “lexical” classification on the other end (Grinevald, 2000). Examples of the grammatical type are count-mass grammar and the gender grammar systems. For example, languages with count-mass grammar (e.g., English, German)

classify nouns in two semantic categories: the category of individuated things (e.g., people, animals, machines) and the category of non-individuated things (e.g., water, sand, butter) and this classification must be done for all nouns, including concepts denoting nonphysical entities. Likewise, languages with gender grammar systems (e.g., German, French, Spanish) classify all nouns into a small number (usually two or three) of gender classes. An example of a lexical system of nominal classification is quantifiers that express quantities of nouns (e.g., a glass of water, a spoon of flour) and that classify nouns only temporarily but not inherently.

The classifier system is located somewhere in between the lexical and the grammatical extreme of the continuum. It differs from the count-mass grammar system or the gender grammar system in that classifiers classify nouns into over 100 classes according to the noun’s inherent semantic features.<sup>1</sup> Classifiers seem to have two important semantic functions. First, they serve to individuate the referent by providing a unit of counting to the noun just as quantifiers in language with count-mass grammar do [*yi* (one) *wan* (bowl) *mi* (rice) “a bowl of rice” in Chinese]. However, different from quantifiers that are used only for quantifying mass nouns, classifiers are applied to all nouns when quantifying them, including what seems to be clearly individuated objects. Second and more importantly, classifiers classify nouns and provide additional semantic information to nouns that are classified (Senft, 2000).

Many researchers have attempted to specify semantic criteria for classifier systems in different languages (e.g., Craig, 1986; Denny, 1986; Downing, 1996; Gomez-Imbert, 1996; Senft, 1996) and have identified several universal semantic features that serve as criteria for dividing entities into classifier categories (e.g., Adams & Conklin, 1973; Allan, 1977; Croft, 1994; Denny, 1979). The system of classification by classifiers is complimentary to the system of classification by nouns and, hence, categories created by the classifier largely cross-cut categories created by nouns. In particular, whereas the noun lexicon is structured



hierarchically around taxonomic relations, the system of classification by classifiers is usually organized around semantic features such as animacy, shape, function, size, rigidity, and social importance, and it does not have hierarchical structures as the noun lexicon does. Let us look at some examples from Chinese classifiers. *Tou* is a classifier for big animals such as cow, elephant, and rhino. *Tiao* is used for objects that are long and curved or flexible, including both animals and inanimates, such as road, jumping rope, snake, or fish. *Ba* is used for objects with a handle or objects that can be grasped by the hand (e.g., umbrella, screw driver, broom, key, or comb).

Given that a classifier system carves up the world in a very different way from taxonomic categories, what cognitive consequences should we expect with respect to representation and cognitive processes, if there are any? One possibility is that classifier systems provide an alternative organization of object concepts that results in categories that are nonexistent for speakers of nonclassifier languages. If this is the case, we expect that speakers of a classifier language and those of a nonclassifier language will behave very differently in almost all cognitive activities including category formation, similarity judgments, and, most importantly, inductive reasoning, as discussed earlier. Furthermore, if the classifier system provides a way of organizing object concepts, we may expect that classifier relations are accessed automatically in on-line processing. Of further interest here is to see the magnitude of the effect due to classifier categories relative to that of taxonomic or thematic relations, as discussed earlier. If speakers of a classifier language utilize classifier category membership in a range of cognitive activities to a greater degree than they utilize taxonomic and thematic relations, that would suggest that classifiers truly serve as the most dominant organizer of the speakers' conceptual structure. Even if the classifier relations are utilized to an equal or smaller degree than the taxonomic or thematic relations, as long as we see the effect in multiple cognitive contexts, especially in inductive reasoning, we would conclude that classifier

categories serve as an organizer of the speakers' conceptual structure, along with (and in parallel to) taxonomic and thematic relations.

A second possibility is that the classifier system is not qualified to be considered a major organizer of the speakers' concepts in light of the criteria discussed earlier, but the experience of linguistically categorizing objects by the use of classifiers may heighten the sense of similarity, and as a consequence, similarity among objects that are members of the same classifier category may be magnified in speakers of a classifier language. If this is the case, the difference between speakers of a classifier language and those of a nonclassifier language may be observed in similarity judgments, but similarity due to classifier relations would not exceed similarity due to taxonomic or thematic relations. Furthermore, even though the same-classifier relations may influence inductive reasoning in the context in which similarity is the only available source for the inference, the classifier influence may vanish when other sources such as background knowledge is available.

A third possibility is that classifiers are "frozen," linguistic conventions, and do not have any cognitive impact on speakers of classifier languages. In this case, we should not see any difference between speakers of a classifier language and those of a nonclassifier language, although the two groups may differ due to factors other than the classifier categorization system (e.g., culture).

To our knowledge, there are only a few studies in the literature that directly addressed these possibilities. One such study is research by Zhang and Schmitt (1998), who asked whether classifiers influence perception of similarity between two objects. They had speakers of Chinese and English rate the similarity of pairs of everyday objects. Half of the pairs consisted of objects that share the same classifier in Chinese and half of the pairs consisted of objects from different classifier categories. Zhang and Schmitt (1988) found that Chinese speakers rated the same classifier pairs more highly than the native English speakers do, whereas ratings of the different classifier

pairs did not differ cross-culturally. On the basis of these results, they concluded that classifier categories strongly affect the speakers' conceptual organization, saying that "The results obtained were a strong indication that objects sharing the classifier are grouped into schematic organizations in Chinese speakers' mental representations. That is, although English speakers may group these objects on the basis of their conceptual similarity, Chinese speakers seem to add a linguistic categorization to the classification of objects" (p.381).

Zhang and Schmitt's results can indeed be taken to be "some" support for the linguistic relativity hypothesis. However, it is not clear whether their results suggest that Chinese speakers' organization of object concepts is significantly different from that of English speakers due to classifier categories, because their experimental design does not allow us to determine how we should interpret the effect they found in light of the criteria we suggested earlier. If Chinese speakers draw inductive inferences on the basis of classifier category membership and the classifier category membership is automatically evoked even when a classifier is not explicitly expressed, we would agree that the classifier system indeed provides Chinese speakers with a way of organizing objects that English speakers do not possess. However, even if this is the case, we would like to know the magnitude of the impact of the classifier system relative to the impact of other major conceptual relations in order to evaluate how important the classifier system is as one of the organizers of concept in the mind of the speakers. It is also possible that the classifier effect found by Zhang and Schmitt (1998) was limited to similarity ratings, and that the classifier relations are not utilized in inductive reasoning, or not activated in automatic processing. If so, claiming that the classifier system adds a new way of organizing concepts might be an overstatement, though it may still be taken as a weak form of linguistic relativity.

To test these possibilities, we conducted two series of cross-linguistic studies, each of

which consisted of multiple cognitive tasks. Study 1 compared Chinese, a classifier language, and German, a nonclassifier language. Study 2 included a second classifier language, Japanese, in addition to Chinese and German to see whether the effect of classifiers is observed across different classifier languages, given the structural difference between Chinese and Japanese. Specifically, as we describe in more detail, classifiers accompany nouns much more systematically and frequently in Chinese than in Japanese. We explore whether this linguistic difference affects the magnitude and nature of the classifier effect for Chinese and Japanese speakers.

#### STUDY 1: EXAMINATION OF CLASSIFIER CATEGORIES IN CHINESE SPEAKERS' CONCEPTUAL STRUCTURES

Study 1 examined whether the Chinese classifier categories are utilized in categorization, similarity judgments, and inductive reasoning of a novel property, and whether classifier relations are automatically activated in on-line processing (Saalbach & Imai, 2007). For this purpose, we compared Chinese and German adults on forced-choice categorization, similarity judgments (on a rating scale), inductive inference of novel properties, and fast-speed word-picture matching tasks. We designed a stimulus set of everyday objects in a way that allowed us to examine four types of relations around the same target (e.g., FLOWER) using four test objects, each of which represented one of the four conceptual relations: (1) taxonomic (e.g., TREE), (2) thematic (e.g., VASE), (3) classifier (e.g., CLOUD), and (4) no-relation (SHOE). The four relations were orthogonally crossed, so that the object serving as the same-classifier item was not related to the target taxonomically or thematically. Likewise, neither the taxonomic item nor thematic item belonged to the same-classifier category in Chinese. Table 7.1 shows the stimulus set of our first study. The objects were presented verbally in the categorization, similarity judgments, and property induction tasks (i.e., in words).

TABLE 7.1. Stimuli Items Used for Study 1

Standard	Classifier	SameClassifier	Taxonomically Related	Thematically Related	Control
Comb	<i>Ba</i>	Key	Hair dryer	Hair	Ticket
Pistol	<i>Ba</i>	Umbrella	Canon	Bullet	Stamp
Scissors	<i>Ba</i>	Fan	Cutter	Paper	TV
Chain	<i>Tiao</i>	Carp	Rope	Lock	Poster
Necklace	<i>Tiao</i>	Blanket	Ring	Dress	Book
Towel	<i>Tiao</i>	Eel	Handkerchief	Shower	Potato
Mountain	<i>Zuo</i>	Tower	Hill	Snow	Necklace
Bell	<i>Zuo</i>	Building	Buzzer	Temple/church	Bike
Piano	<i>Jia</i>	Ladder	Violin	Music book	Scarf
Plane	<i>Jia</i>	Swing	Boat	Airport	Chain
Flower	<i>Duo</i>	Cloud	Tree	Vase	Cup
Newspaper	<i>Zhang</i>	Bed	Book	Morning	Tube
Drum	<i>Mian</i>	Wall	Trumpet	Sticks	Scissors
Tent	<i>Ding</i>	Hat	Sleeping bag	Campfire	Table

**Culture versus Language**

The design of the stimuli also provided us with a unique opportunity to examine a specific hypothesis concerning the extent to which the structure of object concepts is universally shared and to which it is malleable by environmental factors such as culture and language. Nisbett and colleagues have put forward a bold proposal (Nisbett, 2003, Nisbett, Peng, Choi, & Norenzayan, 2001) concerning the role of culture. They argue that philosophy, values, and customs that have been nursed in a culture throughout its history lead to a “culturally specific” style of cognition (Nisbett, 2003, Nisbett et al., 2001). In his empirical work, Nisbett focused on the comparison between East Asians and Westerners. Characterizing the former as “holistic” and the latter as “analytic,” Nisbett and colleagues argued that East Asians tend to view the environment as a unified whole and pay much attention to relations that tie elements in the environment. Westerners tend to focus individual elements of the environment separately. Based on this scheme, they have made a specific prediction regarding the conceptual structure of East Asians and Westerners: East Asians, with their predisposition to see a scene or event as a whole, are expected to categorize the world around thematic relations; Westerners, with their focus on properties of individual objects, are expected to categorize the world by taxonomic relations. Ji, Zhang,

and Nisbett (2004) in fact reported that monolingual Chinese people showed a preference for “relational” groupings whereas European Americans tended to group things “categorically.”

However, as in the case for the classifier effect in the study of Zhang and Schmitt (1998), it is not clear whether the data of Ji et al. (2004) warrant a strong conclusion that object concepts are organized differently for Easterners and Westerners. Ji et al. (2004) showed that Chinese college undergraduates have a relatively stronger preference for thematic-based groupings than American undergraduates, and conversely, the American undergraduates showed a relatively stronger preference for the taxonomic-based groupings than the Chinese undergraduates. However, again, we do not know whether this cross-cultural difference in the relative preference between taxonomic-based and thematic-based groups holds for inductive reasoning or if it is seen in the automatically activated semantic network. Furthermore, as we reviewed earlier, Lin and Murphy (2001) demonstrated that even educated European American young adults sometimes show a preference for categorizing objects based on thematic relations over taxonomic relations. Thus, it is important to determine whether the East–West differences found in the study of Ji et al. (2004) warrant a strong claim that Easterners and Westerners have different ways of organizing objects concepts.

In our paradigm, although the influence of language (the impact of a classifier system) and culture (culture-specific biases of Easterners and Westerners) on conceptual structures was examined simultaneously, we do not need to evaluate the effect of culture and language in a mutually exclusive, black-and-white fashion. For example, it is possible for us to find that Chinese speakers show stronger sensitivity both to classifier relations and to thematic relations than German speakers. Our paradigm also allows us to evaluate the relative importance of taxonomic relations, thematic relations, and classifier relations within the culture. Thus, it is possible that we find that the people from the two culture/language groups show reliance on the three types of relations in the same order but nonetheless find that the two groups rely on the three relations to different degrees. In this way, we can place the effects of culture and language, if we find any, in a global picture of the conceptual structure of everyday objects.

**Procedure and Results of the Categorization Task** The Chinese (undergraduates of Peking University in China) and German (undergraduates of Berlin Institute of Technology) participants were shown a triad of objects, one of which served as the standard and the other two

of which served as test items. They were asked to determine which of the two test items best matched the target item. As stated earlier, our stimuli included a taxonomic item, a thematic item, a classifier item, and a control item around the same target object. We thus constructed six types of contrasts around the same target item by making pairwise combinations of the four relations: (1) classifier vs. taxonomic, (2) classifier vs. thematic, (3) classifier vs. control, (4) taxonomic vs. thematic, (5) taxonomic vs. control, and (6) thematic vs. control.

The results are shown in Table 7.2. They indicate that classifier categories were not used as the basis for categorization by Chinese speakers. When the same-classifier item was pitted against the taxonomic or the thematic item, the Chinese as well as the German speakers made categories exclusively on the basis of the taxonomic or the thematic relations. When the same-classifier item was contrasted with the object that was not related to the target object (control), both the Chinese and German participants judged the same-classifier item to be the better match to the target. This finding suggests that there is an inherent similarity among objects belonging to the same-classifier category even when they do not share any taxonomic or thematic relations, and this inherent similarity is detectable by

TABLE 7.2. Mean Percentages of Classifier, Taxonomic, and Thematic as Well as Control Item Choices across Conditions of the Categorization Task of Study 1

Relation	Chinese (N = 23)	German (N = 24)
Classifier vs. Taxonomic		
Classifier	17.1	11.0
Taxonomic	82.9	89.0
Classifier vs. Thematic		
Classifier	17.1	15.2
Thematic	82.9	84.8
Classifier vs. Control		
Classifier	76.1	71.1
Control	23.9	28.9
Classifier vs. Thematic		
Taxonomic	36.0	34.5
Thematic	64.0	65.5



speakers of a nonclassifier language and is used when there is no other kind of similarity to resort to in forming categories. However, it is not the kind of similarity even speakers of a classifier language rely on for categorization, when taxonomic or thematic relations are present.

In addition, we did not find evidence for the proposal put forward by Ji et al. (2004) that Westerners organize object concepts around taxonomic relations and Easterners organize them around thematic relations. Unexpectedly, not only the Chinese but also the German participants preferred the thematic match over the taxonomic match (see the converging results in American undergraduates in Lin & Murphy, 2001; for more detailed discussion of this results, see Saalbach & Imai, 2007).

In summary, we did not find evidence that classifier categories are used as bases for categorization in the face of taxonomic and thematic relations, when classifiers are not explicitly mentioned. The performance of Chinese and German speakers in the categorization task was strikingly similar. However, this does not preclude the possibility that the classifier system affects the speakers' cognition in a subtler way (e.g., heightening attention to semantic features underlying classifier categories) on more sensitive tasks. We thus conducted similarity judgment and inductive reasoning tasks using a rating scale.

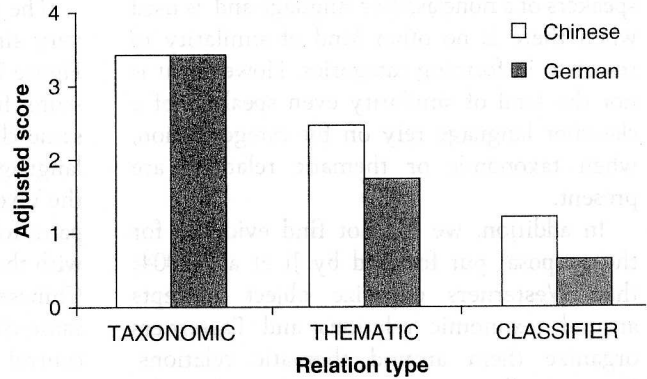
**Similarity Judgments** Chinese and German speakers were presented with pairs of objects and asked to judge similarity between the two objects on a rating of scale of 1 (very dissimilar) to 7 (very similar). The pairs were drawn from the 14 sets of quintuplets that were used in the categorization task. Around the same target object, four pairs were constructed representing taxonomic, thematic, same-classifier, and unrelated relations (see above). As in the forced choice categorization tasks, the objects were presented in words rather than in pictures (see Saalbach & Imai, 2007, for methodological details for this task as well as for other tasks).

The overall pattern of rated similarity was very similar across the two language groups. Figure 7.1 shows the mean adjusted similarity scores for each of the taxonomic, thematic, and same-classifier relation. Participants in both language groups gave the highest ratings for the taxonomic pairs, followed by the thematic pairs, followed by the classifier pairs. Consistent with the results of the categorization task, both Chinese and German participants rated the same-classifier pairs as more similar than the control pairs. This result again suggests that even speakers of a nonclassifier language can detect an inherent similarity between objects belonging to the same-classifier category. However, this inherent similarity may be magnified for speakers of the classifier language, as Chinese participants' similarity judgments for pairs drawn from the same-classifier classes were higher than those of the German participants, even with the correction for overall higher ratings.

Here, we also found some evidence for the proposal of Ji et al. in that Chinese speakers gave higher similarity ratings for thematically related object pairs than the German speakers, and when we tested the effect of culture in the contrast between the effect of the taxonomic item and that of the thematic item by a preplanned contrast after an overall ANOVA, a significant effect of culture was detected. These results suggest that language and culture could influence people's cognitive processes simultaneously, and warrants reconsideration of the traditional approach that assumes the influence of language and culture to be contrastive and asks *which* is the factor to shape thought.

**Property Induction** To assess whether Chinese speakers utilize classifier category membership as a basis of inductive reasoning, we had Chinese and German participants rate the likelihood that the two objects in the pair share an unknown property. They were instructed as follows: "Suppose that property X is an important property for [Object 1]. If [Object 1] has property X, how likely is it that [Object 2] also has property X?" They were

FIGURE 7.1. Adjusted scores for each relation type in each language in Similarity Judgments of Study 1.



Note: The adjusted score was obtained by subtracting the raw score for the control item from each target relation in each set within each language group. We did this manipulation to adjust the baseline differences across the different language groups. For example, Chinese participants tended to give higher ratings than Germans and Japanese for all stimuli types, including the control (unrelated) pairs; and Japanese tended to respond more quickly than Germans and Chinese in the speeded word-picture matching task across all conditions.

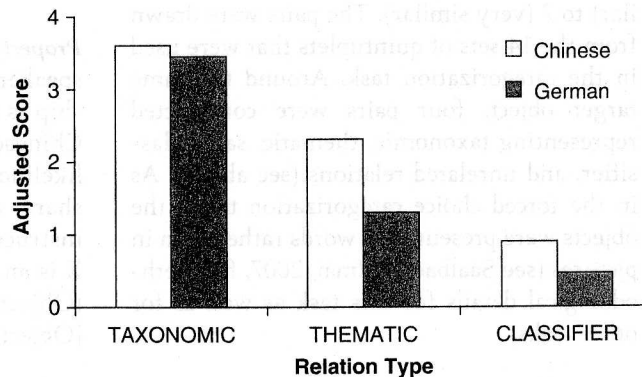
asked to judge the likelihood on a rating scale of 1 (not likely at all) to 7 (very likely). The object pairs were the same as those used in the similarity judgment task.

As shown in Figure 7.2, the pattern of the results of this study was strikingly similar to the pattern observed for the similarity judgments. Participants in both language groups rated the likelihood in the order of the taxonomic, thematic, same-classifier, and control (unrelated) items. As in similarity judgments, not only Chinese but also German speakers judged it more likely that the same-classifier items shared the same unknown property X with the target than the control items did. At the same time, parallel to the results of similarity judgments, likelihood ratings for the same-classifier items as well as for the

thematic items were magnified by Chinese speakers compared to German speakers. This result again shows that the influence of language and culture may not necessarily be mutually exclusive.

The result suggests that classifier category membership not only heightens similarity, but also carries some inductive potential. However, inference of a blank property did not allow the participants to recruit any specific knowledge; thus they had nothing to resort to but similarity (Osherson et al., 1990). It is interesting to see whether people utilize classifier relations in property inference even in a context in which they are able to recruit some background knowledge. We thus conducted a second inductive reasoning task. We used the property "carry the same bacteria," which

FIGURE 7.2. Adjusted scores for property induction (about blank property) for each target type in each language in Study 1.



was used by Lin and Murphy (2001). Participants were asked "How likely is it that [Object 1] and [Object 2] carry the same bacteria?" and judged the likelihood on a rating scale of 1 (not likely at all) to 7 (very likely).

This time, neither Chinese nor German participants rated the same-classifier item as having a higher probability than the control item in carrying the same bacteria as the target object, as shown in Figure 7.3. Although both Chinese and German speakers noted the similarity underlying classifier categories in the similarity judgment task, neither utilized this similarity in inductive reasoning in this context. Furthermore, the language-specific classifier effect observed in the inference of a blank property was no longer found here. The results from the two inductive inference tasks thus suggest that when people make an inductive inference from a completely unknown property, people use similarity as a basis for inductive reasoning. As classifier relations influence Chinese speakers' construal of similarity, classifier relations influence Chinese speakers' inductive inference in this context. However, when they determined the likelihood of the two objects carrying the same bacteria, they engaged in causal reasoning by utilizing existing knowledge about the conditions in which same bacteria were likely to be found. Specifically, as noted by Lin and Murphy (2001), people may have decided that taxonomically related objects were likely to carry the same bacteria because things of the same kind may have similar living conditions for a kind of bacteria. Likewise, they

probably decided that thematically related objects were likely to carry the same bacteria because the transmission of bacteria depends on external contact among items that cooccur in space and time. In this case, Chinese as well as German participants clearly decided that the kind of relation underlying classifier category membership (e.g., shape similarity, size, rigidity, functionality) would not heighten the likelihood of the two objects having the same bacteria.

**Speeded Word–Picture Matching** We also examined whether the language- and culture-specific differences that we observed in the similarity judgment and inductive inference of a blank property tasks are observed in a task that accesses fast and automatic processes. For this purpose we used a version of a semantic priming paradigm. It is widely known that recognition of a word involves activation of its corresponding node in a semantic network, and a priming effect is observed when two objects that are presented sequentially are conceptually related (Anderson, 1983; Joordens & Becker, 1997; Tulving & Schacter, 1990). Yokosawa and Imai (1997) have demonstrated that the conceptual priming effect is observed in picture recognition as well. In their study, participants (Japanese adults) saw a cue, which was presented either orthographically or pictorially, followed by a target picture. The participants were to judge whether the target matched the cue. Yokosawa and Imai (1997) found that regardless of whether the cue was presented as a word or a picture, when the cue was

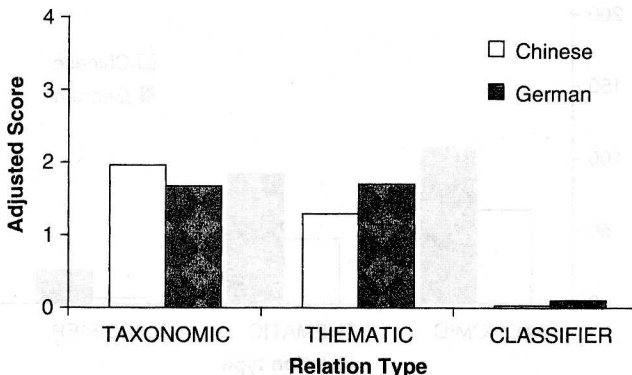


FIGURE 7.3. Adjusted scores for property induction (on the "carrying the same bacteria" question) for each target type in each language in Study 1.

taxonomically (e.g., dog) or thematically (e.g., carrot) related to the target (e.g., rabbit), the participants took a longer time to judge that the cue and the target were different objects (at the basic level) than when the cue was unrelated to the target (e.g., hammer). Here, they demonstrated that conceptual relatedness delays (interferes) with participants' judgments that two objects (the cue and the target) are indeed different.

We thus borrowed this paradigm to test whether the influence of classifier relations is observed in Chinese but not in German speakers. Of additional interest was to see whether the thematic effect was larger for Chinese than for Germans and the taxonomic effect would be larger for German than for Chinese participants, to test Nisbett and colleagues' culture-specific mode of cognition proposal (Nisbett, 2003; Ji et al., 2004). The same 14 quintuplets were used for this study. The target object was presented pictorially, and the cue representing one of the four relations (taxonomic, thematic, same-classifier, unrelated) was presented as a written word. The participants were instructed to verify whether the picture matched the word they had just seen (see Saalbach & Imai, 2007, for the methodological details).

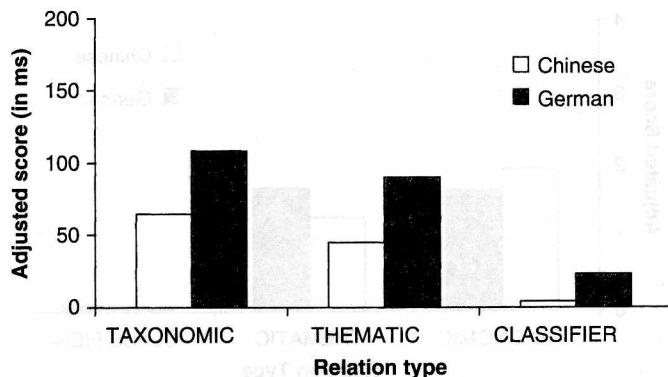
Figure 7.4 shows the mean adjusted response time for each relation type for Chinese and German speakers. Adjusted response times were obtained by subtracting the response time for the control item in each set from the taxonomic, thematic, and classifier item. As in the categorization, similarity

judgment, and inductive reasoning tasks, the taxonomic and thematic relations strongly affected the participants' response latencies in both language groups. In contrast, the classifier relation did not influence picture recognition of the target object in the Chinese group.

Taken together, it appears that the language-specific influence of the classifier classification system obtained for the unspeeded similarity judgments does not hold for a task that requires fast, automatic cognitive processes. The lack of the priming effect due to classifier category membership in Chinese speakers suggests that objects belonging to the same classifier category are not automatically activated when the target object is accessed, whereas taxonomically and thematically related objects are both activated.

It should also be noted that even though thematic items were perceptually very dissimilar to the target objects, the magnitude of delay due to thematic relations did not differ across the two groups. This result again supports the proposal that thematic relations are a universally important and integral part of the conceptual structure (Lin & Murphy, 2001; Wisniewski & Bassok, 1999), and that, unlike classifier relations, thematically related objects are automatically activated with the target object. However, the thematic effect was no larger for the Chinese group than for the German group nor was the taxonomic effect any larger for the German group than the Chinese group. Here, thus, support for Nisbett and colleagues' (Ji et al., 2004;

FIGURE 7.4. Adjusted scores for response latencies for each relation type in each language in the Word-Picture Matching task of Study 1.





Nisbett, 2003) culture-specific mode of cognition proposal was not obtained.

### **Interim Conclusions: Language/ Culture-Specific Cognitive Processes versus Task-Specific Processes**

The results overall show striking similarity across Chinese and German speakers. In both culture/language groups, taxonomic and thematic relations both proved to be important conceptual relations in the structure of object concepts. The results also show that German speakers are sensitive to similarity due to semantic features underlying classifier categories (presumably because they are often based on shape or simple semantic properties), but the magnitude of this effect was larger for Chinese speakers, which provides support for linguistic relativity. However, it would be an overstatement, given this effect, to state that the classifier categorization system in Chinese provides the speakers with a new way of organizing objects, for several reasons. First, the effect of classifier relations was much weaker than the effect of taxonomic or thematic relations when it was found (in similarity judgments and induction of a blank property). Second, the classifier effect found in the blank property induction easily diminished when participants were able to access some background knowledge. Third, classifier relations do not seem to be accessed in fast-speed, on-line cognitive processing. Taken together, a plausible conclusion seems to be that the classifier categorization system does not serve as a major organizer of the conceptual structure nor does it play a major role in the cognitive process in Chinese speakers. The language-specific classifier effect found among Chinese speakers is perhaps best characterized as a magnified sense of similarity through the habitual use of classifiers in association with the names of objects. This magnified similarity may be witnessed in cognitive activities that directly involve similarity, but does not extend to the entire range of cognition.

Concerning the issue of the taxonomic vs. thematic preference across Easterners and

Westerners (Nisbett, 2003; Ji et al., 2004), conclusions were similar to those for the classifier effect. We did find that the Chinese participants gave thematic relations higher similarity ratings as well as higher likelihood judgment in inductive inferences of an unknown property than the Germans, which is consistent with the findings of Ji et al. However, this culture-specific preference toward the taxonomic or thematic relations was not observed in the categorization, inductive inference of a known property, and speeded word-picture matching task. It is important to note that thematic relations are important for Germans (Westerners) just as taxonomic relations are important for Chinese (Easterners). Thus, even though we found stronger preference for thematic relations in Chinese participants than in German participants in the similarity judgment task using a rating scale, this effect should at best be characterized as a quantitative rather than a qualitative difference.

In any case, the results emphasize the importance of examining the effect of given language-specific categories (as well as the effect of culture) in a range of cognitive tasks and systematically comparing the size of the effect to that of other conceptual relations, as the effect may be observed in one type of cognitive activity but not in others, and the effect may be limited in magnitude compared to other conceptual relations. The fact that we obtained the classifier effect in the inductive reasoning task with a blank property but not in the same task with a concrete property (sharing the same bacteria) should be particularly noted in this respect, as it suggests that the influence of linguistic categories deeply interacts with task-specific constraints, such as type of knowledge and cognitive processes required for the task and type of conceptual relations relevant for the task (e.g., Smith, Shafir, & Osherson, 1993).

### **Can the Classifier Effect in Chinese be Generalized to Other Classifier Languages?**

Another aspect that should be considered in examining the effect of language is whether the effect of a target grammatical categorization

holds across all languages having that grammatical function. In the realm of grammatical gender, Vigliocco and colleagues (Vigliocco et al., 2005) found an effect of grammatical gender in Italian speakers' categorization behavior, but this effect was not found in German speakers. Likewise, Sera et al. (2002) found an influence of grammatical gender in categorization in Spanish and French but not in German. Thus, we have grounds to expect that the relation between grammatical categorization system and cognition is not one-fold; whether and how a given grammatical system affects cognition depend on the structural and semantic nature of the system in a given language. In our case, it is important to determine whether the classifier effect we found in Chinese is also found in speakers of other classifier languages, in which the semantic function as well as the grammatical function of the classifier categories are not identical to those of Chinese.

For this purpose, we conducted a second series of studies comparing Chinese and Japanese speakers, with German speakers serving as a control group again. Before reporting this study, however, we briefly discuss how the classifier system differs across Japanese and Chinese.

### Differences between the Japanese and Chinese Classifier Systems

Although Japanese and Chinese are both classifier languages, there are substantial differences between the two languages, especially with respect to the grammatical functions the classifiers play. Chinese classifiers must be used not only in numeral phrases (e.g., [numeral + classifier] table) but also in phrases with demonstratives (e.g., this [numeral + classifier] table). (The numeral after the demonstrative is often dropped, however. Thus, the most often heard demonstrative construction consists of the combination of "demonstrative + classifier + noun.") In contrast, Japanese classifiers are used only with numerals, and are not used in the construction with demonstratives. Furthermore, in Japanese, the classifier is used only when the mention of number is pragmatically important in the discourse. For

example, when a Japanese speaker talks about her cat, unless the fact that she has one cat (i.e., one and not more than one) is important in the discourse, we would not say "Watashi (I) wa (Topic-marking particle) ichi (1) hiki (Classifier for small animals) no (Genitive) neko (cat) wo (Accusative-marking particle) katte (have)-imasu (Present Progressive/State Aspect)" ("I have one cat"). Rather, she would simply say "watashi wa neko wo katte-imasu" ("I have cat") without specifying number. In contrast, in Chinese, the [numeral + classifier + noun] construction, especially with the numeral *yi* (one), is very often used even when the specification of number is not pragmatically important, and this [*yi* + classifier + noun] phrase serves like the English indefinite article. Thus, a Chinese speaker will say "wo (I) yang (grow) yi (1)- zhi (Classifier for small animals)-mao (cat)," meaning "I have a cat," in the context in which the specification of the number is not important in the discourse.

It is expected that this structural difference results in a much higher frequency of classifier use in Chinese than in Japanese. We confirmed this by comparing Chinese-Japanese translation texts using two sources. In the first source, Lammare (2009) compared the frequency of the classifier construction between Chinese and Japanese using the translation of the same original text (Chapter 4 of *Harry Potter and the Chamber of Secrets*, Rowling, 1999). She reported that the classifier construction appeared four times as frequently in the Chinese than in the Japanese translation (82 vs. 19 tokens).

In the second source, we compared a classic Japanese novel "Bocchan" (Master Daring) by Soseki Natsume (1964) using the Chinese-Japanese parallel corpus (Beijing Center for Japanese Studies, 2003). Here, if our linguistic analysis is correct, classifiers must be added in the process of translation from the original Japanese text to Chinese. In the original Japanese text, there were 111 classifier counts. In the Chinese translation, there were 405 counts. Thus, 294 classifier tokens were added through the translation process from Japanese to Chinese. On closer examination, there were 58 cases in which a classifier was used with

"one" ("ichi") in the Japanese original. In the Chinese translation, there were 156 cases of "one" ("yi") with a classifier construction. When the number was "two" or "three," there were 21 classifier counts in Japanese and 53 in Chinese. In the Chinese translation, classifier counts were 175 in the "demonstrative + classifier + noun" construction [e.g., "Zhe (this) zhang (classifier) weirenzhuan (document)"]. However, in the original Japanese text, these were simple "demonstrative + noun" constructions without a classifier in all the cases. Here, classifiers are used roughly four times as frequently in Chinese as in Japanese.

#### STUDY 2: FURTHER EXAMINATION OF THE INFLUENCE OF CLASSIFIER CATEGORIES: COMPARISON OF CHINESE, JAPANESE, AND GERMAN SPEAKERS

Given that there was a language-specific classifier effect for Chinese speakers on similarity judgments and blank property induction in Study 1, we examined whether the classifier effect would be replicated for a larger set of stimuli in Chinese speakers and if it would also be found for speakers of another classifier language, Japanese. We compared Chinese, Japanese, and German speakers on similarity judgments and the two types of property induction tasks as well as on the speeded word-picture matching task.

In this study, we designed the stimuli in such a way that the classifier effect could be examined more finely than in Study 1 so that we could see whether the magnified similarity effect due to classifier relations is observed only for object pairs belonging to the same classifier category in the speakers' own language. We thus tested the classifier effect in three situations: (1) object pairs belonging to the same classifier class both in Chinese and Japanese, (2) object pairs belonging to the same classifier class in Chinese but not in Japanese, and (3) objects pairs belonging to the same classifier class in Japanese but not in Chinese. In addition, to determine if there would be a classifier effect over and above any effect of taxonomic category membership, we contrasted pairs in

which two objects share both taxonomic category membership and classifier membership in both Chinese and Japanese (e.g., bed and table) to pairs in which the two objects shared only taxonomic category membership but not classifier category membership (e.g., bed and chair).

The first type of pairs was particularly important as it allowed us to test the influence of classifier categories in Japanese and Chinese speakers on the very same objects. Even if a stronger awareness of similarity was observed in Chinese speakers than in Japanese speakers for object pairs sharing the same classifier category membership in Chinese (but not in Japanese) but no stronger awareness of similarity was detected in Japanese speakers than in Chinese speakers for pairs sharing the same classifier membership in Japanese (but not in Chinese), it would be difficult to rule out the possibility that this difference could be due to some inherent properties of the stimuli. However, if the amplified similarity due to classifier category membership was observed in Chinese speakers but not in Japanese speakers for the same stimuli, the difference in the classifier effect could be attributed to the structural difference between Chinese and Japanese.

Stimulus set types 1–4 in Table 7.3 were used. Type 1 sets were used to contrast the object pairs from the same classifier class in both Chinese and Japanese (e.g., bone and tube: CH/JP CLS) with the pairs sharing no relation in either (e.g., bone and platter: Control). Type 2 sets, which were also used for Experiment 1, contrasted object pairs sharing classifier membership only in Chinese but not in Japanese (CH CLS) with pairs sharing no relation in either. Type 3 sets were used to contrast object pairs from the same classifier class in Japanese but not in Chinese (JP CL) with pairs sharing no relation in either language. Type 4 sets contrasted pairs in which the two objects shared both taxonomic category membership and classifier class membership in both languages (e.g., bed and table: CH/JP CLS + TAX) with pairs in which the two objects belonged to the same taxonomic category but to different classifier classes in both (e.g., bed and chair: TAX).

TABLE 7.3. Structure of the Stimuli Used for Study 2 with a Sample Set for Each Contrast Type

Contrasts	STANDARD	Same Classifier (CLS)			Control (CON)	
		-TAX			+TAX	-TAX
		CH + JP	CH	JP	CH + JP	
Type 1 CH/JP CLS	Bone	Tube	—	—	—	Platter
Type 2 CHCLS	Flower	—	Cloud	—	—	Cup
Type 3 JPCLS	Bus	—	—	TV	—	Hat
Type 4 CH/JPCLS + Tax	Bed	—	—	Table	Chair	

The procedures for the similarity rating tasks and the two property induction tasks (induction about a blank property and induction about bacteria) were the same as those in Study 1. To test the language-specific classifier effect in fast-speed, automatic processing, we conducted two versions of the priming task. In Study 1, when the cue noun was presented as a bare word, no language-specific classifier effect was found. In fact, within Chinese speakers, the response latencies for the same-classifier items were not different from the control items. However, it is possible that when the noun is accompanied by the classifier, some online activation of classifier relations is evoked.

In a study examining the on-line influence of grammatical gender using a semantic substitution paradigm, Vigliocco, Vinson, Indefrey, Levelt, and Hellwig (2004) found that German speakers tended to produce substitution errors within the same gender category when producing phrases with determiners marked for gender, but that this gender preservation effect disappeared when they produced bare nouns or phrases with determiners not marked for gender (i.e., a phrase with an indefinite determiner plus noun). Similarly, classifier relations may be activated on-line when a noun is presented with a classifier but not when it is presented in isolation (cf. Gao and Malt, 2009). In Study 2, we thus conducted the word–picture matching task in a version in which the cue word was presented in the classifier phrase [e.g., “yi (one) ge (classifier) pingguo (apple)”], in addition to the version

identical to that in Study 1 (i.e., the bare noun version). The same stimuli sets as in Experiments 1–3 were used for this study. Furthermore, additional control items were included: In Type 1 through 3 sets, for each target object, an object that was taxonomically related but belonged to a different classifier category was added; in Type 4, an object having neither a taxonomic nor a classifier relation to the target was added. These manipulations were done to ascertain whether the semantic priming procedure would work throughout Type 1–4 sets. If this was the case, delayed rejection of taxonomically related pairs should occur as compared to unrelated control pairs. Thus, in case no delay due to the same classifier relation should be found, we would be able to determine whether the null result was due to the absence of the classifier effect or to methodological problems.

Given the results of previous research, we might expect a classifier priming effect to occur in the phrase condition but not in the bare noun condition. Here, we tested only Chinese and Japanese speakers, as German has no classifiers. We compared the Chinese and Japanese data here with the German data in the bare noun version.

### Results of Study 2

**Similarity Judgments** As in Study 1, we present data as adjusted (difference) scores so that readers could directly see the effect of classifiers



compared to control (see Fig. 7.5). Replicating the results of Study 1, object pairs belonging to the same classifier category, either in Chinese or Japanese, or both, were rated more similar than the control pairs (object pairs sharing no relation) by not only Chinese or Japanese speakers but also by German speakers. We thus provide additional evidence that there is inherent similarity among objects belonging to the same classifier category, and this similarity is detectable even by nonspeakers of a classifier language. However, when the objects in a pair shared a taxonomic relation, an additional classifier relation did not increase similarity, as there was no statistically reliable difference between the CH/JP CLS + TAX pairs and the Tax (-CH/JP CLS) pairs in the rated similarity.

The language-specific classifier effect observed among Chinese speakers in Study 1 was replicated, but this effect was not found in Japanese speakers. As in Study 1, we first compared the size of the effect of classifier relations with that of taxonomic relations, and whether there was any cross-cultural difference in this respect. In all three language groups, object pairs sharing taxonomic relations received

much higher similarity ratings than object pairs sharing classifier relations (but did not share taxonomic relations) in the same degree.

We then conducted a preplanned contrast on the means of the object pairs belonging to the same classifier category in Chinese (i.e., the average of the CHJP CLS and CH CLS) and the means of the corresponding controls (i.e., the average of the Control items in Type 2 and Type 4 sets) and tested if Chinese speakers showed a larger effect than German speakers on this contrast<sup>2</sup>; there was a highly significant effect for Language on this contrast, revealing that Chinese speakers rated the pairs belonging to the same classifier category in Chinese higher than German speakers. In contrast, when we contrasted the mean similarity ratings for the object pairs belonging to the same Japanese classifier categories (i.e., the average of the CHJP CLS and JP CLS) and the corresponding controls, no effect for Language was found on this contrast, suggesting that Japanese speakers do not show a language-specific classifier effect as compared to German speakers. Importantly, when we compared Chinese

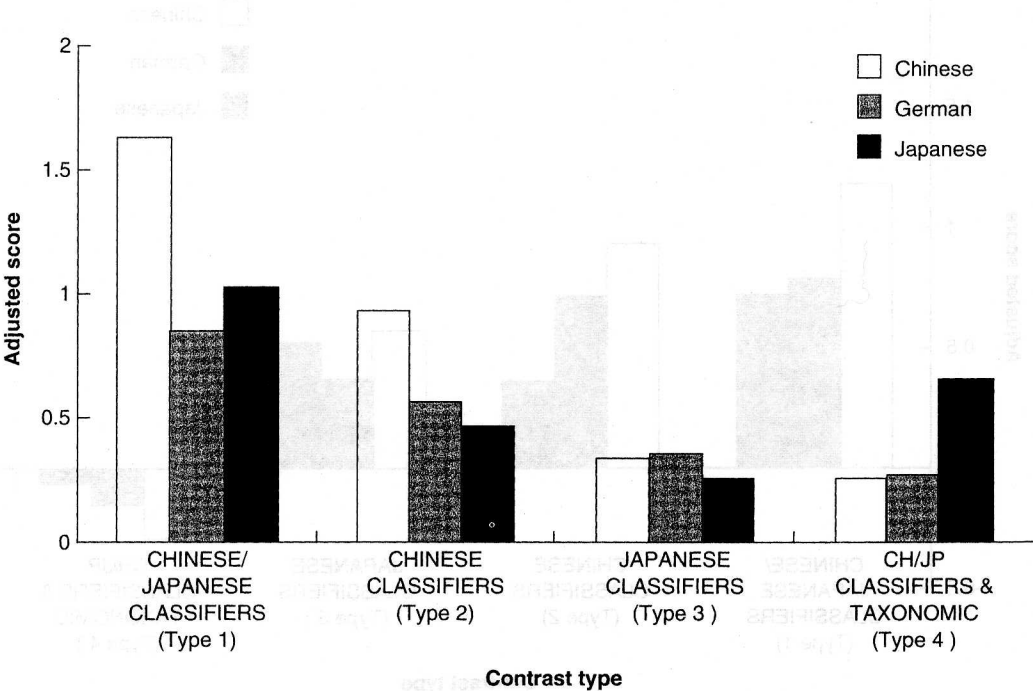


FIGURE 7.5. Adjusted scores for each contrast type in each language in Similarity Judgment of Study 2.

and Japanese speakers on the object pairs belonging to the same-classifier categories on both languages, Chinese speakers gave higher ratings for the same-classifier pairs than Japanese speakers. When object pairs were taxonomically related, sharing the classifier categories in addition did not increase similarity over and above the similarity due to the taxonomic relations in any of the three language groups.

To recapitulate the results, we found the amplified classifier similarity effect in Chinese speakers (in contrast to German speakers), but we did not find the same effect for Japanese here. Furthermore, when we directly compared Chinese speakers and Japanese speakers on the object pairs that shared classifier membership in both languages, Chinese speakers rated these items significantly higher than Japanese speakers, again suggesting that the language-specific amplified classifier effect is found only in Chinese but not in Japanese speakers.

**Induction of a Blank Property** As can be seen in Figure 7.6, all three groups gave significantly higher ratings for object pairs belonging to the same classifier category (only in Chinese, only in Japanese, or in both Chinese and Japanese) than for their corresponding control pairs. However, when both the same-classifier item and the control item belonged to the same taxonomic class (Stimuli Set Type 4), no effect of classifier membership was obtained over and above the effect due to taxonomic relations.

When the language-specific classifier effect was examined, it was again found for Chinese speakers but not for Japanese. In other words, Chinese speakers rated the likelihood of two objects sharing an unspecified property higher than speakers of a nonclassifier language (German) when the objects belonged to the same classifier category in Chinese (CHJP CLS and CH CLS). In contrast, Japanese speakers did not show a language-specific magnified classifier effect for the object pairs from the same Japanese classifier category (CHJP CLS and JP

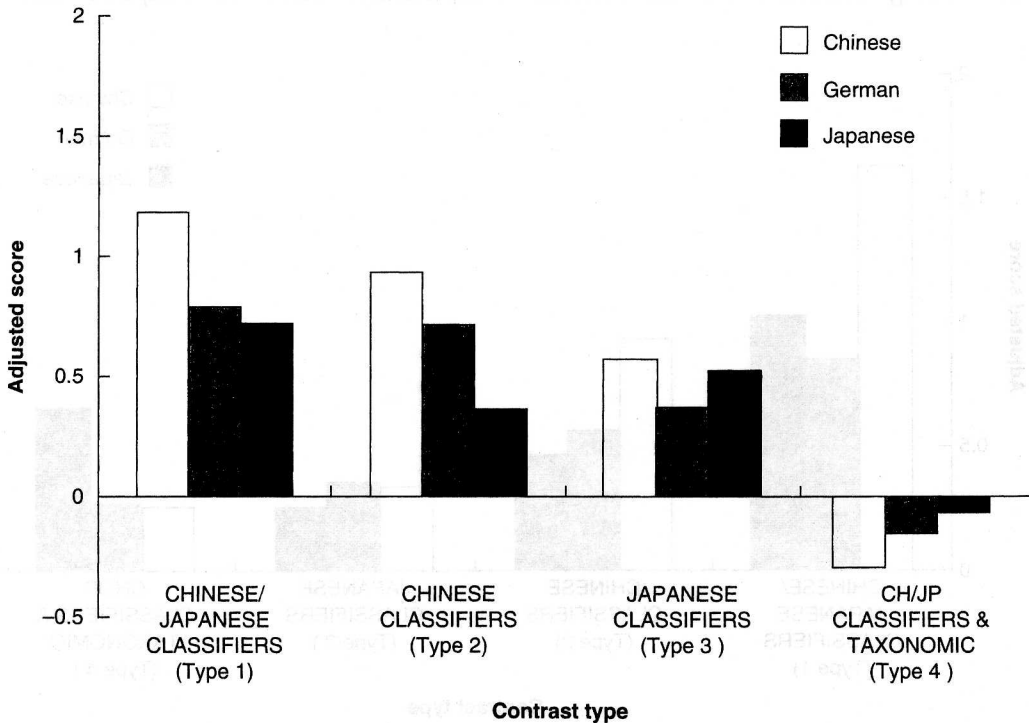


FIGURE 7.6. Adjusted scores for property induction (about blank property) for each contrast type in each language in Study 2.

CLS) greater than German speakers in this task. When Chinese and Japanese speakers were compared on the object pairs belonging to the same classifier category in both languages, again, Chinese speakers gave higher likelihood ratings than Japanese speakers on these pairs.

**Induction of Bacteria** Consistent with the results of blank property induction, all three language groups gave significantly higher ratings for object pairs belonging to the same classifier category than for their corresponding control pairs (see Fig. 7.7). However, unlike the case with the blank property induction, but consistent with the results of the same task in Study 1, there was no language-specific classifier effect in Chinese speakers here: Chinese speakers did not give any higher ratings than Japanese or German speakers for the object pairs belonging to the same classifier category in Chinese. Again, Japanese speakers did not rate the object

pairs belonging to the same classifier category in Japanese any higher than Chinese or German speakers. Also consistent with the results from the similarity judgment task and the blank property induction task, when two objects were related taxonomically, classifier category membership did not increase the likelihood ratings for the same bacteria being found in the two objects.

**Word-Picture Priming** We first report the results from the version in which the cue noun was presented on its own. In this version, the prime was presented in a word in the bare form, and the participants were asked to judge whether the target picture matched the preceding word prime. Figure 7.8 shows the adjusted response times (difference between the mean latency for the same-classifier items and the control items in the corresponding sets) for the same-classifier items in each of Type 1–4 sets. In the far right of the graph, we also included the adjusted times for the

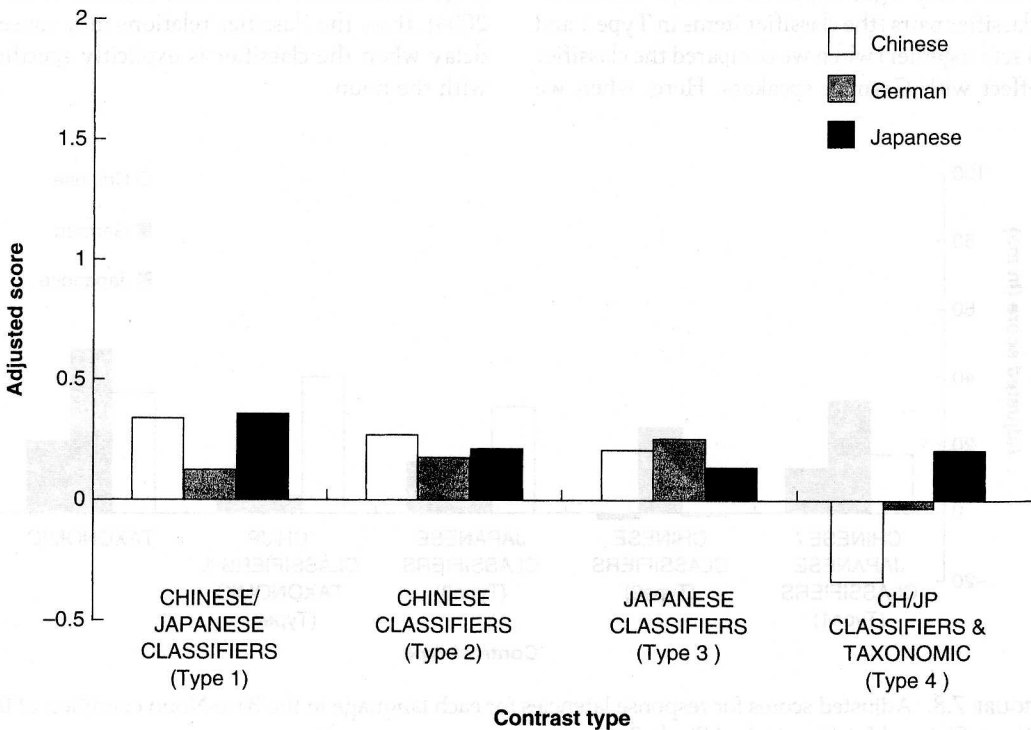


FIGURE 7.7. Adjusted scores for property induction (on the “carrying the same bacteria” question) for each contrast type in each language in Study 2.

taxonomic items, which was obtained by subtracting the latencies for the control items from the taxonomic items (averaged across Type 1–3 sets), so that readers can compare the effect due to classifier relations with the effect due to taxonomic relations. As clearly seen in Figure 7.8, we found that participants from all three language groups took significantly longer to respond to taxonomically related items than to item pairs from the same classifier category (that were not taxonomically related) and control items. The object pairs from the same classifier category (i.e., the classifier items in Type 1–3 sets together) caused longer response latencies relative to pairs from different classifier categories (the control items in Type 1–3 sets together) in all three language groups, again demonstrating that the task was sensitive to important conceptual relations in people's on-line cognitive processing. However, consistent with the results of Study 1, there were no language-specific classifier effects either on the Chinese same-classifier pairs (the classifier items in Type 1 and 2 sets together) or on the Japanese same-classifier pairs (the classifier items in Type 1 and 3 sets together) when we compared the classifier effect with German speakers. Here, when we

compared the classifier effect in Chinese and Japanese speakers on the pairs sharing the classifier membership in both languages (Type 1 sets), no difference was found across the two language groups.

Given these results together with the results of the parallel word–picture matching task in Study 1, it is likely that classifier relations are not automatically activated in processing a noun without a classifier. The fact that the delay due to classifier membership was observed in all of the three languages in roughly the same magnitude indicates that the effect of classifier category membership is due to an inherent similarity underlying classifier categories. Perhaps the cognitive influence of classifiers may be seen not so much as a long-term influence on the representation of objects *per se* but as a temporary shift in the construal of the referent in the way that parallels English speakers' shift of construals when the same noun is marked as a count noun or as a mass noun (e.g., "Jim had a few chocolates" vs. "Jim had some chocolate") (e.g., Middleton, Wisniewski, Trindel, & Imai, 2004). If so, the classifier relations may cause a delay when the classifier is explicitly specified with the noun.

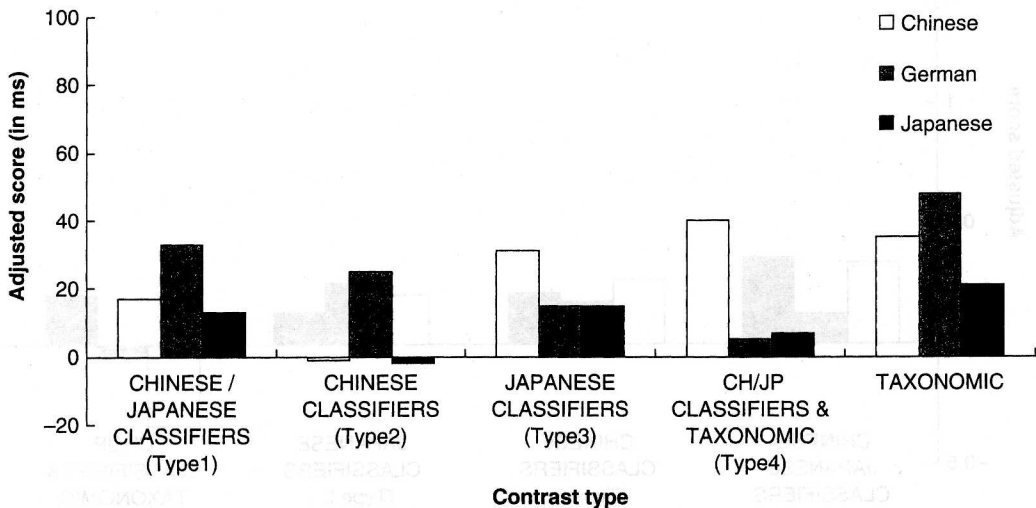


FIGURE 7.8. Adjusted scores for response latencies for each language in the Bare-Noun condition of the Word-Picture Matching task of Study 2.

Note: "Taxonomic" represents the adjusted score for the taxonomic items, which was obtained by subtracting the control (unrelated) items from the mean response time for the taxonomic items in the Type 1–3 sets.



As can be seen in Figure 7.9, the pattern of the results in this *phrase priming task* was the same as in the previous priming task: Although the cue/target pairs from the same classifier categories delayed responses relative to the cue/target pairs from different classifier categories in both Chinese and Japanese speakers, neither the Chinese same-classifier pairs nor the Japanese same-classifier pairs caused language-specific classifier effects on response latencies when compared to the German speakers' latencies.

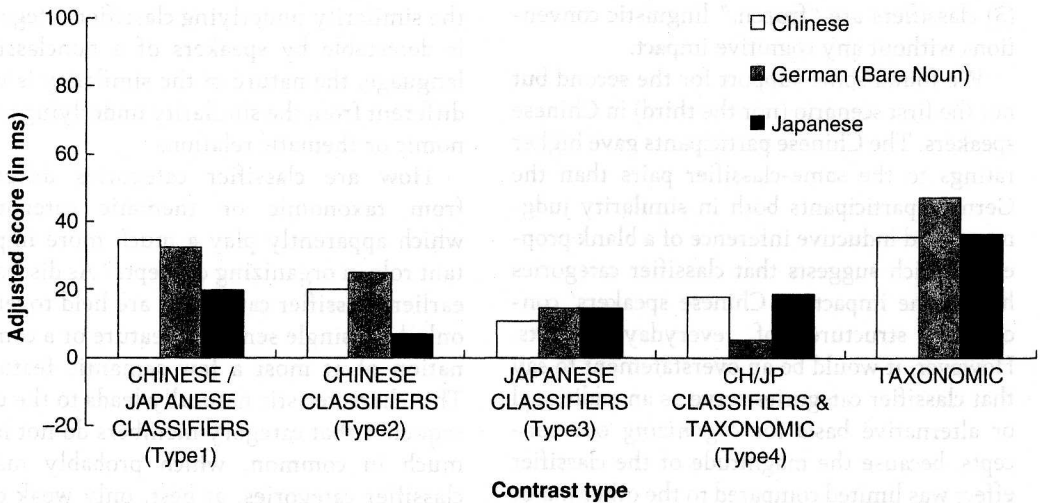
**Summary of Study 2**

The results of the similarity judgments and two property induction tasks in Study 2 converged with the results we reported in Study 1 for Chinese speakers. Two objects from the same classifier categories, when they did not share any other conceptual relations, were construed as more similar than two objects from different classifier categories, and this similarity was detected by people whose language did not have a classifier system and could serve as a basis of inductive reasoning, especially when people could not use much background knowledge. However, in none of the tasks

tested was the magnified similarity effect due to classifiers observed in Japanese speakers.

Consistent with the results of Study 1, the word-picture matching tasks of Study 2 revealed the sensitivity to the similarity underlying classifier categories in speakers of all three language groups. However, the magnitude did not differ between speakers from classifier languages and a nonclassifier language, regardless of whether the classifier categories were explicitly invoked (using nouns in the classifier phrase ) or not (using bare noun). Thus, it seems that the language-specific classifier effect is not evident in fast, automatic cognitive processes.

Overall, although the language-specific classifier effect was not revealed in fast, automatic processing, some influence of the classifier system on the conceptual structure of everyday objects was found in Chinese speakers in non-speeded similarity judgments and blank property induction tasks. However, this effect was not identified in Japanese speakers. Thus, finding a language-specific influence of a given linguistic categorization system in one language cannot be automatically generalized to other languages that have the same linguistic categorization system.



**FIGURE 7.9.** Adjusted scores for response latencies for each language in the Phrase condition of the Word-Picture Matching task of Study 2.

Note: "Taxonomic" represents the adjusted score for the taxonomic items, which was obtained by subtracting the control (unrelated) items from the mean response time for the taxonomic items in the Type 1-3 sets.

## COGNITIVE CONSEQUENCES OF CLASSIFIER CATEGORIES

In summary, what are the cognitive consequences of having such linguistic categories? We set up the following criteria in evaluating the influence of the classifier system: (1) whether the conceptual relation underlying the target linguistic categories serves as a basis not only for similarity judgments but also for inductive reasoning, (2) whether the conceptual relation is evoked automatically, and (3) whether the effect of the conceptual relation is comparable to that of other major conceptual relations such as taxonomic and thematic relations. We then tested three possible scenarios: (1) classifier categories function as the most dominant or one of the major organizers of our concepts and categories (cf. Lakoff, 1987; Zhang & Schmitt, 1998), (2) classifiers heighten the speakers' sense of similarity but the influence of the classifier system is not qualified to be considered as a major organizer of the speakers' conceptual structure, in light of the above criteria, as the classifier influence is not pervasive enough in the context of a broad range of cognitive processes and/or the magnitude of influence is not large enough compared to that of other major conceptual relations, and (3) classifiers are "frozen," linguistic conventions without any cognitive impact.

We found some support for the second but not the first scenario (nor the third) in Chinese speakers. The Chinese participants gave higher ratings to the same-classifier pairs than the German participants both in similarity judgments and inductive inference of a blank property, which suggests that classifier categories have some impact on Chinese speakers' conceptual structure of everyday objects. However, it would be an overstatement to say that classifier categories serve as an additional or alternative basis for *organizing* our concepts, because the magnitude of the classifier effect was limited compared to the other major relations that organize concepts. In Study 1, we demonstrated that taxonomic and thematic relations are important organizers of people's conceptual structures, regardless of whether

they speak a classifier language. In contrast, the impact of classifiers was much smaller in magnitude when it was found at all, and the language-specific influence of classifier categories was limited to just two tasks, i.e., similarity judgment and inductive reasoning of blank properties. Study 2 replicated the results of Study 1 for Chinese speakers. However, the language-specific classifier effect was not found in Japanese speakers in any of the tasks, including those in which the classifier effect was observed in Chinese speakers.

Thus, the pattern of the results suggests that the classifier effect found among Chinese speakers is best characterized as a magnified sense of similarity developed through the *habitual* use of classifiers in association with the names of objects. The fact that the language-specific classifier effect was not found in Japanese speakers is in accord with this interpretation. In Japanese, perhaps classifiers are not used frequently enough to result in magnified sensitivity in the semantic features underlying classifier categories. In other words, it does not seem unreasonable to suspect that the language-specific classifier effect in Chinese speakers arises from the speakers' experience of observing conceptually very different objects being marked with the same grammatical morpheme. In this sense, even though the similarity underlying classifier categories is detectable by speakers of a nonclassifier language, the nature of the similarity is very different from the similarity underlying taxonomic or thematic relations.

How are classifier categories different from taxonomic or thematic categories, which apparently play a much more important role in organizing concepts? As discussed earlier, classifier categories are held together only by a single semantic feature or a combination of at most a few semantic features. This characteristic naturally leads to the consequence that category members do not have much in common, which probably makes classifier categories, at best, only weak conceptual categories. Seen this way, it does not seem unreasonable that the classifier effect was observed in similarity judgments and blank property induction but not in other

tasks. People are very versatile in perceiving similarity, and even the commonality of a single feature can significantly affect the construal of similarity among objects. On the other hand, it is reasonable that people (including both speakers of a classifier language and a nonclassifier language) did not make inductive generalization of a property based on the kind of similarity that underlies classifier categories, when they could access background knowledge.

#### IMPLICATIONS FOR LANGUAGE AND THOUGHT ISSUES

The studies reported in this chapter emphasize the importance of putting the effect of linguistic categories in context by comparing other kinds of conceptual relations and considering to what extent the linguistic relativity effect, if there is any, is meaningful for the global organization of human concepts. As we reviewed earlier, Zhang and Schmitt (1998) found that Chinese speakers rated objects from the same classifier categories more similar than English speakers and interpreted this result as evidence for linguistic relativity. Our own research confirmed this effect, but also found that this effect is much smaller compared to other kinds of conceptual relations, such as taxonomic and thematic relations.

This conclusion is also important for interpreting the results of studies examining the Whorfian effect of grammatical categories other than the classifier system. For example, previous studies examining the influence of grammatical gender reported some evidence for linguistic relativity, as reviewed earlier (e.g., Boroditsky et al. 2003; Konishi, 1993; Gomez-Imbert, 1996; Sera et al., 2002). In general, if a cross-linguistic difference is found between a language having the grammatical gender system and a language without the gender system in any task, be it in similarity judgments, categorization, or attribution of male-like/female-like properties, it is taken as evidence for linguistic relativity. However, it is worthwhile to rethink how meaningful the

effect is for the global structure of the speakers' object concepts. An interesting question in this light is whether the grammatical gender of an animal name influences inductive or deductive inference of a biological gender-specific property. For example, if a given animal's grammatical gender is feminine but the animal's biological sex is unknown, are the speakers more likely to infer that the animal has a biological female property (e.g., having a female hormone) than when the animal's grammatical gender is masculine? If so, the linguistic influence of grammatical gender categories would seem to have substantial meaning for the speakers' conceptual structures.

The research reported in this chapter suggests that the influence of linguistic categories deeply interacts with task-specific cognitive constraints and availability of background knowledge. Second, it also highlighted the importance of examining the influence of linguistic categories not in light of *whether* there is one, but in light of *how large* the influence is in a broad range of cognitive processes, and *how it is related to* other major conceptual relations underlying our conceptual structure. Relevant to this point, the fact that German participants judged objects belonging to the same classifier category to be more similar than unrelated objects supports the notion that grammatical categories are *motivated* (but of course not determined) *by* universally shared cognitive and perceptual experience (e.g., Zubin & Köpcke, 1986). In this sense, our results are not incongruent with the view that grammatical categories are a reflection of cognitive categories (e.g., Lakoff, 1987). At the same time, our results suggest that grammatical categories such as classifier categories do not function as a major organizer of our concepts to the same extent that taxonomic and thematic categories do. More importantly, the two aspects of our findings—that similarity underlying classifier categories can be detected by German speakers on the one hand and that similarity due to classifier relations is magnified by Chinese speakers on the other hand—cogently suggest that the relation between language and thought is not unidirectional: Linguistic categories reflect

universally perceived commonalities in the world, but at the same time they modify universally perceived similarities (see Imai & Mazuka, 2007, for a relevant discussion).

One issue that also warrants some discussion is whether the results we obtained from the two series of studies permit us to draw the conclusion that the classifier system influences Chinese speakers' conceptual structure and cognitive processes, and hence can be interpreted as evidence for the Whorfian hypothesis, given the lack of the classifier effect in Chinese speakers in the on-line tasks. Some researchers might be concerned that Chinese speakers' similarity ratings for same-classifier pairs were higher than those of German speakers because they were aware that the two objects were associated with the same classifier category, which is simple reflection of Chinese speakers' conscious strategy adopted for carrying out the task and hence cannot be considered as the "true" reflection of their cognitive processes.

We set up three points to be considered in evaluating the influence of a given linguistic categorization system, one of which is whether the influence due to the linguistic categorization system is found in unconscious, automatic processes. In this respect, the effect of the classifier system is indeed not as large or important as taxonomic relations or thematic relations. However, in our view, this in itself should not mean that the amplified classifier effect found in Chinese speakers is an experimental artifact and hence is not "real." First, methodologically, we do not think that this conscious "give-higher-ratings-for-same-classifier-object" strategy is the cause for the amplified similarity effect identified in Chinese speakers. If participants had been forced to choose one of two objects, one from the same classifier category and the other with no such relation, and if they could not find reasonable similarity in either object, they might have resorted to this strategy. In the similarity judgment task in our research, however, no direct comparison of the similarity of the same-classifier object and the control object was involved. Furthermore, in the similarity judgment task as well as in the inductive reasoning task, the classifier was not explicitly referred to when presenting the

stimuli, and the classifier relations were not the only kind of relation among the objects in the stimulus set, as our stimuli also included taxonomically related objects. Thus, it is not likely that Chinese speakers consciously thought of classifiers while undertaking the task. Even if the Chinese-speaking participants had used this strategy consciously, they did so spontaneously in situations in which this was not required. Similarity and inductive reasoning are two core processes for human cognitive activities. In our view, if participants had thought about classifiers even when no invocation of the classifier was necessary and spontaneously utilized this knowledge when engaging these activities, this would in itself suggest that classifiers indeed affect speakers' cognitive process.

Another aspect that should be considered in examining the effect of language is whether the effect of a target grammatical categorization holds across all languages having that grammatical function. In the research presented, we found the classifier effect among Chinese speakers but not in Japanese speakers. This parallels the finding that grammatical gender influences similarity and categorization in Italian or Spanish but not in German (Vigliocco et al., 2005; Sera et al., 2002).

In closing our chapter, we suggest that the simple Whorfian-vs.-non-Whorfian dichotomy does not deepen our understanding of the nature of our concepts and cognitive processes very much, given the complexity of the interactions among many factors that affect the structure of our concepts and cognitive processes. In future research, we clearly must go beyond simply seeking evidence for the Whorfian hypothesis. What is important, then, is to clarify *how*, rather than *whether*, language-specific categories, be they grammatical or lexical, affect our concepts, categories, and cognitive processes. It is particularly important to specify how the effect interacts with our universal cognitive biases, the structure of the world, the constraints placed by the task or cognitive activity at hand (e.g., what type of information or knowledge is most relevant for the inference), and, finally, the language-specific characteristics of the given linguistic categorization system.



## ACKNOWLEDGMENTS

We thank Barbara Malt and Phil Wolff for insightful comments on an earlier version of this chapter. We are also indebted to Zhou Xiaolin, Elsbeth Stern, Sachiko Saitoh, Lennart Schalk, Shu Hua, Zhu Liqi, and Huangfu Gang for help with data collection and discussion. This work was in part supported by a Ministry of Education grant-in-aid for Scientific Research (#15300088 and #18300089) and research grants from Keio University (Keio Gijuku Academic Development Funds and Keio Gijuku Mori Memorial Research Fund) to M. Imai and by fellowships from the Japan Society of the Promotion of Science (JSPS) and Friedrich-Ebert-Stiftung awarded to H. Saalbach.

## Notes

1. Here, we consider only so-called "numeral classifiers," and do not include what is sometimes called "noun classes," in which nouns are obligatorily classified into a small number of noun classes as in the case with Dyrbal (Dixon, 1986; see also Lakoff, 1987).
2. We did not conduct ANOVA analyses directly using the difference scores, because it is not statistically desirable. Instead, we conducted a repeated measure ANOVA including the classifier conditions and corresponding control conditions from the four sets (Type 1–4 sets) and then tested specific effects by planned contrasts.

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