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Language-Dependent Classification: The Mental Representation of Classifiers in Cognition, Memory, and Ad Evaluations

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Classifiers are lexico-syntactic structures that are common in Chinese but not in English. In 3 studies, the authors demonstrated that classifiers provide a language-inherent classification of objects (affecting perceived similarity and memory) and, more importantly, guide individuals' judgments in a practically relevant context (e.g., in the evaluation of advertisements). Chinese speaking participants, relative to English speaking participants, judged objects sharing a classifier as more similar than objects not sharing a classifier and were more likely to recall them in clusters. Moreover, objects, presented as consumer products in an advertising context, were evaluated more positively when cued with a visual stimulus that triggers classifier-related associations. Results are discussed in the context of the recent reformulation of the Sapir-Whorf hypothesis.

How individuals classify objects into categories constitutes one of the prime issues in cognitive psychology. Research on categorization in the 1970s adopted primarily an observation-driven, bottom-up point of view; people construct categories by detecting the inherent structure among objects in the real world (Rosch & Mervis, 1975). Later research adopted a concept-driven, top-down approach that focused on the formation of new categories out of existing knowledge structures and theories (Barsalou, 1983; Murphy & Medin, 1985). Common to both approaches is the view that in explaining categorization, it is sufficient to focus on conceptual knowledge as such; concepts are treated as distinct and isolated from other cognitive domains, most importantly language.

The current view of categorization is quite different from the perspective that prevailed in psychology and the social sciences half a century ago. Then, it was believed that there was a strong relation between grammatical or structural features of a language and category formation—a hypothesis that has been expressed most succinctly by Sapir and Whorf (Sapir, 1929; Whorf, 1956).

The Sapir–Whorf Hypothesis and Its Reformulation

The strong version of the Sapir–Whorf hypothesis, which amounts to linguistic determinism,

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proposes that a concept is formed only if there is an equivalent notion for it in a given natural language. That is, a speaker of a natural language without tenses would not be able to form a concept of past, present, and future. The weak version holds that language affects thought such that the presence of a language structure facilitates or hinders the formation of certain concepts.

The Sapir–Whorf hypothesis, both in its strong and weak form, has generated controversies because of its lack of specificity and unequivocal empirical support. Whorf and many researchers examining the hypothesis have failed to specify precisely which language structures should make it easier or more difficult for people to acquire certain concepts and form certain categories (for reviews, see Hunt & Agnoli, 1991; Lucy, 1992; Pinker, 1994). Moreover, empirical tests concerning the Sapir–Whorf hypothesis have been vague (Koslow, Sharndasni, & Touchstone, 1994), and results have been equivocal (Au, 1983; Bloom, 1981; Brown, 1976; Brown & Lenneberg, 1954; Carroll & Casagrande, 1958; Heider, 1972).

Rather than concentrating on the role that language plays in the formation of concepts, it may be more worthwhile to focus on how language affects the operation of concepts as part of an information processing system. Recently, researchers have expressed a need for research investigating how linguistic forms are represented, how they operate in the mind, and how they affect the concepts and categories that denote objects and relations in the world (Hunt & Agnoli, 1991). Hunt and Agnoli presented various examples of linguistic elements and structures that they believed would affect cognition, ranging from gender articles in German and French to syntactic influences in Italian and English.

We suggest that a shift to an information processing perspective should be encouraged for the study of the relation between language and cognition. At the same time, one should guard against unwittingly broadening the initial focus on structural concepts to practically any linguistic form. In the present research, we specify a linguistic structure that is likely to affect categorization and thus present empirical support for the relation between linguistic mental representation and nonlinguistic cognition and behavior.

Specifically, we focus on a lexico-syntactic structure, called *classifiers,* that provides a language-inherent classification in languages in which classifiers are present (such as Chinese) compared with languages in which they are not found (such as English). We show that people who speak a classifier language are likely to perceive and categorize objects on the basis of the categorization schemes inherent in their language. As a result, classifiers affect the perceived relatedness between objects, memory for these objects, and evaluation of these objects in an advertising context when presented with a visual cue that triggers classifier-related associations.

From a practical point of view, classifiers seem to be important in the context of choice and communication. Consider, for example, consumer products that are associated with certain classifiers in Chinese (but not in English). When a product (associated with a certain classifier) is out of stock, consumers may be more likely to select a classifier-sharing alternative product than another product of similar price and quality that does not share a classifier with the out-of-stock product (Schmitt & Zhang, 1998). Moreover, as we will show, consumers may judge an advertisement more positively if the ad displays classifier-consistent attributes or behaviors compared to an ad that focuses on other attributes or behaviors that are not classifier-consistent. Finally, modern technologies have given rise to a variety of new products (e.g., computer chips, CD-diskettes, and electronic organizers) and have drastically changed many existing product forms (e.g., telephone vs. cellular phone, safety-razor vs. electric shaver, piano vs. electronic keyboard, etc.). In languages using classifiers, such new products may be associated with more than one classifier, and the selection of a certain classifier may play an important role in communicating key product features.

Classifiers and Categorization

Classifiers have been defined as measure words that are used in conjunction with numerals (e.g., one, two, three) or determiners (the, this, that, etc.) to form noun phrases (Chao, 1968). We limit our current discussion to Mandarin Chinese (henceforth referred to as Chinese). For example, the counterparts in Chinese for the English noun phrases "one bed" and "that journal" are "*yi*[1]-

zhang[1]-*chuang*[2]" and "*nei*[4]-*ben*[3]-*za*[2]*zhi*[4]." In these examples, *zhang*[1] (inserted between *yi*[1] meaning "one" and *chuang*[3] meaning "bed") is a classifier used for flat, extended objects such as beds, tables, desks, photos, and paper; *ben*[3] (inserted between *nei*[4] meaning "that" and *za*[3]*zhi*[4] meaning "journal") is a classifier for bound materials, such as books, dictionaries, and magazines. Throughout this article, we use the standard pinyin system to transliterate Chinese syllables into the Western alphabet. Hyphens indicate word boundaries. Because Chinese is a tonal language, the pinyin system uses four tone notations to reflect the pronunciation of the transliteration; these tones are indicated by the numbers 1 to 4 in brackets immediately following the transliteration of each syllable.

Classifiers are a widespread phenomenon in Chinese, Japanese, Korean, and Southeast Asian languages (Norman, 1988), and in other languages such as Navajo and Yucatan-Mayan (Lucy, 1992). Classifiers are referential categories, referring to common properties of objects across domains and common relations of objects in the world, rather than to categories having to do solely with language-internal relations (Lucy, 1992). They depict physical features of objects such as shape, size, thickness, length, and other perceptual properties, as well as conceptual properties associated with objects such as bendability, graspability, and moveability. Classifiers are practically nonexistent in Indo-European languages such as English, Spanish, or German (cf. phrases indicating quantity, such as "pack of [wolves]," "flock of [cattle]," "school of [fish]," "stretch of [clouds]," etc.) Table 1 provides the list of classifiers used in the present research, their semantic meanings, and the stimuli objects and products associated with each classifier.

Classifiers are linguistic devices for classifying the world into categories. Unlike gender markers in some Indo-European languages such as *le* and *la* in French, *el* and *la* in Spanish, or *der, die,* and *das* in German, classifiers are not arbitrarily associated with aspects of the external world and therefore are not based on an instance-by-instance type of vocabulary learning. Classifiers reflect fundamental features of objects in the world and the assignment of classifiers to new objects is systematic. The classification inherent in classifiers is systematic, derived from features and relations in the real world, and thus may in turn affect the perceived structure of objects.

Moreover, classifiers can be viewed as type concepts and their members—objects belonging to the same classifier—are token concepts. *Type* concepts apply to a number of instances; *tokens* are instantiations of a particular type (Jackendoff, 1985, 1987). That is, *zhang*[1] is a classifier used for flat objects in general. Unlike an adjective that also precedes a noun, the classifier *zhang*[1] must be used for beds, no matter whether they are genuinely flat or not. In order to indicate that a bed has the property of being flat, the insertion of the adjective for "flat" (*ping*[2]) after the classifier is required. In other words, adjectives and classifiers have different semantic functions and scope. Adjectives serve as modifiers of nouns by restricting the properties of the noun and putting it in a subset of the set of objects denoted by the noun alone. Adjectives answer the question, "What kind of object is it?" Classifiers, on the other hand, answer the question, "What kind of category is this object a member of?" They categorize a given object into a larger set of objects, thus constituting a type concept.

It has been suggested that the kind of lexical-syntactic patterns that we described for classifiers above are part of an innate Universal Grammar (Chomsky, 1986). Although English and Chinese share many structural similarities in terms of linguistic principles, they differ in important ways at lexical and syntactic representations (Huang, 1982; S. Zhang, 1990). In the Chinese language, representation of the noun phrase includes a numeral (or determiner), a classifier, and a noun. In English, however, the classifier component is lacking. In other words, the parameter of the Universal Grammar has been set for classifiers for Chinese native speakers but not for English native speakers. As a result, the system of classifiers should be mentally represented in the minds of Chinese native speakers but not of English native speakers.

Classifiers and Their Effects on Similarity Judgments and Memory

The effects of differential mental representations and operations may be observed in tasks such as similarity judgments and memory for

Table 1
Glossary of the Classifiers and Stimuli Objects and Products Used in the Studies

Classifier[a]	Character[b]	Study[c]	Semantic features[d]	Objects and products[e] (total = 60)
ba[3]	把	1, 3	Can be grasped with a hand	Door key, hack, ruler, pliers, brush, cane, umbrella, broom
ding[3]	頂	1, 2	Top	Hat, mosquito net, tent, palanquin
duo[3]	朵	1, 2	Amorphous	Mushroom, flame, cloud, spray
geng[1]	根	1, 2	Root or root-like thing	Sausage, nail, stick, chewing gum, match, braid
ke[1]	顆	1, 2	Bead-like item	Tooth, star, pearl, heart
kou[3]	口	1	Openings	Vat, coffin
jia[4]	架	1	Wooden frame-like	Airplane, swing
jie[2]	節	1	A cut section, between joints	Battery, railroad car
mien[4]	面	1, 2	Surface	Flag, wall, mirror, drum
mei[2]	枚	1, 2	Round piece	Rubber stamp, ring, political buttons, stamp
pian[4]	片	1, 2	Slice	Meat, snowflake, tablet, tree leaf
shan[4]	扇	1	Fan-like	Window, divider
tiao[2]	條	1, 2, 3	Strip, for long and slender things, often bendable	Snake, river, soap bar, road, boat, fish, pants, cord, rope, cable
zuo[4]	座	1	Seat or seat-like things	House, bell, temple, mountain

[a]Classifiers are given in pinyin, the standard transliteration used for Chinese characters. [b]Chinese characters. [c]Studies in which the classifier effect is tested. [d]The perceptual and conceptual features that each classifier depicts. [e]Stimuli products and objects used in the studies.

objects. When performing similarity judgments or memory tasks, native speakers with classifier languages (compared with speakers of nonclassifier languages) may access the conceptual knowledge, for example, the perceptual and conceptual features, represented in the classifier. As a result, if mental representations are mediated linguistically, then speakers of a classifier language should see objects that share a classifier as relatively more similar than objects that do not share a classifier. That is, in a pairwise similarity ratings task, two objects sharing the same classifier should be viewed as relatively more similar than two objects that do not share the same classifier by native speakers of classifier languages than by native speakers of nonclassifier languages. We test this prediction in Studies 1A and 1B.

Moreover, because most classifiers have more than two objects associated with them, classifiers may display organizational features that result in mental groupings and clustering. In memory research, the sequence in which individuals recall information has been suggested as a measure of such cognitive organization. If classifiers are represented as mental clusters, then classifier-related clustering in recall should be more likely to occur for speakers of classifier languages than of nonclassifier languages. We test this prediction in Study 2.

Presentation and Selection of Stimuli

Certain characteristics of classifiers allow us to test the classifier effect without making participants aware of the purpose of our studies. As

shown in earlier examples, in English, a numeral or determiner immediately precedes a noun, such as in "one bed" and "that journal." In Chinese, numerals or determiners cannot appear alone before the noun. They require a classifier, which, in conjunction with the numeral or determiner, forms a syntactic unit that precedes a noun. However, in the plural, Chinese nouns do not need to be preceded by classifiers. Constructions such as "beds are made of wood" are fully grammatical without a classifier. Therefore, the classifier effect can be tested in a subtle way by presenting objects or products as nouns without the corresponding classifiers in the subsequent studies and by describing them as real-world objects or products to be judged rather than as linguistic elements.

There are approximately 50 classifiers in Chinese (Chao, 1968; X. Zhang, 1991). After eliminating classifiers that are not commonly used or are highly domain specific, there are about 35 potential stimuli; 14 were randomly selected for inclusion in the present research. Table 1 shows the list of classifiers, their meanings, and the objects or products used as stimuli in the studies.

Study 1A: Perceived Similarity

Method

Design and materials. Study 1A took the form of a mixed 2 (language: Chinese vs. English) × 2 (classifier: same vs. different) design. Language was a between-subjects variable, and classifier sharing vs. nonsharing was a within-subjects variables.

We created six sets of four stimuli each. The first two and the last two stimulus items in each set listed below share the same classifier (classifiers are shown in parentheses): (a) mushroom/flame (*duo*[3]), snake/river (*tiao*[2]); (b) meat/snowflake (*pian*[4]), house/church bell (*zuo*[4]); (c) room divider/window (*shan*[4]), sausage/nail (*geng*[1]); (d) rubber stamp/ring (*mei*[2]), door key/hack (*ba*[3]); (e) flag/wall (*mian*[4]), stick/chewing gum (*geng*[4]); and (f) hat/mosquito net (*ding*[3]), tooth/star (*ke*[1]). Allocation of a particular stimulus pair to a set was random. The stimulus items within each set were presented in the same random order to Chinese and English respondents.

Participants and procedure. The experiment was run in Shanghai and New York in regularly held classes at universities. Thirty-one native Chinese speakers and 30 native English speakers provided pairwise similarity ratings for the set of stimuli. Chinese respondents were barely familiar with English, and English speaking respondents did not know Chinese. Participants were given a booklet to provide their ratings on 7-point scales (1 = *not at all similar;* 7 = *very similar*). The stimuli were presented as Chinese characters to Chinese speakers (without classifiers) and as English written words to English speakers.

Results and Discussion

We expected that Chinese native speakers, compared with English native speakers, would rate the item pairs sharing the same classifier as relatively more similar than the object pairs not sharing the same classifier. The similarity means for items sharing and not sharing (separately for each set) and for aggregate scores across sets are given in Table 2.

A 2(language) × 2(classifier) mixed model analysis of variance (ANOVA) was performed on the aggregate data across all sets. The ANOVA

Table 2
Means of Pairwise Similarity Judgment for Study 1A

		Same classifier[a]		Different classifier[b]		Difference
Set	Language	*M*	*SD*	*M*	*SD*	score[c]
1	Chinese	4.19	1.48	2.69	1.15	1.50
	English	2.62	1.10	1.80	0.78	0.80
2	Chinese	3.80	1.40	2.59	1.01	1.21
	English	1.58	0.84	2.89	0.71	−1.31
3	Chinese	4.48	1.44	2.63	1.38	1.85
	English	2.67	0.91	1.79	0.88	0.87
4	Chinese	3.98	1.55	3.54	1.28	0.44
	English	1.45	0.87	2.19	1.13	−0.74
5	Chinese	4.10	1.51	2.98	1.81	1.11
	English	2.78	1.63	2.10	0.96	0.68
6	Chinese	3.95	1.70	2.72	1.28	1.23
	English	2.23	1.48	1.28	0.62	0.95
All[d]	Chinese	4.09	1.17	2.82	0.96	1.27
	English	2.22	0.84	2.01	0.58	0.21

[a]Pairs of items sharing the same classifier. [b]Pairs of items not sharing the same classifier. [c]Score obtained by subtracting different from same. [d]Across sets.

revealed a language main effect and a classifier main effect, $F(1, 57) = 38.43$ and $F(1, 57) = 49.99$, respectively; $ps < .0001$, and, most important, the predicted interaction of language and classifier, $F(1, 57) = 25.57$, $p < .0001$. Chinese speakers provided higher ratings than did English speakers ($M = 3.84$ vs. $M = 2.12$), resulting in the language main effect. Also, participants gave higher ratings to the item pairs sharing a classifier than those not sharing a classifier ($M = 3.16$ vs. $M = 2.41$), producing the classifier main effect. The classifier main effect seems to suggest that different cultures are sensitive to similar object properties; in Chinese, these properties have become lexicalized and linguistically encoded in the classifiers.

These two main effects need to be interpreted, however, in the context of the significant interaction. The interaction between language and classifier was observed because Chinese speakers gave pairs sharing a classifier much higher similarity ratings than those not sharing classifiers ($M = 4.09$ vs. $M = 2.82$), whereas English speakers gave almost identical similarity ratings ($M = 2.22$ vs. $M = 2.01$) to both pairs sharing a classifier and pairs not sharing a classifier.

Study 1B: Replication of Perceived Similarity

Study 1B was an empirical replication of Study 1A, using different respondents and new stimuli. Participants were 30 native Chinese speakers and 28 native English speakers. Procedures were identical to Study 1A. The stimuli sets were (classifiers are shown in parentheses): (a) tablet/tree leaf (*pian*[4]), temple/mountain (*zuo*[4]); (b) mirror/drum (*mian*[4]), match/braid (*geng*[1]); (c) political button/stamp (*mei*[2]), ruler/pliers (*ba*[3]); (d) vat/coffin (*kou*[3]), battery/railroad car (*jie*[2]); (e) cloud/spray (*duo*[3]), soap bar/road (*tiao*[2]); and (f) boat/fish (*tiao*[2]), airplane/swing (*jia*[4]).

Table 3 shows the similarity means for objects sharing and not sharing a classifier for Chinese and English speakers, for each set and across all sets. The ANOVA results of Study 1A were replicated in Study 1B. In the aggregate ANOVA across sets, a language main effect, $F(1, 55) = 40.32$, a classifier main effect, $F(1, 55) = 54.43$, and a significant interaction of language and classifier, $F(1, 55) = 17.66$, were observed (all $ps < .0001$). This pattern of results was equivalent to the pattern observed in Study 1A: Chinese speakers gave pairs sharing a classifier much higher similarity ratings than those not sharing classifiers ($M = 4.36$ vs. $M = 3.19$) compared with English speakers ($M = 2.60$ vs. $M = 2.28$).

Table 3
Means of Pairwise Similarity Judgment for Study 1B

Set	Language	Same classifier[a] *M*	Same classifier[a] *SD*	Different classifier[b] *M*	Different classifier[b] *SD*	Difference score[c]
1	Chinese	4.88	1.38	3.48	1.56	1.40
	English	2.96	1.40	2.45	1.10	0.51
2	Chinese	3.78	1.52	2.69	1.01	1.09
	English	1.39	0.77	1.82	1.00	−0.43
3	Chinese	4.47	1.68	2.57	1.18	1.90
	English	2.55	1.30	2.15	1.68	0.40
4	Chinese	4.80	1.56	3.63	1.40	1.17
	English	2.79	1.68	2.77	1.57	0.02
5	Chinese	3.67	1.42	3.38	1.22	0.29
	English	2.46	1.25	2.13	0.88	0.33
6	Chinese	4.41	1.76	3.46	1.54	0.95
	English	3.42	1.16	2.33	0.99	1.09
All[d]	Chinese	4.36	0.98	3.19	0.76	1.17
	English	2.60	0.92	2.28	0.85	0.32

[a]Pairs of items sharing the same classifier. [b]Pairs of items not sharing the same classifier. [c]Score obtained by subtracting different from same. [d]Across sets.

Study 2: Clustering in Recall

Studies 1A and 1B showed that Chinese speaking participants' similarity judgments of objects were influenced by the language classification schemes present in their language. In Study 2, we examined whether classifiers form schema-like structures when they are mentally represented. Studies of memory have been viewed as a way of probing schematic cognitive structures (Lynch & Srull, 1982; Minsky, 1975; Puff, 1982). Clustering in recall, that is, the sequence in which individuals recall information in unaided recall, has been used as a measure of schematic organization. In Study 2, we tested whether thinking about one item belonging to a classifier enhances the thinking of another item belonging to the same classifier.

Method

Design and materials. Two lists (A and B) of stimuli were created, each consisting of 16 items that were based on four groups of objects. Each group had a common classifier. The stimuli in List A were flag, mirror, wall, drum (*mian*[4]); match, stick, chewing gum, braid (*geng*[1]); hat, tent, palanquin, mosquito net (*ding*[3]); and tooth, star, pearl, heart (*ke*[1]). The stimuli in List B were cloud, spray, mushroom, flame (*duo*[3]); soap bar, river, snake, road (*tiao*[2]); church bell, temple, house, mountain (*zuo*[4]); and tablet, tree leaf, snowflake, meat (*pian*[4]). In total, there were eight distinctive classifiers. The items sharing a common classifier were carefully selected such that they represented high conceptual variety within each group.

Participants and procedure. Two classes of students in Shanghai (31 in one class and 28 in the other class) and two classes of students in New York (26 in one class and 27 in the other class) participated in Study 2. Chinese speaking participants were monolingual and had learned only very basic English; English speaking participants did not know any Chinese. One class was given List A to recall and the other class was given List B to recall. Items were presented as dictionary entries, one item per page. Chinese speakers saw Chinese characters without classifiers and English speakers saw English words. Stimuli were presented in four different random orders in a booklet. Each random presentation order was matched for Chinese speaking and English speaking participants. Participants were paced to look at each item for about 2 s. After the presentation of the items, they recalled as many items as possible by writing them down on a sheet of paper, one underneath the other.

Results and Discussion

We predicted that Chinese speakers' recalls should exhibit more classifier-related clustering in recall than that of English speakers. To measure clustering in recall, we used Pellegrino and Hubert's (1982) clustering index [X − E(X)], where X is the original pairs that would be considered to belong to the same cluster (here, items sharing a classifier), and E(X) is the expected number of originally adjacent items recalled adjacently. This measure yielded a strong language effect for both Lists A and B. Chinese speakers were more likely to cluster by classifier than were English speakers; for List A, $M = 8.38$ vs. $M = 2.97$, $F(1, 55) = 38.86$, $p < .0001$, and for List B, $M = 10.78$ vs. $M = 4.05$, $F(1, 53) = 52.34$, $p < .0001$. However, Chinese speakers also recalled significantly more items than English speakers, perhaps because of a facilitation of the classifier-related cognitive organization; List A, $M = 11.84$ vs. $M = 7.58$, and List B, $M = 13.18$ vs. $M = 9.22$. Therefore, the data were also analyzed using a conservative index adjusting for the number of items recalled, [X − E(X)]/[max(X) − E(X)] (Pellegrino & Hubert, 1982), where max(X) is the maximum number of adjacent items possible given the total number of items recalled. In the adjusted score, the effect was significant for List B but not quite statistically significant for List A: Chinese speakers were more likely to cluster by classifier than English speakers; for List A, $M = 0.68$ vs. $M = 0.48$, $F(1, 54) = 3.50$, $p = .07$, and for List B, $M = 0.68$ vs. $M = 0.51$, $F(1, 53) = 4.16$, $p < .05$.

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.

Study 3: Ad Evaluations

In Studies 1 and 2, we showed that classifiers affect the perceived similarity of objects and their association in memory. Can the conceptual knowledge represented in classifiers also guide individuals' expectations and actions? In other words, are classifier effects purely cognitive events with little practical relevance, or do they set up expectations and guide actions in a practically relevant context, for example, by affecting evaluative judgments? In the following study, we investigate this issue in an advertisement evaluation context.

As suggested by Hunt and Agnoli (1991), language may affect representational levels and direct nonlinguistic cognitions and experiences. These nonlinguistic cognitions can provide directions for native speakers to look for certain

information, to pay attention to certain object properties, and to expect certain actions. For example, the classifier *ba*[3], which is used for graspable objects, may not only increase the perceived relatedness of objects in similarity judgments and memory by virtue of being a linguistic conceptual feature that is shared among *ba*[3] objects. It may also reach beyond the linguistic realm by relating objects because they are graspable and get individuals to direct their attention to the graspability aspects of these objects. We conducted Study 3 to demonstrate this effect in an advertisement evaluation context.

In Study 3, participants were shown a series of photos of objects. They were asked to consider the photos as the visual components of advertisements and the objects as consumer products. Some of the objects shown are linguistically encoded in Chinese by the classifier *ba*[3] (used for graspable objects). When participants see the ads, the classifier attribute should become accessible and thus available for making a judgment. To make the attribute relevant for judgment, half of the participants saw a hand in the picture that grasped the object. The other half saw the picture of the object without the corresponding hand. We predicted that the evaluation of the photo as being suitable for an advertisement would be more positive if the hand was in the picture because the attribute of graspability is then relevant for judging and evaluating the ad and the object.

Moreover, to check whether participants generally judge the pictures of products with hands in the ads more positively, it was necessary to employ a control group in which pictures of other products that are not associated with the classifier attribute were shown (i.e., objects associated with *tiao*[2], a classifier used for bendable objects). We expected to find no significant differences for the control group.

Finally, to make sure that the effect is due to the classifier rather than certain idiosyncratic product characteristics of *ba*[3] objects (compared with *tiao*[2] objects), we asked Japanese participants to judge the same stimuli. The Japanese language, like Chinese, uses classifiers. However, in Japanese, the classifier *hon* (for long objects) is used for all the objects presented in the study (i.e., objects belonging to Chinese *ba*[3] and *tiao*[2]). Therefore, we expected to find no significant effects within the Japanese sample.

Method

Participants and procedure. Participants were 40 Chinese and 30 Japanese students, who participated in groups of 5–10 people. The study took approximately 20 min. Chinese participants were recruited from Shanghai and they were monolingual, and Japanese participants were visiting students from Japan, registered for an introductory English language training program at Columbia University. Participants saw a total of eight photographs. Participants were told that an advertising agency was planning to use similar photos as the visual components of an ad campaign. They were asked to evaluate the idea of using such a photo of the product rather than judging the creativity of the ad execution or the product quality. All the photos were similar in terms of layout and product display; they used the same background and lighting and showed the product at a similar angle and position. The pictures were bound in a photo album and shown to the participants in one of four random orders.

Design and manipulations. The study took the form of a 2 (language: Chinese vs. Japanese) × 2 (type of classifier-encoded products: *ba* vs. *tiao* products) × 2 (type of ad: hand vs. no hand) experimental design. To manipulate the within-subjects variable, type of classifier-encoded object, half of the products shown in the photos were associated with the classifier *ba*[3] in Chinese (brush, cane, umbrella, and broom), and the other half were associated with the classifier *tiao*[2] (pants, cord, rope, and cable). In Japanese, all the products used in the experiment were associated with the classifier *hon*. To ensure the experimental realism of the stimuli, great care was taken to select products within the *tiao*[3] category with similar features to those of *ba* products; specifically, objects were long and usage included the handling and grasping of the product.

Type of ad was manipulated on a between-subjects basis. Half of the participants saw photos that included the hand of a person holding or grasping the object (without showing the person itself); the other half saw the photos without a hand. Participants were randomly assigned to the two experimental conditions.

Participants provided their evaluations on four scales: (a) a bipolar, attitude-toward-the-ad scale

(*bad–good*); (b) a product attitude scale (*do not like at all–like very much*); (c) a product-usage measure (*not easy to use–easy to use*); and (d) a scale that specifically measured how well the product was suited for being handled with a hand (*not at all–very much*). A factor analysis conducted on the four measures revealed one factor with an eigenvalue > 1 (eigenvalue = 2.54; explained variance = 63%). All variables had loadings above 0.55. Subsequent statistical analyses were conducted on the aggregate evaluation variable based on the sum of the four variables.

Results and Discussion

The means of the evaluations, aggregated across products, are shown separately for Chinese and Japanese participants in Figure 1. The data were analyzed by conducting contrasts on the evaluations variable for product photos shown with and without hands, separately for Chinese and Japanese, and for objects encoded by the *ba*[3] classifier and the classifier *tiao*[2] used for long objects. As predicted, only one of the four contrasts was statistically significant: For Chinese speaking participants, the evaluations of *ba*[3] objects were significantly more positive when there was a hand in the pictures than when there was not ($M = 5.45$, $SD = 0.95$ vs. $M = 4.72$, $SD = 1.04$), $t(35) = 2.19$, $p < .05$; however, there was no significant difference for *tiao*[2] objects ($M = 4.61$, $SD = 0.74$ vs. $M = 4.58$, $SD = 0.86$, $p > .90$). As expected, there was no significant effect for either *ba* or *tiao* objects ($ps > .87$) for the Japanese (*ba* objects, $M = 4.43$, $SD = 0.88$ vs. $M = 4.38$, $SD = 0.95$; *tiao* objects: $M = 3.95$, $SD = 1.17$ vs. $M = 3.97$, $SD = 0.83$). This pattern of results produced a significant two-way interaction of type of classifier and type of photo in the evaluations of Chinese participants, $F(1, 35) = 5.53$, $p < .05$, in addition to a significant classifier main effect, $F(1, 35) = 10.9$, $p < .05$. In the evaluations given by the Japanese participants, only the main effect, $F(1, 28) = 5.54$, $p < .05$, but not the interaction, was significant ($p > .86$). These results fully support our hypothesis that conceptual features associated with classifier objects can influence evaluations in a practically relevant judgment context.

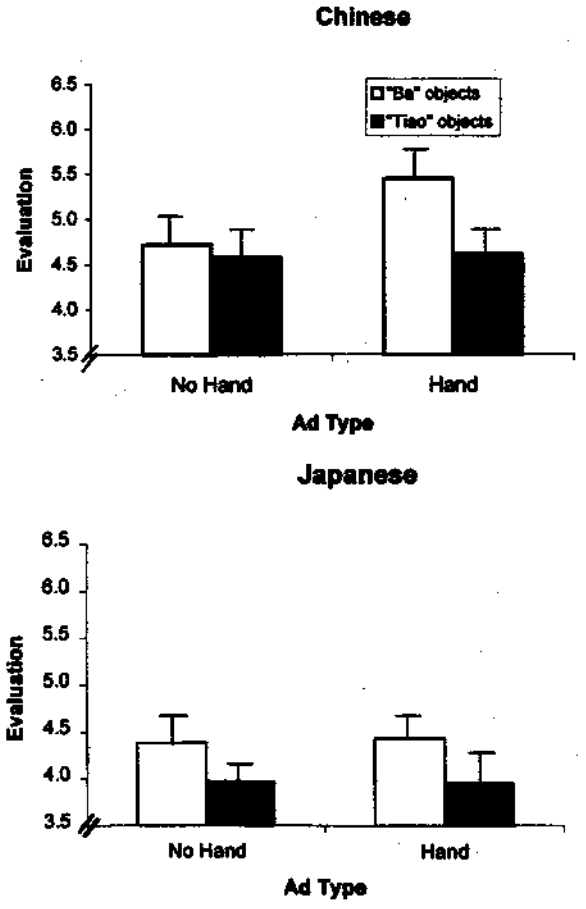

Figure 1. Evaluations of ads for Chinese speakers and Japanese speakers in Study 3. Error bars are indications of standard errors.

General Discussion

In three experiments, we showed that native Chinese speakers' perceptions of similarity, mental organization of objects, and, more importantly, evaluation judgments of products and objects in a visually cued setting are influenced by linguistic classification elements. In Studies 1A and 1B, we found that native Chinese speakers were more likely than native English speakers to perceive objects belonging to a common classifier as more similar than those belonging to different classifiers. In Study 2, Chinese speaking participants were more likely to recall classifier-sharing objects in clusters than were English speaking participants. These results suggest that these language classification elements have sig-

nificant effects on native Chinese speakers' cognitions but not on English speakers' cognitions.

Most important, Study 3 demonstrated the practical relevance of classifiers in a judgment context. Participants used the conceptual knowledge represented in classifiers in their judgments of the ads when they were cued by a visual advertisement element. That is, classifiers are not only of theoretical interest because of their effects on similarity and memory but also because of their practical relevance as choice and judgment criteria (Schmitt & Zhang, 1998). It is noteworthy that similarity and categorization in the mind may impact actual categorization in a store. For example, Chinese department stores, unlike their U.S. counterparts, typically offer products that share the classifier *tai*[3] (used for electric and mechanical equipment such as blow dryers, TVs, radios, washing machines, computers, electric fans, and electric cooking knives) on the same floor.

The notion that language structure influences cognition, particularly in a cross-cultural context, is consistent with the recent reformulation of the Sapir–Whorf hypothesis, which proposes to focus on how linguistic forms are represented, how they operate in the mind, and how they affect the concepts and categories that denote objects and relations in the world (Hunt & Agnoli, 1991; Lucy, 1992). The present research offers support for this view by demonstrating how grammar-related differences influence perceptions of similarity and schematic organization of information in memory. Furthermore, the present research suggests that linguistic structures of different languages affect judgment, for example, when the conceptual knowledge is triggered by a visual cue in a communication context. It is important to note that classifier effects, because of the lexico-syntactic nature of classifiers, seem to occur outside of conscious awareness. Similar to primes, classifiers have a high degree of automaticity within a cognitive system as do other aspects of linguistic performance (Bargh, 1984). They are perhaps exactly the type of nonconscious, reality-shaping linguistic devices that Whorf (1956) envisioned.

Some limitations of the present research should be addressed in future research. First, borderline conditions of classifier effects need to be investigated. For some classifiers that we may not have investigated here and in some situations (laboratory or real life), category membership and category groupings may be equally salient or distinctive for both Chinese and English speakers. This may be the case when English speakers pay natural or exclusive attention to the features of objects that happen to be depicted by classifiers in Chinese. For example, if we asked both Chinese and English speakers to judge explicitly the similarity of objects in terms of their flatness or graspibility, differential effects due to classifiers should not occur. In other words, future research should be directed toward understanding which cues in people's environments trigger classifier effects. Moreover, Mandarin Chinese was the primary language investigated; Japanese was included in Study 3 only because it served as a tool to create a baseline control condition. Because different languages possess different classifier structures concerning scope and perceptual and conceptual properties, it is worthwhile to test the generality of our results with other classifier languages such as Cantonese, Japanese, and Korean.

Finally, future research on classifiers should address how language classification schemes, that is, conceptual knowledge, may interact with the change of technologies. These technological changes can result in a situation where specific features, both perceptual and conceptual, become inconsistent with classifier attributes. For example, how do consumers resolve an inconsistency between a major classifier attribute and an object attribute (e.g., a curved table)? Does it matter whether this inconsistency is presented in verbal or visual form, for example, in the form of numerals or determiners and classifiers, or in the form of a product picture followed by the product-class name with the corresponding classifier? Many such cases have started to occur in China. For example, the classifier *tai*[2] has been conventionally used for big objects with an electric or electronic component, such as for machines and desktop computers. However, *tai*[2] seems to be an inappropriate classification element for a laptop computer or an electronic organizer. In this case, native speakers either opt for the generic classifier *ge*[4] or use adjectives such as "mini" and "palm-sized" together with the classifier *tai*[2] to describe the products. These cases raise important practical issues concerning the selec-

tion of classifiers to communicate critical features of objects when introducing new consumer products.

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