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Universality and language specificity in object naming☆

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Abstract

Rather than having universal linguistic categories for sets of common objects, languages develop their own, idiosyncratic naming patterns for them. Accounting for these patterns requires reference not only to the understanding of stimulus properties by individual speakers of a language, but also to the linguistic and cultural histories of the language they speak. To better understand how these two sources of influence work together to produce linguistic categories, we examined the relations among linguistic categories for 60 common containers for speakers of English, Spanish, and Chinese. We discriminated among several possibilities that imply different relative contributions of the two sources of influence. No single type of relation dominated; the contributions of the two influences varied across different parts of the container domain. We suggest that perception of stimulus properties by individuals interacts with linguistic and cultural histories, but their interaction is constrained by structure in the stimulus space.

Keywords: Naming; Categorization (linguistic); Linguistic diversity; Cross-linguistic comparison

English labels one set of objects *bottle* and another set *jar*, one set *chair* and another *sofa*, and so on. The differences between bottles and jars, chairs and sofas, etc., seem so obvious to English speakers that intuition suggests the same distinctions should be observed equally by speakers of other languages. The words themselves will differ, but the sets of things they refer to should be parallel for all languages. That is, the linguistic categories should be universal.

However, the situation is not so simple. Much informal evidence suggests cross-linguistic diversity in how languages segment domains by name. For instance, Russian has separate words for one's wife's brother, wife's sister's husband, and husband's brother, all of which would be labeled *brother-in-law* in English (Lyons, 1968). Polish speakers label a telephone table and a coffee table by one word and a dining room table by another, although English speakers use the same label for all three (Wierzbicka, 1992). English speakers use the same name for a large, stuffed seat for one person (*chair*) that they do for a smaller wooden seat, but Chinese speakers give the stuffed one the same name that they would give a stuffed multi-person seat (what English speakers would call *sofa*) (Gao, personal communication). Wierzbicka (1992) has argued that body part terms, kin terms, and emotion terms show less universality in their extensions than has been assumed.

Several studies have provided more systematic evidence of cross-linguistic diversity in naming. In the classic case of color, some languages have large color vocabularies that divide the color spectrum quite finely; others have only a small or moderate number of color words for the same color spectrum (Berlin & Kay, 1969; Kay, Berlin, Maffi, & Merrifield, 1997). In the domain of

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space, Bowerman (1996a, 1996b) has found that prepositions indicating basic spatial relations, such as *in* and *on* in English, do not map directly onto the closest comparable terms of other languages; they divide the domain in substantially different ways. Studying artifacts, Kronenfeld, Armstrong, and Wilmoth (1985) found that speakers of English, Hebrew, and Japanese partitioned 11 drinking vessels by name in different ways. For instance, the Americans gave the same name to a paper drinking vessel and one for drinking tea (calling both *cup*), but the Israelis called them by different names. Overall, speakers of Japanese used three different names in partitioning these objects, but speakers of English and Hebrew used only two. In a larger-scale study of artifacts, Malt, Sloman, Gennari, Shi, and Wang (1999) compared naming for 60 common containers by speakers of American English, Mandarin Chinese, and Argentinean Spanish, and they found a similar pattern. The composition of the named categories differed across the three languages, as did the number of categories. For instance, the 16 objects named *bottle* in English were spread across seven different linguistic categories in Spanish. The Chinese category that contained the 19 objects called *jar* in English also included 13 objects called *bottle* in English and 8 called *container*, although others called *bottle* or *container* appeared in different Chinese categories. These findings support the idea that rather than there being universal linguistic categories for objects or other sorts of entities, languages may develop their own, idiosyncratic naming patterns for them.

Strikingly, this cross-linguistic diversity in naming arises even when speakers of the languages perceive the commonalities among the entities being named in much the same way. Malt et al. (1999) measured the perceived similarity (of the physical, functional, and overall properties) of their 60 objects as well as linguistic categorization of the objects. They found that their speakers of English, Spanish, and Chinese produced highly correlated judgments of similarity among the objects, despite the divergent naming patterns. They concluded that perception of the objects' commonalities—and so the way that people conceptualize them non-linguistically—may indeed be largely universal. Likewise, Kronenfeld et al. found comparable similarity judgments for the drinking vessels for their speakers of Hebrew, English and Japanese, despite the differences in naming patterns. A dissociation between perceived similarity and naming appears to exist, suggesting that linguistic categories are not driven solely by a shared understanding of commonalities among the objects.

Malt et al. argued that accounting for naming patterns requires reference not only to the understanding of stimulus properties by individual speakers of a language, but also to the linguistic and cultural histories of the language they speak. The name used for a given object in any particular language may be influenced by multiple historical factors including what *names* happened to exist in that language at some earlier time and so were available for extending to new objects (and what new names became available through language contact; see Brown, 1999); what *objects* happened to exist in the culture at some earlier time and either formed a similarity cluster that was given a name, or extended outward from a cluster and caused a name to be extended to less similar objects by chaining (Brugman, 1983; Lakoff, 1987; Taylor, 1995); what names happened to be bestowed on objects by a manufacturer either from within that culture or from outside for marketing purposes; and what domains were of particular interest to a culture at some point in its history and so required finer linguistic differentiation of the conceptual space. The specific impact of each factor will vary from culture to culture and language to language, and so languages will diverge in their naming patterns.

To better understand how these two influences—nonlinguistic conceptualization by individual observers and linguistic and cultural histories of language communities—work together to produce linguistic categories, we investigate here the precise nature of the observed naming diversity. We report the relations among the linguistic categories of Chinese, Spanish, and English in one domain, that of common containers. Different forms of diversity would implicate different degrees of influence of non-linguistic conceptualization vs. linguistic and cultural histories, and they would also provide different suggestions about the nature of the interaction between these sources of influence.

Possible relations

Same prototypes, varying boundaries

One possibility for the relation between the categories of different languages is that speakers of all languages form their linguistic categories around the same prototypes, with variability occurring only in the naming of peripheral items not closely allied with the categories of any language. This possibility is compatible with suggestions that compelling structure exists in the world that "cries out to be named" (e.g., Berlin, 1992; Hunn, 1977), and that named categories are formed around clusters of correlated properties (e.g., Anderson, 1991; Jones & Smith, 1993; Rosch & Mervis, 1975; Smith & Heise, 1992). It would suggest a relatively small role of the differing cultural and linguistic histories of groups of speakers in creating naming patterns, and a relatively heavy dependence of linguistic categories on shared nonlinguistic understanding of a domain.

A variant of this possibility is that linguistic categories may be universally formed around the same prototypes but vary more substantially in the categorization of objects beyond those most closely associated with the

prototypes. This case would imply a greater level of influence of language- or culture-specific factors on the formation of linguistic categories, but it would still suggest that they are constrained by a common conceptual core.

Nestings

A second major version of the relation across languages is that diversity might consist of one language making finer distinctions within a domain than another. For instance, a set of objects that are all called *bottle* in English might, in another language, have different names depending on whether they are made of glass vs. plastic, or hold liquids vs. dry material. English either makes no linguistic distinction or recognizes the difference only through phrases involving modifiers attached to the same basic level name (*plastic bottle*, *glass bottle*), rather than through separate primary lexemes.

The nesting possibility is consistent both with descriptions of linguistic diversity in the color domain (e.g., Berlin & Kay, 1969; Kay et al., 1997) and with suggestions about the role of expertise in the location of the basic level. With regard to color, it has been argued that languages follow a constrained evolutionary path in the development of their color vocabulary, with finer linguistic differentiation of the color space driven by increased industrialization (Berlin & Kay, 1969; Casson, 1997; Kay et al., 1997; see also Wolff, Medin, & Pankratz, 1999, for a related proposal on naming of trees[1]). In the more general literature on categorization, it has been suggested that different populations of people make their primary categorizations at different levels of abstraction, reflecting their level of expertise in the domain (e.g., Berlin, 1992; Dougherty, 1978; Johnson & Mervis, 1997; Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976; Tanaka & Taylor, 1991).

These literatures suggest two different versions of the source of differences in degree of linguistic differentiation by speakers of different languages. One is that their naming practices reflect the vocabulary made available to them by their language (which is a function of linguistic evolution and cultural needs), and the patterns are not a direct reflection of differences in domain knowledge or perception by individual speakers of the languages. The second possibility is that differences are attributable to the degree of expertise held by individual speakers of the language (with speakers of a given language tending to share a level of expertise), and the patterns directly reflect the perceptual or conceptual salience of groupings at different levels of abstraction to the speakers. The second case would argue for a primary role of non-linguistic understanding of the domain by the individual observer, with culture having only an indirect influence (perhaps by encouraging a particular level of expertise). The first case would argue for a heavier role of linguistic and cultural history.

Cross-cutting categories

A third major possibility suggested by the existing literature is that different languages use more radically different linguistic categories, forming their categories around different dimensions or combinations of dimensions, or simply following such language- or culture-idiosyncratic paths in the evolution of their linguistic category membership that the end result is substantially divergent category membership. For instance, the objects that in English are called *jar* might, in another language, fall into two or three different categories that also contain other objects not called *jar* in English. This possibility is consistent with constructivist views emphasizing the importance of top-down, culture-specific processes in category formation (e.g., Leach, 1976; Malinowski, 1954; Murphy & Medin, 1985; Wattenmaker, Dewey, Murphy, & Medin, 1986; although these authors have not necessarily distinguished linguistic from conceptual categories). Such a finding would indicate a large degree of independence of linguistic categories from any shared understanding of the domain. It would further imply either that sufficient perceived structure in the world does not exist to compel shared naming patterns, or that such structure exists (and may underlie non-linguistic groupings) but the processes that produce linguistic diversity overwhelm the influence of such structure in naming patterns.

Mix & match

Finally, a fourth logical possibility is that the observed diversity is not characterized fully in any one of these ways but rather is a mixture of two or all three of these types of relations. This possibility is not suggested by any existing literature, but it is a potential outcome of variable interactions between conceptualizations of individual speakers and linguistic and cultural histories. For instance, a culture may currently have, or have had in the past, a need to more finely differentiate some entities by name than another does, but this need may apply to only some portion of a domain. Likewise, variable orders of entry of entities into cultures could result in some shared linguistic groupings and some divergent ones, or some varying only in category boundaries and others varying more drastically in composition. A mixture result would suggest, at a general level, that the degree of influence of each factor can vary within a domain. The precise implications of such a result would depend on the nature of the mixture found.

[1] The classic, if apocryphal, case of Eskimo words for snow is another example of this suggestion (Martin, 1986; Pullum, 1991). According to the standard story, Eskimos have a highly developed vocabulary for snow that allows them to make finer distinctions among types of snow than do people speaking languages that have developed in warmer climates.

Study

The current study examined the relations that hold between linguistic categories of Chinese, English, and Spanish in order to learn more about the nature of linguistic categories and how they are formed. Our study is based on names for artifacts, in particular, the set of common containers studied by Malt et al. (1999). The artifact domain is of interest here, as in many other studies of naming and non-linguistic categorization, because it is a domain that is highly salient, familiar, and frequently interacted with (in all industrialized cultures), and relatively easy to study in the laboratory. Use of the common container stimulus set also has the advantage of allowing us to discriminate between the two possible sources of any differences in degree of differentiation. For our ordinary household containers and participant samples of university students, true differences in individual expertise (such as one might find for birds or fish, by lay people vs. ornithologists or ichthyologists) should not be relevant. Because the objects were American in origin, however, it is possible that Americans had a slightly greater level of familiarity with the objects than the other participants (although familiarity ratings collected by Malt et al. for American and Argentinean participants did not show substantial mean differences, and native informants indicate that similar objects are for the most part in use in Argentina and urban areas of China). Either no differences in level of differentiation, or else nesting relations in which the English speakers make distinctions nested within those of the other languages, would thus be expected under the interpretation of expertise effects as residing in individual knowledge. Any other case of the linguistic categories of one language being nested within those of another would indicate an influence of longer-term cultural and linguistic histories on the domain vocabulary, not differences in the knowledge held by individual speakers.

Of course, results from any single domain will not necessarily generalize to all other domains. We consider the possibility of different outcomes in different domains in the General Discussion.

We used the data collected by Malt et al. (1999) on names produced for a large set of common containers by speakers of English, Chinese, and Spanish. We also collected ratings of the typicality of each object as a member of the major linguistic categories that emerged from the naming data. With these data, we evaluated which of the four possibilities just identified best describes the relations among the categories of these three languages. We examined each pairing of languages—English with Spanish, English with Chinese, and Chinese with Spanish—and examined the applicability of the possibilities to each pairing. For each of the first three major possibilities, we evaluated first whether the type of relation held across the board; that is, whether a given relation fully characterized the relation between the languages. If it did not apply across the board, we asked whether it characterized any portion of the relation. If multiple relations appear within a pairing but none provides an across-the-board description of the relation, this outcome would support the fourth possibility.

Method

Participants

Participants for the naming task were 28 native speakers of English, all students at Lehigh University (additional American participants in the Malt et al. study gave judgments not relevant here); 50 native speakers of Chinese, 10 of whom were students at Lehigh and 40 of whom were students at Shanghai University, China; and 51 native speakers of Spanish, all students at Comahue National University, Argentina. The ten Chinese students at Lehigh used English in their academic work but used Chinese for all other purposes. The remaining Chinese participants and all the Argentinean participants exclusively used their native language in their daily activities, although some had had training in English. The American students received course credit for their participation. The Chinese and Argentinean students were paid or unpaid volunteers.

For the typicality rating task, Chinese participants consisted of the 40 students at Shanghai University who also provided names. Argentinean participants were 40 of those who provided names. American participants were an additional 28 Lehigh University undergraduates who had not participated in any other tasks.

Materials

Sixty common containers served as stimuli. The set consisted of a mixture of objects likely to be called *bottle* or *jar* in English, along with some additional ones not likely to be called either *bottle* or *jar* but sharing one or more salient properties with bottles and jars. The objects represented a wide range of bottles, jars, and other similar containers. The large size of the stimulus set and the large range of objects in it allow a sensitive comparison of the linguistic category boundaries for speakers of the different languages.

The objects were photographed against a neutral background with a constant camera distance to preserve relative size. A 12 in. ruler in each picture provided size information. Descriptions of the objects are given in the Appendix, and the complete set of objects is included as supplementary material for the web version of this article (see Malt et al., 1999, Fig. 5 for several examples). Because the labels on the objects were in English, for the Chinese and Argentinean participants, each picture was marked at the bottom, in the relevant language, with the nature of the contents of the object (e.g., milk, iodine).

This information did not indicate a name for the type of container.

The category names used in the typicality rating task were those that emerged as the most common names for the first ten participants for each language. For English and Chinese, the three names that applied to the largest sets of the objects were selected; the other names were used for fewer objects. For Spanish, seven names were selected because after the first and second-most common, a number of others were similar in the size of the object sets they applied to.

Procedure

Data from Argentinean participants were collected in Spanish by a native speaker of Argentinean Spanish. Data from Chinese participants (in both the US and China) were collected in Chinese by a native speaker from the Shanghai area. These experimenters, who are also fluent in English, translated the English instructions into their native language conveying the meaning of the English versions as closely as possible.

Participants first completed either one or two nonlinguistic sorts for use in the similarity analyses in Malt et al. (1999). The pictures were then shuffled and participants were asked to give a name for each object. They were asked to give whatever name seemed like the best or most natural name, and they were told that it could be one word or more than one word. The instructions emphasized that participants should name the object itself, not what it contained.

For typicality ratings, participants were instructed to rate how good an example of the named category each object was, using 0 if they felt the object did not belong to the category at all and a number between 1 (low) and 7 (high) if they felt it did belong to the category. They were told not to worry about the name they had earlier given for the object (for those who participated in the naming task), nor whether they might be judging the same object to be an acceptable member of more than one category. Category order was rotated across participants. American and Chinese participants each rated all three categories for their language, with the result that 28 Americans and 40 Chinese provided ratings for each category. Because seven categories were selected for Spanish, each Argentinean participant provided ratings for between one and three of the categories, with each category being rated by 12 participants.

Results and discussion

Preliminary analyses

Typicality ratings were averaged across respondents for each object in each category for which ratings were collected. The complete set of typicality ratings is included as supplementary material for the web version of this article.

The names produced for each object were tallied for each of the three languages, producing a frequency distribution of names across items. Tallies were based on the head noun of each response. (For instance, *bottle*, *juice bottle*, and *small bottle* all counted as instances of the *bottle* name.) In Spanish, the names given were sometimes single-word diminutive forms of other names (e.g., *frasquito* is a diminutive of *frasco*). In the naming analyses reported below, the diminutive form was combined with the non-diminutives and treated as a single category because phrases like *small bottle* in English were counted as instances of *bottle*. (Separate typicality data were collected for *frasco* and *frasquito* because the treatment of the naming data had not been determined at the time of collection.)

We define the dominant name for each object as the name produced most frequently for it. Across the 60 objects, seven different names emerged as dominant for at least one object in English, 15 in Spanish, and 5 in Chinese. Table 1 shows the dominant names and number of objects receiving each name in each language.[2] (Pilot data using participants from other Spanish-speaking countries revealed large dialect differences for these objects. The names reported here are not necessarily those that would be used by non-Argentinean speakers of Spanish.) The Appendix provides a listing of the dominant name for each object in each of the languages along with the percentage of participants giving that name for the object, and Table 2 gives informal glosses of the Spanish and Chinese names based on the intuitions of several native speakers for each language.[3] (English glosses are included for a comparison discussed later.) The glosses reflect primarily properties associated with typical examples of each name and should not be taken to fully describe the use of the names, as an examination of the Appendix makes evident.

As a general measure of the relative degree of correspondence between each pair of languages, we evaluated the extent to which pairs of objects received the same name in both languages. If two languages group the objects by name in the same way, then if two objects share a name in one language, they should also share a

[2] For ease of reference, we use pinyin here and subsequently rather than characters to designate the Chinese categories. The numbers following the letters designate the tone for each word. Two of the categories have the same pinyin spelling but are distinct words as indicated by the different tones.

[3] Dictionary definitions appear to be a less useful source of information. Definitions provided by dictionaries for all three languages tend not to capture well the observed uses of the words; for instance, two major monolingual Spanish dictionaries emphasize type of lid in the definition of "bidón," but native speakers and our data suggest that shape is more central to determining use.

Table 1
English, Spanish, and Chinese linguistic categories for 60 stimuli

English	*N*	Spanish	*N*	Chinese	*N*
Jar	19	Frasco	28	Ping2	40
Bottle	16	Envase	6	Guan4	10
Container	15	Bidón	6	Tong3	5
Can	5	Aerosol	3	He2	4
Jug	3	Botella	3	Guan3	1
Tube	1	Pote	2		
Box	1	Lata	2		
		Tarro	2		
		Mamadera	2		
		Gotero	1		
		Caja	1		
		Talquera	1		
		Taper	1		
		Roceador	1		
		Pomo	1		

name in the other. If there is no shared pattern of naming, then object pairs will share a name in both languages no more often than expected by chance. In English, 23% of the object pairs shared a name; in Spanish, 24% did, and in Chinese, 48% did. The proportion of object pairs that would be expected to share a name in two languages if the naming patterns are independent is the product of the proportion sharing a name in each language. The first row of Table 3 provides the expected proportion for each language pair if the patterns are independent, and the second row shows the actual number. The difference between expected and observed is highly significant, $\chi^2(2) = 16.02$, $p < .005$, indicating that the naming patterns are not independent. Most important for current purposes, the difference between expected and observed values indicates that the Chinese–Spanish pairing has the greatest degree of correspondence, and the English–Spanish and English–Chinese pairing have about the same, lower, level of correspondence.

Although this measure indicates that the naming patterns are not independent of each other (consistent with evidence in Malt et al., 1999), the difference between independence and the observed degree of correspondence is modest. For instance, Spanish and English each has slightly over 400 object pairs that share a name. If it were the same sets of objects in both languages, the number of pairs that share a name in both would be about 415; the actual number is half that. The incompleteness of the correspondence is reflected in the differences in the number and size of the categories across languages shown in Table 1. Malt et al. (1999) provide additional observations and use the Cultural Consensus Model (Romney, Weller, & Batchelder, 1986) to demonstrate reliable differences in naming patterns across the languages (as well as similarities). It is the existence of differences that makes examining the nature of the relations among the categories important.

Two points about the data should be noted before beginning the analysis of the correspondences between categories. First, the fact that *container* emerged as one of the dominant names in English raises the question of whether this word is a superordinate term not comparable to basic level terms such as *bottle* and *jar*. We think it did not function as a superordinate in our naming data. It is not uncommon for nouns to have a dual function as superordinate and contrastive basic level (e.g., in *doing the dishes*, *dishes* includes bowls, plates, and cups, but in *baking dish*, *serving dish*, and *casserole dish*, *dish* labels a set of objects that contrasts with those labeled as *bowl*, *plate*, or *cup*). In the case of our stimulus set, for a few less common objects (e.g., a large plastic object labeled "sodium sulfite"), participants may have drawn on *container* as a default or superordinate term. But most objects receiving the dominant name of *container* were familiar household items such as standard objects holding kitchen cleanser and baby powder. It is likely that for such items, *container* functions as their primary, basic-level name. In any case, interpretation of our results does not hinge on the status of *container* as basic level or superordinate. If speakers of all languages see and label essentially the same groupings, then they should have a grouping corresponding to *container*. If they label different groupings (e.g., subdivide *container* into smaller, nested categories), then our analysis will reveal that relation.

Second, by taking categories circumscribed by the head nouns as our categories of interest, we are setting aside information about the modifiers that were produced for some objects. These phrases may pick out conceptual sub-groupings of objects; for instance, there is little doubt that English speakers recognize that things they may call *plastic bottle* or *squeeze bottle* differ in some ways from things they may call *juice bottle*. However, the fact that modifiers are sometimes produced in naming these objects does not indicate that those objects are particularly atypical applications with functionally different names that should not "count" as instances of use of the noun. For 55 of the objects in the set, at least 50% of the responses were in the form of a bare noun. For the other 5, 28–43% of the responses consisted of the bare noun. Most of the remaining responses for these 5 and all the other objects were in the form of adjective–noun pairings, not noun–noun compounds that might be argued to be less compositional in meaning. In any case, noun–noun combinations are often used to label highly typical instances of linguistic categories (e.g., a *shoe box* is a highly typical example of things called *box*; a *Coke bottle* is a highly typical example of things called *bottle*). The occurrence of a particular noun modifier for certain objects appears to be

Table 2
Informal glosses for English, Spanish, and Chinese dominant names

English
Bottle: for containing liquids; usually cylindrical, made of glass or plastic, narrow neck
Jar: for containing things, e.g., jelly, jam, pickles; cylindrical, glass, wide mouth
Container: for storing non-perishable things, putting things into; square or cylindrical or other shapes, made of plastic or wood
Can: contains soup or soda, small, metal (aluminum or tin), cylindrical, sealed
Jug: for liquids; large, plastic
Tube: for holding cream, paste, etc.; cylindrical, plastic; or hollow inside and used to put rolled-up things inside
Box: for storing household items or other things or for moving or shipping; large, square, made of cardboard

Spanish
Frasco: made of glass, airtight lid, short neck, wide mouth
Envase: used to store liquids or solids; made of any material
Bidón: typically for liquids (sometimes having measurement markings); made of plastic, with a small opening and lid, short neck, fat body, with a handle
Aerosol: contains a type of gas, made of metal (sometimes plastic), tall, cylindrical, with a device on top for spraying by pressing
Botella: mostly for liquids; made of glass, with a long neck and small lid and opening
Pote: contains semi-solids, typically used for cosmetic cream; short, cylindrical body, wide opening and lid, with or without neck, made of cardboard or plastic
Lata: made of metal, typically cylindrical and tall or short, no lid, no neck, airtight seal
Tarro: made of metal or plastic, typically taller and less fat than *pote*, wide opening, with or without lid, no neck
Mamadera: for feeding milk; slim, tall, made of glass or plastic, top rubber device for easy sucking; sometimes other shapes to make handling easier for baby
Gotero: for administering drops; contains liquid, made of glass or plastic, cylindrical, relatively short, small, has a top opening or dropper inside that allows liquid to be obtained drop by drop
Caja: for storing or carrying; typically cardboard (sometimes glass), square shape, with or without lid, tall or short
Talquera: for storing powder; plastic (sometimes cardboard), tall or short, with or without neck, cylindrical, with lid or little holes to get the powder out by shaking
Taper: for liquids or solids; made of transparent plastic, with airtight lid, any shape
Roceador: for spraying liquid on things; made of plastic, tall, lid with holes to get liquid by shaking or with a device to get liquid by pressing
Pomo: made of soft plastic or metal that can be squeezed to obtain contents, long shape, small screw-on lid, with or without neck.

Chinese
Ping2: for holding liquids or solids, typically glass (sometimes plastic), sometimes tall, thin
Guan4: for holding solids (sometimes liquids); short, flat, round, non-transparent
Tong3: for holding liquids; larger than *ping2* and *guan3*, big and round, wood or plastic
He2: for holding solids; typically square or with many angles (sometimes round), mostly wood (sometimes cardboard or plastic)
Guan3: for holding cream; long and thin, cylindrical, soft or hard

Note. These glosses are derived from the intuitions of native speakers of each language and reflect primarily the properties associated with typical examples of each name.

Table 3
Number of object pairs sharing a name in two languages

	English–Spanish	English–Chinese	Chinese–Spanish
Expected	.06	.11	.12
Observed	.12	.17	.21

Note. "Expected" is the value that would occur if naming patterns in the language pair are independent.

related to how restricted the usual use of the object is and not necessarily to its similarity to other objects labeled with the same head noun.

Evaluation of category correspondence

We now evaluate in detail how well categories of the languages correspond to each other and in what ways they diverge. We look at the three possible pairings—English with Spanish, Spanish with Chinese, and Chinese with English—and we assess in turn whether the categories share prototypes, whether they nest within each other, and whether they cross-cut each other.

To summarize and visually display the relation between categories of each pairing, we present them in

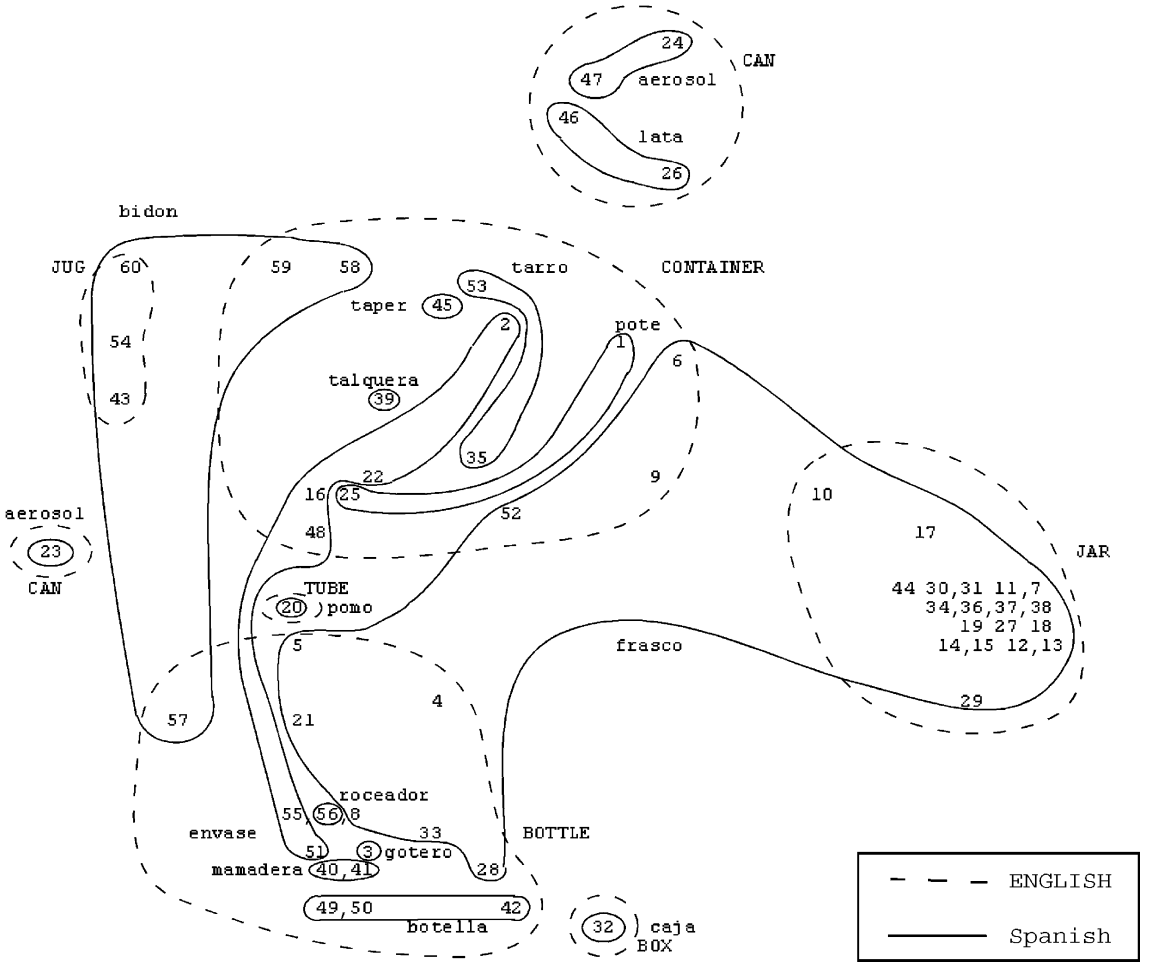

Fig. 1. English–Spanish comparison (with English providing the spatial layout). Note. For all the figures, when two or more objects fall at the same point in space, they are shown adjacent instead (to the side, separated by commas, or above/below) so that all objects are represented in the figure.

terms of Venn-like diagrams (see Figs. 1–3).[4] The objects are grouped according to the linguistic categories of one language, and the categories of the other language are superimposed on them. The spatial layout of the diagrams is provided by a multi-dimensional scaling solution (e.g., Shepard, 1974) of the similarities of the name distributions of the objects, produced using the KYST algorithm. (See the supplementary material on the website for a tabular representation of the category relations.)

To create the simplest visual display, the language with the smaller number of categories for each pairing was used as the input to the MDS solution, resulting in two diagrams using Chinese to provide the layout and one using English. The stress values for the two-dimensional solutions were low (.14 for Chinese and .15 for English), indicating a good fit to the data.

The similarity value for each pair of objects is the Pearson correlation of the name distributions of that pair of objects. For instance, suppose one object were named *bottle* by 20 participants, *jar* by 4 participants, *container* by 6 participants, and *can*, *jug*, *tube*, and *box* by 0 participants. Suppose a second object had a similar distribution. Then the correlation of these distributions, and hence the similarity value, would be high. If the second object had a substantially different name distribution, e.g., if it were named *jug* by most

[4] The placement of object 23 in Fig. 1 appears to be an anomaly produced by a quirk of the scaling program. In a three-dimensional solution of the same data, this object is placed near the other objects with the dominant name of *can*, as would be expected.

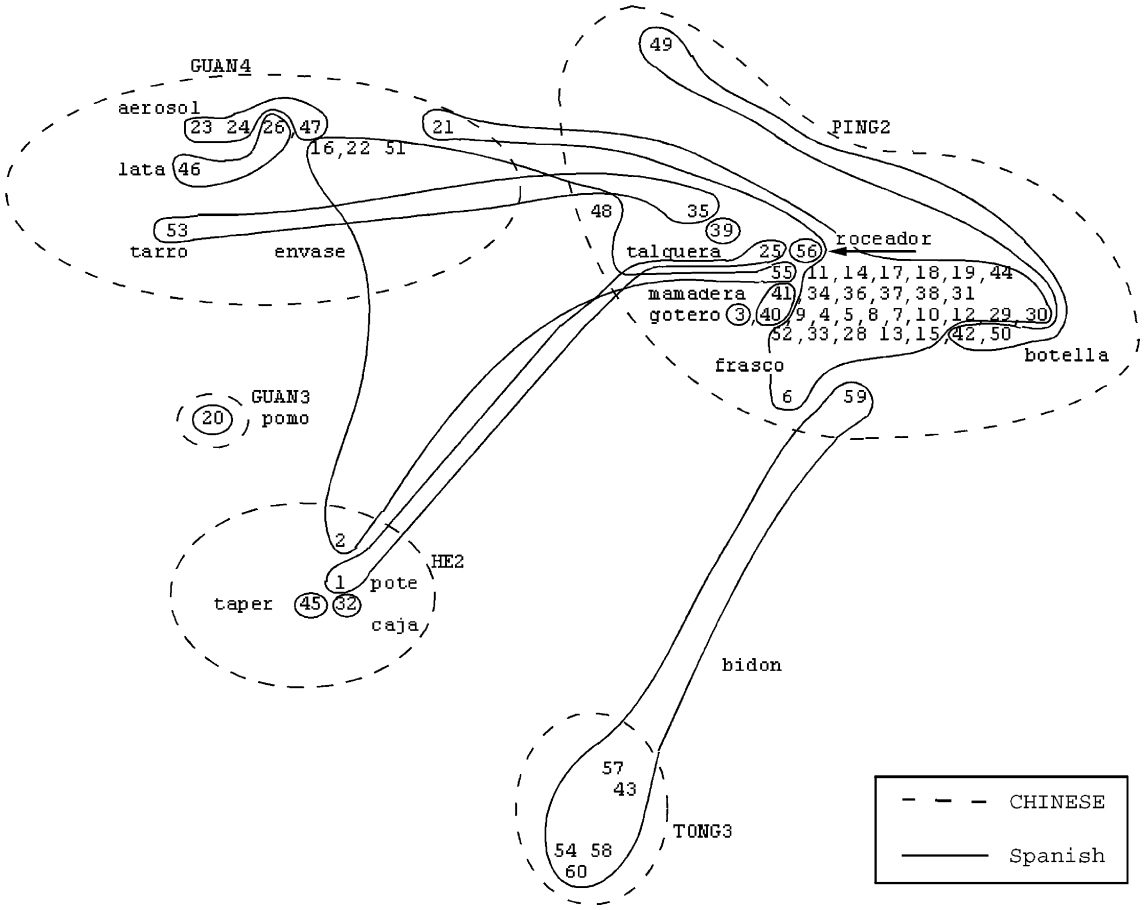

Fig. 2. Chinese–Spanish comparison (with Chinese providing the spatial layout).

participants, the similarity value for the pair would be low. Distances in the diagrams therefore indicate (for the language used to provide the layout) the extent to which the objects were given the same or different names. Because objects frequently given the same name will cluster together, objects at the periphery of their linguistic category will be those for which the name of that category was less strongly dominant and for which the name of some other category or categories was produced more often. The diagrams thus show whether objects that vary in their classification across the paired languages are ones that are central or more peripheral to the categories of the language providing the layout. We will use the naming distributions themselves, in conjunction with this visual information, to determine whether there are close competitors to the name that is dominant for each object. This information is critical to determining whether objects that fall into different linguistic categories in different languages represent cross-cutting classifications or merely noise in the naming responses.

Same prototypes, varying boundaries. If the categories are always formed around the same prototypes, with variation only in the placement of peripheral objects not closely associated with any prototype, then several predictions follow. On the strongest version of this possibility, in which only minor boundary variation occurs, there should be the same number of categories for each language, because each language would be labeling largely the same groupings formed around the same prototypes. The corresponding categories should be of approximately the same size, because only items at the boundaries will vary in their placement. The prototypes of the categories should match, as indicated by the same sets of objects receiving the highest typicality ratings across aligned categories. Finally, the overall typicality gradients should correspond as well, as indicated by a high correlation of typicality ratings for the objects across the aligned categories of the languages.

If groupings are always formed around the same prototypes, but treatment of objects outside of those

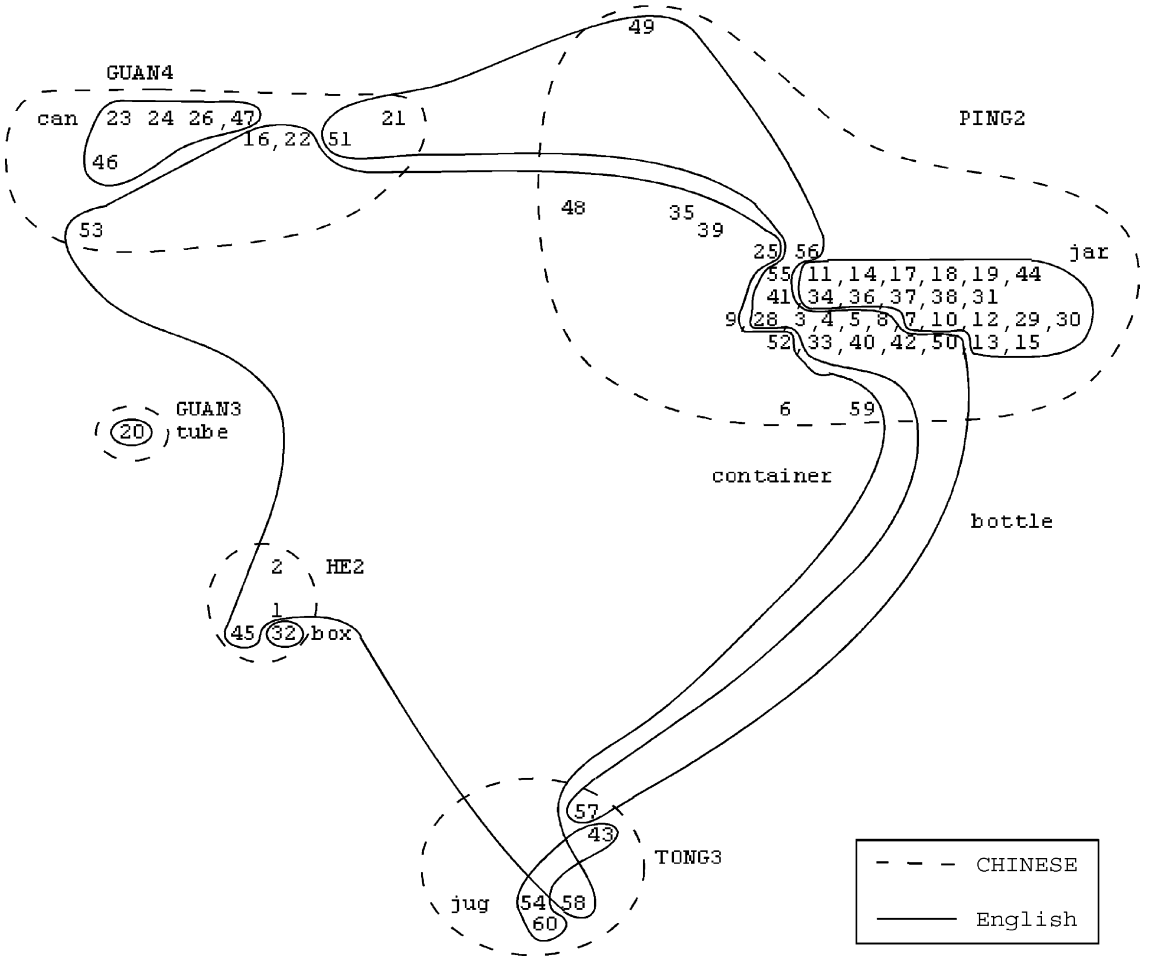

Fig. 3. Chinese–English comparison (with Chinese providing the spatial layout).

most closely related to the prototype varies more substantially across languages, a modified set of predictions applies. The number of categories across languages and their prototypes should still match. However, the size of corresponding categories across languages may vary more dramatically. Correlation of typicality gradients should be strong but less so than those for which category size is similar, because more objects considered relevant to one category will be low in relevance to the other.

Finally, if only some categories are formed around the same prototypes, then the number of categories per language may vary and not all categories will have prototypes that correspond across languages, but a subset of them will.

As Table 1 makes clear, and as has already been noted, the three languages do not have the same number of categories for the objects: they range from 5 for Chinese to 15 for Spanish. This fact forces the conclusion that speakers of the three languages do not form all their categories around the same set of prototypes. There is no across-the-board correspondence of categories based on a common set of prototypes. We next assessed whether there are any categories in each of the language pairs that appear to be formed around the same prototypes. The complete matrix of inter-category correlations of typicality ratings is available as supplementary material on the web.

English–Spanish comparison. For the English–Spanish comparison, the primary candidate to examine for a close correspondence is *jar–frasco* because this is the only pairing with sizeable categories containing substantially the same set of objects (see Fig. 1). The prototypes of these two categories do appear to be similar: three of the five most typical objects as *jar* correspond to ones in the top five typicality ratings for *frasco*, and the other two also received high ratings for *frasco*. The correlation between typicality ratings for *jar* and for *frasco* is

.92,[5] indicating a strongly shared gradient of typicality. This pair of categories, then, does appear to be based on the same prototype and to closely correspond overall. One other pairing, *jug–bidón*, also may have this sort of relation, having mostly shared membership (the three English objects that are *jug* are among the 5 named *bidón* in Spanish). Because *jug* did not emerge as one of the primary English names for the stimulus set, typicality ratings were not collected for this category and we cannot assess its relation to *bidón* in more detail.

Although no other categories share membership to such an extent, several can be evaluated for whether they may share prototypes but have more radically different boundaries. English *container* encompasses exemplars receiving a number of different names in Spanish. It is by dictionary definition equivalent to Spanish *envase*, but many fewer objects were called *envase* by Argentineans than were called *container* by Americans. None of the five most typical objects as *container* are among the five most typical as *envase*, and the overall correlation of *container* typicality with *envase* typicality is only .28, indicating a poor correspondence between these categories. *Tarro* and *pote* are nested within *container*, but none of the five most typical *container* exemplars were among the most typical as *tarro*, and only one was as *pote*. The correlation of *container* typicality with typicality for *pote* and *tarro* is .22 and .19, respectively, confirming that these two categories do not closely correspond to *container*. Two other possible candidates, *bidón* and *frasco*, have part of their membership within *container* but have more of it associated with other English categories. None of the top five most typical exemplars of *container* overlapped with those for *frasco*, and the correlation of typicality was a modest .35. Three of the most typical objects as *bidón* were within the top five as *container*, but the correlation of typicality was a fairly modest .41. These latter points suggest that there may be some correspondence between *container* and *bidón*, but because both *bidón* and *frasco* have more overlap in membership with other English categories (and only a modest typicality correlation), neither of these category pairings with *container* can be said to closely correspond. Thus *container* does not seem to be centered on the same prototype as a Spanish category.

English *bottle* likewise encompasses exemplars receiving a number of different names in Spanish. A strong potential candidate for a shared prototype is with *botella* because *bottle* is translated as *botella* (and vice versa) in dictionaries. However, of the five most typical bottles, only one corresponds to a highly typical botella (the remaining correspond to one *bidón*, two *mamadera*, and one very atypical *botella*). The one object highly typical of both *bottle* and *botella* is a glass, graduated container for holding a drink (object 50). The differences suggest that the function of being used for drinking may be more heavily weighted in making something a typical *bottle* whereas physical properties of glass and a graduated shape may be more heavily weighted for *botella*. The typicality ratings suggest in addition that *bottle* is only partially centered on *botella*. The typicality ratings for the objects as *bottle* correlate .61 with ratings for them as *botella*, a substantial relation but not as strong as that of *jar* and *frasco*. These two categories may have some overlap in prototype, then, but the relation appears to be imperfect.

The only other Spanish category having more than two exemplars that fall into the English *bottle* category, *frasco*, has no overlap of most typical exemplars and no correspondence of typicality gradient with that of bottle, $r = -0.14$, n.s.

Thus, overall, one of the three major categories of English matches a Spanish category in prototype and typicality gradient well (the *jar–frasco* pair) and one pair of smaller categories (*jug–bidón*) may also. The others do not, and there is only modest evidence of one case of a shared prototype with more drastically varying boundaries (*bottle–botella*).

Chinese–Spanish comparison. For the Chinese–Spanish comparison, similar to the case for English–Spanish, the primary candidate for closely corresponding categories being formed around the same prototype is *ping2* with *frasco*, because this pairing involves largely the same set of objects (see Fig. 2). The prototype of *ping2* appears to be related to that of *frasco* but not the same. The five most typical objects as *frasco* are highly typical of *ping2*, but many more objects are typical of *ping2* overall than of *frasco*: *ping2* has 31 objects that are rated highly typical (above 6.0), reflected in a mean rating of 5.11, whereas *frasco* has only 10 rated that high, and it has a mean rating of 2.88. This difference does not appear to be merely an avoidance of lower numbers on the rating scale by Chinese participants, because Chinese participants gave 13 objects ratings in the lower half of the scale for this category, and for the other two rated categories they

[5] Since "0" on the rating scale was to indicate that the object did not belong to the category at all, a mean typicality rating below 1.0 indicates that on average, participants did not view the object as relevant to the category. If not relevant for either category in the pairing, the ratings for that object should not be included in assessing correspondence of typicality gradients. We therefore eliminated any pairs for which the object received a mean rating of less than 1.0 for both of the languages in the pairing. For most correlations, no objects were eliminated by this criterion. When less than 60, the number of pairs in the correlation is given following the correlation value.

gave more ratings in the lower half than in the upper half. The single most typical object as *ping2*, receiving a perfect 7.0 mean, is rated low in typicality as *frasco* with a mean of only 0.92. This object is a highly typical *botella* for Spanish speakers. The overall correlation of typicality ratings is .65 ($n = 56$), strong but substantially less strong than that of *jar* with *frasco*. It thus appears that the *ping2* prototype incorporates features of Spanish *frasco* but incorporates others in addition, including some that Spanish speakers segregate into separate linguistic categories.

The remaining Chinese and Spanish names were applied to substantially smaller numbers of objects, making it difficult to assess correspondence. However, there are some indications of whether they do or do not share prototypes. *He2* contains four objects each having a different Spanish category name. All four of the objects in it have high typicality ratings as *he2*, so their occurrence together within one linguistic category is not a fluke. *He2*'s strongest positive correlation with the seven Spanish categories for which typicality ratings are available is a low .26 ($n = 50$) with *pote*. This Chinese category therefore does not appear to be closely related to any Spanish category. *Guan4*, with 10 objects, has members of six different Spanish categories within it, indicating little correspondence to any single Spanish category. Typicality ratings show a poor correspondence with the Spanish categories within it for which ratings are available: *envase* ($r = -0.35$), *frasco* ($r = -0.71$) and *tarro* ($r = 0.08$, $n = 57$). We do not have ratings for *aerosol* and *lata*; however, it is clear that at best *guan4* could only be partially based on either prototype, since it encompasses substantially divergent exemplars. Finally, *tong3* encompasses all but one Spanish *bidón* and no others; the two categories may closely correspond, as *jug* may with *bidón*.

Thus, the largest category of Chinese matches a Spanish category in prototype and typicality gradient fairly well (the *ping2–frasco* pair), though less well than *frasco* matched English *jar*. One pair of smaller categories (*tong3–bidón*) may likewise be based on similar prototypes (parallel to the *jar–bidón* case), while the remaining Chinese and Spanish categories do not appear to be closely related.

Chinese–English comparison. Finally, for the pairing of Chinese with English categories, no pair of major categories has closely shared membership (see Fig. 3). Thus at most these languages may have categories that share prototypes but have substantially different boundaries. The large Chinese category, *ping2*, has English *jar* completely nested within it, but most objects called *bottle* and a number called *container* are also within it. The top five most typical jars are rated high as *ping2*, and three of the five most typical bottles are also rated high as *ping2*. Overall, many more objects are typical of *ping2* than of either of the two English categories, with 31 objects rated above 6.0 in typicality as members of *ping2*, compared to 15 for *jar* and three for *bottle* (the mean ratings are 5.11, 3.88, and 3.86). Again, this difference does not appear to be merely an avoidance of lower numbers on the rating scale by Chinese participants because across the three sets of typicality ratings, Chinese participants made liberal use of numbers in the lower half of the rating scale. *Ping2* ratings correlate 0.64 ($n = 60$) with *jar* and 0.45 ($n = 60$) with *bottle*. It appears, then, that the prototype of *ping2* does not correspond directly to either that of *jar* or *bottle* alone but rather encompasses both. Although its large size and inclusiveness might suggest that this category would also encompass objects called *container* in English, it is noteworthy that about as many objects (seven) called *container* in English appear outside of *ping2* as appear in it (eight), and the correlation of *ping2* typicality with that of *container* is a negligible 0.14 ($n = 60$). The five most typical objects as *container* are not among the many objects rated as 6.0 or above for *ping2*. This category thus does not seem to correspond closely to any single English category, but has a relation to both *bottle* and *jar*, and not to *container*.

Among the smaller categories, *he2* does not correspond to any obvious English category, as was the case with Spanish. It includes one object named *box* and three others named *container* in English. Its typicality gradient correlates negatively or not at all with English *bottle*, *jar*, and *container*. *Guan4* seems to be related to English *can* but is broader, again, similar to the case with Spanish. It includes all the cans and five objects having other names in English. It correlates negatively or not at all with *bottle*, *jar*, and *container*, but may share a typicality gradient for *can*, for which ratings are not available. Similar to the other pairings, *tong3* appears to be related to English *jug* but somewhat broader, including all the jugs and two additional objects. These two categories may share a prototype, although ratings are not available.

Conclusion: same prototype, varying boundaries. The three languages do not show a simple pattern of having categories that share prototypes, varying only in classification of peripheral objects. Some of the major categories of a given language do not have strongly shared prototypes with other languages—for instance, English *bottle* and *container* have only a modest correspondence to any Spanish or Chinese categories. At the same time, some of the categories do indeed match moderately to very well in prototypes and typicality gradients (though varying in how well the category size corresponds). There is some consistency in which groupings are shared, with *jar/frasco/ping2* and *jug/bidón/tong3* being the most similar. In addition, several instances exist of single objects that received names not shared by other objects in the

stimulus set. In English, these were one *box* and one *tube*; they corresponded to one *caja* and one *pomo* in Spanish. The second of these also had a unique name in Chinese, although the first was included within *he2*. Because we have only a single exemplar of these categories in the stimulus set, we do not know how well the larger categories these names designate would match each other. However, the fact that at least the second object was isolated from the others in all three languages supports the idea that some sets of objects may be segregated perceptually or conceptually from others for speakers of all languages.

The observations of shared category membership based in common prototypes suggests that some groupings are apparent to speakers of different languages on the basis of their properties and so are linguistically segregated by all the languages. However, not all linguistic groupings formed within this domain are shared by the three languages. At least as many appear not to be as are.

Nestings. If one language consistently makes finer discriminations within a domain than another language, so that it divides the categories of that language into smaller categories of its own, then the nested language should show at least twice as many categories as the other language. The linguistic groupings it recognizes should be contained with the larger groupings of the other language, and they should be consistent with covert groupings made by the other language (that is, groupings identified by conventional modifier-plus-noun phrases, e.g., *baby bottle* or *plastic bottle*). If one language makes finer distinctions in only a portion of the domain, then some but not all of its categories will be nested within those of the other language.

If nestings are driven by greater domain expertise possessed by individual speakers of a language, then our stimuli, familiar household objects of American origin, should produce either no nesting relations or a pattern of nestings in which Americans most finely differentiate the domain. If nestings reflect not individual expertise but the richness of vocabulary for a domain available to individuals as a result of cultural and linguistic histories, then any of the three languages may show nestings.

A preliminary examination of the data indicates that the situation is not a simple one of across-the-board finer discrimination by those whose familiarity with the objects may be greatest. Spanish had 15 linguistic categories for the same set of objects for which Chinese had 5 and English had 7; therefore Spanish rather than English is the primary candidate for having categories nested within those of the other languages. As Figs. 1 and 2 show, furthermore, the nesting relation of Spanish within the other languages does not hold across-the-board.

English–Spanish comparison. Although Spanish has more categories than English, Spanish contains one large category, *frasco*, that is larger than any of the English categories. It contains all of the objects called *jar* in English plus additional objects named in English as *bottle* and *container*. Thus in the case of this category, the Spanish one subsumes the English one. Spanish does not simply subdivide English categories.

Some Spanish categories do, however, appear to be nested within English ones. Both of the objects labeled *mamadera* in Spanish were contained within the English category *bottle*, and because this Spanish label refers exclusively to baby bottles, this relation is a clean nesting. Likewise, all the objects labeled *botella* were contained within English *bottle*. Native informants indicate that this category is more narrowly restricted to glass, graduated containers than English *bottle* (see also discussion above); hence it also appears to be a case of nesting. Likewise, the Spanish category *aerosol* is nested within English *can* and is restricted to cans with spray pumps. Other cases of nesting also occur; for instance, *talquera* is a Spanish term applying only to containers of talc or similar powders and so is nested within *container*. However, the English categories involved in these nestings are not simply subdivided by Spanish speakers into finer categories, because both English *bottle* and *container* also contain objects having Spanish names that overall correspond better to other English categories (e.g., *bottle* also has some objects called *frasco* in Spanish, as does *container*).

Most of the cleanly nested categories correspond to divisions recognized covertly by English speakers, and so appear to be based on the same dimensions. *Baby bottle* and *spray can* or *aerosol can* are conventional modifier-plus-noun phrases in English. Glass bottles, as *botella* seems to label, are also a standard grouping in English (the one object having *botella* as dominant name but not made of glass was given this name by only 14% of participants; it appears to have no good name in Spanish). *Talquera* and *gotero* correspond to (talc-like) powder containers and medicine bottles with dropper tips, respectively. However, one category, *pote*, labeled two objects containing moisturizing products that are quite different in form. This grouping does not appear to correspond to any standard linguistic category of English.

Chinese–Spanish comparison. The relation of Spanish categories to Chinese appears to be somewhat simpler than that of Spanish to English, in part because of the large size of one of the Chinese categories. The large *ping2* contains all but one instance of *frasco* in Spanish, as well as all the objects called *mamadera* and *botella*. As with English, a single Chinese category, *guan4*, contains the Spanish *aerosol* examples plus *lata* examples. Thus nesting of Spanish categories with Chinese ones does

occur and without any reversal of the nesting relation as occurred in English. However, as with English, the overall relation between the languages is not one of pure nestings. *Tong3* has no Spanish subdivisions within it, and Spanish labels appearing within one Chinese category also sometimes appear under another (e.g., one *frasco* was not contained with *ping2*, and a case of *bidón* and *envase* occurred in two different Chinese categories).

Conclusion: nesting. We cannot fully determine the status of all the non-English categories because of limited representation in the stimulus set. Nevertheless, as with the previous analysis, the data do afford several clear conclusions. The size of the linguistic categories encompassing portions of the stimulus set varies widely across languages, and there are nesting relations between the languages. However, the nesting of one language's categories within another is not complete nor even entirely consistent; one language's categories may generally be nested within another's but the reverse relation may also occur within the pairing. In addition, some categories are roughly equivalent, and some categories have a more complex distribution across the other language even when others are nested. The general trend of the nesting relations found for these American objects—with Spanish having the most categories nested within those of the other languages—cannot be attributed to domain expertise of individual speakers, which would favor the Americans. The effects, if not due to individual speaker knowledge, must reflect longer-term linguistic and cultural needs and levels of expertise that have given the languages vocabularies of differing degrees of richness for labeling these objects.

Cross-cutting categories. If languages organize linguistic categories around partially or entirely different dimensions, or assign names to individual objects in other idiosyncratic ways, or both, categories of different languages might have some members in common but not others. We would expect to see that the objects called by a single name in one language would fall into two or more different categories in the other language. We would also expect to see that these violations of direct matching in the data are not created only by noise in the naming data; that is, an object does not differ in category assignment between the languages only because a close name competitor fell just short of emerging as dominant for one of the languages.

By revealing some cases of close correspondence, as well as some cases of nestings, our analysis so far indicates that English, Spanish, and Chinese will not show radical cross-cutting with little correspondence across all categories. As with the other analyses, though, we must ask whether the category relations show some degree of cross-cutting membership. Inspection of the language pairings indicates that there are instances where one category contains members of more than one category of the other language without these relations constituting clean nestings. For instance, English *container* includes objects with seven different Spanish names. Some of these may be nested categories, but others (e.g., *frasco*, *bidón*) involve categories that correspond better overall to a different English category. Likewise, English *bottle* contains several nested Spanish categories but also contains objects called *frasco* and *envase*; these categories correspond better to other English categories. As the figures show, the other language pairings show similar cases of potentially cross-cutting category membership. The figures suggest that the cross-cutting cases tend to be ones that lie toward the periphery of the linguistic categories of the language used for the spatial layout. The name dominance measure allows us to determine if these objects are mismatched in category assignment only because another name narrowly missed emerging as dominant for them in one or the other of the languages. A list of the objects in each pair that were identified as cross-cutting, along with their dominant name, second-most dominant name, and the dominance values for each is available as supplementary material.

English–Spanish comparison. Fourteen objects in Spanish cross-cut the English categories in that their dominant name matched a different English category than the bulk of the objects getting that Spanish name. These cross-cutting objects do tend to be ones that are less firmly members of either their English or their Spanish category, as indicated by the fact that a smaller percentage of participants produced that particular name. For English, the mean name dominance for aligned objects (those that do not cross-cut; $n = 46$) is 75.11, meaning that about 75% of participants used the dominant name for the objects. In contrast, the mean name dominance for cross-cutting objects ($n = 14$) is 60.57, $t(58) = 2.78$, $p < .01$. For Spanish, the mean name dominance for aligned objects is 74.93, and it is 63.07 for cross-cutting objects, $t(58) = 1.52$, $p < .07$. However, it appears that these objects do not cross-cut only because of instability in the naming data. Only one object had a closely competing name (defined as 10 or fewer percentage points difference in dominance) in English that would have resulted in alignment for that object if that name had been dominant, and only one had a closely competing Spanish name that would have resulted in alignment if it had been. So these objects by and large appear to be ones that truly do cross-cut the English categories: their linguistic category in Spanish maps onto members of more than one English category.

Spanish–Chinese comparison. For the Spanish–Chinese pairing, seven objects have Spanish names that

cross-cut the Chinese categories. (The number may be lower for this pairing than for Spanish–English because of largely shared membership in the one large category of each.) The seven are objects with lower name dominance in both Spanish and Chinese relative to objects whose membership is aligned between the two languages. For Chinese, the mean name dominance for aligned objects is 86.45 ($n = 53$), and the mean name dominance for cross-cutting objects is 61.14 ($n = 7$), $t(58) = 3.86$, $p < .01$. For Spanish, the mean name dominance for aligned objects is 75.96 and the mean name dominance for cross-cutting objects is 43.43, $t(58) = 3.40$, $p < .01$. Despite the lower name dominance for the cross-cutting objects, as before, the existence of cross-cutting category membership cannot be attributed only to instability in the naming data for these items. Only one had a closely competing name in Chinese that would have resulted in alignment if that name had won out as dominant, and only one did for Spanish. At least six of the Spanish category assignments appear to be ones that truly cross-cut the Chinese categories.

English–Chinese comparison. For English–Chinese, 10 objects cross-cut the Chinese categories with their English category membership, and these objects have lower name dominance in both languages than the aligned members. For Chinese, the mean name dominance for aligned objects is 86.84 ($n = 50$), and the mean name dominance for cross-cutting objects is 66.80 ($n = 10$), $t(58) = 3.48$, $p < .01$. For English, the mean name dominance for aligned objects is 73.25, and the mean name dominance for cross-cutting objects is 64.3, $t(58) = 1.43$, $p < .08$. Once again, however, the existence of cross-cutting objects cannot be due to instability in naming for these objects, because only one of the 10 had a name that was a close competitor and would have resulted in better alignment if it had emerged as that object's dominant name.

Conclusion: cross-cutting. The analysis of prototypes and nesting relations, along with the current analysis, indicates that the three language's categories do not radically cross-cut each other, with objects being grouped in substantially different ways by the three languages. However, the way the three languages name objects in this domain does yield category membership in one language that in some cases cross-cuts the categories of another language. Note also that our analysis probably underestimates the true amount of cross-cutting between these languages. Our stimulus set included only a few representatives of some of the categories, limiting the ability to detect cross-cutting cases. If we had had more objects named *envase*, *pote*, *tarro*, or *roceador* in Spanish, for instance, we might have found that they cross-cut the English categories to a greater extent than could be seen in our data.

We suggested initially that cross-cutting categories might arise either because languages form categories around different dimensions or combinations of dimensions, or because they simply follow such language- or culture-idiosyncratic paths in the evolution of linguistic category membership that the end result is substantially divergent membership. The informal glosses of the words given in Table 2 give us some idea which of these two possibilities better explains the nature of the divergences found. As noted earlier, because of the diverse membership of some of the categories, it cannot be expected that the properties listed provide true "definitions" of the words nor even that they necessarily apply to the majority of members of the category. They can, however, indicate whether the labels of any of the languages are centrally associated with different types of features than the labels of others (for instance, if one language's categories are associated heavily with shape while another's are associated with size, or function, or type of closing, or setting of use—cooking vs. health care vs. merchandise).

These glosses suggest that the languages are not structuring their categories around radically different dimensions. All have labels that evoke different typical combinations of size, shape, material, type of closing, and type of contents/function. Although any more detailed conclusions must be tentative given the limited sampling these glosses are based on, it also appears that Spanish labels may tend to specify more of the possible dimensions and to be associated with more restricted dimension values (e.g., the contents of *talquera* are limited to powder, the contents of *mamadera* to milk) than English or Chinese. Cross-cutting category membership in our data thus does not appear to derive from the use of fundamentally different dimensions or combinations of dimensions. It may arise instead from associating labels with different numbers of dimensions, different values on the same dimensions, and differences in how restricted the dimensions values are, and from language- or culture-specific patterns of extension that evolve from these differing central tendencies.

General discussion

What is the relation between linguistic categories of different languages?

Neither shared prototypes, nesting, nor cross-cutting was an accurate across-the-board characterization of the relations among the three sets of linguistic categories. Instead, the fourth possibility, a "mix & match" combination of the first three, more fully describes the data. Some of the categories are centered around similar prototypes, whereas others are not. Some of the cate-

gories have similar boundaries, whereas others have boundaries that are broader or narrower than the closest corresponding category in the comparison language. Some categories of one language may be nested within those of another language, whereas other categories of those same two languages are about the same size, and the nesting that does exist cannot be attributed to differences in domain expertise held by individual speakers of a language. And while many members of a linguistic category of one language belong to a single linguistic category of the comparison language, by either a close match of the categories or nesting within a larger category, some members appear to cross-cut the other language's categories. Those that cross-cut do not do so only because of instability in the naming data (although they do tend to be more peripheral members of the categories).

This outcome indicates that we cannot characterize the linguistic categories formed as mostly driven by shared conceptualization of the objects, with only boundary variations caused by differing linguistic and cultural histories, nor can we characterize them as mostly driven by top-down language- and culture-specific construals of the world with little influence of shared conceptualizations. Likewise, we cannot characterize the categories as differing only in the level of differentiation of a domain that they provide. Instead, shared understanding of the domain and differing linguistic and cultural histories jointly shape the categories formed but may have different levels of influence in different portions of a single domain.

How do linguistic and cultural histories interact with shared conceptualizations to yield linguistic categories?

We have already noted a number of ways in which differences in the linguistic and cultural histories of communities of speakers may lead to divergent naming patterns despite shared understanding of a domain. Our current data also provide the new suggestion that there may be influences from morphology and syntax. Spanish, on the one hand, can productively form single-word names for containers by adding the *-ero*/*-era* suffix and the *-or* suffix to root words; hence *talquera* names an object for holding talc or similar powders, *mamadera* names an object for sucking on, and *roceador* names an object for spraying. The productive morphology for this domain may cause Spanish to be particularly prone to develop names that convey relatively fine distinctions. Chinese, on the other hand, may be less likely to develop names that finely divide the container space because nouns in Chinese are, in many contexts, obligatorily preceded by classifier morphemes (Allan, 1977; Craig, 1986). These classifiers often provide additional information about properties of the object being referred to. Their availability may lessen the need for nouns that make finer discriminations.

Combining these suggestions with our previous ones, we can summarize the factors that may impact a linguistic community's naming pattern as follows: (1) *Domain structure* including the extent to which there are major discontinuities in the stimulus space or portions of it produced by clustering of entities, the extent to which any entities fall between clusters, and the extent to which there are multiple salient dimensions or values on dimensions that can serve as the basis for similarity-based links; (2) *Cultural factors* including the degree of cultural need to communicate about distinctions within a domain or portions of the domain, the set of exemplars that exists in the domain initially, and what order subsequent exemplars enter the culture; (3) *Linguistic factors* including what names already exist and might be extended to new cases; what names are imported through contact with other languages, what level of differentiation in naming the language's morphology may encourage, and what level of differentiation in naming the language's syntax may encourage; (4) *Chance*: there may be some random variation in what objects or dimensions a linguistic community starts building a category around.

Notably, domain structure will constrain the operation of other factors in causing diversity across languages. When there is strong structure in a domain or part of a domain (that is, strong clusters of entities in similarity space with gaps between clusters), many other sources of influence have minimal chance to influence the names assigned. A new exemplar will tend to be assigned the same name regardless of which other exemplars the culture has experienced or in what order. Chains of entities sharing a name will not develop even if the domain has a rich dimensional structure because no entities are scattered between clusters to provide the basis for chaining. Only cultural needs influencing how many dimensions a language considers in assigning names can still operate, along with those linguistic factors having to do with richness of available vocabulary, both influencing how finely differentiated by name a domain (or portion of a domain) will be. Thus presence of the clusters will dominate naming and all language communities will tend to have the same linguistic categories, with the potential for some variation in degree of differentiation. At the other extreme, when there is little domain structure (weak clusters; exemplars scattered throughout dimensional space), much greater cross-language variability can be expected. What the starting point for naming is and in what order subsequent exemplars are encountered will influence what exemplars are retrieved by any new exemplar, and hence what name will be assigned. Chains may develop based on entity-to-entity similarities, but the particular chains created will depend on other factors. Because the stimulus

dimensions are not highly correlated with one another, attentional variation may result in different languages forming linguistic categories around different dimensions. Thus it can be expected that in highly structured domains or portions of domains, languages will tend to form the same linguistic categories, with variation primarily in degree of differentiation. In contrast, in domains or portions of domains with less correlational structure, linguistic categories will be more variable. In cases of little domain structure, different languages may even form categories along different dimensions altogether, creating radically cross-cutting categories.

Malt et al.'s scaling solutions of the (non-linguistic) similarity data based on judgments of overall similarity (see Figures 7, 10, and 13 in Malt et al.) provide some information about the validity of this proposal as an explanation of the current data. If the perceived similarity of the objects in our set were such that all the objects strongly clustered, other processes could only minimally influence naming. However, if no clusters emerged at all, shared conceptualizations based on strong domain structure could not easily account for universals in naming. The scaling solutions show two noteworthy points. First, they all contain a strong cluster of objects that encompasses many of those named *jar* in English, *frasco* in Spanish, and *ping2* in Chinese. This appears, then, to be a case where a largely shared linguistic category has been driven by a shared perception of object similarity. Second, the similarity space as a whole does not consist of clusters of objects separated by unoccupied space. Rather, objects are spread out through much of the space, with some having no clear affiliation to a cluster. The naming of many of these objects, then, may not be unambiguously determined by domain structure. The other processes that impact naming in cultural- and language-specific ways have room to operate in much of the domain.

The objects in our set do not include all possible objects that would receive the target names in each language, and they also do not represent objects that might have historically influenced naming but no longer are used. As a result, we cannot assume that the scaling solutions provide an exhaustive picture of the similarity relations among objects that fed into the development of the current naming patterns. However, the solutions do support the viability of an account in which naming is constrained by shared perception of similarity clusters but influenced by other processes to an extent inversely proportional to the amount of structure in the stimulus space.

Implications for how linguistic categories are acquired

Our results suggest that in choosing names for the objects in our set, adults are doing more than simply applying a name associated with a set of objects that cluster in similarity space; they are drawing on a set of conventions developed by their language community. By implication, then, in learning word meanings and in learning names for individual objects, children must be doing more than forming concepts pre-linguistically and linking names to them. Of course, recognizing clusters of objects is also important (along with other aspects of learning, such as top-down influences). In addition to this recognition, though, children must be learning conventions that are not entirely motivated by shared properties.

The particular sound strings that children learn as the words of their language are largely arbitrary with respect to their meaning. Each child readily learns thousands of them, but children learning different languages learn different sets of thousands. Because children can acquire vast numbers of language-specific sound strings (and perform many other feats of memory, such as recognizing faces or pieces of music), it should perhaps not be surprising if some of the linkage of sounds strings to referents relies on memory for particular applications. What is to be learned in naming is rarely completely arbitrary: no one uses *bottle* to label sets of conceptually unrelated objects such as a drink container, a surface for writing, and a four-legged animal. It is simply that within a domain, the particular label for an object may be underdetermined by the object's features and its relation to other objects in the domain. The child must learn that a particular object is called *bottle* in English and not *jar*, or that there are five names dividing some set of objects and not one or two, when other name assignments may have been possible.

Implications for second language learning

Our results also have implications for second language learning. The data indicate that *bottle* is not just *botella* and vice versa, despite the tendency to treat them as such by researchers of second language acquisition (e.g., Crutcher, 1998; De Groot, 1993; Kroll, 1993; Meara, 1993; Schneider, Healy, & Bourne, 1998) as well as foreign language teachers and dictionaries. Learning to use the nouns of a second language as a native speaker does must be more than a matter of paired associate learning. It must involve learning, in part, the linguistic conventions of the specific language involved. This process may be hampered by the existence of a different pattern in the native language that must be overridden in the second language. As such, it may be a much longer and slower process than would be predicted based on the ability to do paired associate learning in a second language learning context. Malt and Sloman (in press) have found that non-native speakers of English re-

quire many years of immersion in an English-speaking environment before their naming of this same stimulus set (and another set of 60 different objects) approximates that of native speakers, and even with many years immersion, some differences remain.

The acquisition process might be aided by making learners aware of some non-equivalences so that they are more sensitive to the need to attend to differences in usage. Given the very large number of possible discrepancies in naming patterns across languages, though, probably nothing can substitute for an immersion experience in which the learner is exposed to a wide range of individual objects and their names over a long period of time.

From a theoretical perspective, if word retrieval involves mapping from a common conceptual store to lexical items of either of two languages (e.g., De Groot, 1993; Kroll, 1993), the mapping for a fluent bilingual cannot be identical for the person's two languages. For instance, for Spanish and English, the portions of representational space associated with a word such as *bottle* are not identical to those associated with any individual Spanish word. This point is consistent with our suggestion (Malt et al., 1999; Sloman, Malt, & Fridman, 2001) that conceptual representations do not contain inherent category boundaries. Instead, category boundaries are flexibly created by the demands of different tasks (in this case, the demands of naming in one language vs. in another). It also suggests that a complete model of bilingual lexical knowledge cannot consist simply of nodes representing conceptual categories that are each linked to a pair of lexical items, one from each language. The conceptual knowledge must be unpacked in the model to allow the different relations of lexical entries to this knowledge to be shown. (The simpler model may, however, be an accurate representation of the knowledge of a speaker low in fluency who attempts to map words more directly across the two languages.)

Will the pattern of results for our 60 common containers generalize to other stimuli?

Finally, we must ask whether the "mix & match" pattern of relations that we observed is likely to generalize broadly. As we noted initially, evidence suggests linguistic diversity in a range of domains (including, for instance, color, space, and kin), not just in the artifact domain. It has sometimes been suggested (e.g., Bowerman, 1994; Gentner, 1981, 1982; Gentner & Boroditsky, 2001; Medin, Lynch, & Solomon, 2000) that there is more inherent structure (in the form of clusters of correlated properties) in the broad domain of concrete objects than there is in domains such as space and motion. The implication of this suggestion is that there is likely to be more diversity in how languages segment the latter domains by name than how they segment objects. The current study indicates, however, that for a subset of the object domain, that of common containers, the constraints imposed by the structure of the domain are not overwhelming, allowing substantial cross-linguistic diversity to arise. Indeed, as we have already noted, the scaling solutions from Malt et al. (1999) suggest a relatively unstructured space in this subset of the domain, without strong clustering of objects in space. The additional evidence about naming patterns for drinking vessels (Kronenfeld et al., 1985) and furniture (Gao, personal communication; Wierzbicka, 1992) suggests that the naming outcome is not unique to containers. Casual observation also suggests the possibility of virtually continuous variation in the nature of objects in many artifact sub-domains (see also Kempton, 1981; Labov, 1973). We thus suggest that similar results are likely to be found for other parts of the artifact domain. Further, if non-object domains such as space and motion have even less inherent structure, one should expect an even larger degree of diversity in the categories formed in these domains, with fewer categories formed around shared prototypes and having similar boundaries, and more having substantially divergent membership. Bowerman's (1996a, 1996b) results on spatial terms across languages do indicate a great deal of diversity, although the exact nature of this diversity has not been analyzed.

Note that although marketing schemes or introduction of new exemplars into a culture are not relevant for domains such as space or motion, diversity in naming patterns of the same sorts discussed can still occur for reasons similar to those we have proposed for artifacts. Linguistic categories, even for domains having universal instantiation across cultures, are not assigned from scratch by each new speaker of the language; they are transmitted across generations of speakers. If cultures have either random starting points or motivated variation in what they first name, phenomena similar to those for artifacts can occur. A culture names certain points in space and then extends these names in various ways or introduces new names, depending on what else needs to be named and what those things are similar to within the set already named. Different cultures will thus generate different clusters and chains sharing names when the structure of the stimulus space provides such opportunities. External factors such as contact with other languages will also influence how names evolve within a domain, and internal factors such as morphology and syntax of a language can also have an impact.

Perhaps the strongest arguments advanced for universal constraints on category formation have been for portions of the natural world, specifically, plants

and animals. It has been suggested that folkbiological categorization (usually assessed in terms of the nature of named categories) is largely shared across cultures, being based on perception of "discontinuities in nature"; that is, clusters of entities sharing many properties with one another and segregated from other clusters (Berlin, 1992; Hunn, 1977).[6] There does indeed appear to be a large degree of commonality in the nature of the folk categories named across a range of cultures (see e.g., Berlin, 1992, Hunn, 1977; Malt, 1995). This portion of the object domain, then, may be one in which structural constraints dominate and other influences have relatively little opportunity to operate. In this case, diversity may be limited to minor variation at category boundaries and to degree of differentiation. (Notably, the greatest degree of cross-linguistic diversity appears to occur at the higher levels of abstraction, where discontinuities in the stimulus space are suggested to be less evident; see Malt, 1995.)

Conclusion

Our analyses indicate that the difference in naming patterns across languages, at least within the domain of artifacts, is not characterized by a single type of relation but rather is a combination of differences in degree of differentiation, boundary variations, and more substantial differences in category composition yielding cross-cutting membership. This complexity is not obvious without close examination, underlining the importance of detailed cross-language comparisons before drawing conclusions about universality of naming or the nature of divergences. Most centrally, the results implicate an interaction of a shared understanding of the domain with differing linguistic and cultural histories in the formation of linguistic categories. They suggest that perceived domain structure may constrain the influence of other factors on the linguistic categories formed; where strong discontinuities in the stimulus space exist, languages will tend to share linguistic categories (possibly with differences in degree of differentiation), but where the stimulus space is less structured, boundary variation and even substantially cross-cutting categories may exist.

[6] Boster and Johnson (1989) and Medin and colleagues (e.g., Lopez, Atran, Coley, Medin, & Smith, 1997; Lynch, Coley, & Medin, 2000) have demonstrated culture- and expertise-specific categorization patterns for some parts of the natural world (e.g., fish and trees). Note, though, that their work has generally concerned conceptual and not linguistic categories. Responses to instructions to put together the things that go together by nature reflect goal-oriented conceptual groupings but not necessarily linguistic categories. Although landscapers may tend to put together trees that have similar functional value in a landscape, and taxonomists may tend to put together ones that cluster taxonomically, it is unlikely that the membership of their lexicalized categories such as *conifer* or *oak* diverge.

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Appendix: English, Spanish, and Chinese dominant names for 60 common containers

Notes. (1) "%" column indicates the percentage of participants who produced the name listed. (2) The descriptions were composed by the first author and contain information in the following order: size; material; shape; type of opening; contents. Although an attempt was made to be systematic, they should not be taken as constituting a complete account of the features of each object. The descriptions were composed as follows. Size was divided into large, medium, and small, with large being objects of 5 in. or greater at the base and 5 in. or more tall; small being less than 2 in. at the base and not more than about 3 in. tall; and medium being all sizes in between. Materials were glass, plastic, and cardboard. Mouth was considered wide if as wide as the rest of the container or almost so; small if less than half the width of the rest of the container, and medium if between those. Type-of-top options were shaker, squirt, spray, screw-on, snap-on, nipple, dropper, flip-top, pump, and pour spout; a few other phrases were used to describe idiosyncratic tops not common to other objects. Contents of the container were taken from the label. Shape was impossible to capture well with a small number of descriptors because of the complexity and variability of shapes involved. The descriptors given (mostly variants of cylindrical, rectangular, or square) are often only a rough approximation of the object's shape, but readers should often be able to fill in details of the shape from their familiarity with typical containers holding the specified substance. Pictures of the actual stimuli is included as supplementory material for the web version of this article.

Stimulus number	Object description	English dominant name	%	Spanish dominant name	%	Chinese dominant name	%
1	Small/squat, metal, cylindrical, wide mouth, screw top, lip balm	Container	68	Pote	69	He2	82
2	Small, plastic, cylindrical, wide mouth, snap-on top, 35 mm film	Container	86	Envase	20	He2	70
3	Small, glass, cylindrical, narrow neck, small mouth, dropper top, medicine	Bottle	50	Gotero	80	Ping2	100
4	Small, plastic, cylindrical, wide mouth, screw top, vitamins	Bottle	54	Frasco	88	Ping2	100
5	Small, plastic, cylindrical, wide mouth, screw top, ibuprofren	Bottle	57	Frasco	65	Ping2	90
6	Small/squat, plastic, cylindrical, wide mouth, screw top, ground cinnamon	Container	57	Frasco	49	Ping2	56
7	Small, glass, cylindrical, wide mouth, screw top, crushed garlic	Jar	93	Frasco	100	Ping2	100
8	Small, plastic, rectangular, narrow neck, small mouth, screw top, iodine	Bottle	78	Frasco	76	Ping2	100
9	Small, plastic, cylindrical, wide mouth, screw top, dried basil	Container	46	Frasco	84	Ping2	100
10	Medium, glass, graduated cylindrical, wide mouth, screw top, dried bay leaves	Jar	57	Frasco	88	Ping2	100
11	Medium, glass, graduated cylindrical, wide mouth, screw top, olives	Jar	93	Frasco	96	Ping2	96
12	Small, glass, graduated cylindrical, wide mouth, screw top, baby juice	Jar	96	Frasco	94	Ping2	100
13	Small, plastic, graduated cylindrical, wide mouth, screw top, brown mustard	Jar	96	Frasco	92	Ping2	98
14	Medium, glass, cylindrical, wide mouth, screw top, maraschino cherries	Jar	89	Frasco	100	Ping2	96
15	Small, glass, graduated cylindrical, wide mouth, screw top, baby applesauce	Jar	89	Frasco	98	Ping2	100
16	Medium, plastic, cylindrical, wide mouth, screw top, deodorant	Container	54	Envase	35	Guan4	76
17	Small, glass, cylindrical, wide mouth, screw top, instant coffee	Jar	75	Frasco	88	Ping2	98
18	Medium, glass, graduated cylindrical, wide mouth, screw top, butterscotch sauce	Jar	96	Frasco	96	Ping2	96
19	Medium, glass, cylindrical, wide mouth, screw top, salsa	Jar	93	Frasco	98	Ping2	96
20	Medium, flexible plastic, flattened cylindrical, medium mouth, flip top, petroleum jelly	Tube	61	Pomo	70	Guan3	74
21	Medium, plastic, cylindrical, baby-head top, squirt hole, baby lotion	Bottle	68	Frasco	53	Guan4	52
22	Medium, plastic, thin cylindrical, shaker top, foot powder	Container	61	Envase	31	Guan4	56
23	Medium, plastic, cylindrical, spray top, screw-on cover, bug repellent	Can	46	Aerosol	63	Guan4	92
24	Medium, metal, cylindrical, wide mouth, spray top, bug repellent	Can	93	Aerosol	76	Guan4	88
25	Medium, plastic, squarish, narrow neck, pump top, hand lotion	Container	39	Pote	39	Ping2	70
26	Medium, metal, cylindrical, wide mouth, screw top, machine belt cleaner	Can	46	Lata	45	Guan4	74
27	Small, glass, graduated cylindrical, wide mouth, screw top, grape jelly	Jar	96	Frasco	100	Ping2	98
28	Medium, flexible plastic, conical, small mouth, squirt top, brown mustard	Bottle	68	Frasco	39	Ping2	98

Appendix (*continued*)

Stimulus number	Object description	English dominant name	%	Spanish dominant name	%	Chinese dominant name	%
29	Small/squat, plastic, cylindrical, wide mouth, screw top, peanut butter	Jar	86	Frasco	92	Ping2	96
30	Medium, plastic, cylindrical, wide mouth, screw top, popcorn kernels	Jar	86	Frasco	100	Ping2	98
31	Medium, glass, graduated cylindrical, wide mouth, screw top, honey	Jar	86	Frasco	96	Ping2	92
32	Medium, cardboard, rectangular, small opening for straw, children's juice	Box	71	Caja	76	He2	88
33	Medium, flexible plastic, graduated cylindrical, small neck, screw top, grape jam	Bottle	75	Frasco	51	Ping2	100
34	Medium, glass, cylindrical, wide mouth, screw top, mayonnaise	Jar	93	Frasco	100	Ping2	94
35	Medium, plastic, cylindrical, wide mouth, shaker top, kitchen cleanser	Container	54	Tarro	25	Ping2	70
36	Medium, plastic, cylindrical, wide mouth, screw top, peanut butter	Jar	89	Frasco	100	Ping2	96
37	Medium, glass, cylindrical, medium mouth, screw top, applesauce	Jar	96	Frasco	100	Ping2	96
38	Medium, glass, cylindrical, medium mouth, screw top, spaghetti sauce	Jar	86	Frasco	100	Ping2	96
39	Medium, plastic, rectangular, medium mouth, shaker top, baby powder	Container	75	Talquera	39	Ping2	54
40	Medium, plastic, elongated annular, wide mouth, nipple, baby milk	Bottle	100	Mamadera	94	Ping2	100
41	Medium, plastic, cylindrical, plastic liner, wide mouth, nipple, baby milk	Bottle	93	Mamadera	82	Ping2	90
42	Medium, glass, flattened cylindrical, narrow neck and small handle, small mouth, screw top, maple syrup	Bottle	64	Botella	86	Ping2	100
43	Large, plastic, graduated cylindrical, handle, small mouth, screw top, windshield fluid	Jug	54	Bidón	82	Tong3	72
44	Medium, plastic, roughly cylindrical, wide mouth, snap-on top, roasted peanuts	Jar	78	Frasco	100	Ping2	96
45	Medium, plastic, squarish, wide mouth, snap-on top, marinara sauce	Container	78	Taper	70	He2	92
46	Medium, cardboard, metal ends, wide mouth, pull-off end, frozen orange juice	Can	57	Lata	88	Guan4	66
47	Medium, metal, cylindrical, spray top, compressed air	Can	71	Aerosol	76	Guan4	84
48	Medium, plastic, graduated cylindrical, medium mouth, shaker top, body powder	Container	54	Envase	33	Ping2	38
49	Medium, plastic, cylindrical, handle, wide mouth, screw top and straw, sports drink	Bottle	71	Botella	14	Ping2	34
50	Medium, glass, graduated cylindrical, narrow neck, small mouth, metal cap, sparkling juice	Bottle	100	Botella	100	Ping2	100
51	Medium, flexible plastic, rectangular, flip top, shampoo	Bottle	78	Envase	45	Guan4	50
52	Small, plastic, flattened cylindrical, wide mouth, snap-on top, bubble bath	Container	50	Frasco	63	Ping2	96
53	Medium, cardboard, cylindrical, sealed ends, metal pour spout, salt	Container	61	Tarro	31	Guan4	42
54	Large, plastic, rectangular, handle, small mouth, screw top, corn oil	Jug	46	Bidón	78	Tong3	70
55	Medium, plastic, hourglass, narrow neck, small mouth, squirt top, dish soap	Bottle	82	Envase	37	Ping2	84

Appendix (*continued*)

Stimulus number	Object description	English dominant name	%	Spanish dominant name	%	Chinese dominant name	%
56	Medium, plastic, roughly graduated rectangular, spray top, household spray cleaner	Bottle	68	Roceador	25	Ping2	74
57	Large, plastic, roughly rectangular with handle, medium mouth with screw top, liquid laundry detergent	Bottle	43	Bidón	76	Tong3	68
58	Large, plastic, squarish, handle, small mouth, screw top, soy sauce	Container	46	Bidón	96	Tong3	80
59	Large, plastic, cylindrical, embedded handle, wide mouth, screw top, sodium sulfite	Container	46	Bidón	61	Ping2	60
60	Large, plastic, roughly cylindrical, handle, small mouth, snap-on top, milk	Jug	61	Bidón	82	Tong3	78

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