

QUESTÕES E PROBLEMAS/SQUIB

**SIMILARITIES AND DIFFERENCES IN CATEGORIZATION BEHAVIOR BY BRAZILIAN
PORTUGUESE AND AMERICAN ENGLISH NATIVE SPEAKERS**
(Semelhanças e Diferenças em Comportamentos de Categorização de
Falantes do Português Brasileiro e do Inglês Americano)

Ana Cristina Pelosi Silva de MACÊDO (*Programa de Pós-Graduação em
Linguística da Universidade Federal do Ceará*)

ABSTRACT: The present paper presents a brief account of the nature and formation of categories. It also reports on some of the findings obtained by investigating the way native speakers of Brazilian Portuguese and American English organize their semantic categories. Eleven semantic categories taken from the Battig and Montague (1969) category response norms were used in the study. The way the Brazilians and the Americans behave, in ranking the various category members is statistically analyzed by assessing levels of agreement within and between groups. The results of the analysis indicate that, although, there exists some correspondence in the way the two groups behave in ranking and in describing functions and attributes associated with category members, culturally specific constraints also exist and these will influence ranking decisions. Additionally, subjects' performance suggests that categorization behaviors appear to be motivated by two broad approaches to category structure: a prototypical approach based on feature overlap and a schema-directed approach based on instantiations prompted by the individual's world knowledge.

RESUMO: O presente artigo relata alguns dos resultados que obtivemos ao investigar como brasileiros e americanos organizam suas categorias semânticas. Para a análise foram utilizadas onze categorias semânticas tiradas das normas de frequência de respostas de Battig e Montague (1969). O comportamento dos brasileiros e americanos ao sequenciarem os itens a partir dos mais típicos aos menos típicos nas várias categorias é estatisticamente analisado por se calcular níveis de concordância intra-grupo e inter-grupo. Os resultados dos dois grupos e nas suas descrições sobre funções e atributos associados com os membros das categorias, delimitações culturais também existem e estas influenciam decisões de categorização. Os resultados também indicam que comportamentos de categorização parecem ser motivados tanto por uma visão prototípica da categoria baseada no compartilhamento de funções, quanto por uma visão esquemática da mesma baseada em instanciações motivadas pelo conhecimento de mundo do indivíduo.

Key words: Categories; Categorisation; Exemplar; Prototype; Semantics

Palavras-Chave: Categorias; Categorização; Exemplar; Protótipo; Semântica

0. Introduction

This paper summarizes some of the findings from the research which I have carried out on how Brazilian and American subjects assign category membership in their native languages. It reports on some of the findings obtained from presenting Brazilian subjects and American subjects with items which belong to various semantic categories such as *Animal*, *Furniture* etc., and asking them to rank the items according to their concept of the categories. This ranking is in harmony with the evidence gathered by cognitive psychologists notably Rosch and her colleagues (1973b, 1975, 1975b, 1975c, 1976) that categories center around a prototype and that categorization decisions are governed by degrees of distance between the prototype and remaining category members. In line with such evidence, some of the similarities and differences in the way the two groups of subjects ranked items into the categories were analyzed. The statistical analysis performed on the data also allowed for some conclusions to be drawn regarding the categorization behaviors which the subjects appear to have displayed in ranking the various category members.

Basically, there are two apparently opposing psychological accounts of how individuals assign membership into a category, a prototype-based account and an exemplar-based account. The prototype-based account posits that gradation in a category departs from the prototype, which is conceived as either the best exemplar or exemplars in a category or as a mental abstraction containing summary information (i.e. the central tendency) about criteria viewed as essential for membership into the category. Prototype models of categorization have thus generally assumed that membership decisions will be governed by degrees of perceptual or functional feature overlap between category items and the category's best exemplar(s) (Franks and Bransford, 1971; Reed, 1972, Rosch and Mervis, 1975). On the other hand, exemplar-based models have asserted that rather than focusing on feature overlap, individual information about actual category members are encoded and may be retrieved when a subject is faced with a categorization task (Brooks, 1978; Hintzman and Ludlam, 1980; Medin and Schaeffer, 1978). Categorization decisions viewed this way may also make use of contextual information which may be present at the time a category item is experienced (or encoded). These

results suggest that rather than being exclusive, the prototype-based approach to categorization and the exemplar-based approach may be simultaneously employed by subjects when these are faced with a categorization task. This conciliating view implies that in most, if not all, categorization tasks, the individual will be making use of both categorization procedures.

This study, having been carried out with the help of Brazilian-Portuguese native speakers and American-English native speakers, also made possible the investigation of categorization behaviors adopted by individuals who belong to different cultural groups. This has contributed to shedding light on the fact that, despite certain variations in item salience, there are categorization behaviors and linguistic ways of expressing fuzziness which may well be universally shared by the human mind.

Before reporting on the study and its findings, I have included, in the next two sections, a brief review of the theoretical background which points to the insufficiency of the classical theory of categorization and highlights the non-traditional view as a more plausible account.

1. The Nature of Categories

Why do people usually consider table a more representative member of the category *Furniture* than shelf or lamp; dog a more representative member of *Animal* than turtle or snake? If the classical theory which has traditionally regarded categories as rigid logically bound domains were right, this should not be so. After all, according to this view, membership of any items into a category will be solely determined in terms of necessary and sufficient criteria. From such a viewpoint, category membership is an all or none phenomenon. Adoption of such a position leaves no room for fuzziness or membership gradation within categories. As evidence from empirical research has time and again demonstrated, though, (Berlin and Kay, 1969; Ekman, 1971; Kay, 1979; Rosch (1973), the classical theory of categorization is not capable of providing a solely satisfactory account for the way concepts are acquired and organized in the mind. Everytime an individual is able to decide on how well a category item represents the concept entailed by the category, s/he provides evidence that category structure is not rigid. Rather than static, category structure allows for gradation of representativeness so that some category members will be more central to the concept entailed by the category label than others. Evidence of fuzziness and prototype effects have been found both in language and cognition. Lakoff (1972), for example, points to the existence of linguistic

hedges, such as, "a sort of", "strictly speaking", "more of a" as evidence of fuzziness in natural languages. The dominance of central category members (i.e. prototypes) is furthermore ascertained by improved performance on categorization tasks, ease of encoding items into memory for free recall, and category acquisition as research carried out by a considerable number of psychologists has indicated (see Bjorlund and Thompson 1983; Duncan and Kellas 1978; Hayes and Taplin 1993; Keller and Kellas 1978).

2. Category Formation: The non-traditional view

In contrast to the classical view, Rosch (1978) provides a more plausible explanation of how categories are formed. According to her, two general basic principles are responsible for the formation of categories, cognitive economy and perceived world structure.

The first principle (cognitive economy) allows us to "treat new stimuli as equivalent to other stimuli already categorized therefore reducing the infinite differences among stimuli to behaviorally and cognitively usable proportions" (Rosch, Mervis, Gray, Johnson and Boyes-Braem, 1976).

The ability of the human brain to classify new stimuli as equivalent to stimuli previously found and categorized is advantageous in at least two ways. First, it allows the individual to impose order into her/his environment. Without the ability to categorize, the individual would not interact meaningfully with the infinitely diverse number of objects and situations s/he is exposed to and, in fact, life would be chaotic. Secondly, it is cognitively advantageous and economical since it allows one to organize the infinite number of objects and events encountered through life into manageable easily accessible categories.

The second principle, Rosch (op. cit.) highlights as essential for category formation, i.e. perceived world structure, asserts that unlike the sets of stimuli traditionally used in laboratory-concept attainment tasks, the perceived world is not an unstructured total set of equiprobable co-occurring attributes. Rather, things found in the world display, highly correlational structure. Therefore, a knower who understands the complex attributes of feathers, fur and wings, knows by experience with the perceived world that wings co-occur more frequently with feathers than with fur. Perceived world structure, thus, allows for a high level of certainty as to which attributes or parts of totals will occur together.

Although it is plausible to accept that the two principles briefly outlined in the preceding paragraphs form the basis of the category systems found in the world, one point to note, however, is that the formation of categories itself is culture specific. This implies saying that, while cognitive economy and perceived world structure may be universal principles employed in the classification and grouping of stimuli, the actual categories found in a culture and coded by the language at a particular point in time will reflect the historical, social and environmental constraints which are relevant to the cultural context in which the categories are formed. Along these lines, Lakoff (1990: 92-102) provides an enlightening analysis of the Dyirbal language in which he highlights the link between the formation of categories in Dyirbal culture and the language classifier system pointing to the importance of the cultural context in which the categories of the language were formed and to the domains of experience of the people involved as crucial to the way Dyirbal categories came to be organized.

3. The Study

Nine categories¹, taken from among the 56 categories used by Battig and Montague (1969) to obtain category response norms, were ranked as to degrees of concept representativeness by 30 Brazilian-Portuguese native speakers. These categories represented a sub-set of the same categories which have been ranked by 76 American subjects in a previous study on fuzzy semantic categories by Markovitz (1977). For the purposes of the cross-cultural analysis which was attempted, the ranks given by the two groups of subjects have been statistically compared in order to ascertain levels of similarities and differences in the behaviors of the two groups in ranking the various category items. Since the categories used are part of a word list specific to American English, it was felt that, before being ranked by the Brazilian subjects, they needed to be modified for the purposes of the analysis.

The modification of the categories was done by presenting the categories (translated into Portuguese) to another group of thirty Brazilian-Portuguese native speakers who took part in a pilot study. These assessed the extent to which the category items reflected Brazilian-Portuguese categories, by eliminating items which were considered not to be part of the categories and/or by adding, if necessary, other items considered more typical of their own native language categories. In order that interesting borderline cases of category

¹ The nine categories were translated to Portuguese before being presented to the Brazilian subjects.

membership might not disappear from the original categories, only items eliminated in a frequency of 100% were to be left out from the original categories. Since none of the items were eliminated by all the subjects, all the items which appear in the original categories remained. Table 1 shows the final version of the categories. The items appearing in italics are the extra ones which were added by the Brazilian subjects. In order for an item to be added, it had to have been included by at least 20% of the subjects.

Animal: dog, cow, deer, squirrel, turtle, snake, elephant

Drink: milk, coffee, juice, cider, soup, beer, tea

Fuel: oil, coal, wood, paper, steam,, alcohol, gas

Furniture: chair, lamp, dresser, stool, picture, bed, table

Insect: fly, ant, grasshopper, flea, centipede, cockroach, spider

Seasoning: salt, pepper, garlic, ketchup, nuts, parsley, herbs

Toy: doll, block, soldier, balloon, swing, paint set, teddy bear, ball

Tree: oak, pine, birch, ash, weeping willow, palm, bamboo, mango

Weapon: gun, bomb, bow and arrow, stick, rock, grenade, knife

Table 1: List of the Modified Categories Category Stimulus Items

4. Method

In order to obtain the various ranks, the Brazilian subjects were presented with nine 3cm x 5cm card sets composed of the category name and individual cards of some of its members. Three additional sets (*Clothing*, *Sport* and *Vehicle*) were used as demonstration sets to introduce and explain the ranking task. These were not included in the analysis. The procedure for the ranking task was as follows; the subject was asked to select the category member or members which best fitted their concept of the category name and align it or them below the card containing the category name. S/he would then be asked to align the remaining category member cards according to the same concept of how well they represented the category name, from best to least representative of the category. The subject was allowed to eliminate any item or items which s/he did not consider to be a member of the category. Tied ranks were accepted. This meant that more than one item could receive the same rank. A 1 to 7 point scale was used and the first item(s) on the list was considered the most typical.

5. Results and Discussion

Both the Brazilian subjects and the American subjects were willing to rank the various category items. The fact that the task made sense to them thus exposes graded category membership as a cross-culturally shared phenomenon. Moreover, the mean ranks obtained from both groups of subjects are many times very close (see Table 2, next page).

The two groups also produced various instances of identical tied ranks. The fact, for example, that ties such as *dog/cow* in *Animal*, *salt/pepper* in *Seasoning*, and *stick/rock* in *Weapon* were produced by both groups of subjects gives evidence that concepts regarding some of the various category members are, at times, shared between the two culturally distinct populations analyzed in the study.

In addition to the ranking task, subjects were also asked to express their views as to the inclusion or exclusion of items into the various categories or as to the assignment of items into alternative categories. When asked to do so some of the Brazilian subjects made use of linguistic hedges to express fuzzy or doubtful category membership. Whereas some subjects would assign full membership to certain items in alternative categories, others would restrict an item's full inclusion by inserting a hedge to express a certain degree of fuzziness in their taxonomic statements. For example, when expressing their views about the items lamp and/or picture included under *Furniture*, the subjects invariably ranked such items as poor members of *Furniture*. On several occasions they would either totally assign the items to a new category, saying for instance, "A picture is an *Ornament*" conferring therefore full membership on the specific item (picture) in the alternative contrast category. Or they would still shift the item to the alternative category but signal a certain degree of uncertainty as to the full extent of the item's membership within the newly assigned category by saying "It (picture) is more a type of *Decoration*" or "These (picture and lamp) remind me more of *Ornaments*". Such a trend was often observed throughout the ranking statements for all ten categories included in this study. The term 'picture', therefore, sets *Furniture* against *Decoration* or *Accessory* on the basis of a diminishing degree of functionality or of serving a useful basic purpose. The best examples of the category are always those items which fulfill functions viewed as very necessary within the confines of a house, such as beds, tables and chairs. The hedges, 'like' and 'more of a' were also employed to express the fuzzy nature of the category *Toy*. Depending on the existence and complexity of rules and sense of competition for example, *Toy* can fuzz into *Sport*; and depending on the age group involved, they can be viewed more as *Hobbies* or *Pastimes*.

Category Items Study	Present Study	Markovitz's
dog	1.8	1.7
cow	1.6	2.2
deer	2.7	2.4
squirrel	3.8	3.6
turtle	3.9	5.1
snake	4.3	5.8
elephant	2.2	-
milk	2.5	2.1
coffee	3.1	2.3
fruit juice	2.0	2.1
cider	3.5	3.8
soup	5.4	4.7
beer	2.7	-
tea	3.0	-
fly	1.5	2.0
ant	3.3	1.9
flea	2.8	3.4
grasshopper	3.2	3.7
centipede	4.5	3.9
spider	3.1	-
cockroach	1.9	-
oak	2.1	1.2
pine	2.3	3.1
birch	5.1	3.4
weeping willow	3.8	2.7
palm	3.1	4.7
bamboo	4.8	5.8
ash	5.3	-
mango	1.5	-
gun	1.6	1.3
bomb	2.3	2.9
bow and arrow	3.8	3.2
stick	4.9	3.8
rock	4.5	3.8
knife	2.6	-
grenade	2.8	-

Table 2 Mean Ranks for some Category Items in Both Studies

Category	Kendall's W Score	Percent. of Agreement
<i>Animal</i>	0.47	22
<i>Drink</i>	0.36	13
<i>Fuel</i>	0.63	39
<i>Furniture</i>	0.72	52
<i>Insect</i>	0.41	17
<i>Seasoning</i>	0.65	42
<i>Toy</i>	0.29	09
<i>Tree</i>	0.53	28
<i>Weapon</i>	0.52	27

Table 3 Intra-Group Agreement for the Brazilian Subjects

Levels of agreement within and between groups were calculated by the Kendall's Coefficient of Concordance and the Spearman Rank Correlation.

The W scores and the corresponding percentages of agreement obtained for the Brazilian subjects, shown in Table 3, above, are all above chance at $p < .001$. Such a result shows that the ranks produced for all the categories used in this study were not random. There is, however, a great diversity of levels of intra-group agreement. As we see, there was only 9% and 13% of agreement for *Toy* and *Drink* and even the highest percentage for the category *Furniture* reaches only 52%. A comparison of Table 3 with Table 4 where the levels of intra-group agreement obtained from the American subjects is shown, reveals that although there is partial agreement between the two groups, the American subjects on the most part displayed greater agreement in their ranking of the category members. Something which stands out, however, is that culturally specific categories such as *Tree*, and *Seasoning*, are among the categories which display the highest percentages of intra-group agreement in both studies.

Category	Kendall's W Score	Percent. of Agreement
<i>Animal</i>	0.76	58
<i>Drink</i>	0.55	30
<i>Fuel</i>	0.58	34
<i>Furniture</i>	0.83	69
<i>Insect</i>	0.33	11
<i>Seasoning</i>	0.81	65
<i>Toy</i>	0.56	31
<i>Tree</i>	0.71	50
<i>Weapon</i>	0.45	20

Table 4: Intra-Group Agreement for the American Subjects

In order to assess levels of inter-group agreement, the data emerging from the Brazilian subjects was statistically tested against the one produced by the American subjects. As an attempt to do this, the mean ranks given by both groups of subjects for each member of the nine semantic categories common to both studies were analyzed. The Spearman's Rank Correlation Coefficient test was used to assess the level of agreement of the mean ranks obtained for the two groups.

The basic hypothesis underlying the use of such a test was that despite the fact that the two groups of subjects came from culturally distinct environments, their common life experiences as members of two modern westernized nations would act as a cohesive factor in making their behaviors uniform.

The correlations obtained for most of the categories, with the exception of *Insect*, *Seasoning*, *Toy* and *Tree*, proved to be significant at $p < .01$ (see Table 5).

Categories	Correlations
<i>Animal</i>	0.91
<i>Drink</i>	0.93
<i>Fuel</i>	0.98
<i>Furniture</i>	0.95
<i>Insect</i>	0.65
<i>Seasoning</i>	0.89
<i>Toy</i>	0.53
<i>Tree</i>	0.89
<i>Weapon</i>	1.00

Table 5: Spearman Correlation Coefficients for Mean Ranks Given by Brazilians and Americans

This finding appears to confirm the hypothesis stated above. The fact that *Animal*, *Drink*, *Furniture*, *Fuel* and *Weapon* emerge as categories for which significant correlations are obtained seems to indicate that, from among the nine categories which are compared, these are, in the case of the present analysis, the categories for which the concept of membership gradation appears to be consistently shared by both the Brazilian and the American subjects. The nature of these categories stands out, I believe, as a positive factor in obtaining such a result. The remaining four categories are, to a greater or lesser extent, constrained in the way they are organized in the two cultures, and given members become, therefore, more or less salient by cultural or environmental factors. In contrast, when one thinks of the category *Weapon*, for instance, it is easy to verify that items included in this category are quite universally common and used for the same purposes in different cultures. The same line of reasoning also applies for the categories *Animal*, *Drink*, *Furniture* and *Fuel*. On the other hand, categories

such as, *Insect*, *Tree* and *Seasoning* are more susceptible to environmental or cultural constraints, such as the flora and fauna and cooking habits found in one part of the world but not so common in another. Constraints such as these, therefore, seem to play a part in the way the various category members are ranked by individuals belonging to different cultures.

Pairs of items belonging to all the categories were submitted to the Wilcoxon statistical test of significance. This additional test needed to be done, in the first place, to assess whether differences between mean ranks would indeed prove to be statistically significant. Furthermore, it would provide statistical evidence which would allow me to assess whether there were any differences between the performances of the Brazilian and the American subjects in assigning ranks to the various category items.

The results of the Wilcoxon test for matched pairs indicated a significant difference at $.01 < p < .05$ between the means of most of the members used in this study. However, as shown in Table 6, next page, a considerable number of items did not reach a significant difference in the way they were ranked. The number of such items varied from five in *Fuel* and *Seasoning* to ten in *Weapon*. The results of such a test suggest that the Brazilian subjects may have applied more than one categorization behavior in ranking the various category items. This is the case because amongst the pairs of items whose ranks the Wilcoxon test for matched pairs exposed as not statistically different there are both perceptually similar but also perceptually very different items.

For example, in the category *Animal*, pairs of anatomically similar animals such as cow/dog do not reach a significant level of difference in the way they are ranked, interestingly, however, pairs of physically very different animals such as squirrel/snake do not equally reach a significant level of difference either. What do these results suggest as to the categorization behavior adopted by the Brazilian subjects? If the representation accessed for a category (i.e. the abstracted summary information about the category) incorporated, as orthodox prototype theorists have claimed, mainly perceptually overlapping features instead of exemplar-based information which is context-sensitive, then perceptually distant pairs of category items would not receive ranks which do not reach a significant difference. The results of the Wilcoxon, thus, suggest that in ranking the various category items the Brazilian subjects were operating not only on prototype-based information but equally on a more all encompassing schematic view of the categories which may incorporate context-sensitive information besides private and/or culturally shared knowledge about the various exemplars in the category

Category	Member	Means	
<i>Animal:</i>	dog	1.8	
	elephant	2.2	
	deer	2.7	
	elephant	2.2	
	cow	1.6	
	dog	1.8	
	squirrel	3.8	
	turtle	3.9	
	snake	4.3	
	<i>Drink:</i>	beer	2.7
		coffee	3.1
		fruit juice	2.0
beer		2.7	
beer		2.7	
milk		2.5	
<i>Fuel:</i>	oil	1.8	
	gas	2.2	
	coal	2.4	
	oil	1.8	
<i>Tree:</i>	alcohol	1.7	
	oak	2.1	
	pine	2.3	
	palm	3.1	
	weeping willow	3.8	
	birch	5.1	
	ash	5.3	
	bamboo	4.7	
<i>Weapon:</i>	bomb	2.3	
	knife	2.6	
	knife	2.6	
	grenade	2.8	
	rock	4.5	
stick	4.9		

Table 6: Some Members Whose Means were Not Statistically Different from Each Other

This result partially harmonizes with what was found in the ranks assigned by the American subjects. Although Markovitz (1977) used a *t* test of significance, which, due to the nature of the data, is actually less appropriate than the Wilcoxon, the American subjects also assign ranks to perceptually quite different pairs of items which do not reach a significant level of difference (see Table 7).

Category	Members	Means
<i>Animal:</i>	cow	2.2
	deer	2.3
<i>Drink:</i>	milk	2.1
	coffee	2.3
	fruit juice	2.1
<i>Fuel:</i>	oil	1.7
	coal	1.8
<i>Tree:</i>	pine	3.0
	birch	2.8
	weeping willow	3.1
<i>Weapon:</i>	stick	3.8
	rock	3.8

Table 7: Some Members Whose Ranks were Not Statistically Different from Each Other in Markovitz's Study

6. Conclusion

In conclusion, it is relevant to bear in mind that a study such as the one here reported constitutes only a minute step into the investigation of categorization behaviors displayed by adults subjects.

Since only two culturally distinct populations were used, any conclusions as regards the universality of the behaviors displayed by the subjects can only be hinted at. Additional cross-cultural studies of a broader nature involving different age groups from various cultures and linguistic backgrounds are, therefore, in order to allow for a clearer understanding on how the human mind deals with the issues involved in assigning category membership and in expressing semantic fuzziness in different languages.

Finally, it can be said that, despite the limited scope of the present study, the evidence emerging from it indicates that category membership is a phenomenon which varies according to the cultural settings in which concepts are formed or come to be incorporated by members of a given culture. In addition, the results of the Wilcoxon and the *t* test, seem to suggest that categorization tasks, such as the ranking task performed by the Brazilian subjects

and the American subjects, may involve the use of both a prototype-approach and a schema-directed approach to category structure. Thus, rather than being exclusive, the two approaches may be part of a common phenomenon. In other words, in assigning membership, the individual may adopt a mixture of behaviors. One which focuses on degrees of feature overlap amongst the various category items with the prototype and, at the same time, a global schema which incorporates a universe of information based on each individual's world knowledge.

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