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Linguistic diversity and the bilingual lexicon:
The Belgian Story

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Abstract

Analogous to Malt, Sloman, Gennari, Shi and Wang (1999) we examined the relation between linguistic categorization and similarity of artifacts by Dutch-speaking and French-speaking monolingual Belgians. We replicated the dissociation between naming and sorting found by Malt et al. (1999) for speakers of English, Chinese and Spanish. We also investigated the relation between the two naming patterns of bilingual Belgians, raised simultaneously in French and in Dutch, and how these naming patterns can be linked to the naming of the monolinguals. The results showed that the French and Dutch naming pattern of the bilinguals didn't parallel the respective naming patterns of the monolinguals, but rather merged into a common naming pattern.

Introduction

Research from several different traditions concerns the coupling of similarity and naming. However, different studies have resulted in contradicting conclusions. Some studies found that categorization judgments paralleled similarity judgments, for example the study of Smith and Sloman (1994). Other studies have shown a clear dissociation between similarity judgments and preferred category labels for novel objects. Keil (1989) and Rips (1989) presented participants with artifacts described as physically resembling one type of object, but having been made to be used as another type, or with animals looking like one type of animal but said to have internal parts of a different species. They both found that although objects were rated as more similar to the former, they tended to be categorized as the latter (see also Rips & Collins, 1993). Also studies that look at well-established lexical categories and make comparisons across speakers of different

languages find substantial differences in naming objects, but only small differences in perceived similarity among the objects. For example, Kronenfeld, Armstrong and Wilmoth (1985) looked at the names given to various drinking vessels and the similarity among them judged by American, Japanese and Israeli participants. They found a dissociation between naming and similarity. However, the sample of objects used by Kronenfeld et al. (1985) was small and they did not attempt to assess whether the observed differences in naming paralleled the differences in perceived similarity.

Malt et al. (1999) carried out a larger-scale evaluation of the relation of perceived similarity among objects to the names they are given. They presented data from speakers of three different language groups: American, Chinese and Argentinean participants, speaking respectively English, Chinese and Spanish. The participants performed two tasks: they named 60 common containers (all mostly called 'bottle' or 'jar' in English) and they provided similarity ratings, by sorting the objects into piles based on three types of similarity: physical, functional or overall similarity. Speakers of the three languages showed substantially different patterns of naming for the set of containers, but they saw the similarities among the objects in much the same way. Malt et al. claim that the linguistic differences arise from differences in language-specific conventions and differences in language history.

The imperfect relation between naming patterns of a language and non-linguistic knowledge of objects and between the naming patterns of two different languages raises questions about how bilingually-raised individuals build and maintain their two lexicons. Do they maintain two distinct and native-like naming patterns, each with its own language-specific conventions or do the two competing

patterns merge into a single pattern that may not be fully native-like for either language. The latter might be due to individual cognitive constraints on memory capacity. One way to address this issue is to examine the two naming patterns of bilinguals to see how they relate to one another and to the naming patterns of corresponding monolinguals. Belgium, a bilingual country where French- and Dutch-speaking monolinguals live alongside bilinguals, who are brought up simultaneously in French and Dutch, live together, provides us with a laboratory to investigate this issue.

Two hypotheses are suggested concerning the naming patterns of bilingual Belgians: First, the French and Dutch naming patterns are kept separate and thus parallel the naming patterns of respectively the French-speaking monolinguals and the Dutch-speaking monolinguals. Second, the two naming patterns merge into one naming pattern and the bilinguals use just one single naming pattern both for the French and the Dutch naming.

Method

Participants

Thirty-two native speakers of Dutch, all students or research assistants at the Psychology Department of the Leuven University, and 29 native speakers of French, students at the Faculty of Law of the University of Liège, participated both in a naming and a sorting task (to be described below). Five participants of the Dutch-speaking group were retested for the naming, to check for within subject reliability. The time span between the test and the retest was approximately six months. The bilingual subjects consisted of 25 people whose father is Dutch-speaking and whose mother is French-speaking (14 out of 25) or vice versa (11 out of 25) and who have been raised in both languages. All of them were students (except one research assistant) at the university of Leuven, Brussels or Louvain-la-Neuve. The bilingual subjects performed the naming task twice (once in French and once in Dutch) and the sorting task once. They also completed a language history questionnaire, used to determine the participants' language background. Five bilinguals renamed the objects in French and five other bilinguals renamed the objects in Dutch after a time span of about six months.

The Dutch- and French-speaking monolingual subjects received course credit or participated as unpaid volunteers. The bilinguals were systematically paid for their participation.

Materials

Objects. There were 2 sets of stimuli, one consisting of 73 pictures of storage containers (as in Malt et al.'s study (1999)), the other consisting of 67 pictures of housewares for preparing food and serving food and drink. The objects of the first set were selected to be likely to receive the name 'bottle' or 'jar' in American English, or else to share one or more salient properties with bottles and jars. Translated into

Dutch and French, the objects are likely to be called respectively 'fles' or 'bus' and 'bouteille' or 'flacon'.[1] For the second set, the 'dishes set', objects had been selected to be likely to be called 'dish', 'plate' or 'bowl' in American English. In Dutch, the objects are mostly called 'bord', 'schaal' or 'kom', in French 'assiette', 'plat' or 'bol'.[2]

The objects were all found at home, work, or in stores frequented by the researchers. For both sets, we made an effort to include objects that would represent a wide range of respectively bottles, jars and other similar containers (Set 1) and of dishes, plates, bowls and other similar housewares (Set 2). The wide range of objects allows a sensitive comparison of the naming patterns of the Dutch-speaking monolinguals, the French-speaking monolinguals and the bilinguals.

All objects were photographed in color against a neutral background with a constant camera distance to preserve relative size. In front of each object a ruler was included to provide additional size information. Because the labels on the objects were mostly both in Dutch and in French, no additional information about the nature of the content (e.g. ketchup) was necessary.

Language history questionnaire. A questionnaire was used to determine the language background of the bilingual participants. Questions were asked about age and sex; where the participant was raised; what language her mother and father speaks; what language she speaks with her mother and father and whether she systematically speaks the same language (Dutch or French) with her mother and the same other language (French or Dutch) with her father; what language was used at primary and secondary school, during leasure activities; which language she currently uses most and estimated proficiency for both languages. Proficiency estimates were obtained by asking the participants for each language to encircle a number between 1 ('not at all fluent: you can barely speak the language') and 7 ('very fluent: you can speak the language like a native speaker').

Procedure

Naming task. In the naming task, participants were asked to name each object of two sets of pictures (the bottles and dishes sets), after looking through all the pictures of the set to be named to familiarize themselves with the variety of objects in the set. The instructions were the same as in the naming task of Malt et al. (1999): They were asked to give whatever name seemed like the best or most natural name, and they were told that they could give either a single-word name or a name with more than one word. The instructions emphasized that participants should name the object itself

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[1] It should be noted that we do not claim 'jar', 'bus' and 'flacon' to be translation equivalents or to cover the same group of referents. Referring to a dictionary, 'bus' is translated as 'can', 'flacon' as 'bottle'. 'Fles' and 'bouteille' are however translated unambiguously as 'bottle'.

[2] As for the bottles set, the corresponding names ('dish', 'bord' and 'assiette'; 'plate', 'schaal' and 'plat'; 'bowl', 'kom' and 'bol') 'are not assumed to be perfect translation equivalents.

and not what it contained. Each participant named first all the objects of one set (bottles set or dishes set) and then all the objects of the other set (dishes set or bottles set). The order of the two sets was counterbalanced. The bilingual participants named both sets in French and in Dutch. Hence, besides the order of sets also the order of languages was counterbalanced. Between the Dutch and the French version of the naming task, the pictures were shuffled.

After participants completed the naming task (once for the Dutch- and French-speaking participants, twice for the bilinguals), the pictures were again shuffled. The second task to be performed was the sorting task.

Sorting task. The large number of objects prevented us from collecting direct pairwise similarity judgments. Instead we asked the participants to sort the objects into piles. Based on these sorting data, we can calculate a derived measure of similarity for each pair of objects. Sorting was based on overall similarity. First, participants were asked to look through the pictures. The instructions for the sorting were as follows: 'I would like you to focus on the overall qualities of each container. This means that you focus on any feature of the container including what it looks like, what it's made of, how it contains the substance that is in it (in a stack, in separate pieces, as a single solid, as a liquid, with pouring capability, etc.[3]) or any other aspect of the container that seems important or natural to you. I would like you to put together into piles all the containers that you think are very similar to each other OVERALL. Note that we are interested in how similar the containers themselves are overall, not what is in the containers. Only put two pictures together if the containers are like each other in an overall way. DO NOT put pictures together just because the containers hold things that tend to be found together. For instance, if several containers contain health products, DON'T put them together unless you really think the containers themselves are alike in an overall way.'

Further, the participants were instructed to use as many piles as they wanted, but at least two different ones. They were not allowed to make a pile of only one picture, unless they really could not classify the object in one of the existing piles. They could take as much time as they wanted to complete the sort. In general, the sorting task took about 30 minutes.

Due to space restrictions, we will focus on the results of the bottles set only. However, the results with the dishes set were perfectly parallel to those of the bottles set.

Results

Replication of Malt et al.'s study

Comparison of linguistic category boundaries. For each name produced for each object, we first calculated its frequency separately for each language group. Only the

head noun of the response was considered as the name given to the object. Diminutive forms of names and additional adjectives were disregarded. The first analysis is restricted to the dominant category names for each object: i.e. the most frequently produced name for each object.

Table 1 shows the Dutch and French dominant category names for the bottles set together with the number of objects out of 73 for which each name was dominant. To gain an insight into the similarities and differences between the Dutch and French categories, the French categories are described in terms of their Dutch composition.

Table 1: Linguistic categories for the bottles set of the Dutch- and French-speaking monolinguals.

French bottles (monolinguals)	N	Dutch Composition (monolinguals)
bouteille	16	13 flessen, 3 bussen
flacon	16	10 flessen, 3 bussen, 2 potten, 1 roller
pot	10	9 potten, 1 fles
boîte	7	3 dozen, 2 brikken, 1 blik, 1 pot
tube	6	4 tubes, 1 pot, 1 stick
spray	5	5 bussen, 1 spray
bidon	3	3 bussen
brique	2	1 bus, 1 doos
berlingo	2	2 brikken
biberon	1	1 fles
bombe	1	1 bus
canette	1	1 blik
pannier	1	1 mand
poivrier	1	1 molen
salière	1	1 vat

For Dutch-speaking monolinguals, there were three main categories: 'fles', 'bus' and 'pot'[4]. The three categories together encompassed 74 per cent of the stimulus set. The remaining names were given to only a few objects. The French-speaking monolinguals used a total of 15 categories. Three category names were dominant for at least 10 objects out of 73: 'bouteille', 'flacon', 'pot'[5]. The other names were restricted to a smaller number of objects.

When we look at the Dutch composition of the French categories, we find some resemblance in how the two languages classify the objects into linguistic categories: the largest part of the objects called 'pot' in Dutch (9/13) are put into one single French category 'pot'. All Dutch 'tubes' are put together into the French category of objects called 'tube'. On the other hand, there are also prominent differences between the naming patterns of both languages: The objects called 'fles' (# 25) in Dutch are mainly split up

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[3] This information is only provided for the sorting of the bottles, since it is not applicable to the dishes.

[4] 'Fles' is translated as 'bottle', 'bus' as 'can' and 'pot' as 'pot' or 'jar'.

[5] 'Bouteille' is translated as 'bottle', 'flacon' as well, 'pot' as 'pot' or 'jar'.

into two different categories in French: 'bouteille' (# 13) and 'flacon' (# 10). The Dutch category 'bus' is not represented in a corresponding French category, but the objects are spread over 6 different categories ('bouteille', 'flacon', 'spray', 'bidon', 'brique' and 'bombe').

By looking at the dominant names, a lot of information in the data is lost. For the bottles set, only 5 objects were called by the same name by every Dutch monolingual and the same was true for the French monolinguals. Hence, it would be more useful to include all the names used for each object in the analysis. Therefore, in a second analysis, we calculated for each object the name distribution which can be described as the number of times each name was allocated to each object. Our intention was to compare the linguistic categories of the different language groups by comparing the naming distributions across the language groups. However, the naming distributions cannot be compared directly across the language groups since different language groups use different sets of names ($Dutch_{monolingual}$ versus $French_{monolingual}$). As an alternative, for each language group we compared the similarity of each object's name distribution to every other object's name distribution by using a Pearson correlation. The similarity in name distribution between two objects was calculated as follows: for each pair of objects within a language group, the correlation was computed across all the names between the name frequencies for both objects. For each language group, this resulted in 2628 correlations (for 73*72/2 pairs of objects). These correlations indicated the name distribution similarity between each possible pairing of the objects. The next step consists in correlating the 2628 name similarity values for the Dutch-speaking monolinguals with the corresponding 2628 name similarity values for the French-speaking monolinguals. This correlation mirrors the extent to which the two language groups correspond in the pairs of objects that have similar name distributions. The correlation between both monolingual language groups is 0.63: a substantial correlation, but far from perfect. Both the analysis of the dominant names and the correlation between the name distribution similarities confirm that the French- and Dutch-speaking monolinguals named the objects differently.

Comparison of the perceived similarity. The data from the sorting task were used to obtain a measure of similarity for each pair of objects. Pairwise similarity was recovered by counting for each pair of objects how many participants of a language group placed that pair of objects in the same pile. For each of both language groups, these calculations gave us 2628 pairwise similarity judgments. The similarity judgments of both groups were correlated. The resulting correlation of 0.87 -comparable to the mean estimated reliability of .92- indicates that the French- and Dutch-speaking monolinguals agree to a considerable extent on their perception of similarities among the objects.

Conclusion. For the two monolingual language groups, we found substantial differences in naming and no differences

in sorting. These results replicate the findings of Malt et al. (1999) for speakers of three different languages.

Naming in bilinguals: Two hypotheses

How did the French and Dutch naming patterns of the bilinguals interrelate and how are they linked to the naming patterns of the respective monolingual language groups? One possibility is that the naming of the bilinguals follows that of the corresponding monolinguals, i.e. the French bilingual naming pattern equals the naming pattern of the French-speaking monolinguals and the Dutch bilingual naming pattern equals that of the Dutch-speaking monolinguals. Another alternative possibility is that the bilinguals use just one naming pattern, or in other words, that their naming patterns of their two languages converge into a single naming pattern. To decide between these hypotheses, we analyzed the data both on a group level and on an individual level.

Group-level analysis. Correlations were calculated among all the language groups ($Dutch_{monolingual}$, $Dutch_{bilingual}$, $French_{monolingual}$, $French_{bilingual}$) between measures of name similarity (i.e. name distribution similarities). Figure 1 shows the pattern of correlations.
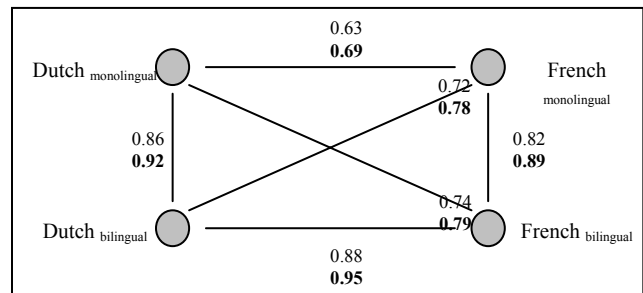

Figure 1: Pattern of correlations between the name distribution similarities of the language groups.[6]

When we compare the observed pattern of correlations with the patterns of correlations predicted by the two hypotheses (see Figure 2), we can conclude that the data are inconsistent with the two-pattern-hypothesis, since the correlation between the two naming patterns of the bilinguals (0.88) was significantly larger than the correlation between the naming patterns of both monolingual language groups (0.63), $Z = 21.82 > 1.96$. The data favor the one-pattern-hypothesis. Note however that some deviations from a single common naming pattern were observed. For example, it happens that a group of objects, with a single

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[6] The upper r_{XY}'s are the Pearson correlations, the lower $\mathbf{r_{XY}}$'s (in bold) are correlations corrected for unreliability of the data ($r_{XY}^* = \dfrac{r_{XY}}{\sqrt{r_{XX}} * \sqrt{r_{YY}}}$ with r_{XX} the reliability of X and r_{YY} the reliability of Y).

name in Dutch ('fles') is subdivided into more than one category in French (e.g., 'bouteille' and 'flacon').[7]
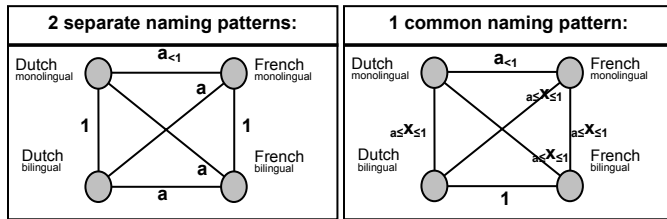

Figure 2: Patterns of correlations between the name distribution similarities of the language groups, predicted by the first and second hypothesis, respectively.

Individual-level analysis. On the individual level, object*object-matrices for each individual task, containing 0's and 1's with 0 indicating equal naming of both objects by the person performing the task and 1 indicating different naming of both objects- were correlated with each other. This resulted in $126*125/2$[8] different correlations between all possible pairs of individual tasks. Next, the correlations were Z'-transformed to normalize the sampling distribution of the correlations. Then, the Z'-transformations of the correlations were analyzed in a randomized block factorial ANOVA design, with three factors: language (two levels: the subjects of the pair perform the naming task in the same language or in a different language), person (two levels: correlation between naming data of the same subject or of different subjects) and linguistic statute (three levels: both subjects are monolingual, one subject is monolingual, the other bilingual and both subjects are bilingual), resulting in a 2*2*3 design with unequal cell frequencies and three (structurally) empty cells (see Figure 3).

The results of the ANOVA confirmed the conclusions that were derived from the correlational group-level analysis. The three main effects –language, person, linguistic statute- were all significant, respectively $F(1,7866) = 23.29$, $p < .0001$, $F(1,7866) = 42.61$, $p < .0001$, $F(2,7866) = 8.15$, $p < .0005$) as was the interaction effect language*person*linguistic statute, $F(4,7866) = 25.05$, $p < .0001$. We tested the following crucial contrasts: μ_{221} versus μ_{223} (C1) and μ_{113} versus μ_{213} (C2). If C1 is significant, Hypothesis 1 is rejected, since according to the two-pattern hypothesis, the mean correlation between the naming of a French-speaking monolingual and the naming of a Dutch-speaking monolingual must be equal to the mean correlation between the French naming of a bilingual and the Dutch naming of a(-nother) bilingual. If C2 is significant, Hypothesis 2 is rejected, because the one-pattern hypothesis

claims that the Dutch and French naming task of a (same) bilingual correspond equally well as the naming of that bilingual and the renaming (retesting) of the same bilingual in the same language. We found that C1 was significant, $F(1,7866) = 299.94$, $p < .0001$, and hence Hypothesis 1 is rejected. C2 was not significant, which means that Hypothesis 2 is retained.
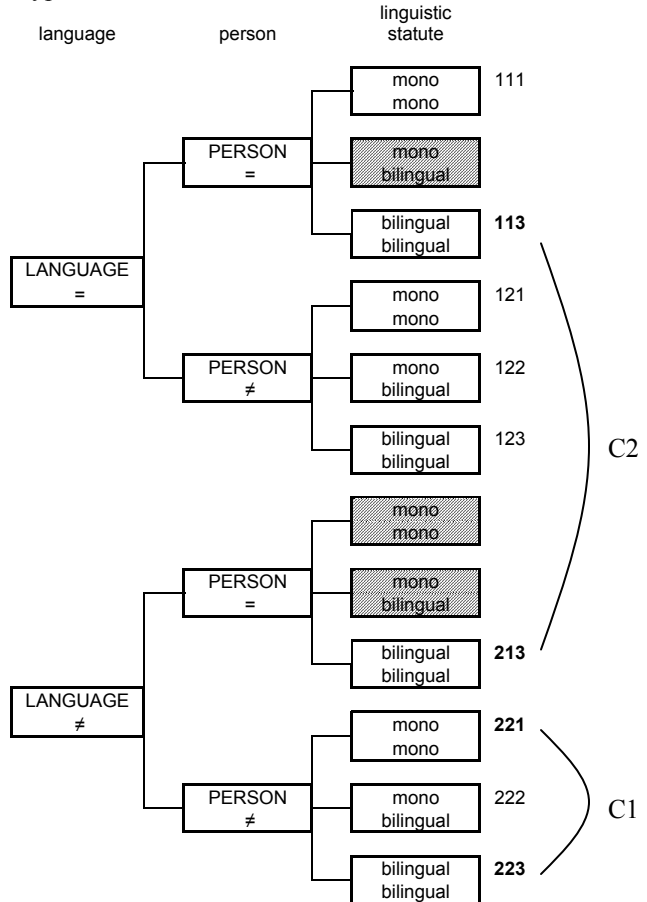

Figure 3: 2*2*3-factorial design with unequal cell frequencies and three empty cells.

General Discussion

The dissociation between naming and sorting, found by Malt et al. (1999) for three different language groups was replicated for the French-speaking and Dutch-speaking monolinguals: The analyses of the dominant names and of similarities among naming distributions revealed substantial differences in French-speaking and Dutch-speaking monolingual linguistic categories for the bottles set, while in contrast, no differences were found in their perceptions of the similarity among the objects, as revealed by the high correlation between the sorting data of both monolingual language groups. Hence, similarity cannot fully account for the observed naming patterns. Other factors must contribute to linguistic categorization. Malt et al. (1999) proposed that besides the contribution of similarity to naming choices,

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[7] Remark that this kind of subdivisions occurs much more frequently between the monolingual naming patterns than between the bilingual naming patterns.

[8] 126 individual tasks: = 32 Dutch-speaking monolinguals + 5 retested Dutch-speaking monolinguals + 29 French-speaking monolinguals + 25 bilinguals (Dutch naming) + 5 retested bilinguals (Dutch) + 25 bilinguals (French naming) + 5 retested bilinguals (French).

mechanisms such as chaining, convention and pre-emption influence naming patterns.

Concerning the bilingual naming patterns, the data (at group and individual levels) reject the two-pattern hypothesis. So, we can conclude that the French and Dutch naming patterns of the bilinguals are not kept separate and hence don't parallel the naming patterns of the French and Dutch monolinguals, respectively. The data are more consistent with the one-pattern hypothesis, suggesting that the two naming patterns of the bilinguals merge into one. However, the data also show that the assumption of a perfect match between the naming patterns is too strong and that is should be attenuated, since bilinguals did not use the French and Dutch category names as perfect translation equivalents. Apparently, even if the two naming patterns of bilinguals deviate from the corresponding monolingual naming patterns, naming in each of both languages is still influenced by culture- and language-specific factors: bilinguals name the objects in a way that is consistent with the language in which they name the object. This is not so surprising, since language and culture can't be considered separately. On the other hand, the convergence of the two naming patterns on one naming pattern suggests that bilinguals do not only satisfy cultural and linguistic constraints, but also individual cognitive constraints: it is less demanding on the limited sources of memory to store only one set of mappings between objects and names. So, in a way, bilinguals do find a set of mappings between words and objects that meet linguistic, cultural and individual memory constraints.

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