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Effects of task and category membership on representation stability

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This study examined the within-subject stability of 150 participants who performed both a sorting task and a property-generation task over multiple sessions, focusing on three concrete concept categories (food, animals and bathroom products). We hypothesized that (1) the within-subject stability would be higher in the sorting task than in the property-generation task and (2) the nature of the category would influence both the within-subject stability of the classification groups in the sorting task and the properties generated to define these groups. The results show that the within-subject stability of conceptual representations depends both on the task and on the nature of the category. The stability of the representations was greater in the sorting task than in the property-generation task and in the food category. These results are discussed from a longitudinal perspective.

According to Poitrenaud, Richard and Tijus (2005), "the role and nature of categories, as well as the process of categorization itself, are all highly controversial" (p. 151). The conceptual core of categories (i.e., the idea that concepts are stable because the foundation of their coherence is non-perceptual and reflects representations and beliefs about things of the world) is indeed questionable. From one perspective, conceptual representations are temporary constructs realized in a specific context and with a particular goal that is based on to the task at hand (Barsalou, 1993). In addition, representations are “assembled on-line from multiple knowledge sources and specific experience provided by the task context” (Poitrenaud et al., 2005, p. 154). Given this definition, are conceptual

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representations stable over time? In this study, we examined the within-subject stability of representations in relation to the type of task (a sorting task versus a property-generation task) and to the nature of the categories (natural versus manufactured categories).

Few authors have studied the temporal, within-subject stability of conceptual representations in relation to task. Bellezza (1984a, b and c) and Barsalou (1989) were the first authors to demonstrate such variability in the property-generation task. Bellezza (1984c) asked participants to produce several descriptive properties to qualify various concepts such as personal friends. The properties of a concept are the dimensions (e.g., height) and the features (e.g., tall) that characterize it. The participants in Bellezza's study repeated the task one week later and displayed low within-subject stability. Indeed, only 38% of the generated properties were consistent between the two sessions. These results are in line with the results of Barsalou, Spindler, Sewell, Ballato and Gendel (1987, cited in Barsalou, 1989) and Barsalou, Sewell and Ballato (1986, cited in Barsalou, 1989). Barsalou et al. (1987) showed that, regardless of the proposed task (the production of either ideal or defining properties for the categories), only one-third of the properties were common across all of the participants. Thus, the property-generation task seemed to be an important indicator of within-subject variability.

More recently, Cartier, Rytz, Lecomte, Poblete, Krystlik and Belin (2006) examined the within-subject stability of a sorting task. In their study, participants were asked to sort breakfast cereals according to the cereals' similarities. The task was repeated once a day for five days, allowing the measurement of within-subject stability. The results showed high within-subject stability, displaying only small changes in the sorting over time and reflecting within-subject consistency. However, this result cannot be directly generalized because it was obtained under very specific conditions using a small number of objects (13) from a single category (cereals) that consisted of edible labels. Moreover, the task was repeated every day for five days, a substantially shorter time interval than the one used by Bellezza and Barsalou (who looked at one repetition after at least one week). Consequently, the knowledge mobilized during the sorting task seemed stable in Cartier's study, whereas the properties produced during the generation task seemed highly variable.

The stabilities related both to the sorting task and to the property-generation task have been studied both separately and individually. In studies of object representations, however, many authors recommend using a method that combines the two tasks (Hoc & Leplat, 1983; Richard & Urdapilleta, 2004). Indeed, this combined method allows researchers to collect data on the exemplars of the categories (i.e., the extensional level) and the properties of these exemplars (i.e., the intentional level) (Urdapilleta, Bernard, & Tijus, 2004). Additionally, this method provides data about the nature of representations and has been applied in studies examining the representations of various objects (Cartier et al., 2006; Faye, Bremaud, Teiller, Courcoux, Giboreau, & Nicod, 2006; Lelièvre, Chollet, Abdi, & Valentin, 2009; Urdapilleta, Mirabel-Sarron, Eiber, & Richard, 2005). However, previous research employing this methodology has only focused on data gathered during one session and therefore does not provide information about the within-subject stability. Thus, the first goal of our experiment was to observe the within-subject stability in a sorting task and a property-generation task using the same objects.

The stability of individual representations depends on the task. However, the within-subject stability may also depend on the nature of the category, as demonstrated by Bellezza (1984a, 1984b, 1984c). The author asked participants to generate descriptive properties of familiar people, friends or concepts (e.g., chair, cat and apple) in two different sessions separated by one week. The results showed that the within-subject stability was higher for concepts (69% consistent exemplars between the two sessions) than for familiar people (55% consistent properties) and friends (38% consistent properties between the two sessions). However, the author did not compare various ontological domains such as natural categories (i.e., categories belonging to the living domain) and manufactured categories (i.e. categories belonging to the non-living domain). It is generally agreed that the differences between natural and manufactured categories are based on the specific categorization process (for reviews, see Chemlal & Cordier, 2006; Dompnier & Cordier, 2009; Medin, Lynch, & Solomon, 2000). The reasoning used to categorize objects into natural and manufactured categories varies (Bloom, 1998; Kelemen, 1999), as does the inference used in the production of features (Coley, Hayes, Lawson, & Moloney, 2004; Gelman, 1988). Several results from categorization studies in children and adults have shown that the exemplars for natural categories such as food and animals are classified according to perceptive and taxonomic properties (e.g., form, color and height) in category membership tasks. However in manufactured categories (such as tools) scripts related to the functional properties of the exemplars are mobilized (e.g., a hammer is used to drive nails) (Bonthoux & Kalénine, 2007; Bloom, 1998; Kalénine, Garnier, Bouisson, & Bonthoux, 2007; Nguyen, 2007). Furthermore, Silveri and Gainotti (1988) observed that brain-damaged patients have specific recognition or denomination deficiencies for musical instruments (i.e., manufactured categories) but not for natural categories such as food (Laws, Leeson, & Gale, 2003). Thus, the ontological domain of categories—

especially whether the category is natural or manufactured—seems to influence the way the categories are processed (Estes, 2003). Nevertheless, the distinction between living and non-living concepts does not adequately explain the results obtained in these previous studies. Indeed, there seems to be particular cognitive processes that allow subjects to distinguish between different categories in the living domain. For instance, food categories are considered more familiar than animal categories (Barsalou & Medin, 1986; Dubois, 1991; Rosch, 1976). Neuropsychological studies have also provided new insight into categorization. Hillis and Caramazza (1991) have observed that brain-damaged patients have specific recognition or denomination deficiencies for the fruit and flower categories but not for the animal category. According to Ross and Murphy (1999), "Food categories are an interesting case because they clearly have both correlational structure and are used in a variety of goals" (p. 500). As Urdapilleta (2006) suggests, investigating real-world categories (such as food) is informative because many people use these categories and because these categories are highly integrated with other knowledge. Thus, studying different natural categories seems relevant to the study of categorization overall (Hampton, 1998; Hampton, Dubois, & Yeh, 2006; Rosch, 1975). Thus, the second goal of our experiment was to compare the variability in descriptions produced for different natural and manufactured categories.

In this study, we are interested in the within-subject stability in relation to the task and to the domain category. The task influences representation stability; the sorting task may mobilize stable knowledge (Cartier et al., 2006), while the property-generation task leads to important within-subject variability (Bellezza, 1984a, b, c; Barsalou, 1989). Although these tasks are often combined, no study (to our knowledge) has simultaneously assessed the variability produced by two tasks using the same objects. Thus, our first aim was to measure the within-subject stability during repetitions (in three sessions) of a sorting task and a property-generation task using the same objects. We expected to observe high within-subject representation stability in the sorting task and poor within-subject stability in the property-generation task.

The category domain may also influence representation stability (Bellezza, 1984b, c) and lead to different categorization processes that are determined by the properties of the object (Cordier & Tijus, 2001). These differences are especially apparent between natural and manufactured categories (Estes, 2003). However, few studies have measured the effect of the ontological domain on within-subject stability. Thus, our second aim was to assess whether the nature of the categories affects the within-subject stability in repeated sessions. We compared two natural categories (food and animals) and one manufactured category (bathroom products). We expected to observe higher within-subject stability in representations of food labels relative to the animal or the bathroom products because food labels are omnipresent, familiar and used in a variety of goals (Rosch, 1975; Ross & Murphy, 1999).

METHOD

Participants. The participants were 150 undergraduate Psychology students at Paris 8 University. They were divided into three experimental conditions, and each participant group was assigned to a specific material: food labels (n = 50), animal labels (n = 50) and bathroom product labels (n = 50). The participants were all native French women. The age distributions of the participants are presented in Table 1; there were no significant differences between the three participant groups in age ($F(2,149) = 0.05$, $p = .10$, NS). All participants were unaware of the aims of the study. A questionnaire was used to verify that the participants did not suffer from an eating disorder (Eating Attitude Test 40, Garner & Garfinkel, 1979). None of the participants reported being a vegetarian or having food allergies.

Table 1. Age characteristics for the participants in each condition.

	Food labels	Animal labels	Bathroom labels
Average age (SD)	23.52 (5.80)	23.48 (5.53)	23.42 (4.41)
Range	18-27	18-28	19-28

Materials. A total of 135 stimuli were divided into three categories: 45 to the food category (e.g., fruits, vegetables and meats), 45 to the animal category (e.g., birds, reptiles and wild animals) and 45 to the bathroom category (e.g., hygiene, makeup and perfume). Familiarity—omnipresence in everyday life—was essential to the experimental design because it ensured that all participants had a substantial and sufficient knowledge of the proposed material. Indeed, many authors (Bonin et al., 2003; Rico Duarte, Gély-Nargeot, & Brouillet, 2007) have described the necessity of selecting exemplars based on several dimensions that have a significant impact on the cognitive tasks (e.g., a faster semantic treatment for words with high frequencies). In the present study, we took these dimensions into account and thus used three lists of concrete labels (food, animal and bathroom) that were selected on the basis of their subjective frequency (the frequency of the word in spoken or written language; Balota & Chumbley, 1984), their emotionality (the feeling generated by the word; Niedenthal, Halberstadt, & Setterlund, 1997), their concreteness (the concrete or abstract aspect of the word; Paivio & O'Neill, 1970) and their imageability (the word's capacity to create a mental image; Denis, 1983).

We controlled these four dimensions using 270 participants who were not included in the main experiment (Mean age = 22.3; SD = 2.1). These participants were divided into three participant groups of 90, with one group for each of the three conditions. In each condition (food, animal or bathroom product labels), the 90 participants were asked to evaluate 100 labels using a five-point scale for each of the four dimensions (1 = a non-frequent label, a non-abstract label, a negative label and a label that does not present a mental image; 5 = a frequent label, a concrete label, a positive label, and a label that clearly presents a mental image). We evaluated the scores, and then chose a selection of labels to construct three equivalent lists of labels based on the averaged evaluation of the four dimensions for each label. We kept only the 45 labels with the most equivalent averaged evaluation for each of the three label categories. A three (label categories) x four (dimensions) ANOVA was conducted on these pilot data. In this analysis, the dependent variable was the ratings for the four dimensions, and the between-subjects factor was the three label categories This analysis did not show any significant differences between the three label categories in the four dimensions (subjective frequency $F(2,132) = 1.946$, $p = .15$, NS; emotionality $F(2,132) = 0.676$, $p = .51$, NS; concreteness $F(2,132) = 0.140$, $p = .87$, NS; and imageability $F(2,132) = 1.978$, $p = .14$, NS). The average scores for each dimension for each label category are presented in Table 2.

Procedure. In the main experiment, subjects participated individually and anonymously. The participants were presented with a list of 45 food, animal or bathroom labels. They participated in three sessions, with an interval between sessions of fourteen days. Each session consisted of a sorting task combined with a property-generation task. During the sorting task, the participants sorted the labels into different classification groups according to the perceived similarities of the labels. Then, in the property-production task, the participants were asked to explain the criteria used to perform the sorting, identifying the common properties of each label within a classification group. The number of classification groups was decided by each participant.

The instructions were the same for each condition: “You are going to be presented with a list of 45 labels. Your task is to classify the labels that go together—in other words, those that are similar. The number of groups is up to you. You have 25 minutes to complete this task.” The participants were then asked to “describe each group and how the labels in each classification group are similar.”

Table 2. Means and Standard Deviations for the subjective frequency, the emotionality, the concreteness and the imageability for the three labels categories

	Frequency	Emotionality	Concreteness	Imageability
Food labels	3.18 (0.69)	3.39 (0.53)	4.35 (0.72)	4.64 (0.45)
Animal labels	3.02 (0.72)	3.25 (0.52)	4.32 (0.73)	4.65 (0.45)
Bathroom labels	3.27 (1.39)	3.31 (0.48)	4.34 (0.65)	4.58 (0.57)

Data analysis

Our experimental design was $S_{50}<C_3>*T_2*S_3$ where S represents the fifty participants, C represents the three experimental conditions (the different categories), T represents the two tasks (sorting and property-production) and S represents the three different sessions.

Sorting Task

The data from the sorting task, in which participants were asked to classify groups according to label category, were analyzed in two steps measuring the within-subject stability relative to (1) the number of classification groups and (2) the composition of the classification groups.

The first step assessed whether the number of classification groups was modified over the three sessions. For each category, we counted the number of groups for each participant during each session. Then, a three (label categories) x three (sessions) repeated ***measures*** ANOVA was conducted. In this analysis, the within-subject factor was the number of classification groups created by each participant during each session, and the between-subjects factor was the three label categories.

The second step analyzed the within subject-stability relative to the individually created classification groups. We first transformed these data using the process that was described by Urdapilleta, Mirabel-Sarron, Héron-Benaïcha and Richard (2003). We built an individual dissimilarity matrix (45 x 45) for each participant, indicating whether two labels were grouped (coded as 0) or separated (coded as 1). We then summed these individual matrices to obtain a global dissimilarity matrix for each participant group. We compared each pair of global dissimilarity matrices by calculating the correlation coefficient of Mantel (1967) (see Legendre & Legendre, 1998).

Property-generation task

The analysis of the data concerning the property-generation task (i.e., the properties quoted for each classification group) consisted of three steps that measured the within-subject stability relative to the quoted properties. The first step specifically analyzed the label categories, and the second step semantically analyzed the label categories (i.e., considered as the general level of description). The third step compared the nature of these types of properties.

In the first step, the entire set of properties generated by each participant for each classification group and each label was considered. To assess the stability of the quoted properties in each condition, we calculated the Jaccard's rating (Sokal & Sneath, 1963) using the formula C / (P1+P2+P3) - 2C, where C is the number of consistent properties over the three sessions, P1 is the number of properties produced during the first session, P2 is the number of properties produced during the second session and P3 is the number of properties produced during the third session. The rating varies from 0 to 1 (1 meaning a highly consistent rating). The rating highlights the percentage of consistent properties across the different sessions. A one (Jaccard's rating) x three (label categories) ANOVA was then conducted. In this analysis, the dependent variable was the Jaccard's rating, and the between-subjects factor was the three label categories. Post-hoc tests were conducted with Tukey's HSD.

In the second step, 40 independent participants (Mean age = 23.7; SD = 2.6) classified the given properties according to the following types of properties: taxonomic, biological, sensory, dietetic, hedonic, physical, spatial, functional and related to the practices and modes of consumption, as presented in Table 3. The nine types of properties were considered at the general level. To assess the stability of the types of properties in each condition, we calculated the Jaccard's rating as described above. A one (Jaccard's rating) x three (label categories) ANOVA was then conducted. In this analysis, the dependent variable was the Jaccard's ratings, and the between-subjects factor was the three labels categories. Post-hoc tests were conducted with Tukey's HSD.

Table 3. Principal type of properties coding

Associated dimension	Definition and example
Sensory properties	Evokes the senses being solicited and can be applied to different types of objects (e.g. *soft, bitter*)
Taxonomic properties	Designates an object or family of objects (e.g. *grapefruit, medicine*)
Hedonic properties	Expresses a negative or positive value or the effects of the object in the subject (e.g. *bad, enchanting*)
Functional properties	Evokes the utility of the object (e.g. *pets, entertainment*)
Dietetic properties	Evokes the effects of an object on your body (e.g. *heating, bad for health*)
Practical and consumption properties	Designates the practice of consumption of an aliment or the preparation of a dish (e.g. *fresh, cooked dish*)
Biologic properties	Evokes the natural property of an object (e.g. *lives in water, push in the trees*)
Space properties	Designates the place where you can see, eat or use the object (e.g. *pharmacy, from jungle*)
Physical properties	Evokes the physical characteristics of an object or term that are not hedonic, sensory or attached to a single category, (e.g., *new, mildew*).

In the third step, we considered the nine types of properties used to describe the labels of each category. To compare the type of properties used for each label category across the sessions, we conducted a three (label categories) x three (sessions) x nine (type of properties) repeated ***measures*** ANOVA. In this analysis, the within-subject factor was the number of occurrences of each type of properties in each session, and the between-subjects factors were the three label categories and the nine types of properties. For each label category, we then conducted a three (sessions) x nine (type of properties) repeated measures ANOVA. Post-hoc tests were conducted with Tukey's HSD.

RESULTS

Sorting task

The analysis of the within-subject stability of the number of classification groups showed no significant effect of repetition over the three sessions regardless of the label category ($F(2,49) = 0.471$, $p = .49$, NS). The details for each of the three label categories are presented in Table 4.

Table 4. Means and Standard Deviations for the number of classification groups created for the three labels categories during each session

	Food labels	Animal labels	Bathroom labels
Session 1	10.82 (2.45)	9.34 (2.50)	9.76 (2.09)
Session 2	10.34 (2.63)	8.92 (2.41)	10.08 (2.05)
Session 3	10.66 (2.39)	9.10 (5.53)	9.74 (2.35)

In the analysis of the within-subject stability of the classification groups, the correlation coefficient of Mantel showed an excellent matrix correlation regardless of the proposed label category and repetition of the sessions (see Table 5). Indeed, the correlations were higher than 0.98 regardless of which sorting session or label category was analyzed. These results demonstrated excellent within-subject stability in the sorting task of the labels.

Property-generation task

Table 6 shows the average Jaccard's ratings for each label category according to the level of the object description.

The analysis of the within-subject stability for each specific label category showed that the nature of the category influenced the participants' descriptions ($F(2,149) = 26.46$, $p < .001$). The descriptions were more stable in the food condition relative to the animal (Tukey's HSD < .001) and the bathroom conditions (Tukey's HSD < .001). There were no significant differences between the animal and bathroom conditions (Tukey's HSD > .20).

Table 5. Mantel's coefficients for the three labels categories

	Session1*Session2	Session1*Session3	Session2*Session3
Food labels	0.994	0.996	0.996
Animal labels	0.988	0.994	0.984
Bathroom labels	0.986	0.989	0.993

Table 6. Jaccard's rating for the three labels categories according to both description levels (specific/general)

	Jaccard's rating	
	Specific	General
Food labels	0.63 (0.26)	0.67 (0.26)
Animal labels	0.31 (0.28)	0.35 (0.26)
Bathroom labels	0.39 (0.14)	0.45 (0.21)

The analysis of the within-subject stability for each general label category indicated that the nature of the category influenced the participants' descriptions ($F(2,149) = 23.52$, $p < .001$). The descriptions were more stable in the food condition relative to the animal (Tukey's HSD < .001) and bathroom (Tukey's HSD < .001) conditions. There were no significant differences between the animal and the bathroom conditions (Tukey's HSD > .11). In addition, the participants' descriptions were more stable under the food condition when compared to the animal and the bathroom conditions regardless of the description level (properties/type of properties).

The analysis of the type of properties varied according to the label categories (see Table 7).

Table 7. Number of occurrences for each type of properties for the three labels categories

	Type of properties	Session 1	Session 2	Session3	Means
	Taxonomic	1609	1708	1720	1679
	Physical	868	914	705	829
Food	Sensory	669	677	570	639
labels	Consumption	370	378	341	363
	Biologic	194	136	145	158
	Dietetic	110	113	100	108
	Space	1155	1156	1174	1162
	Taxonomic	1949	691	701	1114
Animal	Physical	913	875	909	899
labels	Biologic	785	803	900	829
	Functional	623	538	665	609
	Functional	2142	2242	2156	2180
Bathroom	Taxonomic	2032	817	938	1262
labels	Physical	459	589	503	517

For the nine types of properties, we observed a significant effect between the label categories and the use of the type of properties ($F(141,9) = 121.95$, $p< .001$). For the food labels, the type of properties most often used by the participants were taxonomic, physical and sensory (Tukey's HSD < .001). For the animal labels, the descriptions were based solely on spatial and taxonomic properties (Tukey's HSD < .001). For the bathroom labels, the participants primarily generated functional properties (Tukey's HSD < .001). Natural categories (food and animal labels) were based on biological properties (taxonomic, physical or spatial properties), whereas the manufactured category (bathroom products) was based on functional properties. Thus, there was a difference between the type of properties produced for the natural and the manufactured categories.

DISCUSSION

The aims of this study were twofold. First, we sought to investigate the temporal stability of representations according to the task (measured through the repetition of a sorting task and a property-generation task). Second, we examined the effect of the nature of the category (natural versus manufactured) on the temporal stability of the representations.

In the sorting task, the results concerning the temporal stability of the representations showed excellent within-subject stability regardless of the label category. These results are in agreement with the results of Gaillard and Urdapilleta (submitted for publication), who studied the cognitive processes associated with food. The authors asked participants to sort 65 food labels for two sessions spaced 14 days apart. Their results showed that the participants consistently sorted the food labels over the two sessions. Our results also confirmed the high stability found by Cartier and her colleagues (2006) in a breakfast cereal sorting task. In Cartier's study, the within-subject stability was measured by repeating the sorting task every day for five days.

The results from the property-generation task showed that, regardless of the level of description, the within-subject stability of the representations was higher for the food labels than for the animal and bathroom labels. For the animal and bathroom labels, less than 40% of the properties were consistent over the three sessions. This low within-subject stability seems inconsistent with the results of Bellezza (1984 b, c), who found relatively good within-subject stability in a property-generation task for the concepts *apple, chair* and *cat* (69% consistent properties over the two sessions). However, Bellezza controlled neither the category membership (natural versus manufactured concepts) nor the time interval between the two sessions. Additionally, it is difficult to rely on observed stability using a single specific factor. For the food labels, the within-subject stability was near 65%. Our results confirmed the observations of Vrignaud (1999), who found relatively good within-subject stability for these labels (around 50% for the fruit category). As expected, we observed high within-subject representation stability in the sorting task and poor within-subject stability in the property-generation task. The perceived similarities between exemplars were stable over the three sessions, but the properties used to describe the objects varied. As a consequence, the same object could be described from different perspectives in different sessions. Participants were asked to quote the properties that differentiated a target category from nearby ones without quoting other properties, possibly leading to confusion. In this way, the participants followed a semantic principle called the *principle of relevance* that was identified by Grice (1957) and later named by Sperber and Wilson (1987). The principle of relevance stipulates that participants use economy in an experimental situation: they do not state all the possible answers but only those answers that seem relevant in each situation (Poitrenaud, Richard, & Tijus, 2005).

The results regarding the effect of the ontological domain showed that the properties generated for the food labels were more stable than the properties that were produced for the animal and the bathroom labels. Moreover, the labels in the natural categories (food and animal labels) were defined by their biological properties while the items in the manufactured category (bathroom products) were defined by their functional properties. Our results confirmed the results obtained by McRae and Cree (2002), who found that the description of manufactured labels is related to their functions (Chemlal & Cordier, 2006; Dompnier & Cordier, 2009; Medin, Lynch, & Solomon, 2000). Manufactured objects have few visual similarities, but their forms should be associated with their different potential functions. In contrast, natural objects have many visual similarities, so their variations in form are less important during categorization (Gonnerman, Andersen, Devlin, Kempler, & Seidenberg, 1997). The distinction between natural and manufactured categories is also linked to the nature and relation of their properties (McRae & Cree, 2002; Warrington & Shallice, 1984). Moreover, the within-subject stability was higher for the food labels than for the animal labels. For the food labels, many taxonomic and physical properties were produced; a result that was also observed by Ross and Murphy (1999). In contrast to the food labels, most of the generated properties for the animal labels were spatial and taxonomic. This result makes sense when one considers the link between the concept and previous knowledge: food is eaten in a specific context (e.g., vegetables for lunch, cereals for breakfast), and an animal lives in a particular space (e.g., in a farm, in a jungle, in the sea). We also confirmed our second hypothesis that the food labels would show higher within-subject representation stability than the animal or the bathroom product labels. Previous studies have found that food is a unique category (Ross & Murphy, 1999; Urdapilleta, 2006) because it regroups highly familiar concepts (Rosch & Mervis, 1975; Ross & Murphy, 1999) that are encountered regularly (Urdapilleta, Mirabel Sarron, Eiber, & Richard, 2005). Thus, the familiarity of the exemplars proposed had a greater effect on the representations and their descriptions than the nature of the category (Ahn, 1998; Bellezza, 1984a; Chemlal & Cordier, 2006).

To conclude, the two variables of our experiment (i.e., the task and the nature of the concepts, in particular the ontological domain and the familiarity) show significant effects on built representations and should be more systematically controlled in the study of representations. Although the task have been largely (Abdi, Valentin, Chollet, & Chrea, 2007; Bergmann Tiest & Kappers, 2006; Guastavino, 2007), they have only been observed at a single session. If we are unsure whether this method is stable, how can we verify its validity for longitudinal studies of representations? Studies on the stability of food representations in anorexic patients during therapy show that food representations are unstable. Likewise, developing children may show a similar evolution in representation. These factors are part of the idea that our personal experience determines our representations of an object (Ahn, 1998). Moreover, studies on social behaviors show a gender effect on representations according to the nature of the categories (Eagly, 1987), that would appear with the tasks. In a future study it would be interesting to control the gender effect in both tasks using different categories.

REFERENCES

Abdi, H., Valentin, D., Chollet, S., & Chrea, C. (2007). Analyzing assessors and products in sorting tasks: Distatis, theory and applications. *Food Quality and Preference, 18*, 627-640.

Ahn, W. (1998). Why are different features central for natural kinds and artifacts?: The role of causal status in determining feature centrality. *Cognition, 69*, 135-178.

Balota, D. A., & Chumbley, J. I. (1984). Are lexical decisions a good mesure of lexical access? The role of word frequency in the neglected decision stage. *Journal of Experimental Psychology, 10*, 340-357.

Barsalou, L. W. (1989). Intraconcept similarity and its implications for interconcept similarity. In S. Vosniadou, & A. Ortony (Eds.), *Similarity and analogical reasoning* (pp. 76-121). Cambridge: Cambridge University Press.

Barsalou, L. W. (1993). Flexibility, structure, and linguistic vagary in concepts: Manifestations of a compositional system of perceptual symbols. In A. C. Collins, S. E. Gathercole, & M. A. Conway (Eds.), *Theories of memories* (pp. 29-101). London: Erlbaum.

Barsalou, L. W., & Medin, D. L. (1986). Concepts: Static definitions or context-dependent representations? *Cahiers de Psychologie Cognitive, 6*, 187-202.

Bellezza, F. S. (1984a). Reliability of retrieval from semantic memory: Common categories. *Bulletin of the Psychonomic Society, 22*, 324-326.

Bellezza, F. S. (1984b). Reliability of retrieval from semantic memory: Information about people. *Bulletin of the Psychonomic Society, 22*, 377-380.

Bellezza, F. S. (1984c). Reliability of retrieval from semantic memory: Noun meanings. *Bulletin of the Psychonomic Society, 22*, 377-380.

Bergmann Tiest, W. M., & Kappers, A. M. L. (2006). Analysis of haptic perception of materials by multidimensional scaling and physical measurements of roughness and compressibility. *Acta Psychologica, 121,* 1-20.

Bloom, P. (1998). Theories of artefact categorization. *Cognition, 66*, 87-93.

Bonin, P., Meot, A., Aubert, I., Malardier, N., Niedenthal, P., & Capelle-Toczeck, M. C. (2003). Normes de concrétude, de valeur d'imagerie, de fréquence et de valence émotionnelle pour 866 mots. *L'année Psychologique, 104*, 655-694.

Bonthoux, F., & Kalénine, S. (2007). Preschoolers' superordinate taxonomic categorization as a function of individual processing of visual vs. contextual/functional information and object domain. *Cognition, Brain, & Behavior*, *11*, 713-731.

Cartier, R., Rytz, A., Lecomte, A., Poblete, F., Krystlik, J., & Belin, E. (2006). Sorting procedure as an alternative to quantitative descriptive analysis to obtain a product sensory map. *Food Quality and Preference, 17*, 562-571.

Chemlal, S., & Cordier, F. (2006). Structures conceptuelles, représentation des objets et des relations entre les objets. *Canadian Journal of Experimental Psychology, 60*, 7-23.

Coley, J. D., Hayes, B., Lawson, C., & Moloney, M. (2004). Knowledge, expectations and inductive reasoning within conceptual hierarchies. *Cognition, 90,* 217-253.

Cordier, F., & Tijus, C. (2001). Object properties. A typology. *Current Psychology of Cognition, 20*, 445-472.

Dompnier, L., & Cordier, F. (2009). Causal relations between features and inferences: The case of object representations. *Current Psychology Letters*, *25*. Retrieved from http://cpl.revues.org/index4902.html.

Denis, M. (1983). Valeurs d'imagerie et composition sémantique: Analyse de deux échantillons de substantifs. *Cahiers de Psychologie Cognitive, 3*, 175-202.

Dubois, D. (1991). Sémantique et catégorisation. *Catégories, prototypes, typicalité*, Paris : Editions du Centre National de la Recherche Scientifique.

Eagly, A. (1987). *Sex differences in social behavior: A social-role interpretation*, Hillsdale, NJ: Erlbaum.

Estes, Z. (2003). Domain differences in the structure of artifactual and natural categories. *Memory & Cognition*, *31*, 199-214.

Faye, P., Bremaud, D., Teiller, E., Courcoux, P., Giboreau, A., & Nicod, H. (2006). An alternative to external preference mapping based on consumer perceptive mapping. *Food Quality and Preference, 17*, 604-614.

Gaillard, A., & Urdapilleta, I. (submitted for publication). Categorization of food names: Study of the variability between and within participants.

Garner, D. M., & Garfinkel, P. E. (1979). The eating attitudes test: An index of the symptoms of anorexia nervosa. *Psychological Medicine, 9*, 273-279.

Gelman, S. A. (1988). The development of induction with natural kind and artefact categories. *Cognitive Psychology, 20*, 65-95.

Gonnerman, L. M., Andersen, E. S., Devlin, J. T., Kempler, D., & Seidenberg, M. S. (1997). Double dissociation of semantic categories in Alzheimer's disease. *Brain and Language, 57*, 254-279.

Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.). *Syntax and semantics: Speech acts* (pp. 41–58). New York: Academic.

Guastavino, C. (2007). Categorization of environmental sounds. *Canadian Journal of Experimental Psychology, 60*, 54-63.

Hampton, J. A. (1998). Similarity-based categorization and fuzziness of natural categories. *Cognition, 65,* 137-165.

Hampton, J. A., Dubois, D., & Yeh, W. (2006). The effects of pragmatic context on classification in natural categories. *Memory & Cognition, 34*, 1431-1443.

Hillis, A., & Caramazza, A. (1991). Category-specific naming and comprehension impairment: A double dissociation. *Brain, 114,* 2081-2094.

Hoc, J. M., & Leplat, J. (1983). Evaluation of different modalities of verbalization in a sorting task. *International Journal of Man-Machine Studies, 18*, 283-306.

Kalénine, S., Garnier, C., Bouisson, K., & Bonthoux, F. (2007). Le développement de la catégorisation : l'impact différencié de deux types d'apprentissage en fonction des catégories d'objets, naturels ou fabriqués. *Psychologie et Education, 1*, 33-45.

Kelemen, D. (1999). The scope of teleological thinking in preschool children. *Cognition*, *70*, 241-272.

Laws, K. R., Leeson, V. C., & Gale, T. M. (2003). Inflated and contradictory category naming deficits in Alzheimer's disease? *Brain and Cognition, 53*, 416-418.

Legendre, P., & Legendre, L. (1998). *Numerical Ecology,* Amsterdam: Elsevier.

Lelièvre, M., Chollet, S., Abdi, H., & Valentin, B. (2009). Beer trained and untrained assessors rely more on vision than on taste when they categorize beers. *Chemosensory Perception*, *2*, 143-153.

Mantel, N. (1967). The detection of disease clustering and a generalized regression approach. *Cancer Research, 27*, 209-220.

Mc Rae, K., & Cree, G. S. (2002). Factors underlying category-specific semantic deficits. In E. M. E. Forde, & G. W. Humphreys (Eds.), *Category-specificity in brain and mind* (pp. 211-249). East Sussex: Psychology Press.

Medin, D. L., Lynch, E. B., & Solomon, K. E. (2000). Are there kinds of concepts? *Annual Review of Psychology, 51*, 121-147.

Nguyen, S. P. (2007). An apple a day keeps the doctor away: Children's evaluative categories of food. *Appetite, 48*, 114-118.

Niedenthal, P. M., Halberstadt, J. B., & Setterlund, M. B. (1997). Being happy and seing "happy": Emotional state facilitates visual encoding. *Cognition and Emotion, 11*, 403-432.

Paivio, A., & O'Neill, B. J. (1970). Visual recognition thresholds and dimensions of word meaning. *Perception and Psychophysics, 8*, 13-24.

Poitrenaud, S., Richard, J.-F., & Tijus, C. (2005). Properties, categories, and categorization. *Thinking & Reasoning, 11*, 151-208.

Richard, J.-F., & Urdapilleta, I. (2004). Evaluation du fonctionnement cognitif du raisonnement humain et perspectives thérapeutiques. *Journal de Thérapie Comportementale et Cognitive, 14*, 84-88.

Rico-Duarte, L., Gély-Nargeot, A. C., & Brouillet, D. (2007). Normes de familiarité pour des concepts vivant et non vivant en fonction de l'âge et du genre. *Canadian Journal of Experimental Psychology, 61*, 35-43.

Rosch, E. (1975). Cognitive representations of semantic categories. *Journal of Experimental Psychology, 104*, 192-233.

Rosch, E. (1976). Classifications d'objets dans le monde réel : Origines et représentations dans la cognition. *Bulletin de Psychologie*, numéro spécial, 242-250.

Rosch, E., & Mervis, C. B. (1975). Family resemblances: studies in the internal structure of categories. *Cognitive Psychology, 5*, 573-605.

Ross, B. H., & Murphy, G. L. (1999). Food for thought: Cross classification and category organization in a complex real-world domain. *Cognitive Psychology, 38*, 495-553.

Silveri, M., & Gainotti, G. (1988). Interaction between vision and language in category-specific semantic impairment. *Cognitive Neuropsychology, 5*, 677-710.

Sokal, R. R., & Sneath, P. H. A. (1963). *Principles of numerical taxonomy*. San Francisco: W. H. Freeman.

Sperber. D., & Wilson, D. (1987). An outline of relevance theory. *Notes on Linguistics*, *39*, 5-24.

Urdapilleta, I. (2006). L'évaluation des perceptions dans les pratiques de terrain. In S. Ionescu, & A. Blanchet (Eds.), *Psychologie cognitive et bases neurophysiologiques du fonctionnement cognitif* (Vol. coordonné par D. Gaonac'h, pp. 513-536). Paris : Presses Universitaires de France.

Urdapilleta, I., Bernard, J. M., & Tijus, C. (2004). Structure implicative des propriétés, conséquences pour l'étude de la catégorisation. *Psychologie Française, 4*, 443-459.

Urdapilleta, I., Mirabel-Sarron, C., Eiber, R., & Richard, J.-F. (2005). What categorization tells us about food representation. *Current Psychology Letters, 17*. Retrieved from http://cpl.revues.org/index457.html.

Urdapilleta, I., Mirabel-Sarron, C., Héron-Benaïcha, G., & Richard, J.-F. (2003). Approche cognitive des représentations d'aliments de jeunes femmes anorexiques. *Psychologie Française, 48*, 39-53.

Vrignaud, P. (1999). *Approche différentielle de la typicalité.* (Thèse de Doctorat). Université Paris V, Paris.

Warrington, E, K. & Shallice, T. (1984). Category-specific semantic impairments. *Brain, 107*, 829-859.

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