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CATEGORISATION PROCESS AND CONCEPTUAL MAPS

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Abstract. This paper refers to the possibility of circulation between the self-organization of the concepts and the relevance of each conceptual property of this cognitive process. The use of technologies in the making of conceptual maps, in special the possibility to create a collaborative map made by different users, points out the cultural aspects of the concept representation, in terms of existing coincidences as to the choice of the prototypical element by the same cultural group. Thus, the technologies of information, focused on the study of individual maps, demand revisited discussions on the popular perceptions concerning concepts used daily (folk psychology). Concept learning supported by computer must take into account not only the features of the groupware used, but the collective semantic universe that is formed as well. A virtual group of students building concepts through the Internet, in a distributed and asynchronized manner, may be recognized as belonging to a given culture through the cognitive dimension expressed by the shared conceptual maps. It aims to identify *ideological similarity* and *cognitive deviation*, both based on the prototypes and on the levels of categorization developed in the maps, with an emphasis on the cultural and semiotic aspects of the investigated groups. This research was done by Brazilian university students of Distance Learning using the software CmapTools from The Institute for Human and Machine Cognition. The maps are made in a collaborative way and they adopt the "learn by doing" approach, centered on the map construction activity that is developed. It is tried to show how the semiotic and linguistic analysis of the categorization process can help in the identification of the ideological similarity and cognitive deviations, favoring the involvement of students in the map production, exploring and valuing the relation between the categorization process and the cultural experience of the subject in the world, both parts of the cognitive process of conceptual map construction.

1 Introduction

Cognitive Science explores the possibility of circulation between the mental process of categorization and human experience to construct conceptual maps. I would like to consider there at least two reasons for this statement: first, concepts are mental schemes produced by repeated experiences, second, the self-organization of the concepts in categories lead the subject to explore the conceptual properties with the concept more representative of a category: the prototype.

This paper describes ongoing research on LEAD – Laboratório de Educação à Distância: Pesquisa em Ciências Cognitivas e Semiótica at Federal University of Rio Grande do Sul (UFRGS). The premise of this paper is that both children and adults are active learners who engage in meaningful learning when a situation of interest presents itself. This study employs concept mapping as a way of the participants understand the categorization process. In this paper I propose a very general definition of concepts by means of the mental sheme and the relation with the categorization process. First its discuss some properties of this general definition and list some problems, as well as connections to related work. As applications of the categorization process, I show that the notion of prototype, introduced in this papers, can be described in two students experiments, that constitute illustrative cases.

2 Concept and Knowledge Organization

"The concept maps, or the semantic nets, are space graphic representations of the concepts and their relationships. The concept maps represent, simultaneously, the organization process of the knowledge, by the relationships (links) and the final product, through the concepts (nodes). This way, besides the relationship between linguistic and visual factors is the interaction among their objects and their codes" (Amoretti, 2001).

The building of a map involves collaboration, when the students share information, still without modifying the data, and involves cooperation, when students not only share their knowledge, but also may interfere and modify the information received from their classmates, acting in asynchronous way to build a collective map. Both cooperation and collaboration attest the autonomy of the ongoing cognitive process, the direction given by the students themselves when trying to adequate their knowledge to their mates' knowledge. CmapTools, for instance, integrates the concept of hypermedia – aggregation/juxtaposition of different media in a sole media with a sole aim – turning each map created into a hyper document, allowing navigation through the unlimited links that may be used to associate information, respecting the user's learning style. However, from the pedagogical point of view, it is not really convenient to offer a navigation with no restrictions through all the hyper document knots (concept map), to avoid that the student feel confuse by the cognitive overload. Besides,

the possibility of the guided multimedia use to illustrate and enrich the concepts studied allows the students to take part in the teaching and learning process, determining their own way of studying, according to personal preferences foe the choice of multimedia references external to the map structure, and being able to review concepts as many times they wish, even in a simulation environment. Multimedia importance is to encourage the students to search for other attributes that will enrich and complete their initial concept, which is rather individualized. The students feel several times shy and unaware of the multitude of relation this concept could generate. (Amoretti, 2003)

3 Schemes, Concepts and Prototypes

A concept is a sort of scheme. An effective way of representing a concept is to retain only its most important properties. This group of "most important" properties of a concept is called *prototype.* The idea of prototype makes possible that the subject has a mental construction, identifying the typical features of several categories and, when he/she finds a new object, they may compare it to the prototype they have in their memories. Thus, the prototype of "chair", for instance, allows new objects to be identified and labeled as chairs. In individual conceptual maps creation, one may confirm the presence of variables for the same concept.

Prototype has given way to a true revolution (the Roschian revolution) regarding classic lexical semantics. If we observe the conceptual map for "chair", for instance, we will realize that the choice of most representative chair type, that is, our prototype of chair, supposes a double adequateness: referential because the sign (concept of chair) must integrate the features retained from the real or imaginary world, and structural, because the sign must be pertinent (ideological criterion) and distinctive concerning the other neighbour concepts of chair. When I say that "this object is a chair", it is supposed that I have an idea of the "chair sign", form the use of a lexical or imagetic competence coming from my referential experience and that my prototypical concept of chair is more adequate than its neighbors *bench* or *couch* because I perceive there is a back part and there are not arms. Then, it is useless trying to explain the creation of a prototype inside a language, because it is formed from context interactions. The double origin of a prototype is bound, then, to *shared knowledge* relation between the subjects and their community (Amoretti, 2003).

4 Cat and Chair Concept as a Study Case

When people do a concept map, they usually privileged the level where the prototype is. The basic concept map starts with a general concept at the top of the map, and then works its way down through a hierarchical structure to more specific concepts. The "empirical concept" (Kant) of "cat" and "chair" has been studied by students with CmapTools. They make an initial map at the beginning of the semester and another on the same subject "cat" and "chair" at the end of the semester. I first discussed how "cats" and "chairs" themselves appear, what could be called the structure of cat and chair appearance. Secondly, I discussed with us how cat and chair are perceived and which attributes make a cat a cat and a chair a chair. Finally, I will consider cat and chair as an experiential category that the point of departure is our experience in the world about cat and chair. The acquisition of the concept cat and chair is mediated by concrete experiences. Thus the learner must possess relevant prior knowledge and a mental scheme to acquire a prototypical concept (Figure 1).

Animal	Furniture
Cat	Chair
Persian Cat	Dining Room Chair

Figure 1: Conceptual Hierarchy

In two classroom experiments I found that students choose spontaneously the basic level as the most important level (Figure 2) and it demonstrates that the benefits of the use of conceptual maps can be achieved in a relatively simple comparative approach to the maps done on the end of the semester, that emphasizes the subordinate conceptual hierarchy, with more names in the expert domain.

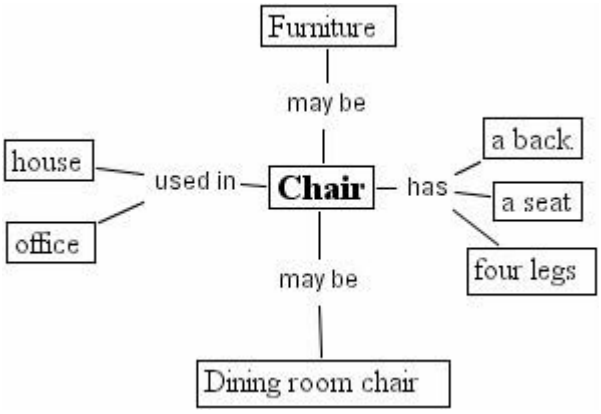

Figure 2: The prototypical level of knowledge

The expertise changes the conceptual level organization competences. In the first maps, the novice chair map privileged the basic level, the most important exemplar of a class, the chair prototype. This level has a high coherence and distinctiveness. After thinking about this concept students – now chair experts – repeated the experiment and carry out again the ”expert” chair map with much more details in the superordinate level, showing eight different kinds of chair: dining room chair, kitchen chair, garden chair, etc. This level has high coherence and low distinctiveness. (Rosch, 2000). So, users learn by doing the categorization process.

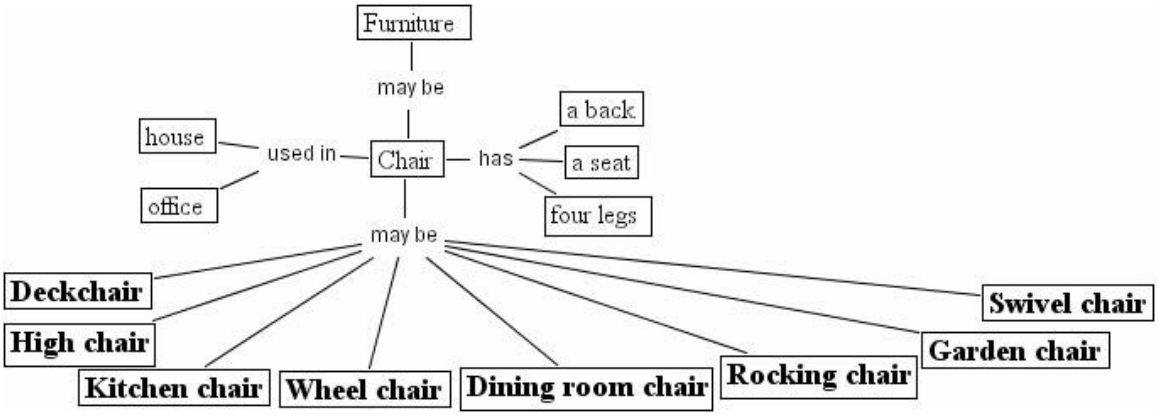

Figure 3: Chair / Superordinate Level

5 Final considerations

It is also important to define **properties heritage** among different category **levels**, viewed throughout hierarchical relations as “it is one” that allowed to “virtually” add certain pairs of value- attributes from a unit to another. Thus, the *sparrow* may inherit the *property of flying* because it is a kind of *bird*. We should also think of concepts managing that, in a given category, are considered as an exception. If we define the ostrich as a kind of *bird*, we need to indicate, in an explicit manner, that despite the ostrich is defined as a bird it does not inherit the *property of flying*. The property of flying, that could be a value *par défaut*, would need, then, explicit information to contradict it. It would be necessary that the software allowed the **heritage blockage** of certain attributes. The circle has closed and we come back, then, to the beginning of this text, which deals with prototypes and stereotypes whose basis is the concepts representation from the heritage *par défaut* that allows a great economy in the acquisition and managing of the information. These are just some suggestions. At the moment we are performing the second phase of this research, comparing the maps that present ideological similarity and those that are divergent and present a “cognitive deviation” (Cordier, 1989). I believe to be opening new perspectives to the study of ideological similarity perception as a way to make the collaborative creation of concepts easier mediated by computer, both in traditional and distance learning.

I believe that the concept mapping categorization evaluation will provide significant apport for many forms of collaborative learning situations and developed the negotiation competence to consensus choice of the plurality of cultural perspectives and user's point of view and help the transformation of the novice competence to categorize into the expert competence.

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