Human–Centered Conceptualization and Natural Language

Javier Andrade
*University of A Coruña, Spain*

Juan Ares
*University of A Coruña, Spain*

Rafael García
*University of A Coruña, Spain*

Santiago Rodríguez
*University of A Coruña, Spain*

Andrés Silva
*Technical University of Madrid, Spain*

INTRODUCTION

Conceptual modeling appears to be the heart of good software development (Jackson, 2000). The creation of a conceptual model helps to understand the problem raised and represents the human-centered/problem-oriented moment in the software process, as opposed to the computer-centered/software-oriented moment of the computational models (Blum, 1996). The main objective of human computer interaction (HCI) is also precisely to make human beings the focal point that technology should serve rather than the other way round.

The conceptual models are built with conceptual modeling languages (CMLs), whose specification involves constructors and rules on how to combine these constructors into meaningful statements about the problem.

Considering the criterion of the representation capability of the CMLs in software engineering, their main drawback is that they remain too close to the development aspects (Jackson, 1995). The constructors are too much oriented toward the computational solution of the problem, and therefore, the problem is modeled with implementation concepts (computer/software solution sensitivity) rather than concepts that are proper to human beings (human/problem sensitivity) (Andrade, Ares, García & Rodríguez, 2004). This stands in open opposition to what we have said about the moments in the software process and HCI. Moreover, this situation seriously complicates the essential validation of the achieved conceptual model, because it is drawn up in technical terms that are very difficult to understand by the person who faces the problem (Andrade et al., 2004).

The semantics of the constructors determines the representation capability (Wand, Monarchi, Parsons & Woo, 1995). Since the constructors are too close to implementation paradigms, the CMLs that currently are being used in software engineering are incapable of describing the problem accurately.

Suitable human/problem-related theoretical guidelines should determine which constructors must be included in a genuine CML. This article, subject to certain software-independent theoretical guidelines, proposes the conceptual elements that should be considered in the design of a real CML and, consequently, what constructors should be provided.

The Background section presents the software-independent guidelines that were taken into account to identify the above-mentioned conceptual elements. The Main Focus of the Article section discusses the study that identified those elements. Finally, the Future Trends section presents the most interesting future trends, and the final section concludes.
BACKGROUND

In generic conceptualization, concepts are logically the primary elements. Despite their importance, the nature of concepts remains one of the toughest philosophical questions. However, this does not stop us from establishing some hypotheses about concepts (Díez & Moulines, 1997):

- **HC1. Abstract Entities**: Concepts are identifiable abstract entities to which human beings have access, providing knowledge and guidance about the real world.
- **HC2. Contraposition of a System of Concepts with the Real World**: Real objects can be identified and recognized thanks to the available concepts. Several (real) objects are subsumed within one and the same (abstract) concept.
- **HC3. Connection Between a System of Concepts and a System of Language**: The relationship of expression establishes a connection between concepts and expressions, and these (physical entities) can be used to identify concepts (abstract entities).
- **HC4. Expression of Concepts by Non-Syncategorematic Terms**: Practically all non-syncategorematic terms introduced by an expert in a field express a concept.
- **HC5. Need for Set Theory**: For many purposes, the actual concepts should be substituted by the sets of subsumed objects to which set theory principles can be applied.

Likewise, from a general viewpoint, any conceptualization can be defined formally as a triplet of the form (Concepts, Relationships, Functions) (Genesereth & Nilsson, 1986), which includes, respectively, the concepts that are presumed or hypothesized to exist in the world, the relationships (in the formal sense) among concepts, and the functions (also in the formal sense) defined on the concepts.

MAIN FOCUS OF THE ARTICLE

It would certainly not be practical to structure a CML on the basis of the previous three formal elements, because (i) concepts are abstract entities (HC1); (ii) relationships and functions are defined on the concepts, which increases the complexity; and (iii) people naturally express themselves in natural language (HC3: connection between a system of concepts and a system of language).

Taking this and HC4 (expression of concepts by non-syncategorematic terms) into account, we propose defining the CMLs on the basis of the conceptual elements that result from the analysis of natural language. This procedure stems from the fact that there is a parallelism between natural language and the CML (Hoppenbrouwers, van der Vos & Hoppenbrouwers, 1997).

From the analysis detailed in this section, we find that the identified conceptual elements actually can be matched to some of the three elements of the previous formal triplet; that is, the generic and formal definition is not overlooked. However, ultimately, a functional information taxonomy can be established, which is much more natural and practical.

Analyzing Natural Language

Based on HC4, the conceptual elements were identified by analyzing the non-syncategorematic categories of nouns, adjectives, and verbs. Moreover, importance was also attached to adverbs, locutions, and other linguistic expressions, which, although many are syncategorematic terms, were considered relevant because of their conceptual load.

Nouns

Nouns can be divided into different groups according to different semantic traits. The most commonly used trait is the classification that determines whether the noun is common or proper.

Considering this latter trait, we notice a parallelism between nouns and elements that are handled in any conceptualization: common nouns can lead to concepts or properties, and proper nouns can lead to property values. The following subsections consider these elements.
Related Content

Computer Mediated Communication in Universities and Further Education Establishments: A Comparison of Use and Utility
Elayne Coakes and Dianne Willis (2002). Human Factors in Information Systems (pp. 296-308).
www.igi-global.com/chapter/computer-mediated-communication-universities-further/22448?camid=4v1a

Teenage Sexting: Sexual Expression Meets Mobile Technology
Lara Karaian and Andrew Tompkins (2015). Encyclopedia of Mobile Phone Behavior (pp. 1500-1513).
www.igi-global.com/chapter/teenage-sexting-sexual-expression-meets-mobile-technology/130251?camid=4v1a

Impact of ICT on Education
www.igi-global.com/article/impact-of-ict-on-education/102982?camid=4v1a

Emotional Intelligence Model for Managers in Mumbai
www.igi-global.com/article/emotional-intelligence-model-for-managers-in-mumbai/116788?camid=4v1a