# Chapter 8
# An Ontological Structure for Gathering and Sharing Knowledge among Scientists through Experiment Modeling

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## ABSTRACT

*This chapter presents a proposal for modeling / simulating experiments conducted by scientists working in common scientific problems, based on gathering and exploiting knowledge elements produced among them. The authors' approach enables the adaptation of knowledge structures (bounded to scientific problems) and is based on recurrent refining processes that are fed by indicators, which come from collaboration among the scientists involved. This scheme captures a web-based infrastructure, which allows scientists to collaborate on synthesizing experiments online. The proposed model is approached as an ontology that contains scientific concepts and actions. This ontology is linked to the scientific problem and represents both the "common understanding" for such a problem and the way it could be managed by the group. This dynamic ontology will change its structure according to the collaboration acts among scientists. Frequent collaboration over certain elements of the experiment will make them prevail in time. Besides, this process has been defined in a way that provides a global understanding of the scientific treatment that could be applied on any scientific problem. Hence, the ontology represents a virtualization of the scientific experiment. This whole representation is aimed at providing the media for developing e-research among scientists that are working on common problems.*

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## INTRODUCTION

Most of the activities developed by humans are based on sets of concepts and the relationships among such knowledge elements. The human's understanding of the environment is defined by the concepts and ideas acquired before. These elements are organized as nets of perceptions in which the relationships are modeled by links of proximity. The nets of concepts provide meaning by clustering related ideas. These meaningful structures could be understood as ontologies.

Our proposal aims at defining an innovative approach for the simulation of experiments through a formal process of gathering and sharing the knowledge from activities related to research, which results in defining an ontological structure. This ontology has dynamic capabilities in order to allow the addition of new slots for knowledge categories, concepts and relationships. The elements of the ontology can be shared among the researchers on common projects, with the purpose of establishing a *common understanding* of a scientific challenge and the topics to be observed and managed along the experimentation experience.

Scientists collaborating on the same scientific problem could modify the already defined structure, and such changes are allowed for all the collaborators. Researchers do not need to vote expressly for concepts (topics) or relationships, since the prolonged use of such elements will imply their confirmation, and the forgotten elements will eventually disappear.

Different tools could be used to build an artificial ontology with standardized format. The resulting construction could be shared among the scientists involved in the same research. We are proposing an abstract tool that may be fed by this model, where the concepts as well as their relationships are immediately shown.

This proposal is, by some means, framed by the regular understanding for e-science suggested by Atkins et al. (2003) and Jankowski (2007). We are trying to fulfill the remaining tasks in the simulation of experiments. In most of the cases, e-science is committed to offer information resources and is frequently focused on social sciences. The spirit of the e-science proposals is the capture of the web-based infrastructure. Thus, our proposal might be rather settled in the way of e-science experimentation, as explained by Walton and Barker (2004). The advance in information and communications technologies has enabled an innovative understanding for the web and its new capabilities allow an enhanced simulation of natural and/or technical phenomena.

## KNOWLEDGE GRIDS AS ONTOLOGIES

It is a fact that knowledge has become an asset for most of the organizations, which are conscious about the resources of awareness and the ways to manage them. Knowledge, by itself, is hard to define and its handling is rather difficult. In such context, any knowledge managing technique acquires some attention from people related to the creation, storing and handling of knowledge. One of the most frequent mechanisms used to manage knowledge is grids (Li & Liu, 2007; Goble, et al., 2005; Zettsu, et al., 2008).

Every concept has its own charge of knowledge, which is a piece of information or even a piece of primitive knowledge. In order to represent a higher level of meaning, concepts can be assembled as nets. Along the process of assembling the nets of knowledge, the semantics bound to the nets becomes complex. Thus the action of assembling is important for meaning, although meaning does not depend on the assembling by itself, it depends on the concepts involved and the kind of relationships established among these concepts. Not every connection of concepts will imply meaningful structures. The connections should be rationally founded in the common understanding of reality.