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Context over content: ICPD, a conceptual schema for the building technology domain

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Abstract

Computational systems in the field of building technology are, at present, mainly employed as electronic catalogs for the retrieval of technological information (content providers). However, the massive amount of information associated with building design demands explicit knowledge about the way various information pieces relate one to another in order to be able to achieve an intelligent use of those resources through the design process. This gives rise to a strong need for computational systems that help not only to retrieve information (design content) but also to explain the relationships between the elements of technological information (design context). The research presented in this paper has developed a conceptual model for the representation of knowledge in building technology based on specific context related to the field. The model employed an associative formalism reflecting the logical connections between pertinent information units used in the technological design process. The model is termed ICPD which stands for: Issue, Concept, Pattern and Detail. This model is to be employed in implementing a computational system to support design in building technology.

Keywords: Knowledge representation; Building technology; Design context; Design content; Detail design patterns; Associative formalism; Computerized libraries

1. Introduction

Knowledge of building technology — the ''knowledge of building making'' — is credited for the physical implementation of architectural design concepts [1]. Buildings today have became a product of advanced technology, implying that architects have to achieve building design while operating in a richly documented technological environment. The building field is characterized by abundant information about every technological aspect of the building components. Therefore, during the building design process, the architect has to investigate, evaluate and process a massive amount of technological information. In order to succeed in this demanding task, vast technological understanding is required. Often, however, the gap between the extensive technological information to be processed and one's insufficient knowledge about how to integrate it usefully into the design, may lead to the so called ''information overload syndrome,'' resulting in the architect's inability to take proper design decisions [2,3]. This situation is made even worse by the fact that current computerized information systems in the building technology field operate mainly as electronic catalogs achieving massive information retrieval in an effortless way [4].

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A solution to this problem resides in making the content related to specific technological information less amorphous and easier to interpret. This may be achieved by binding the pieces of information into some logical, contextual structure in order to be able to provide answers on a general, conceptual level rather than on the level of a specific issue.

In the framework of this paper we will use the terms "design content" and "design context" according to the following definitions:

a. Design content — refers to the categories of technological information pertinent to building design, provided either by traditional or computerized means.
b. Design context — refers to some logical framework which relates to various categories of technological information, making them meaningful in the design process.

Therefore, the research question raised in this paper is: how can information systems be exploited, not only as providers of "design content" but as providers of "design context" as well?

2. Knowledge support: background

Knowledge has been a subject of endless philosophical inquiry since the days of ancient Greece, and it remains an unsolved puzzle today as well. Knowledge and information were always closely related. Kant referred to knowledge as information that was processed by the mind [5]. Moreover, knowledge has always been considered of great value, not as an end in itself but useful only when it can be exploited to help people reach definable goals [6]. The exploitation of knowledge, therefore, implies the concept of information processing. This process includes the extraction of generalizable and useful characteristics of the information and its classification in a manner that is retrievable as well as applicable in similar future situations [7].

In the context of this paper, we will refer to the terms knowledge and information as following:

- knowledge — an entity built of information elements organized in various logical structures, for the objective of reaching definable goals in various domains.
- information — will be referred to as being the raw material of knowledge consisting of data organized by various criteria [8].

The issue of knowledge representation is considered in AI as a prior condition to the development of knowledge support tools [9]. In the framework of this paper, knowledge representation will be referred as the explicit, symbolic expression of some reality or idea for the purpose of communication and presentation [7].

We have to consider three general approaches taken to develop knowledge support tools [9]:

2a. Informative approach — consisting in supplying information in the manner of electronic catalogs.
2b. Explanatory approach — using information in order to explain how and why things have to be as they are.
2c. Guiding approach — handling information for giving instructions on how "things" have to be done.

Knowledge representation models share a common view of the "world" as a twofold structure made by a collection of individuals and one of relationships between them. Depending on the starting point for the definition of this complex, knowledge is represented by network, logical or procedural models [9]. The network model is a general structure which represents knowledge by a collection of nodes — containing information chunks — and an associated group of links, representing the relations between the information elements. When these relations are derived from the semantic meaning of the information elements the model is referred to as semantic network model. The network model is considered a flexible and intuitive knowledge representation model which facilitates its application, on a large scale, in various domains [9]. Nowadays, the (semantic) network model has become popular, along with its implementation in hypertext-based applications and, above all, the web — a hypertext environment in itself.

Hypertext applications are trying to mimic the way humans associate ideas, by linking pieces of informa-