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2001

Design assistance by complexity-supporting precedents' modelling

Architectural design processes imply complexity at every stage of the development of a project. On one hand, this complexity is rarely taken into consideration by the currently used CAD programs. On the other hand, recent theoretical researches indicate that a large proportion of architectural design processes are based on precedents as a source of inspiration or as a basis for reflection. A precedent is usually seen as a sketch, as a picture, as a drawing or as a visual memory of an architectural object or space. Recent research enlarges this concept into at least two directions: (1) precedents are looked for not only in the architectural space, and (2) it's not only the visual aspect of a precedent that is important, but also its internal logic and structure, the know-how associated to it, and the actions needed for its creation. Usually, architectural design knowledge is implicitly presented by precedents. This design knowledge is applied to design-objects having various levels of generality, at different states of detailing and expected to be dynamically transformed during the following stages of design. Having in mind these characteristics of precedents called for during the architectural design process, we propose to join their visual representation with a description of their most important characteristics: structural organisation, way of production, functional organisation, spatial composition, etc. These can be either described or modelled by the original author, or interpreted by the precedent's 'user'. These design-knowledge models can be of use in several ways: (1) providing a library for search of precedents by semantic analogy, (2) offering ready-to-use capsules of design knowledge for new design situations, (3) enriching the 'design world' of the user-architect. We have implemented the proposed method of complexity-supporting precedents' modelling by the means of the functional programming SGDL-Scheme language. The models (a programming function or a structure of programming functions) describe the actions necessary for the creation of an object (or its digital representation) and the structural organisation between the models in order to generate new, more complex ones. The concept of describing actions instead of shapes, provides a multi-level applicability of the models. Visual presentations (digital maquettes, images or animations) of newly generated objects can be stored in a visual-library of the assistant, thus creating a new 'precedent' that can be referred to in future by visual analogy. The design-knowledge that has generated the new object, is stored and linked to the image. Thus, the visual stimulus of a precedent can be joined with functional characteristics, production procedures and/or semantic meaning of the object. The paper will present the 'engine' of the proposed assistant, its organisation, as well as digital models of precedents that have served as a basis for the design of new architectural objects or structures. The assistant is conceived as an open, complexity supporting structure that can be further developed by the 'user-architect'. We will discuss the advantages and limitations of the proposed assistant.