

A digital modeling with reasoning system in early phase of design

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Abstract. This study describes statue in the early phase of design, the approach taken by its conceptual development and manipulation. And on the developing digital tools provide a computational support for the process of indexing and retrieving. The digital modeling also addresses specifically architectural programming, adjacent relationship between the building element and articulation in designing. The overall in building mass development starting with reasoning of the conceptual model in early phase try to find evocative cases to help designer thinking. And finally discuss some issues and challenges of artificial intelligent. The research for representing designer's creativity and searching solution provide another way to generate an articulating conceptual model. The integration approach of research starts with the pure case-based and rule-based reasoning system to help designer generate more understandable and creative product in the architectural design application.

Keywords. case-based reasoning, conceptual model, computer aided design, building mass development, design process,

Introduction

The architectural design process distinguishes from other thinking in many ways. The designer initializes these thinking to obtain knowledge about what is to be designed, constraints and requirements of architectural issues. In the early phase of a design process, the designer analyzes the problem and transforms it to a conceptual framework. However, the issues of the design problems need an environment to make reflect conversation. Those requirements and constraints from architectural programming are not coherent to the real designing process. Therefore, we need back to the design ontology to study what is possible digital way to help design proceeding.

On the one hand, designer has recognized design as an interactive activity in which expert knowledge is used to fill out an initial statement of problem so that a solution can be developed.

Following these issues, designers may solve problems that are not fully understood. They use fragments of information but being explicitly aware of them overall. On the other hand, fully developing CAAD systems discard the creativity in the design process. This is the dilemma to optimize the solution both within the quality and effectiveness in designing. This program with reasoning system not only develops to consider the constraints of problem but also integrates the knowledge about appropriate action to articulate formal possibility. Thus the ability to understand the design constraint and develop the formal expansion explains an answer or reverse of reasoning is a necessary to feature of a design.

Conceptual modeling and conditional cognition

The term 'conceptual modeling' means that we are dealing with designing that is abstract and

hard to organize, understand and represent. In design process, 'reflective conversation' (schoen, 1983) is between the designer and the design situation. This status can be interpreted as an interactive responsibility into new condition, where the context can be defined as the current state of the design representation. Gero recognize the influence of situation both on the design process and design knowledge modeling approaches in design. The development of a good conceptual modeling is based on a prerequisite and constraint to collect necessary knowledge or data.

However, the information conceptual models are difficult to distinguish and collect. Concept development in designing, according to conditional cognition may be preferable to one that requires a design expert to articulate their thought processes. An alternative approach is taking the situated view of cognition and the decisions that are recorded as the protocol and index. Therefore, the design process can be broken into several subsystems to generate, produce possible schema.

In the early design phase, designing include the designer's behavior to implement the requirement and constraint. The building design is divided into the two parts that are activity and space. On these approaches, a linguistic indexing system to conceptual model design is developing. For providing the framework and the linguistic index in the knowledge acquisition process, the digital implement includes the indexing of the cases, retrieving the database and articulating the cases.

Computational modeling

From the computational point, a design case can be viewed as a recorded memory model of design experience, which comprises previous design episodes; the memory model requires additional indexing and navigational knowledge. The expansion and modification of a selected case requires not only knowledge about the design solution, but also knowledge about the design requirements

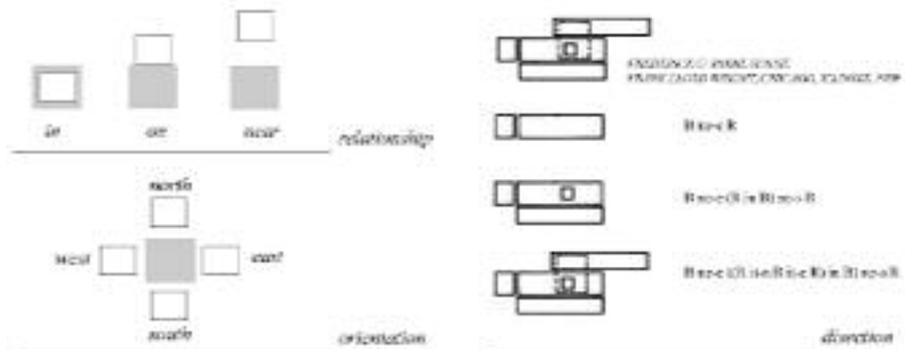
corresponding to that solution.

A more elaborate model should include knowledge about the intermediate design contents and solutions, enhancing the 'requirements - solution' models to 'requirements - design approach - articulation' conceptual model, where 'design approach' categories start the knowledge from the intermediate design steps. The knowledge is a composition of characteristic data about each evocative case. Although these data are available in existing databases or design documentation, the reconfiguration of the data is critical to representing information during spatial development. As the design representation, linguistic approach is a new try for indexing and representing system in this program.

We use the term object here in a conceptual, linguistic sense (syntax) is independent of a specific programming language or implementation environment. This indexing method discard an entity attributes or values which belong to a type or class hierarchy. For example, an element may inherit attributes from a spatial meaning or function. We discuss this element only by formal manipulation at the first stage. As evocative cases generated after retrieving, the next spatial generation can be based on these referral cases to add the spatial meaning and function. This recursive method is responded by activity and space that are the cores of conceptual development during the design. The expectative result is the constituents of a collection of formal unit, which define a spatial or physical hierarchy.

A linguistic approach for indexing

The adjacent relationship of the primitive elements is to investigate building mass development within permutation collection (figure 1) that are able to make strategies and developing a conceptual schema relevant. These relationships construct a serial of collection of shape. The initial definition of element is a prime form, such as



square, and cycle or polygon. These adjacent relationships develop four directions to describe the oriented relationship between the primitive elements that are north, south, east and west. Moreover, the relationships of elements build the Boolean manipulation to construct more complex that are on, in, and some sorts of formal language. The shape characteristics derives from the structure of the space that lead to a way to think about the hierarchy of elements of building mass in the early design dimension.

Case based design

The implementation of Java program is start from indexing the syntax of element primitive form and adjacent relationships. The programming will invoke the polynomial and use the hierarchical graph tree to implement the indexing system. The next step of program is going to build up the database in order to match the indexing system for retrieving the candidate cases. (figure 2)

Cases are design episodes, used to motivate the capture of rules in a simple user-oriented manner. Cases grounded the reasoning system in the real world and provide the context in which the knowledge applies. Rules are the indexes by



which the cases are retrieved. Using the formal control analysis, we are able to build an abstraction hierarchy of the rules and cases. Linguistic index is a kind of design representation. From the indexing to the database retrieving, adjacent relationship can be a re-indexing of evocative cases. (figure 3)

The digital approach means no longer to be activated in a linear sequence that starts with programming and ends with a mass building model. For example, a designer working with digital program should be able to start program on the side to experiment with the element adjacency relationship of some programmatic requirements and, possible, import results generated with some cases back into schematic layout design. The digital model is not only to share problem specifications and case-based solutions during the design process but also to provide the evocative cases to stimulate the designer's thought. The same approach for interaction between designer and computer extend the more possibility that will develop more digital modules in the future.

Spatial articulation and speculation

The creativity of architecture

The architectural design studio theory and technique are developed from practice, we only learn what we make. Stephen Luoni has said, "Thought is bound up with its material production in that one is constructing what one is thinking." Alvaro Siza has said, "Architects do not invent anything; They transform reality." Such as painting and sculpture, is not only the manner in which it is experienced, but also the process of its making. Architecture has characteristics in common with the figurative representative reality.

Design with evocative cases

For building mass development, there are many permutations of primitive shapes. It could be a possibility to articulate the evocative cases that move along the schematic design. The evocate cases provide the two kinds information: hierarchic information as indexing system and original architectural work. The abstract of adjacent relationship is by means of blur of object to speculate the new idea for design. The other possibility is a recursive matching to produce the candidate cases, although it depends on the amount of the database and matching methods.

For the reality of design process, the big constraint from the adjacent relationships of evocative cases is a representation of 2-dimension. Considered this attributes of lacking depth or ambiguity, we may think about the dural characteristics of depth between surface and depth, figure-ground and spatial layering, and so on. They are particular importance to the method of analysis and development of design.

Conclusion

An intelligent approach forces us to think more carefully about the analysis and synthesis that is undertaken at early design stage. The abstract of design representation reflect on the nature of those initial moves and offer some commentary of conceptual model on computing techniques. We need the intelligent system with the expert knowledge and experience in the early phase of the design process.

Although the development of case-based design to support both routine and adaptation design tasks has been an outstanding application in the design circles. CBD may be frustrated by the problem of eliminating plagiarism and creativity. For these critical points, we may address to improve the adaptation of cases in order to extend the possibility of articulation. The current

digital modeling just demonstrates part of the feasibility and application of evocative cases. But it may apply in the interactive environment such as situated or conditional cognition.

Computational modeling system enhances the modeling ability of transformation and implementation in manipulation process. By retrieving data of the reasoning system, digital modeling system performs advantage of both case-based and rule-based reasoning. Through the linguistic interface, it represents conceptual development in the initial phase of design. Due to the complexity of building design, the digital modeling of reasoning reflects the recursive progress of design. The modeling system emerges and articulates the several factors of design in spatial speculation process that will be the main result of reasoning system.

The study depicts the digital modeling with reasoning system applying the conceptual forming in early phase design application. A reasoning system with digital interface is proposed for modeling the architectural process. Such a modeling with reasoning system help designers to make many options or decision based on the expert knowledge and past experience.

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