A NOTE ON THE CONCEPTUAL BASIS OF DESIGNS

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1. Problem

The development of computer technologies has a strong influence on contemporary design theory and practice. But even though computer systems are widely used in the process of representation or execution of designs, their acceptance as an aid in the creative process of the design studio remains poor. Computer aided design is approached by designers with skepticism. And, in the end computational and studio processes remain segregated. Beginning from this problem the paper outlines a computational framework for design with broader aim the use of computation in the studio. It is pointed out that a key issue in the effort to integrate computation is to combine computational devices such as rules and grammars, and digital media, without neglecting any of the existing studio processes or techniques.

2. Proposal

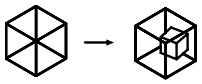
Compounded with several elements demanding attention and specialized knowledge, design cannot be reduced to a system of uniformly determined acts. Each time one has to define the rules and the objectives of one's search. In the absence of universal pre-organizing design principles, architects base their search on their own hypotheses and techniques. Like the craftsmen, architects depend largely on personal working manners that have been proved effective in the past. They usually begin from general views for a given problem and gradually develop ways to achieve more clear objectives. This process, which can be approached as an act of human imagination, can also be approached as a process of calculation. The evolution from something open ended to something specific is analogous to moving from general principles to specific actions and their parameters. Within a formal system, this is similar to moving from general axiom schemata to rules. A formal account of the action of axiom schemata within symbolic systems can be found in Church 1956. A formal account of their action in spatial systems exists in Stiny 1980, 2000. Applications of spatial rule systems in the production of existing designs exist on papers describing Japanese tea-room designs (Knight 1981), Queen Ann houses (Flemming 1987), Taiwanese houses (Chiou and Krishnamurti 1995), Yingzao fashi houses (Li 2000), and

Siza's houses (Duarte 2001). Applications of rule schemata in designing from scratch exist in Kotsopoulos 2005.

2.1. EXAMPLE

A shape rule schema of the form g(x) → g(y) represents an infinite number of rules (or *axioms*) by means of an expression containing variables x, y and some predicate g that indicates the attributes of x, y. For example g: "*x, y are parametric prisms*". The next example presents a design schema for an office building, proposed by Boston architect Kiki Belle, for a publishing firm in Los Angeles, California. First, the design schema is described verbally: "*The building is a box occupying the entire site-area. A second smaller box is placed within the first to accommodate the core activities of the firm. Administrative rooms are placed on the perimeter of the exterior box*". The placement of a box within another is depicted abstractly by a rule schema. In the sample derivation all forms are shown as parallelepipeds and the exterior envelope is represented by its vertices.

Rule schema:



Derivation:

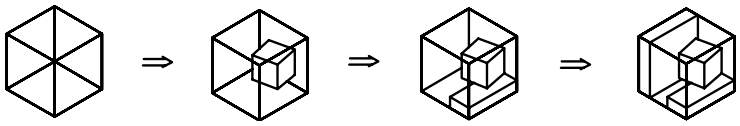


Figure 1. Parametric versions of a single rule schema produce a conceptual design schema.

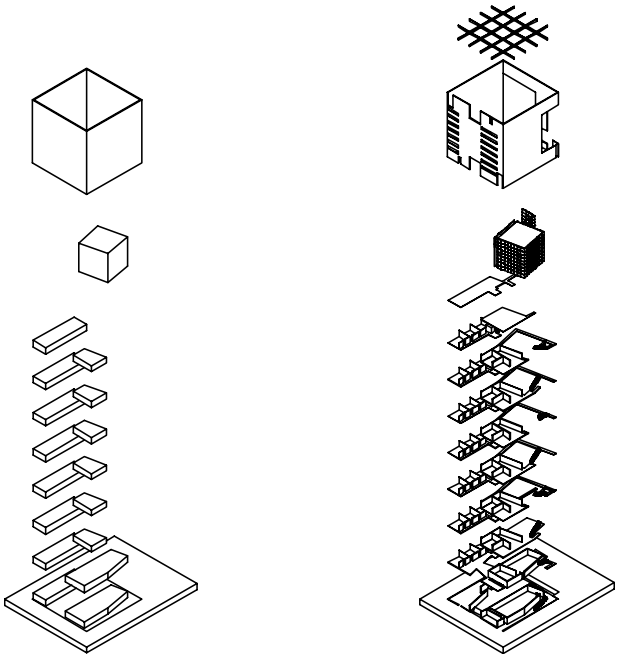


Figure 2. The derived conceptual schema provides a general direction for implementation.

2.2. DESIGN PROCESS

In the studio, designers begin from analysis of the building program, and any relevant, available information. The statement of the building program is usually based on the conventions of the common practice. Statistics, diagrams and building codes prohibit certain options while allowing others. But they do not determine the design objectives. These demand judgment, and evaluation, which is not trivial to produce. The articulation of a working hypothesis (or a design concept) results from synthesis, not analysis, of the provided information. It may suggest a new approach for the problem under consideration. A working hypothesis involves only what one considers crucial for the design. Designers approach the provided information without specific method. Different experiences, needs, and capacity for observation conclude to different approaches. By accepting a minimum number of attitudes and assuming certain parameters a designer limits the space of search. In the next diagram (left) the exterior circle bounds the wider area of a problem. The interior circle bounds the area of interest of a specific designer. Stating the problem and elaborating hypotheses without dealing with their implementation is often a process that terminates to itself (right).

Figure 3. A design problem is a wider issue from the considerations of a specific designer. A design concept may be proposed independently from its implementation.

In design implementation, architects test their hypotheses against existing standards, codes, and conventions belonging to several specialized domains. The role of a design concept is to link the otherwise independent nodes of the search by providing a central theme for the design. The nodes of the search may correspond to programmatic, construction or other requirements, stylistic conventions, cost limitations etc. The design concept brings them in a particular relationship, organizes priorities, and reveals possible conflicts.

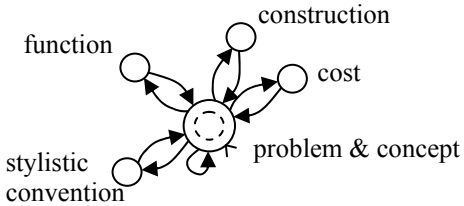


Figure 4. Implementation requires the interaction of many diverse specialized domains.

3. Conclusion

The paper outlines a computational framework for design. It is proposed that in the studio designers practice their ability to "diagnose" problems, and to make productive hypotheses. Hypotheses are expressed as "concepts". Although concepts may often lack quantitative or direct experiential meaning, it is by the means of these that designers interpret and organize existing, trivial descriptions in novel ways. Architects invent general systems of rules implied in terms of them, and interpretations for the emerging network of their produced relationships. Then, they test them against the existing building codes and standards. The approach advocated here is not foreign to the creative processes of the traditional studio. A computational process of testing, and modifying rules and parameters, attempts to capture design ideas and their evolution. The difference is that in the traditional studio most of the design activities remain implicit or situated within particular design trends, while their generative implications are entirely ignored. The merit of a computational approach that makes the articulation of design concepts explicit is to emphasize their generative side. Finally, in implementation, the existence of a conceptual framework permits the evaluation of specific decisions within a more general context. It allows designers to make revisions without defying the adopted general framework.

References

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