

AN EXPERIMENT ON HYBRID ARCHITECTURAL FORM-MAKING

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This paper illustrates an approach to hybrid architectural form-making. A hypothetical project - the Des Moines Art Center 3rd Addition - is employed as a design experiment. The computer is used as a form-searching medium in the form-making process. Suggesting an addition to the existing center designed by Saarinen, Pei, and Meier, the designer is confronting the problem of how to respond to the three distinct architectural styles. The proposed solution to this problem is to create a hybrid building which inherits architectural properties from those precedents. Potentials of the use of the computer for such task are discussed.

1. Hybrid Architectural Form-Making

The purpose of hybrid architectural form-making is to create an architectural work which embodies significant formal attributes of two or more architectural styles. One way to achieve this is based on the concept of design rules. A hybrid architecture is derived through the application of the design rules of two or more architectural styles. (Liou, 1992:91) The design rules can be precisely defined, as shape rule schemata in shape grammars, or appear diagrammatically, as patterns in pattern languages. (Chen and Liou, 1993:427-434) Further development of this approach has encountered difficulties for two important reasons. One has to do with the difficulty for implementing design rules on computers. The other is that the rule-based approach, however correctly it may carry the knowledge of form, is an alien mode of reasoning for designers. (Archer, 1984:348)

This paper illustrates an alternative approach to hybrid architectural form-making. A hypothetical project - the Des Moines Art Center 3rd Addition - is employed as a design experiment. The computer is used as a form-searching medium in the form-making process.

2. The Experiment - the Des Moines Art Center 3rd Addition

The original design of the Des Moines Art Center is the product of work by three well-known American architects. Specifically, Eliel Saarinen first established a U-shaped

exhibit building in 1948. Following that, I. M. Pei provided an addition to the south to close the U shape and formed a sculpture court in 1965. Finally, Richard Meier attached a number of fragmented volumes to the northwest of Saarinen's building in 1984. (See Figure 1.) It is assumed that a third addition is requested to accommodate an architectural exhibit and study center. Suggesting an addition to the existing center, the designer is confronting the problem of how to respond to the three distinct architectural styles. The proposed solution to this problem is to create a hybrid building which inherits architectural properties from the existing precedents.



Figure 1. The Original Design of the Des Moines Art Center

As shown in Figure 2, the procedure of the form-making experiment is made up of three major stages. They are (1) the derivation of prototype models, (2) the derivation of a preliminary hybrid model, and (3) the derivation of a final architectural model. In the first stage, a review of the three architects' work is conducted. It constitutes the basis for the designer to develop two prototype models, i.e. a solid form-model and a void space-model, for each of the architects. A total of three form-models and three space-models are thus established. (See Figure 3.)

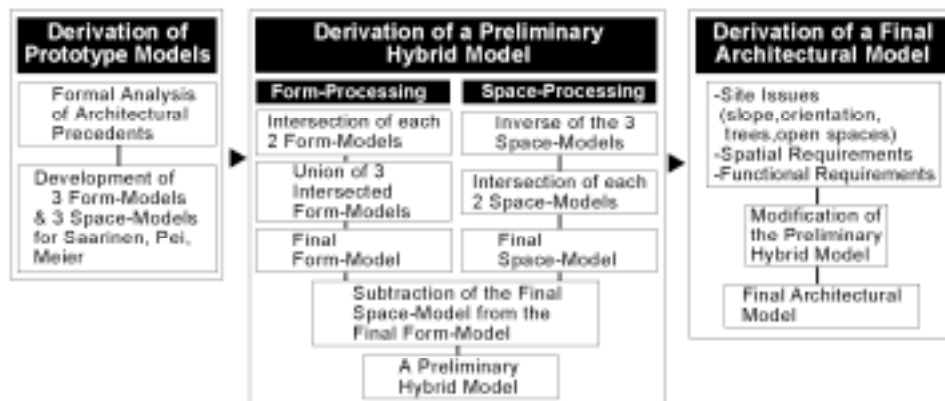


Figure 2. The Procedure of the Hybrid Architectural Form-Making

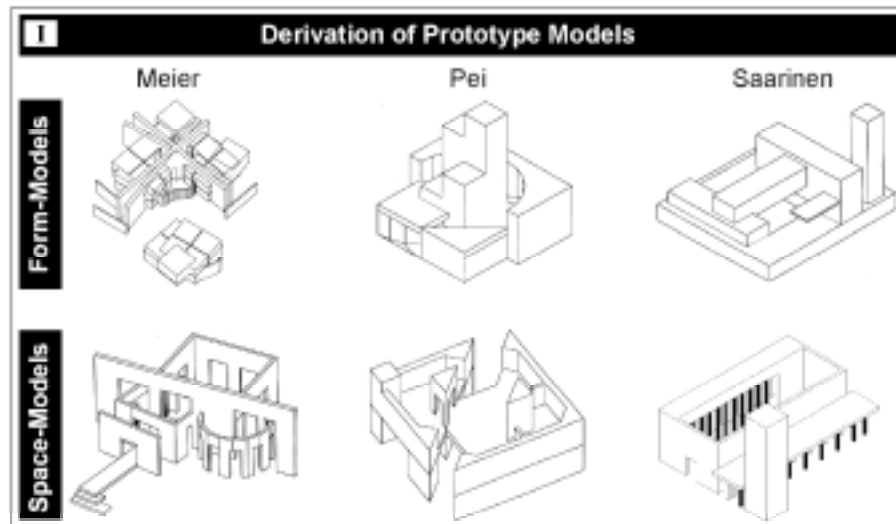


Figure 3. Six Prototype Models

The second stage consists of a number of significant manipulations on the aforementioned solid and void models. Its goal is to derive a hybrid solid model and a hybrid void model. Conceptually, the former can be viewed as the blending of the formal attributes and the latter as the blending of the spatial attributes of the three distinct styles. Moreover, the solid model subtracts the void model would result in a hybrid model filled with spaces. Therefore, as shown in Figure 4, the manipulations can be classified as form-processing and space-processing. Methodically, the concept of union and intersection in set theory is applied. Each two form-models are "synthesized" under the Boolean operation. The synthesis is carried out through the application of "intersect" of AME in AutoCAD. Then, three intersected models are taken together to derive a final form-model. This is carried out through the application of "union." Similarly, a final space-model is derived. Note that in order to manipulate the space-models as "solids," each of them has to be inverted in advance. At last, a preliminary hybrid model is derived through the subtraction of the final space-model from the final form-model.

In the third stage, the hybrid model is placed onto the site. This model is further modified taking into account the site issues such as slope, orientation, trees, and open spaces, as well as the spatial and functional requirements of the program. (See Figure 5.) For example, the preliminary model is located on the east side of the original center to create an entrance court. As well, the whole model is "reflected" to utilize the volumes dissociated from the corner to signal out the new addition. Furthermore, detailed manipulations are taken to resolve the architectural problems such as internal spatial organization and users' needs. Most of the manipulations of form and space are carried out on computers.¹

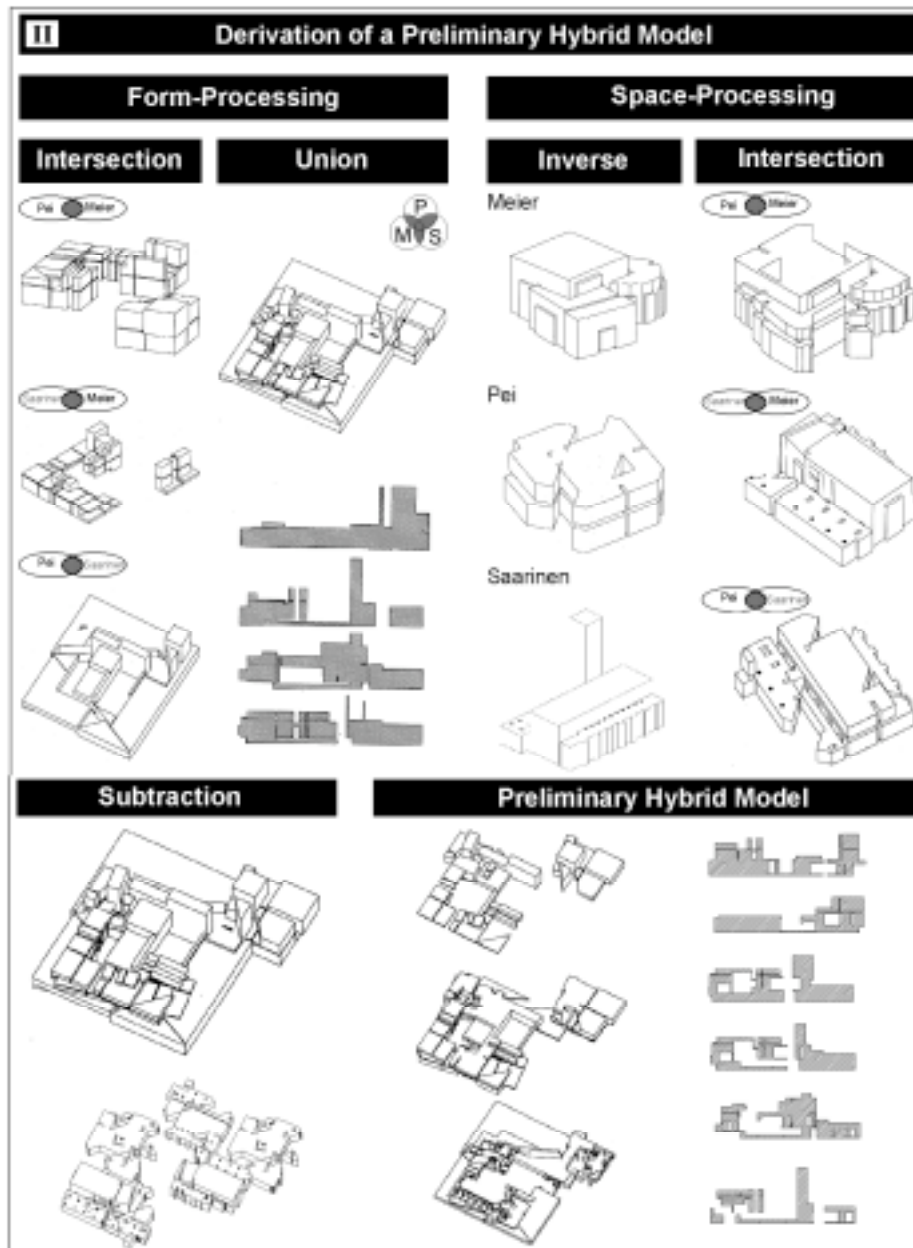


Figure 4.. The Derivation of a Preliminary Hybrid Model

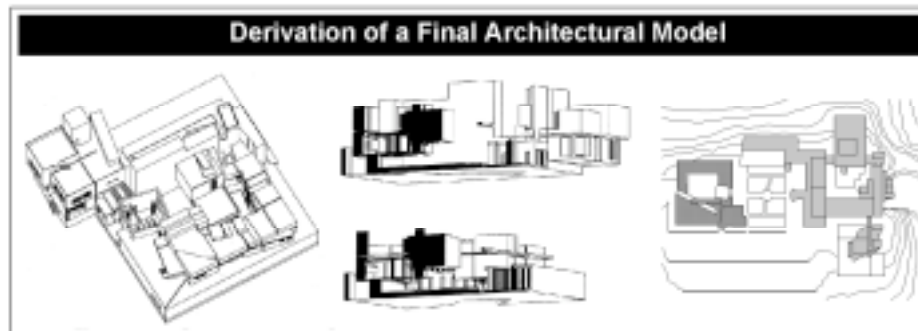


Figure 5.. The Final Architectural Model

3. Discussions

The discussion of the experiment illustrated above may proceed along two different, but interrelated lines. The first is the computer-aided architectural design and the second hybrid architecture. In current use of the computer to aid architectural designs, most emphases are placed on the work of drafting (e.g. in producing work drawings) and final presentation (e.g. 3D animations). It is argued in Liou (1996) that, in addition to “servant” there are various roles such as “assistant,” “partner,” and “expert” that the computer can play. To facilitate the use of the digital environment in the creation of architectural designs, Liou suggests that the designer (1) establish a new relation (other than master to servant) with the computer, (2) be more aware of her/his own design procedure, and (3) solicit critiques on design process instead of product.

In this experiment the computer is used not as a drafting or presentation tool. Rather, it is demonstrated that the computer, when incorporated properly, can be a powerful form-searching assistant in a design process. It is extremely exciting to derive many interesting and unpredictable 2D and 3D compositions. The spatial composition of the sections is particularly noteworthy. (See Figure 4.) In contrast to the vague image normally preoccupying the designer taking the traditional design approach, the unpredictable form solutions derived through computation constitute an important basis for decision-making in the design process. Moreover, the new digital work environment provides a great opportunity for 3D thinking and manipulation, which were once difficult, if not impossible tasks.

It should also be noted that the design procedure of the experiment is flexible and in many episodes designer-oriented. For example, the intersection of models may not results in satisfactory forms and the designer may has to go back to adjust the locations of the models. This and other similar actions allow the designer’s creation to be exercised within the procedure. As a matter of fact, it is not surprised that the ability to derive a good solution is dependent strongly on the designer’s discipline of architectural design.

As to the purpose of hybrid architecture, the final modified model expresses, in a subtle form, the stylistic characters of the three architects. Due to the limitation of time, however, the derivation of the prototype models for the three architects is quick and further refinement is not pursued. To understand how the accuracy of the prototype models would affect the making of the final hybrid model, it seems that certain detailed experiments are required. Last but not least, this experiment exemplifies the use of three architectural precedents. It is expected that complexity would decrease when two precedents are used and increase when four or more are used.

Hybrid architectural form-making like this experiment may be applied, among other things to discern and capture the stylistic influences different precedents may have on a specific building design. As well the concept of hybrid architecture may be particularly useful in situations where a designer is asked to propose a design for a site whose physical context comprises buildings that are distinctly different stylistically. Different from the rule-based approach, this experiment offers a greater flexibility for the designer to interpret architectural precedents, and the power of the computer is easier to be incorporated into the design process. As such it may also be seen as a digital design game that can be used to hone one's form-making ability.

Note:

1. The softwares employed includes AutoCAD R12 for MS Windows 3.1, 3DStudio R4, Animator Pro, Photoshop 2.51, Lotus Ami Pro 3.0, MediaStudio 1.0/Album/ScreenCapture/VideoEditoe/ImageEditor, AuthorWare Professional 2.0 for MS Windows 3.1

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