

Adaptable Morphology in Architectural Design.

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PAPER

1 Introduction

The paper presents the study of free form evolution in architectural generation processes and its transformation from original ideas to a final architectural project. It provides a theoretical background for advanced geometric modeling, focusing on the conception and creation of architectural designs. The goal is to learn to read in greater depth and to see in greater detail- to recognize the visual and verbal languages that architects use, how they use them and to what end.

It introduces the principle of object-oriented design, complex topological modeling of freeform designs, animation structures and physical simulation spaces, as well as the study of some basic processes to create architectural projects. For that end, the study presents an adaptable design process that introduces the use of theoretical models and prototypes to study the evolution of form in architectural design. It covers an uncommon methodology, based on adaptable modeling systems which support the development of complex geometrical shapes, parametric variations and feature based models. Special topics, such as the use of computerizing and manufacturing design processes, the understanding of related experiences used in architectural design, the study of design methods on the actual shaping of buildings or the use of three-dimensional digitizing systems to create initial models and to translate them into physical designs are presented.

2 Adaptable architectural design.

The proposal adaptable design system promotes the use of advanced techniques for an integrated representation of design contents, the exploration of complementary representations for different design objectives and the presentation of a systematic framework for developing narrative and for documenting architectural designs. Theories, methods, concepts, techniques, computer-oriented procedures and graphic methods of organizing, analyzing, synthesizing and interpreting architectural designs are proposed. The goal is to explore with those tools, the broad processes of architectural design to provide a forum for critical discussion of contemporary design practices, emphasizing collaborative thinking to expand the understanding of architecture and the development of critical interpretation of form, technology, program, patronage and site.

The study explores the evolution of form via the construction of series of prototypes that represents different stages of development of an architectural project selected for its ability to exhibit the

processes from conception to creation. It explores through the analysis of different drawings, issues such as linearity, fragmentation, the use of the grid, the concept of narrative and the idea of a "formless" architecture. The attempt is to present it as a way of theoretical constructions in architecture to discuss their formal configuration in relation to question the reasons on which they are based in ideological, technical and aesthetical terms.

The conceptual models present essential dimensions in connection with formal configuration, structure, natural light, texture and the outer skin. Later on, another dimensions, such as the surrounding environment, the climate, the temperature and the functional program are introduced onto models defining the morphology of the final project. For that purpose, the adaptable models are inserted into specific locations to resolve a functional program. This way, the original proposals never lose consistency but rather grow to become a complex design involving the surrounding environment to make up an architectural whole.

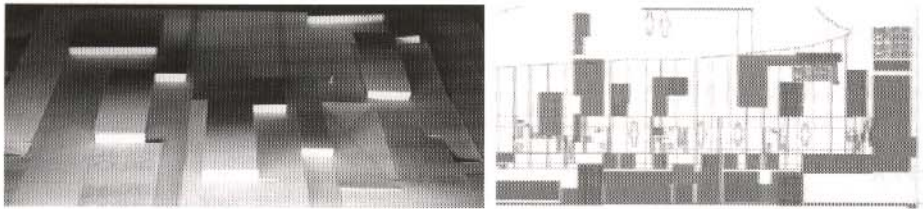


Figure 1. Theoretical model (spacial intuition of an architectural space) and drawing of the architectural project derived from the prototype model

The research is based on an ongoing exploration of an adaptable design system that gives rise to the understanding of unpredictable dynamic systems in architectural design. Architecture derived from this methodology develops a circular and not predefined process where several ideas are explored, tested, compared, modified and rejected. Analysis, synthesis and evaluation provides ideas to define the path for the development of architectural designs, through diagrams that embrace endless possibilities. Although no diagram would be able to represent the complex mental process happening in the brain, the schema maps the design experience to report the process followed by the creative mind of the architect to translate from ideas to matter.

3 Adaptable morphology in Architectural Design.

The presented design system has demonstrated to be an ideal process to lead architectural designs by including in the first stages of development intuitive parameters such as interpretation, observation, research, imagination, critical thinking and creativity rather than theoretical considerations, structural knowledge, past experiences or rational issues, that are introduced in final phases of architectural processes. This way, theoretical models emerge literally as a result of architect relationships and dialogue with different parameters from reality through the observation and interpretation. Then, progressively and by intuition, the architect develops design skills to create different spaces according to the exploration of selected references. And finally, probably unconsciously, they start imagining new structural forms.

First phases of development require conceptual drawings and diagrams to start sketching the initial design idea through brainstorming sessions. Moreover, it is necessary to translate concepts from critical thinking to architectural projects, through sketching intuitive ideas to visualize geometries, textures, shaped of leaves, volumes, light and spaces directly derived from initial ideas. At this point, it is very interesting to explore structural forms related to building processes, in order to balance conceptual and technical considerations. Accordingly, the design process suggests the use of

computer and freehand drawings to produce sketches, diagrams and pictures on the first stages to report on the design development from its conception to the creation of architectural projects.

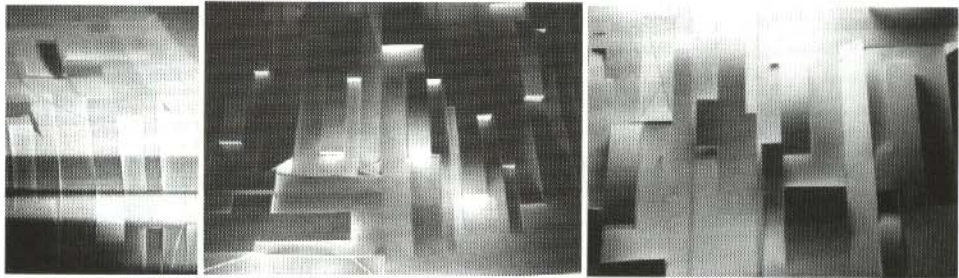


Figure 2. Preliminary designs showing intuitive ideas to visualize geometries, textures, shapes, volumes, light and spaces directly derived from initial ideas.

The second stage promotes a deep study of the building's structure through the creation of small-scale models and their transformation to final designs. The consideration of prototype models as sensitive and adaptable structures, allows architects to transform them on architectural designs, moving on from ideas to matter. This second phase also attempts to create a sequential evolution of multiple design models into a single project. This way initial concepts are maintained, although they are constantly modified to better suit aesthetical, functional and technical issues.

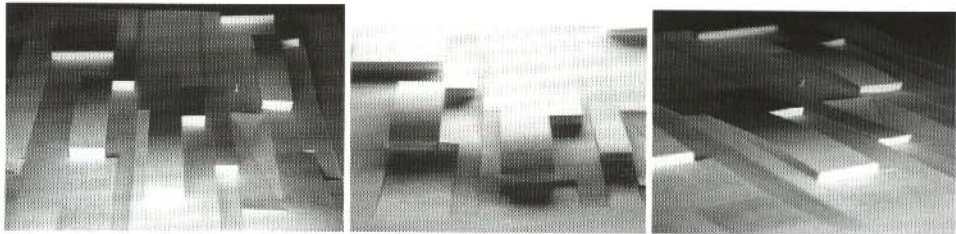


Figure 3. Sequential evolution of architectural design prototypes that modify its morphology to better suit aesthetical, functional and technical issues

The third stage of development requires the use of freehand drawings, presentation techniques, model making and detailing to scale up a selected conceptual model to lead the final architectural project. Also it is focused on drafting some details such as connections, size and shape of elements to identify assemble details.

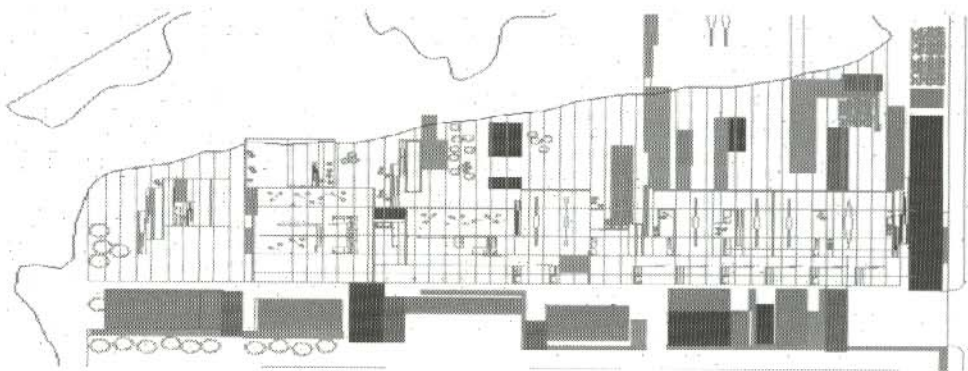


Figure 4. Final architectural project derived from the evolution of theoretical models.

And finally, it requires the logical definition of components and construction methods, the study of the material properties derived from the construction processes, the modification of the initial design as a consequence of the change in scale, the review of the geometry and the election of an appropriate constructive system according to the structure of the final form.

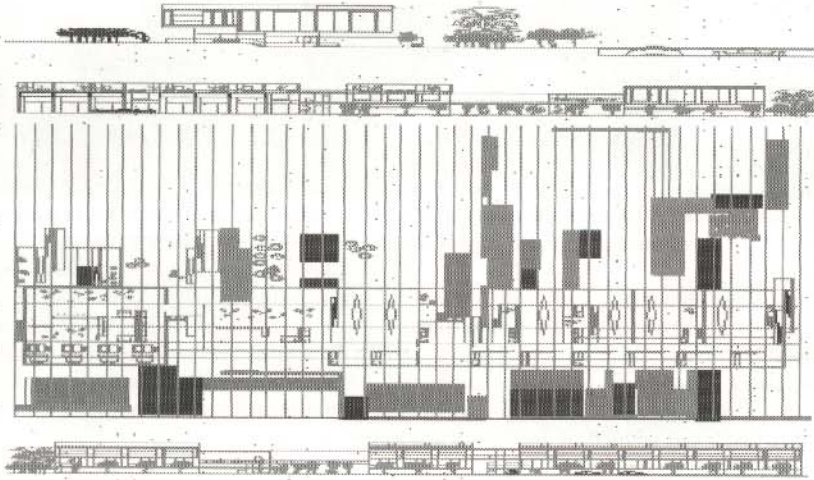


Figure 5. Plan and section of the final architectural project.

Moreover, the relationships between functional, technical, formal and aesthetical concepts and manufacture, assembly and compatibility processes can be appreciated in optimum structures through technology details, logical synthesized forms, beauty conceptualization of volumes, harmonic composition of elements, coherent proportions and shapes of forms, logical lightness of spaces, sensitive interlocked surfaces and appropriated supporting frames. Technology advances and new building techniques including standardization, the use of prefabricated elements, simplified constructive systems or self construction, provides a technically way of thinking on architectural design. For that reason, mental schemas of architects have changed to include those parameters, being required a new design system to include all them into architectural design processes.

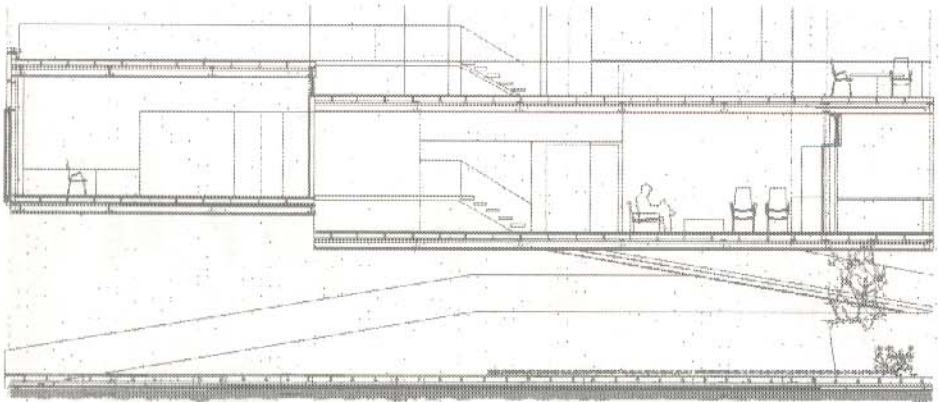


Figure 6. Cross section of the final architectural project.

As you have seen in the related design experience, architecture derived from the adaptable architectural design system, keep a closer relationship between conceptual ideas and design processes allowing to avoid negative considerations on architectural projects such as complexity, inappropriateness, high cost, misinterpretation of concepts, copying another structures without thoroughly analyzing the reasons behind them, bad translation of principles, inappropriate analogies, poor detailing, unawareness of execution implications or unpredicted human errors. In contrast, this methodology promotes the critical thinking, the development of design skills, the logic performance of structural models into architectural designs, the use of an appropriate scale in relation to function and the consideration of material properties such as forms, textures, shapes, colours or size. All this provides the architect an intuitive understanding of architectural design, that allows him to include in design processes conceptual ideas such as efficiency, order, stability, growth, sensitivity, harmony, coherence and logical thinking.

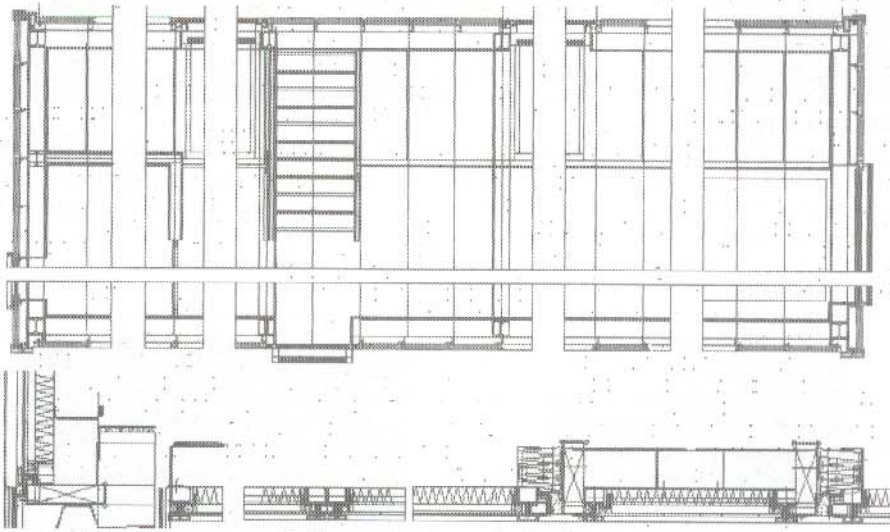


Figure 7. Detail of the final architectural project.

In conclusion, the present design experience is presented as an iterative cycle, a dialogue between ideas and projects; abstracting principles and specific structural properties; structural forms and constructive systems or conceptual designs and imaginative solutions. After all, architecture is no longer defined by geometrical relationships between different elements but it is highly influenced and configured by several interdisciplinary decisions derived from design processes.

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