Digital Design – Integrating Content, Models and Skill

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Abstract *Digital design is currently emerging as a unique field of design endeavour, motivated by its own body of theoretical sources and unique methodologies. The paper introduces current changes in theory and methodology. Following this theoretical introduction, the paper presents an experimental framework for digital design. The novelty of this framework is the way it reflects the need to address both digital design content and digital design skill. A series of experimental designs carried out in an experimental design studio at the faculty of Architecture and T.P at the Technion presents and demonstrates this framework.*

Introduction Theories and methods of digital design can no longer be conceptualize as the emerging of traditional CAD (drafting and modeling). There is a need to pioneer a new understanding of the nature of architectural and design theory and design thinking in relation to the new media. Today there is a need to address the integration of digital media, and digital design methodologies as an integral part of digital design thinking. Terms such as 'designerly ways of knowing' (Cross, 1982; 2001) are particylar significant since they introduce the notion of knowledge and what it might imply with respect
To new approaches in digital design.

The following issues are addressed:

a. accepted design media

Designerly ways of knowing and thinking are usually related to traditional paper-based sketches as media, of what is referred to as conceptual and explorative medium. Today it has become important to reconsider the influence of digital media and what they might imply with respect to different reasonning processes. If indeed contemporary phenomena of digital design media are different from traditional paper-based media, and we may encounter new knowledge and new models of design, than there is a need to pioneer a new set of phenomena that characterizes the way in which the digital designer is beginning to think and employ digital media as part of a new design paradigm.

b. accepted knowledge-bases

Most designers still employ accepted knowledge-bases and typologies. During the last decade concepts related to digital architecture have begun to emerge as significant ideological resource for design (Oxman and Rotenstreich, 2005). Theoreticians are able to define new paradigmatic approaches that are based on the impact of digital technology (Lynn, 1998, 1999, Kwinter et. Al., 2004).

c. accepted models and methodologies

Design is usually interpreted by a theoretical interpretation of program, site and conditions carried through models of conceptualization, schematic design and design development. Today there is a need to re-formulate design methodologies that promote new relationship between the process and the product. Recently a theoretical schema (Oxman, 2006) introduced a working taxonomy for the conceptual formulation of digital design models.

Theory: transcending the syntactic paradigms Rather than providing a comprehensive survey that is beyond the scope of this paper we present an attempt to introduce and define types of transition in architectural theory. The impetus toward formal diversity and differentiation may be seen as a rejection of the compositional strategies. Rather tham strategirs of hybridization, combination and transformation we see that concepts such as "hyper-connectivity" are replacing complexity and contradiction.

In design theory the decline and transformation of root concepts such as representation, typologies, and other concepts that are related to the visual literacy school of design are replaced. However, it appears to be that the theoretical foundations of digital design as a form of design are still unformulated. As new ideas and concepts have emerged in digital praxis, the emphasis and the need to provide a theoretical framework is becoming a real need. It is this articulation of the conceptual and the methodological that is presented in this paper.

Methodology: models of digital design

It is apparent that in spite of a high level of gtheoretical and design projects the methodological distinctions are not yet fully formulated. In recent paper a structured series of models of digital design were defined (Oxman, 2006). One way in which we can clsrify the uniqness of the digital media is by explicating digital design processes. In this way structured series of models can further be developed. The classification of paradigmatic models include the following digital models: formation, generation and performance-based design. These models are significant in introducing the integration between product and processes.

In the following section we present an experimental framework that was set to test these ideas.

Experimental framework

Our experimental program is based on the integration of two modules: a theoretical module and methodological module, both carried out in an experimental design studio. The main goal was to provide and create and to address new design paradims, new knowledge and models of digital design in relation to digital media. One goal was to create a conceptual vocabulary. This could range from philosophical foundations or scientific and technological basis. For example, concepts such as non-linearity, hyperconnectivity and non-hierarchical have helped to theorize designs in relation to digital models and techniques. Parametric design for example, (Burry and Muray, 1997) is an example of this phenomenon. This type of experimentation with new concepts (Reiser and Umemoto,

2006) articulate a design environment. Given that a rigorous formulation of such concepts is not yet exists, any work must by neccesity be experimental.

In the following section, selected experimental projects are presented as mini-project exercises. Each project is emphasizing the integration of theoretical and experimental design. Each project was developed by exploiting digital models and techniques that suit the theoretical and conceptual content of the project. The experimental projects explored digital shapes and forms, (geometries, topological surfaces etc.), digital techniques (parametrics, animation, etc.) and new styles of representational modes, all underlying the integration of content and skill.

The following projects are presented below:

Project 1: Free form, topology, formation and hypercontinuity

This project demonstrtaes the concept of hypercontinuity. It accomodates the certain aspects related to topology (Emmer, 2005) in order to maintain relations along a boundary line. Changing requirements along the boundary create a constantly changing conditions of context and program along the boundary. *(Figure 1)*.
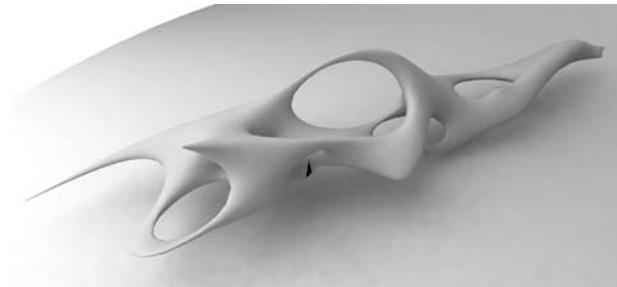

Figure 1 *Topological design of a dynamic boundary (Farha - Farha – Technion)*

Project 2: folds and spatial continuity

This project explores a topology of folds and employs them as a spatial organizational system. In this project the folds are associated with spatial continuity and blurred conditions such as the horizontal and the vertical. These are than utilized to design a continuous space *(Figure 2)*.
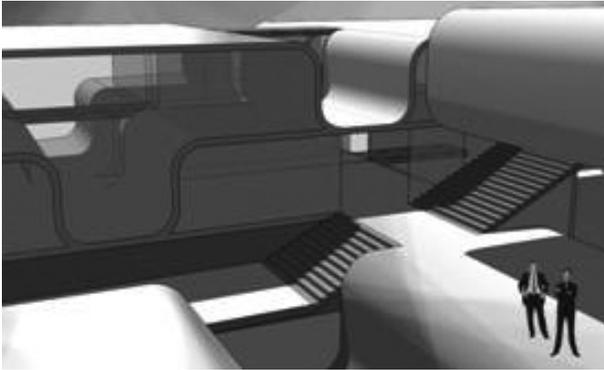
skin has been generated by performance simulations of wind and light penetration *(Figure 5)*

Figure 5 performance based design and responsive skin (Shoham Ben Ari and Roey Hamer – Technion)

Figure 2 Folded structures (Nitzan Koprard - Technion

Project 3: Fopology, formation, external and internal space This project explores the Mobius Ring as a spatial organizational diagram. It is characterized as an infinite topology – no definitions of inside and outside, horizontal and vertical.

Project 4: structural morhology, parametric design and differentiation This project explores parametric design as a design strategy to explore relations between morphology and structure. This is resulted in the creation of differentiated morphology *(Figure 4)*
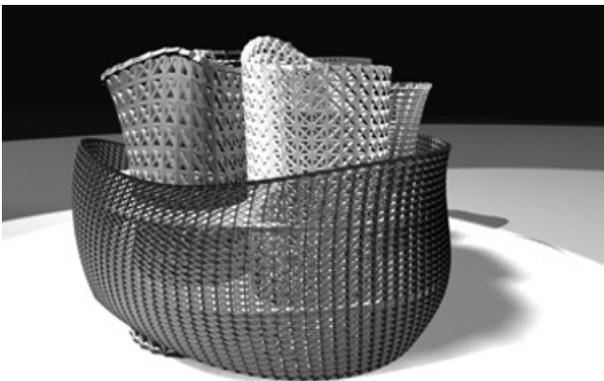

Figure 4 Parametric design (Shoham Ben-Ari - Technion)

Project 5: performance-based simulation and responsive skin This project integrates a constructive skeleton that supports a system of scales. The

Project 6: dynamic programe This project explores relations between function and space based on dynamic conditions. Dynamic programes are programmed as a generative input that affects the size and shape of a given space. In this project the size of a music hall generates the floor area and slope.
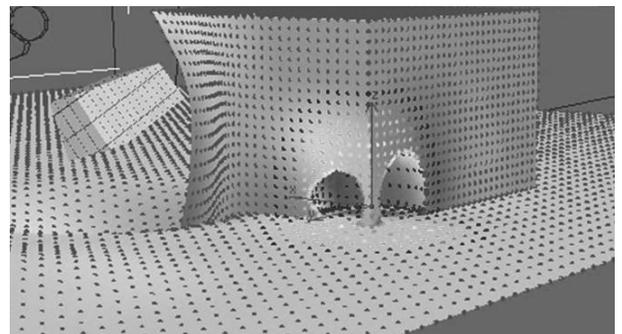

Figure 6 From dynamic program to responsive space (Levav Shahar – Technion)

Summary and conclusions As a result of these experiences we were begining to conceptualize and demonstrtae the impact of digital media as a mediator between content and skill. New body of conecots were derived from the synergy of digital media, models and techniques and theoretical discourse.

We belive that our experimentation could demonstrtae that content and theoretical discourse are important subject of digital design.

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