

Conceptual Content of Digital Design

The emergence of new conceptual structures in digital architecture

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Abstract. *Concepts related to digital architecture have begun to occupy a central role in current architectural discourse. Design concepts that have been the conceptual content of this discourse are now becoming integrated into the general architectural discourse. The research reports on this process of the emergence, migration, and crystallization of a new conceptual structure over the past decade under the influence of digital design and its emerging conceptual structure. The research presented in this paper examines the emergence of new ideas in architectural thinking that are related to digital architecture since 1990 until today. In order to demonstrate this shift, we have selected a representative architectural building type that is strongly and directly influenced by the conceptual content of the cultural discourse in architecture. A museum type was selected to represent features of the expression that reflects the changes and evolution of conceptual structures that underlie digital design. The research methodology is based on a method known as “content analysis”. Content analysis in our research was defined as including textual material in books, book chapters, essays, articles, and historical documents. A new approach for Design Content Analysis was accomplished employing the ICF analytical framework. In order to conduct a content analysis the text was coded and was broken down into categories on a variety of theoretical design themes. Our findings demonstrate that certain expressions related to digital technology have moved up from a low level descriptive function to a significant conceptual role in formulating the design content of architectural design. In our paper we describe the research, methodology findings and contribution to the definition of the conceptual content of contemporary architectural discourse on digital architecture.*

Keywords. *Digital Design, Digital Architecture, Content Analysis, Conceptual Design*

1. Introduction

Beyond the exploitation of digital media as tools, the relations between digital design and architectural thinking have begun to emerge as a significant ideational resource for design. Digital design discourse in the past decade has become part of the dominant theoretical discourse of architecture today. Concepts whose theoretical source is digital design have begun to occupy a central role in current architectural discourse. The research reports on this process of the emergence, migration, and crystallization of a new conceptual structure over the past decade under the influence of digital design.

As a result of this intellectual phenomenon, architecture as a design discipline has become rich in ideas that drive the design process as well as changing the test of ideas that serve as the ideational content of the architectural artifact itself. As a result, we are able to define new paradigmatic approaches in architectural design that are based on the cultural impact of digital technology.

The aim of this research is to investigate changes in architectural discourse in relation to the increased significance of digital technology. Our assumption is that certain terminology related to digital technology employed as descriptive content of architectural production is now used to represent the paradigmatic content of “digital architecture” itself. The research presented in this paper examines the emergence of new ideas over the years since 1990 and until today.

2. Discourse in Digital Architecture

As the critique of Post Modern design mounted in the 1980's (Jencks, 1997) other theoretical perspectives began to emerge. The evolution of digital design as a unique field motivated by its own body of theoretical sources and supported by new technologies has been emerging rapidly in the past decade. To some extent these new directions can

be understood as the evolution of certain tendencies already present today in design practice. By the year 2003 and with the Non-Standard Architectures Exhibition at the Pompidou Center in Paris (Migayrou, 2002) the concept of the digital design had become a major theoretical focus of this new phenomenon. The rise of a theoretical discourse reflecting the increasing importance of this field became a seminal issue in the 1990's (Spybroek, 1999; Spybroek and Lootsma, 1997; Van Berkel and Bos, 1999; Lynn, 1999; Eisenman, 1992; Goulthorpe, 2003; Goulthorpe, 2004)

During this period, the theoretical discourse around developments in digital design culture became one of the substantive influences upon design theory (Liu, 2002). An attempt to define a set of design issues and attributes that were potentially the unique content of digital designs was emerging.

The works of the 1990's, the literary production, the public events of conferences, competitions and exhibitions, and the resulting design production served as catalysts during this period to formulate the theoretical discourse of digital design. These characteristics emerged in various designs that were realized before and after the millennium. In architecture, the Guggenheim Museum, Bilbao by Frank Gehry (1992-1997) was the most prominent catalyst of theorizing new formal directions and postulating new design methods.

In order to study this phenomenon we selected the museum as a representative architectural building type that has always been strongly and directly influenced by the conceptual content of the cultural discourse in architecture. The museum as a building type has become one of the symbolic features of the cultural expression of the age. In fact, the expression of cultural content, expressed as design concepts, has become the most characteristic content of the museum type. Museum design acts as a cultural seismograph that signifies the dominant streams of architectural culture today (Lampugnani and Sachs, 1999) and reflects

the changes and evolution of conceptual structures that underlie design. As such, the museum has become one of the most culturally significant building types of our time.

In the following paper we describe the research, its methodology and its findings and its contribution to defining the conceptual content of the contemporary discourse on digital architecture.

3. Methodology

The research presented in this paper is based on textual analysis and exploits the research method known as “content analysis” (De Sola, 1959; Weber, 1990; Krippendorff, 1980). In order to define conceptual structures in digital architecture we conducted a content analysis of textual material related to twenty projects of museums that were built during the last twenty years. The textual material related to these projects were selected and analyzed reflecting their conceptual content, design methodologies, and their physical features. The aim of our analysis was to trace how these texts related to “digital content” and how this relationship of general conceptual content to digital conceptual content has changed its structure and meaning during this period. Textual material was coded and broken down into manageable categories on a variety of themes. Part of this analysis was accomplished employing the ICF analytical framework. The methodology is presented below.

3.1 Conceptual knowledge

By classifying textual material, we are attempting to identify conceptual structures in digital architecture. In general, the way conceptual knowledge is organized is as important as the amount of knowledge one has. This view emphasizes the notion of structure. One’s conceptual structures, or the structure by which one organizes his knowledge of the world, is not something of which we are naturally aware. Language is a case of the

natural structural organization characteristic of human thinking. It is an important source of evidence in the investigation of conceptual structure. For example, we can explicate conceptual structuring in how people externalize their thought processes in communication with other people through textual material. One of the main resources for the acquisition of knowledge is through written language and textual description, forms in which knowledge is conceptualized and organized.

3.2 Content analysis

Principles of our textual analysis exploit the research method known as “content analysis” (Weber, 1990; Krippendorff, 1980). Content analysis classifies textual material, reducing it to a relevant, manageable data. As a research tool it is employed to determine the presence of certain words or concepts within sets of texts. Using this method, we quantify and analyze the presence, meanings and relationships of words and concepts, make inferences regarding the messages within the texts, the writer(s), the audience, and even the culture and time of which these are a part.

We have employed content analysis to explore conceptual thinking in architecture that reflects the general impact of digital culture in architecture today. In our methodology we have focused on concepts and on semantic relationships rather than simply words (de Sola Pool 1959).

Texts in our research were defined as books, book chapters, essays, articles, and historical documents. In order to conduct a content analysis the text was coded and was broken down, into manageable categories on a variety of themes. The analysis was accomplished employing the ICF analytical tool.

In design content analysis text selection is particularly significant, since it should be accomplished within an appropriate sector of the discourse. This is significant in all forms of content analysis. However in design content analysis, we can distinguish various sub-domains of discourse,

such as design presentation and critique, use and user descriptions, methodological analyses, etc. in each of which the sphere of discourse may differ considerably, and with it, the conceptual and semantic content.

3.3 Employing the ICF Methodology in content analysis

The design precedent has a significant place in design research. Conceptual abstractions derived from the precedent are those which bridge between the conceptual and the physical and thus provide the basis for exploiting the conceptual knowledge of precedents. In our approach, the acquisition and the construction of the body of concepts from precedents is considered as means to demonstrate and facilitate meaningful learning.

In order to conduct a content analysis on text in books and publications in our research the text was coded and broken down into design categories related to a variety of different themes. It was then examined by employing a method which is similar in its goals to classical conceptual and relational analysis methods. Relational analysis examines the relationships among concepts in a text. With relational analysis it is possible to identify what words, or phrases, appear in what relationships and then to determine what different meanings emerge as a result of these groupings.

The ICF methodological framework was employed as a method in our conceptual analysis (Oxman, 2003). It proposes that by constructing a conceptual structure that reflects one's thinking in a specific domain, we can make explicit the knowledge of this domain. The representations of concepts and their relationships to other concepts are structured and filled with the content of the specific design domain, or design task. These concepts and structures (related to work on precedent-based design), are analysed according to the three categories of: design issues, design concepts and design forms (I-C-F). The ICF methodology has been applied to various analytical tasks;

among these it has recently it has been exploited for organizing and representing conceptual maps of a specific domain in an educational environment (Oxman, 2003).

In this research we use the ICF methodology in the preliminary content analysis task. Preliminary organization of the textual data and its resulting structured representation of knowledge were later accessed and reanalyzed for additional processes of our content analysis.

4. Analyzing the conceptual content of digital architecture

The following stages demonstrate our research on Design Content Analysis methodology. The analysis presented below contains the following steps. The goal of the first step was to define relevant expressions in theoretical and descriptive texts. In order to do that, relevant written material describing significant projects was selected and initial analysis of the textual material was carried out. Following the initial step a higher level analysis was conducted, defining higher level categorization. Expressions were found to share the same category, if the interpretation of their meaning was similar. These categories were significant in describing the thematic content of “digital architecture” today. These steps are described below.

1. Selection of relevant projects

We have selected a group of projects which were among those recognized as having a strong impact upon, and contribution to, architectural discourse during the period of the mid-1990's to 2005. This was a period of certain important museum building projects and, coincidentally, the period in which interest and application of digital design increased dramatically. The museum as a representative architectural building type that is strongly and directly influenced by the conceptual content of the cultural discourse in architecture was selected to represent features of the cultural expression that reflects the changes and evolution of concep-

tual structures that underlie digital design.

Among those projects that were selected are the following: Wexner Center for Visual Art by Peter Eisenman (1989); Carré d'Art by Norman Foster (1993); Milwaukee Art Museum, by Santiago Calatrava (1994); Groninger Museum by Coop Himmelblau (1994), Guggenheim Museum, Bilbao by Frank O. Gehry (1997); Salt-Water Pavillion by Kas Oosterhuis (1997); Hel Volkhof Museum by UN Studio (2000); Ambient Amplifiers Oslo by Ocean North (2000) Contemporary Art Museum – CAC by Zaha Hadid (2003); and the Art Museum in Graz by Cook and Fournier (2004). Relevant textual material was collected and gathered for further analysis.

2. Textual analysis

Employing the ICF methodology we undertook a first step in our Design Content Analysis. This first step was a deductive process identifying the relevant textual units in analyzed selected published material. Textual expressions that were found meaningful in this domain related to “Issues”; “Concepts” and “Forms” were stored in a common data-base. For example, the term “dynamic” is marked in figure 1 and 2 in bold letters in two different texts.

Contemporary Art Museum, Cincinnati / Zaha Hadid

(Webb, M, Out of the box, Architectural Review vol.214 no.1277, July 2003 p.28-65)

“A spatial and formal experience that is dynamic rather than merely useful that announces to all who enter that this is a place for experiment, a place to leave behind assumptions and conventions, a place that lays us open to the surprises and challenges that are necessarily presented by new art.. The constant alternation of enclosure and void, the shifts of angle and level, the cutaways that reveal unexpected vistas and the opening in the fifth-floor members room that reconnect you with the city, all contribute to a feeling of exhilaration few art museums can match.”

3. Thematic analysis and new categorization

In the thematic analysis, additional stages of analysis and conceptual categorization were made. On the basis of this analysis of textual expressions new categories have emerged. For example, significant terms such as: “dynamic” “interactive” “responsive”, “adaptive”, “hybrid” “animated”, etc., were classified as new categories. A new organization and classification was made. The focus here was on looking at the relative classification of selected terms within the text. In other words, the focus of this type of analysis was to look for the thematic quality of the term. This way we could identify expressions that were found as expressing different meanings in different precedents. For example, the term “dynamic” in the work of Contemporary Art Museum, Cincinnati designed by Zaha Hadid is describing a spatial and formal experience, while the same term “dynamic” in the work of Ocean North is related to a diagram employed as an enabling tool to get beyond a fixed scenario and design schemata. This was considered as a higher level thematic content in our research.

Figure 1. Design content analysis – Zaha Hadid: Contemporary Art Museum, Cincinnati

“The computer is used as an engine to produce **dynamic generative diagrams** which serve to address the mentioned aspects. The **dynamic generative diagrams** always feeds on contextual matter, but it deforms the fields of forms and forces in a topological animation, which produces series of intermediate steps, articulating and forming both spatial and temporal thresholds. The use of such techniques implies the introduction of an "untamed" set of information. The reason to do this is to resist the obvious "designed" solution, which would only engage in a fixed scenario. **The dynamic generative diagram is used as negotiation engines towards context as well as resistance buffers against fixed design schemata.**”

Figure 2. Design content analysis – Ocean North/ Ambient Amplifiers, Oslo

4. Chronological Analysis

The ICF hierarchical structure was classified to following levels: low level (e.g., describing technical means for modeling and representation); a conceptual- generative level; and a conceptual-thematic level. Digital expressions in this database were analyzed according to their classified location in the hierarchies of the ICF structure. The role of this analysis was to determine the different meanings that emerged as a result of this classified location in the ICF structure.

4. Findings

Our findings have demonstrated that certain expressions related to digital technology have moved up from a low-level descriptive function, such as the technical means for modeling and representation, to a significant conceptual role in formulating the design content of the building. This type of finding was implicit in the text itself. For example, the term “dynamic” appears as a concept in architectural projects designed by Zaha Hadid, Himmelblau, etc. It later appears as a new design issue related to the conceptual and theoretical understanding of designing in digital design works

such as those designed by Ocean North (see figure 2).

This new role of digital technology is also discussed by G. Lynn (Tate Gallery, 1995): “Themes of motion and dynamics in architecture are typically addressed through pictorial views of static forms...computer-animation software reinforces this normative assumption that architectural design belongs ...to be animated by a mobile view.” “This shift from determinism to direct indeterminacy is central to the development of a dynamic design method and will present a new role for design direction and authorship”. Such transformations of meanings were clearly demonstrated by our design content analysis method as can be seen in figures 1 and 2.

5. Summary and conclusions

A new approach to Design Content Analysis was accomplished employing the ICF analytical framework and tool in making a content-analysis in the domain of digital architecture. Our research assisted in demonstrating the following findings. We have identified new meaning for concepts that are associated with digital technology such as

“dynamic”, “animated”, “interactive” “responsive”, “adaptive”, “hybrid” etc. and new usage of terminology and conceptual structures in the design of digital design projects.

We have employed a thematic analysis of certain design hierarchies in our design content analysis. According to this thematic postulation in our research, design concepts have emerged as the architectural content of what is defined today as digital architecture. Due to this Design Content Analysis method we were able to demonstrate how selected terms within a text or texts, had changed their meanings during the last decade, although this information was implicit and hidden in the text.

We have demonstrated how these terms have changed their meaning from being employed as descriptive content of architectural production to terms that represent the paradigmatic content itself. Another significant finding was that the change of meaning of the same expressions was due to a chronological shift in understanding the conceptual content of digital architecture.

This method appears to provide a powerful analytical method to study the evolutionary properties and emphasis in current theoretical and critical formulations in the architectural discourse. Thus it appears to be a means to represent significant conceptual formations in domain discourse as well as to study and represent that elusive form of intellectual change that we might term, the dynamics of discourse.

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