Digital Design Hermeneutics

Proposing a Metacode for Architectural Pedagogy in the Information Age

Anthony Papamanolis[1], Katherine Liapi[2]
[1,2]Department of Architecture, University of Patras, Greece
[1,2]{apapamanolis|kliapi}@upatras.gr

This paper forms part of a broader inquiry regarding possible theoretical models for interpreting and understanding digital architectural design. Such models include hermeneutics, activity theory and design protocols. Starting by highlighting the limits of computational methods in an architectural context, it will be attempted to explore certain implications of the introduction of digital media in the design process. Certain elements from the field of hermeneutics will be introduced in order to understand the impact computational logic has on architectural culture especially in a pedagogical setting. It is argued that such an understanding is crucial in order to design effective strategies for architectural design education in the Information Age.

Keywords: *Computational Design, Architectural Pedagogy, Digital Design Education, Architectural Hermeneutics*

INTRODUCTION

In order to support the need for a holistic theoretical framework for digital architecture pedagogy, we will approach the issue of digital design media in architectural praxis from two different perspectives.

On the one hand, we will focus on identifying and describing certain characteristics that are inherent in digital design discourse. It can be hypothesized that these characteristics are an element the majority of contemporary computational design methodologies share in common, notwithstanding individual differentiations on the tools and logic utilized in each individual approach. Furthermore, we will attempt examine the effects these common characteristics have on the design discipline, especially in the context of architectural education. It will be argued that the questions posed by computational design logic to architectural pedagogical strategies cannot be answered through a narrow focus on information technologies.

On the other hand, an attempt will be made to utilize concepts drawn from the field of hermeneutics in order to address the broader challenges computational design poses for architectural pedagogy. It is posited that approaching digital design education as a process of understanding in the interpretive sense will aid in the comprehension of the broader architectural context in which it is situated. Although a comprehensive theoretical model for architectural pedagogy in the information age cannot be determined, it is hoped that the insights provided by a hermeneutic approach to the digital design process, some points of reference may be established.

NATURE AND LIMITS OF DIGITAL DESIGN

The introduction of information technologies in the form of digital design media in architecture has led to the emergence of autonomous field, that of computational design. In its context, computational tools and methods are not used as a glorified pen limited to the digital reproduction of preconceived projects (Pongratz & Perbellini 2000). On the contrary the digital is conceived as a collaborating partner in the architectural process, able to autonomously influence the design project (Negreponte 1973).

The far reaching implications of this conception of digital design in architectural praxis cannot be adequately examined in the context of this paper. Nevertheless, it is important to note the common assumption shared by these approaches, namely that how we design (i.e. "computationally"), ultimately affects what we design (i.e. "digital") (Kolarevic 2000).

In any event, these approaches are usually described as constituting a "paradigm shift" in the field of architecture (Terzidis 2006). Most of them revolve around the implementation of computational models in design via digital media and are therefore described as "algorithmic", "parametric", "emerging" etc. A detailed presentation of the "project" presented (Schumacher 2008) in each individual approach is beyond the scope of this paper. Suffice to say that it can be argued, that all "digital architectures" beyond the obvious influence on the "why" and "how" of design are affecting the "why", that is the purpose of the design process (Zellner 1999).

This unique "digital architecture project" (Leach 2002) revolves around the underlying principle that it is possible to computationally express at least some part of the design process and in doing so allow for a radically different approach to the architectural project. These computational expressions define digital methodologies (Kolarevic 2000) and borrow models from fields such a mathematics and geometry, biology and physics, computer science etc. In other words, digital design methods are based on concepts and structures transferred from the realm of the natural sciences.

In any case it can be argued that the important and usually overlooked aspect of digital design is the relation of these natural science frameworks vis a vis those parts of the architectural process that cannot be expressed in a computational manner. Furthermore it can be suggested that a disproportionate focus on digital methods in design could lead to the reduction of the broader field of architecture solely to those aspects that can be quantified (Vesely 2004).

Setting aside the broader philosophical questions regarding the conception of architectural design as a formal logic process of formal logic (Snodgrass & Coyne 1997) two individual issues of this paradigm shift will be briefly explored.

On the one hand it is highly doubtful that technology in and of itself can be the generator of meaning for the architectural project (Vesely 2004). Computational models are incapable of answering the question of "why we design" save in that case where the architectural project has been reduced to its basic and quantifiable elements. Therefore, methodologies revolving solely around such models of digital architectural design are limited in scope.

On the other hand, the fascination with advances in the field of information technologies often link architectural praxis to certain digital media or concepts. The rapid evolution of the field of computer science means that these tools and methods will be outdated in a matter of years. Since architectural thinking cannot adapt to the pace by which computational methods evolve, it risks either being rendered obsolete by technological advances either relegated to following the latest digital trend. Therefore, it is highly doubtful that it is possible to establish a meaningful theory for architecture based solely on digital media. On the contrary, linking design discourse exclusively to them affords architectural thinking neither the time nor the space to articulate a conceptual framework of its own. Instead it is relegated to describing fragmented personal visions (Vesely 2004) or isolated design methodologies (Goulthorpe 2003) without coalescing into a cohesive framework for architectural design in the Information Age.

The issues briefly outlined above constitute but some of the challenges facing architecture and design education in an increasingly digital world. One could list a vast number of issues that stem from the broader changes brought upon by the Information Age. Furthermore, it can be argued that it is a futile exercise to ignore these changes or even more try to resist them, since this new age is a fact whether architecture as a discipline agrees with it or not. What is at stake, is the position that architecture occupies within this new world, and how it can avoid either disappearing into the processes of production or retreating into a hypnotic solitude (Taffuri 1969). It is useful to cite Mies van der Rohe's description regarding the stance architecture should adopt when faced with another New Age, that of the Industrial Revolution. Mies suggested that what was important was not the mode of building, on the contrary, what was at stake according to him was a matter of spiritual nature. Architecture should focus not so much on the how and what, rather on how it can reassert itself vis a vis these new givens (Neumeyer 1991). This it can be argued remains true, whether we are discussing the Industrial or the Information Revolution.

Any such effort is essentially ontological in nature. As a result, it cannot be tackled through a strictly technological approach, since such an approach, as has been demonstrated will be limited to discussing the technical and quantifiable aspects rather than the spiritual ones. Therefore, it seems necessary to transcend a narrow computational logic that by definition limits the scope of architectural discourse. In order to achieve this, it is proposed that design thinking must turn to other fields to obtain the conceptual tools necessary for articulating a broader theoretical framework. This framework it is argued is vital if architecture is to address the issues that the Information Age raises and by extension if design thinking can escape a narrow computational interpretation and reassert itself in a digital environment.

TEACHING COMPUTATIONAL DESIGN AND ARCHITECTURAL EDUCATION

Before we turn to the description of the theoretical tools that will be used to underpin the proposed theoretical framework it is useful to briefly mention the educational aspect of the introduction of digital media to the design process.

The discussion regarding the optimal methods of introducing computational design to architectural education is almost as old as the concept of computational design itself (Asanowicz 1989) (Akin 1990) (Gero 1990). Again, it is not possible in the context of this paper to examine the nuances and particularities of each approach.

There is an ongoing discussion that covers various aspects, such as if digital design be taught in isolation or integrated in the design studio (Kvan 2003), if the curriculum should be changed to incorporate the new media or if the new media should be integrated in existing frameworks (Mark et al 2001), whether a process centric or project centric approach to digital design training should be adopted (Oxman 2008) and so forth.

It must be noted that any attempt to articulate a holistic conceptual model for design education is hampered by fact that it requires the backdrop of a broader architectural culture that can act as a point of reference. Unfortunately, contemporary architectural culture has been subsumed by architectural theory, which in turn is considered an autonomous entity, completely separated from what is considered architectural praxis (Hays 1998).

This fragmentation is especially pronounced in the field of digital design, due to the apparent autonomy of computational design methods from established architectural thinking. In other words it is even more difficult to reconcile digital media with architecture theory in order to establish and ultimately teach a cohesive architectural culture. As a result, it can be said that in contemporary architectural edu-

cation the practical aspects of digital design methodologies receive far more attention than theoretical architectural elements. This phenomenon can also be viewed in the context of two broader issues.

On the one hand it is the logical result of a broader trend against theory in the field of architecture (Martin 2005). This trend can be described as a preference to approach design projects in isolation as opposed to situating them in the broader social, cultural and political context of which they are ultimately a part. One can easily see how digital design methodologies, already somewhat distanced from physical reality due to their very nature are especially suspect of such a stance.

On the other hand, it is an unavoidable fact that elements subject to rapid change command far more attention than those that remain relatively unchanged (Gadamer 1975). In this sense, when considering computational design, it comes as no surprise that new digital tools and the capabilities they offer will inevitably be the focus of architectural discourse, as opposed to other aspects of the architectural field that it can be argued remain more or less the same.

Bearing in mind the factors mentioned above, namely the criteria of a pedagogical system and the fragmentation of contemporary architectural culture the theoretical models presented in the following paragraphs will attempt to outline the possible form of a conceptual framework to address said issues. It must be noted that it is not the goal of this paper to provide a detailed description of a mode of thinking, rather it aims to suggest certain elements that can aid in the articulation of a strategy regarding digital media and their introduction in architectural education. In other words, this paper aims to briefly explore certain "codes" that can be combined to form a "meta-code" of digital design. The term "meta-code", as elaborated by Frederic Jameson refers to the process of setting into active equivalence two preexisting codes that result in a new one that is more than a synthesis of the two previous ones (Jameson 1981).

Therefore it is hoped that the concepts described here will aid in the expression and interpretation of digital design and its impact on architectural education.

COMPUTATIONAL DESIGN WORLDS

It has been argued that digital design discourse shares a common theme. This can be defined as the implicit or explicit belief that at least a part of the architectural design process can be described, codified and explained in terms of a conceptual model based on computational logic (Snodgrass & Coyne 1997).

We can juxtapose this belief with the understanding of architectural process as series of "design worlds" (Mitchell 1990). In this context, design activity can be conceptualized as a series of operations involving primary elements (such as graphical tokens) according to a certain set of rules (for example a computational logic). This is termed a design world. Furthermore, within each design world, the operations undertaken should produce a result that satisfies both the internal logic of the design world as well as the original design intent.

Now it is important to note that nature of both the primary tokens manipulated as well as the rules that govern their manipulation depend on the nature of the design world selected. Therefore, a design process utilizing clay models will operate in a different framework than one utilizing freehand sketching, digital fabrication methods or parametric design software. In other words, what is designed depends on the chosen design world's interpretation of the architectural project.

It can be theorized that during the course of the design process, the architect utilizes multiple design worlds, depending on the aspect of the project he wishes to focus on. One can further assume that the ensemble of the utilized design worlds is in some way connected and influence the final design product to varying degrees. Taking into account the previously mentioned limitations inherent in computational logic models derived from the natural sciences, one can question

- the impact of digital design worlds on the whole of the architectural process and product (Salman 2016)

- the issue of integrating the teaching of these digital design issues in contemporary architectural pedagogy (Kvan 2003)

It must be noted that the utilization of digital means is not necessary for the implementation of a computational logic in design (Antonio Gaudi, Pier Luigi Nervi, Frei Otto are examples of a digital-less computational approach to architecture design). Nevertheless, this paper's argument will focus mainly on those methods / design world that utilize both digital media and digital logic.

THE LOGIC OF DIGITAL DESIGN

As has been established above, digital design methodologies can be conceptualized a category of design world, where both the elementary tokens and the rules according to which they are manipulated are dictated by the computational logic behind the digital media utilized. This leads to the description of the architectural process - that is to say the sequence of manipulations within the design world - as a formal grammar. (Mitchell 1990). As a result, at least part of the architectural process is codified in a language based on such models as syntactic structures and mathematical logic. In other words it constitutes positivist approach to architectural design (Snodgrass & Coyne 1997).

In the following it will be attempted to describe the limitations of such an approach and more specifically the problems it creates in an educational context. It is argued that the proliferation of digital media in the architectural field (Kolarevic 2003) has led to an increase in the possible design worlds that are structured around some type of mathematical - computational logic (Lynn 1999) (Spuybroek 2004).

As a result, it can be hypothesized that these "digital design worlds" form the majority of design worlds that constitute the entire design process. Therefore, computational and digital logical systems play an increasingly dominant role in architectural process and the resulting architectural product (Terzidis 2006) (Schumacher 2008).

It has already been discussed that these systems, being positivist in nature are unable to encompass all aspects of the architectural praxis, and are confined to those aspects that are in some sense quantifiable. Thus, the increase of digital design worlds in the process of architectural synthesis leads to those elements of architecture that are quantifiable to assume precedence over those cannot be codified and manipulated in the framework of a mathematical logic.

Therefore, how can the teaching of digital design methods incorporate the influence of digital media in order to restore the balance between quantifiable and non quantifiable elements in architectural pedagogy?

THE LIMITS OF COMPUTATIONAL DESIGN LANGUAGES

At this point, it is useful to briefly describe some characteristics and limitations of such computational logic structures and as a consequence, the characteristics of the models of architectural design they frame.

At its essence, computational thinking is conceived as a positivist model of language (Snodgrass & Coyne 1997).One can therefore infer that the design worlds structured by such logic will share the same characteristics. As such they claim, as Wittgenstein noted, to escape contextual preconceptions, subjective opinions and critical judgements and remove such notions from the domain of concrete experience.

"The limits of my language are the limits of my world. Logic fills the world: the limits of the world are also its limits" (Wittgenstein 1921)

This positivist conceptual model has several severe limitations, namely that understanding actually occurs in a context, as a "form of life" not through a logically described system of rules imposed on a situation. Wittgenstein utilizes an architectural metaphor to describe the relation of everyday language to the formal languages of logic.

"Our language can be seen as an ancient city - a maze of little streets and squares, of old

and new houses with additions from various periods and surrounded by a multitude of new boroughs with straight rectangular streets and uniform houses"(Wittgenstein 1921)

It could be argued that digital design methods are the new boroughs around the old city of non quantifiable aspects of the design process. In this context, how can a holistic framework for digital architectural language be understood in conjunction with the introduction of computation in design education (Kvan 2003)?

In describing the mechanism by which children learn languages, Wittgenstein states that they are engaged in a form of life, in which they share goals and interest with the teachers and parents who in turn do not so much define words and set rules, rather share a context with the child through which understanding is attained (Snodgrass & Coyne 1997)

"What one acquires here is not a technique, one learns judgments. There are also rules but they do not form a system and only experienced people can apply them right. Unlike calculation rules"(Wittgenstein 1921)

It is interesting at this point to compare this with strategies proposed to introduce shape grammars to architectural education (Stiny 1980) (Dokonal & Knight 2007). In both we can find a method of gradually introducing elements in conjunction with problems to solve as an educational tool. Therefore, we can hypothesize that in order to avoid the limitations of mathematical logic inherent in "digital design worlds" computational education in the context of an architectural pedagogy can be approached as a language game (Cheng 1996), in which computational tools are introduced as an element of the broader design process rather than an autonomous design world (Kvan 2003).

Thus, what can be claimed to be missing is an architectural language able to incorporate computational thinking into the broader architectural culture in order to teach design for the digital age.

ARCHITECTURAL DESIGN AS A HUMAN SCIENCE

In order to better understand the nature of this missing architectural language, the distinction between natural and human sciences must briefly be described. It has been proposed that digital design methods constitute models of thinking drawn from the field of the natural sciences (Kolarevic 2000).One can further argue that computational design logic, despite being based on an inherently positivist concept of language, as described above, has proved useful in architectural discourse and has indeed provided new paradigms and insights regarding the design process and product (Yessios 2006).In this context, whether these models are actually suited to represent the totality of architectural design seems beside the point (Snodgrass & Coyne 1997).

The counter argument to this thesis hinges on the differentiation between human and natural sciences. A general trend has been observed in the field of human sciences, regarding the adoption of precise and formal languages derived from the natural sciences. This is seen as the only method for the human sciences to be able to lay claim to the concept of truth and knowledge (Gadamer 1975).In other words, a field of human knowledge is seen to be in a way less truthful if it cannot be expressed in a mathematical - logical model.

It can be hypothesized that the current trend towards computational logic and digital media in the architectural design process represent such a phenomenon. Nevertheless, it is valid to claim that architecture as a field of knowledge cannot be conceived outside the context of human activity, and as such requires elements and modes of thinking from the human sciences.

The scientist of humanities cannot break free from human society - context and therefore cannot step outside it to examine it as an external object. By contrast, the domain of the natural sciences ignores facts and theories that do not conform to the strict logic of formal languages (e.g. mathematics). Focusing on the domain of architectural design, this means

that computational logic, when used to externalize at least part of the design process (Spuybroek 2004) ignores those parts of the architectural project that cannot be expressed in a digital design language.

One can remark that no pattern of human behavior can be understood unless the context (i.e. the non quantifiable aspects) can be taken into account. On the same note, no -digital- design methodology can be understood outside a holistic framework of architectural context that also takes into account the non quantifiable aspects of architecture.

A more elaborate examination on how human sciences and their methodologies differ from the field of natural sciences cannot be made here. Suffice to say that the natural sciences examine and explain phenomena which do not ascribe meaning to themselves. Human sciences by contrast attempt to understand phenomena which have a self-reflexive quality. As a consequence, they differ radically from the natural sciences in their goals, relation to practice and type of knowledge they disclose (Snodgrass & Coyne 1997).

When approaching design, especially in an educational setting, how can architectural thinking address and the limitations of computational logic in describing the architectural project? In order to examine this we will utilize the model of the hermeneutics circle

A HERMENEUTIC CIRCLE OF COMPUTATIONAL ARCHITECTURE

As has been described above, hermeneutics examine why understanding arises. In this sense, hermeneutics can contribute to the articulation of an architectural education framework regarding computational design by helping understand

- the impact of digital media on architectural education (on part of the educators)
- the purpose of teaching computational design methods (on part of the educated)

In order to achieve this it is proposed to approach the -digital- design process and education in the context of the hermeneutic circle. It is not possible in the context of this paper to fully elaborate on the structure and workings of the hermeneutic circle. Suffice to say that it is a model of understanding based on the dialogical relationship between part and whole.

To illustrate this consider the example of a text . It is obvious that the words that comprise it only make sense in the context of the particular sentence. But how does one reach understanding if in order to comprehend the sentence (the whole) one must be able to interpret the individual words (parts).(Snodgrass & Coyne 1997)

According to the hermeneutic circle one neither first ascertains the meaning of individual words (which is impossible considering the need for context to give meaning) nor reads the whole sentence and retroactively understands what is being said. Rather, we approach the sentence and project certain expectations regarding the meaning as soon as some sense can be established. This projection is based on the prejudgments we bring to each situation, which Gadamer termed prejudices. As the process of interpretation proceeds, our preconceptions are redefined based on new information acquired and the projected meaning is revised. This is a cyclical process in which one cannot isolate either the part or the whole.

"A person who is trying to understand a text is always preforming an act of projection. He projects himself a meaning for the text as soon as some initial meaning emerges in the text. Again, the latter only emerges because he is reading the text with particular expectations in regarding to a certain meaning. The working of this fore project, which is constantly revised in terms of what emerges ... is understanding what is there" (Gadamer 1975).

In broader terms, in any interpretive event, (which we can argue includes the design process) before we begin to consciously interpret, we have already placed the matter to be interpreted in a certain context, viewed it from a given perspective, conceived of it in a certain way.

"The process that Heidegger describes is that every revision of the fore project is capable of project-

ing before itself a new project of meaning, the rival projects can emerge side by side until it becomes clear what the unity of meaning is, that interpretation begins with fore conceptions that are replaced with more suitable ones. This constant process of new projection is the movement of understanding and interpretation" (Gadamer 1975)

It is these preunderstandings, or prejudices that form the core of Heidegger and Gadamer's critique of the Enlightenment's (and by extension natural science's) logic. The crucial role of these preconceptions, cannot be adequately explored in the context of this paper. Suffice to note that without preconceptions, i.e. based on a formal rule model, no understanding - as defined by human sciences can emerge.

Returning to the domain of architecture, we can question how computational design can be conceived in this context and how the hermeneutic circle can be applied to the -digital- design process.

A DIALOGICAL MODEL FOR DIGITAL DESIGN EDUCATION

We will now examine in some detail the potential of applying the hermeneutic framework described above in understanding computational design methods and teaching digital design. It has been demonstrated that architectural design can be approached as a dialectical process. The protocol studies conducted by Donald Schon describe design and design education in terms very similar to those of the hermeneutic circle presented above.

According to Schon, design can be defined as a reflective action, that is to say a process of dialogue between the architect and the design project. Briefly, this means that design progresses through a constant interplay between the designer and the design as well as between the part (i.e. the design element being examined) and the whole (the entire architectural project). What is important to highlight is that the process commences with the projection of the designer's expectation regarding the possible form of the architectural project (it can be noted that this is the literal interpretation of the word "project"). This projection is mainly based on the preconceptions the designer brings to the process.The design project then "talks back" to the designer, who in turn responds by adjusting his approach to the problem and by extensions revising his preconceptions.

This constitutes a circular model. Each design move (or question) is informed by the previous ones, while also affecting the expected projection of the whole. Therefore the designer creates a "web of moves, consequences, implications, appreciations of further moves"(Schon 1987)

This has several implications regarding the way we approach design activity.

- In the context of a hermeneutic approach design is not approached as a "problem", that is to say a situation that has a single correct solution. On the contrary the design process is conceived as a dialogue that aims at understanding the design situation.
- The relation between parts and whole, i.e. the relation of particular design actions to the total architectural projection. In other words, "local" design elements (such as those to which computational logic can be applied) cannot be viewed in isolation from the "global" architectural project the two elements define each other.
- Viewing architectural design as a hermeneutic act underlines the importance preconceptions play in the process. These "prejudices" frame the design situation by defining the expected outcome. Contrariwise, by providing answers to the questions posed by the architect, the design situation leads to the revision of those prejudgments. Thus the project is continuously modified and refined in tandem with the evolution of our preconceptions regarding it.

In light of this, it can be argued that designers can either allow this questioning to reframe his preconceptions or proceed in a one sided manner and ignore the inputs of the design process. It is obvious

that in a pedagogical process, it is crucial to be able to reconsider and evolve these preconceptions. Thus an hermeneutic approach is of use in an educational context, since it demonstrates that the design process, digital or otherwise is a process of understanding in two senses

- Understanding the design project
- Understanding the architectural preconceptions that led to it

"If the design educator acknowledges the ineradicable existence of presuppositions, recognizing them as stemming from experience that underpins all understanding and as the base from which the design image is projected, then the educator, rather than attempting to eradicate all prejudice in the students, will introduce them to a design dialectic, in which those presuppositions and preunderstandings are constantly under question and are revised, expanded or rejected as responses to those questions.We believe (sic) that this, rather than any model based on logical sequences of operation is fitting and appropriate foundation for a digital design pedagogy."(Snodgrass & Coyne 1997)

EPILOGUE

Further implications of the hermeneutic model to digital design cannot be adequately explored here.

It has been briefly demonstrated that computational logic is incompatible to certain architectural elements and that even those that are quantifiable and therefore able to be manipulated according to such a logic must refer to the architectural project as a whole iin order to be meaningful.

Also, the role of prejudgments and the ability to revise them according to the progress of the architectural process is something that is problematic in methods of computational design, since such models have no way of contextualizing them and therefore rendering them open to question.

It is hoped that a hermeneutic context may help in provide some insight to these issues especially in juxtaposition with other theoretical frameworks. It is further hoped that such a process will aid in the emergence "metacode" of architectural pedagogy for the digital age.

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