

# Digital Design Tools versus Architectural Representation and Design Approach

## *A reading off architectural press*

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**Abstract.** *This study aims to investigate the relation between evolving graphic representations and due to new digital tools and how they affect architects' approach to design process. In order to do this, Yapı Magazine being published since 1973 in Turkey will be retrieved and data related to types of architectural design representation used will be recorded. The study will conclude with an evaluation of new representation means such as 3D render, other 3D digital products and diagrams and how they have influenced new approach to design.*

**Keywords.** *Digital design tool; architectural representation, architectural design thinking.*

## INTRODUCTION

This study is interested in transformative reflections of digital design developments at two levels: architectural graphic representation and architectural stand.

The notion of “generic design” proposes that there are great similarities between design acts (Gero and Purcell, 1998) independent of the domain (Zimrig and Caine, 1994). On the contrary, there are also opinions supporting the presence of significant differences depending on design situations (Visser, 2009). Visser (2009) enhances the notion of generic design and states that there are different forms of design. He defines three dimensions as sources of differences in design consisting of the process, the designer and the artefact

Here it is hypothesized that as new tools of design are adopted, such as digital tools, a relevant shift in design stand takes place. This study aims to

read this shift through a collection of architectural representations.

## METHOD

This study will attempt to demonstrate a relation between the shift in graphic representation and design stand of architects in respect to architectural press, Yapı Magazine. Yapı, the oldest established magazine still in press today in Turkey, will be utilized as a tool in order to evaluate the chronological period between 1973, the year Yapı had first been published, and 2012 to understand how digital tools have affected architectural representation and approach. Yapı Magazine, as a tool to navigate through time and variety of projects, will provide evidence for claimed mutual evolution between digital design tools and architectural design approach that is proposed to be read off architectural graphic representation.

## READING OFF ARCHITECTURAL PRESS

The reason for studying evolution of architectural representation due to digital technologies off of an architectural press is that these magazines publish, at least today, a variety of projects with consistency and that they reach a large amount of people. Significance of its audience is that although it refers to architects, professionals and architecture students by content, anyone can reach it. It makes information on architectural design affordable and it constructs a communication line with the people in the same field.

An architectural publishing may reflect personal views of the author or a collective view of the editors. Certain types of style may be or may not be of preference to the magazine or which aspects of a design to focus on such as detail, process, construction etc. may depend on the principles set by the editorial board. Although a magazine may be reproduced from a subjective point of view, this is a consequence of communication through any kind of medium (Sert, 2006). What is more valued here is that architectural magazines provide a record of change in terms of preferences, culture, tool and representation.

## REPRESENTATION AS A REFLECTION OF THOUGHT: TOOLS HAVE SHAPED THE WAY DESIGNERS REPRESENT AND APPROACH TO DESIGN

Representation is a mean in which information is embedded. Abstraction and use of symbols are its core features through which the aimed information is communicated. It is a process in which an idea is presented in another form. In this process, information is put into related forms of conveyance.

Architectural representation acts as means of communication of those ideas embedded in design through a visual forum. In order to represent an architectural design idea, scale models, sketches, renderings, perspective drawings and photographs are used most commonly (Kalay, 2004). When communicating a design idea, representation methods that explain the project best are preferred. The in-

tent is to convince reviewers that the design solution is the preferable one to the design problem in hand. To achieve this, the project has to speak for itself through its graphics. The core of the design idea should be able to reveal itself through the way it is represented. Sole image of the design proposed is not always enough. The reviewer needs additional graphic representations that reveal intangible information about the design to fully comprehend it. Architects produce plans, sections, elevations, scale model, diagrams, flow charts, exploded axons to make the project as explicit as possible. The difference between these representation types is defined as either yielding the “receiver to be an active participant in the communication process, or pass the idea directly to the receiver” (Kalay, 2004).

As printing technology evolved and digital design tools became ubiquitously used, they made indispensable impact on graphic representation of a design which we have previously related to reflection of design stance. In 1970's, a project was represented solely with its technical drawings such as plans, sections and elevations. However, due to technological restrictions of the time, they were far from being explanatory and acted more as technical reports. These drawings are referred to as “static” by Kalay (2004). The drawings were made by hand and there was no way of altering them so that reviewers other than the client and the contractor may be involved in the process. These representation norms have also been necessary as they are today. Today, these technical drawings are enhanced with sketches, perspectives and other graphical materials. Today, we should review the gradual change of graphic representation norms and attitudes. The hypothesis is that, graphic representation of an architectural design have become more analytical and revealing in terms of how the building will behave once it starts functioning as well as the process leading to the particular solution.

In order to support this argument, a collection of examples relevant to a 40 years span of timeline will be utilized and make this tool dependent shift in graphic representation in architectural design

comprehensive. A paradigm shift from sketches to orthogonal drafted representations of design proposals are expected to evolve into photo-realistic renders, exploded axons and more descriptive diagrams regarding performative analysis, function and expected behaviour of the building and algorithms.

As Archim Menges (2010) points out, designing with digital software requires to think of design with an algebra of collections, in a more abstract way. Also architectural representation is not static as it had been; it also has transformed with regard to new ways of design approach.

In this study, architectural graphic representation is taken as a reflection of architectural design stand. Results regarding the design approach adopted will be driven through analyzing its graphic representation; and the impact of digital design tools on architectural design thinking is expected to become more rationalized as navigated towards present day on the chronologic timeline.

## THE STUDY

Yapi Magazine was examined from 1973 to 2012 to investigate the change in architectural graphic representation. Three issues for each year were examined. These issues are January, May and September – so that the publishing is followed with 4 months interval for the last 39 years.

The retrieval process consists of three phases. Graphic representation means were extracted through the first phase. They are as follows: plans, section, elevations, partial details, 3D renders, 3D digital perspectives – wireframe and axonometric views, sketches, hand drawn perspectives, diagrams, physical model photographs and photographs.

In the second phase, these graphics were quantified to see how intensely they are utilized. In addition, 3D digital perspectives – wireframe and axonometric views as also referred to as other 3D digital products, and diagrams were assessed in terms of for what purposes they were used so that they may be related to possible tool developments. During the second phase of the study, the records also included project name, function of the building and the archi-

tecture group in charge in addition to information regarding year, issue and page references. This additional information may help for a deeper understanding of representational means utilized as they may vary according to function or the design team being local or international.

And in the third phase, an assessment of the nature of drawing belonging to one category during the span of 39 years were compared qualitatively to investigate how that certain types of representation have evolved in time.

## RESULTS

Yapi Magazine was retrieved between 1973 and 2012. Relevant issues in 1973, 1977 to 1982, 1984 and 1986 to 1987 were either could not be found or has been observed not to contain any design projects. It is almost with 1990 that design projects are published with consistency and it is after 2001 that the magazine publishes multiple design projects in each issue. According to this, a total of 155 design projects were recorded in terms of which representation types they have used.

The first phase of the study shows that plan, section, elevation, detail (construction drawings) 3D renders, 3D digital wire-frame/perspective/axonometric views, sketches, hand drawn perspectives, diagrams and physical model photographs (explanatory drawings) and photographs are used collectively with varying percentages in time.

In the second phase, as already expected, the results show that plans, sections and elevations as conventional architectural representation types are commonly used. It should be noted that actual photographs of the buildings are the most frequently used representation type. However, this was omitted in the results so that the evaluations can be made within those types of representation that are involved during the design process. Beginning with 1994, 3D renders as well as diagrams and other 3D digital products start to enhance architectural representation medium. In Figure 1, a bar is dedicated for each year. Each graphic representation type is assigned a colour and bars are segmented according

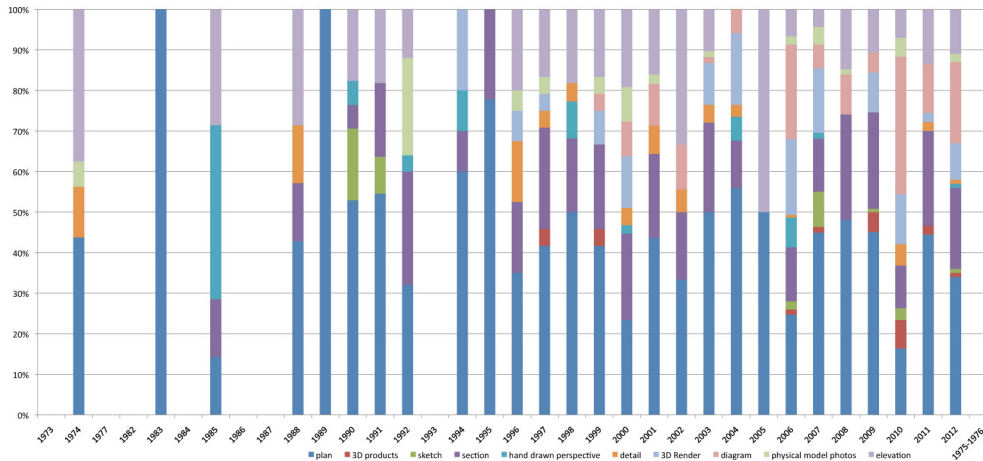


Figure 1  
Distribution of Representation  
Types Among Years.

to their percentage of use. The increase in the variety of colours between 1973 and 2012 represents the variation in representation medium used in presenting architectural design projects (Figure 1).

As it may be read on Figure 2, first 3D render has been encountered in 1994, first 3D digital product consisting of wireframe, perspective or axonometric views with no intention regarding photo-realistic images in 1997 and first diagram is encountered in 1999. It may also be observed that use of diagrams are usually aligned with use of 3D digital products and 3D renders are always the most preferred type

of representation among these three (Figure 2).

These data have also been re-interpreted in terms of by the design teams they have been produced. Expected frequency of 3D renders, other 3D digital products and diagrams have been much higher in contemporary design projects. However, since the data is acquired from a local magazine a question of whether the results may come up as expected had this study been conducted through a magazine of another nation or an international magazine. Results have shown that the number of international design teams using diagrams are triple

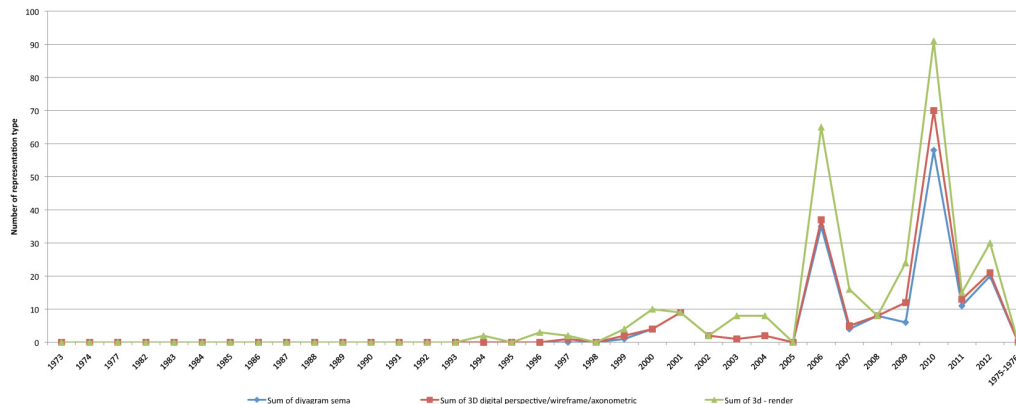
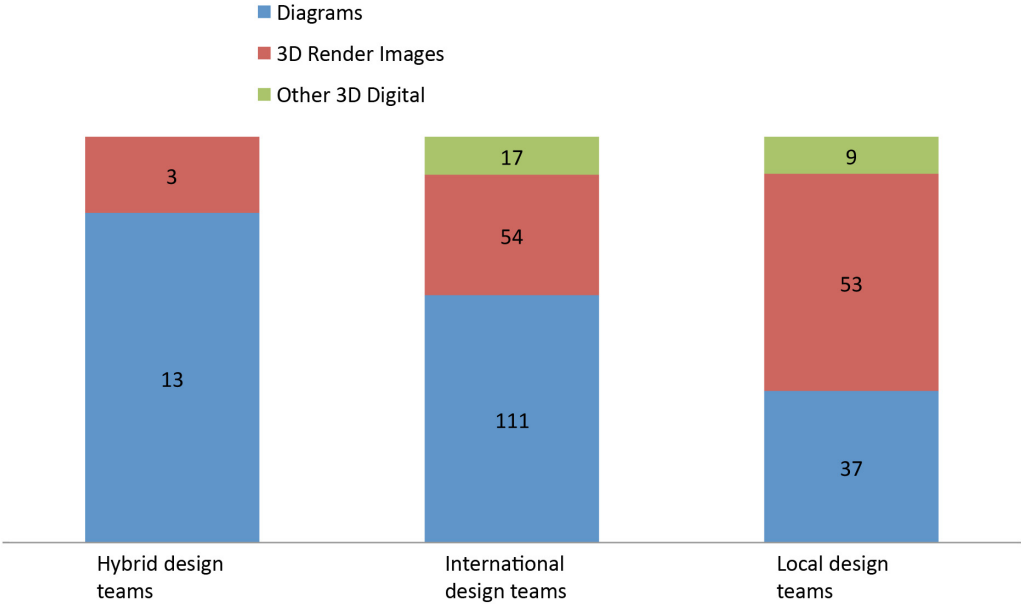


Figure 2  
Beginnings of representing  
with 3D digital media and  
diagrams

Figure 3  
Use of diagrams, 3d Render Images and other 3D Digital Products by Local and International Design Teams.



the number of local design teams. The number of international design team using 3D renders are almost equal to local design teams. The number of international design teams using other 3D digital products are almost double the number of local design teams utilizing these representation mediums to present their project (Figure 3).

The third phase of this study was an evaluation of qualitative features of the architectural representations. In the last years digital technology has influenced architectural representation and transmission of design ideas with new methods and tools. With new possibilities of expression in architecture, transmission of ideas has differentiated from traditional architectural representations.

In this direction, the presence of multi-disciplinary approach such as graphic techniques based on diagrams and schematic drawing, the use of abstract representations, more simple drawings even cartoonish, the presence of simple mathematical expressions can be found in architecture milieu.

Previously, architectural representation was once a language that can be understood merely by architects, planners and related disciplines but now it is transformed into a language that can be understood by everyone. Even traditional representations such as plan, section and elevation have transformed into a simpler and schematic form with reduced level of detail and high level of abstraction (Figure 4 and 5).

As Kalay (2004) mentioned, main mechanism that transforms an idea into a communicable message is abstraction. Abstraction, extracts and distills the meaning of the message, focusing attention on its salient characteristics. Higher degree of abstraction makes communication more efficient and it helps to focus the receiver's attention on the parts of the message that the sender considers most important. According to the results of the third phase, simple graphical expressions, schematic drawings and diagrams become a more efficient way of representing design ideas, an ideal method of communicating ideas to others (Figure 6).

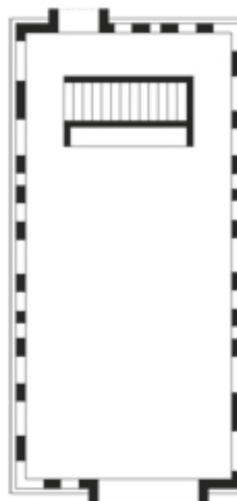
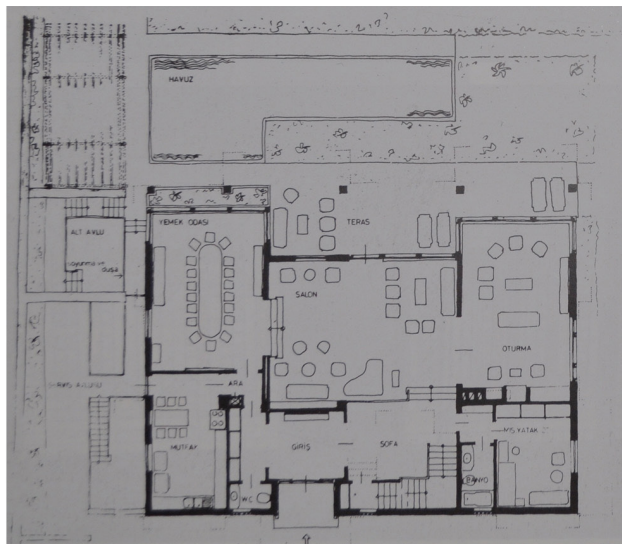


Figure 4  
Evolving Representation,  
Plan in 1990 and 2010 (Yapi  
Magazine).

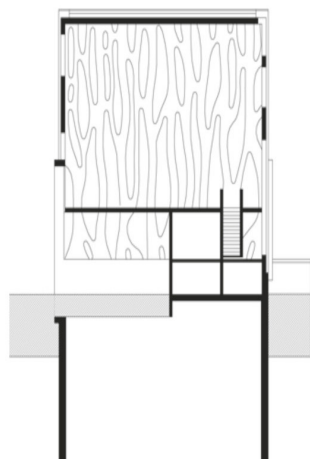
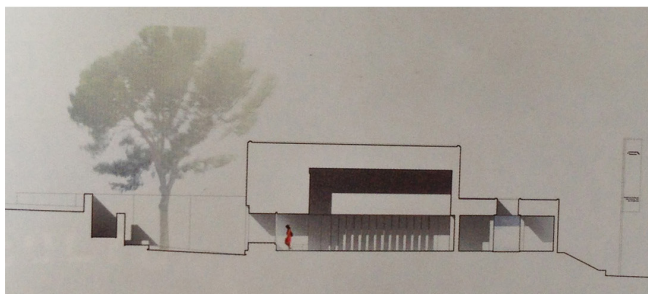


Figure 5  
Evolving Representation,  
Elevation, Section (Yapi Maga-  
zine, 2010).

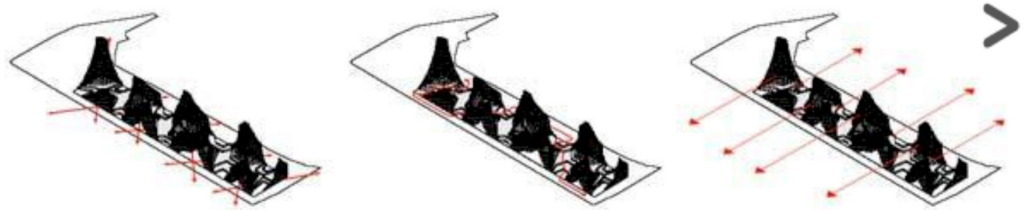
## EVALUATION OF RESULTS

### What Diagrams Tell

Diagrams provide a visual medium of communication for the sake of architectural representation. The most important feature of a diagram is that it has its own language that everyone can comprehend. They

work across linguistic and cultural boundaries. (Kallay, 2004) Another important feature of diagrams is that they tell stories regarding the evolution of an architectural idea. They may be referred to as inclusive and dynamic. They include any viewer into the process of form in formation. Contrary to traditional ways of architectural representation, they do not

Figure 6  
New Representations,  
Diagram, Battery Project,  
JDS+BIG (Yapi Magazine,  
2010).



act as final reports of a process but represent the process itself. They “*explore, explain, demonstrate or clarify relationships among parts of a whole*”. (Kalay, 2004) Similarly, according to Rowe (1987) diagrams are used to explore, analyze and synthesize ideas. Diagrams may be utilized to establish design principles that help the designer reflect on and prepare for subsequent exploration (Rowe 1987).

Architectural diagrams do not only represent physical elements, but also forces and flows. In the early phases of designing, architects draw diagrams and sketches to develop, explore, and communicate ideas and solutions. Design drawing is an iterative process. It involves externalizing ideas to store them and recognizing functions as well as finding new forms and integrating them into the proposal. Thus drawing is not only a vehicle for communication with others. It also helps designers understand the forms they work with (Edwards 1979; Do and Gross, 2001).

With a more thorough approach, Oxman (2000) states that diagrams play a role in visual reasoning. And through what this representation medium provides, what Schon (1992) refers to as “*reflection in action*”, what Lawson (1980) describes as having a “*conversation with the drawing*” takes place and aids the design process.

### What 3D Products Tell

According to Lopes (1996) due to techno cultural changes, pictures are re-emerging. They now play a role in terms of storage, manipulation and communication of information.

Beginning with 1994, 3D render images have evolved into photo-realistic images where the de-

sign proposal is presented as a finished product. This representation type is specifically chosen for presentation purposes rather than aiding design development phase. These images are used to aid those who are not architects or professionals in familiar fields but individuals who can not read construction documents.

Although this representation medium needs to be evaluated differently than diagrams and other 3D digital products, it also serves for the same purposes: inclusion and exposition. Similar to diagrams, 3D render images also tell stories. They are used to reveal how the space created during different times of the day or different days of the year. Through the photo-montages made, they give clues regarding how the spaces may be used and what kind of life will take place once its inhabited. These images are used for revealing a certain experience provisioned for designed space.

According to Bares-Brkljac (2009), these images inherit accuracy, realism and abstraction. It is through these features that non-professionals believe in what they see. According to this, accuracy aids non-professionals to be acquaintance with the space. It is related to scale, distances and relations of volumes and spaces. (Bares-Brkljac 2009) It is also related to chosen view points regarding angle and height. Human eye angles are preferred on purpose so that the viewer can imagine himself in the picture. Realism helps the viewers understand and evaluate the proposal the same way they perceive the environment. (Bares-Brkljac 2009) Abstraction refers to reduced information about design. (Bares-Brkljac 2009) A high level of abstraction may not sufficiently present the proposal where a low level



of abstraction may overload an image and draw the viewer away with the information he does not need and comprehend. According to Bares-Brkljac, the collective effect of accuracy, realism and abstraction in relevance to the form, influence observer's perceptual responses.

On the other hand, Koutamanis (2000) draws attention to a cognitive property of this representation medium by stating that they act as a reinforcement of internal representation by external ones.

### **Why have we not encountered more?**

Contrary to expectations, research areas studied in the computational design such as parametric design, scripting and building information modelling (BIM) has not taken place in the design magazine to represent design proposals yet. This may be due to similar reasons for why use of CAD tools have been slow in the 1980's. In 1980's, Jon Pittman explains the reason for slowness in computerization as the expenses of owning the machines. Koutamanis' (2000) approach also supports Pittman's. After the democratization of computer technologies domain specific systems such as drafting, modelling and computer generated images were expected to flourish. However, this process took time as well. According to Koutamanis, *"The main reason has been the understandable caution with which we approach systems that purport to improve not only efficiency but also design quality and performance."*

Although today, every design office holds sufficient amount of hardware and a more advanced software along with its know how, these offices can not afford to spend time to master even more recent software offering new methods and possible incompatibilities due to new design methods between co-workers and other professional teams. However, the authors expect to see these contemporary methods of design and their graphic representatives in architectural design magazines in the following years.

### **CONCLUSION**

Evolution of new digital tools and new representation medium for the architectural design process

has enriched the way architects represent their work. And how they represent their work is here associated with their stand and the way they think about architecture through what these new representation types offer. According to this and through the data acquired from Yapı Magazine regarding the use of representation types, this study may conclude that architects have become more process oriented, expository, transparent in terms of reflecting the design process, inclusive rather than exclusive or isolating, abstract as well as more precise in revealing experience where on the contrary it had been all about communicating the information to the contractor to build the project.

The authors had expected to encounter traces of contemporary design methods such as algorithmic design, building information modelling and parametric design. However, due to reasons explained above the expectations have not been met. The belief is that these methods still need time to penetrate into more design offices and find place in design magazines ubiquitously.

If another magazine was chosen as source, the data may come up differently due to publishing principles of the magazine. However, this approach is still seen valid since it establishes a controlled experiment by stabilizing the source and searching for evolution of new representation types among years.

Again, if another magazine was chosen with an international identity, some results may have doubled since the results of this study has shown that the number of international design teams using diagrams, 3D renders and other 3D digital products are double the number of local design teams utilizing these representation mediums to present their project

A future method to test this idea is to look at design competition entries both locally and internationally. This way, more ambitious sets of representation is expected to encounter as well as more contemporary methods of representation where architects feel encouraged to try new methods rather than to follow conventional methods of a design office.



## REFERENCES

- Bares-Brkljac, N.:2009. Assessing perceived credibility of traditional and computer generated architectural representations, *Design Studies*, 30, 415-437
- Do, E. and Gross M, 2001, Thinking with diagrams in architectural design, *Artificial Intelligence Review*, Kluwer Academic Publishers, Netherlands, 135-149.
- Edwards, B. (1979). *Drawing on the Right Side of the Brain: a course in enhancing creativity and artistic confidence*. Los Angeles, J. P. Tarcher.
- Kalay, Y., 2004, *Architecture's New Media*, MIT Press.
- Koutamanis, A. 2000. Digital architectural visualization, *Automation in Construction*, 9, 347-360
- Lawson, B. 1980. *How Designers Think*, The Architectural Press, London.
- Lopes, D. 1996. *Understanding Pictures*, Clarendon, Oxford.
- Menges, A.2010, *Instrumental Geometry*, in Corser, R. (eds), *Fabricating Architecture*, Princeton Architectural Press, New York, pp. 22-41.
- Oxman, R. 2000. Design media for the cognitive designer. *Automation in Construction* 9, 337-346.
- Pittman, J. 2003. Chapter 18: Building Information Modeling: Current Challenges and Future Directions, in Kolarovic B. (ed), *Architecture in the Digital Age: Design and Manufacturing*. New York: Taylor and Francis. pp.254-8.
- Purcell, A.T. and Gero, J.S.:1998. Drawings and the design process, *Design Studies*, 19, 389-430.
- Rowe, Peter. *Design Thinking*. Cambridge: MIT Press, 1987.
- Schon, D.A., Wiggins, G.:1992. Kinds of seeing and their function in designing, *Design Studies* 13, pp. 135 - 156.
- Sert, G. B., 2006, *A Survey On Photographic Representation In Architectural Magazine Covers: Covers Of Arredamento Mimarlik*, Master Thesis, METU, Ankara.
- Visser, W 2006. Both generic design and different forms of designing, Paper presented at Wonderground, the 2006 DRS (Design research society) International Conference, Lisbon, Portugal, November 1-4. <http://hal.inria.fr/inria-00118256/en>
- Willis, D. and Woodward, T. : 2010, *Diminishing Difficulty: Mass Customization and the Digital Production of Architecture*, in Corser, R. (eds), *Fabricating Architecture*, Princeton Architectural Press, New York, pp. 178-213.
- Zimrig, C.M., Craig, D.L. 1994. Defining design between domains: an argument for design research a la carte in C. Eastman, M. McCracken and W. Newstetter (eds) *Design Knowing and Learning: cognition in design education*, Elsevier Science, Amsterdam pp 125-146.

