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LEARNING THROUGH GRAPHIC COMMUNICATION ON THE VERGE OF DIGITAL ERA

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Abstract

Today, architectural and computational knowledge are not performed as different medias in both academic environments and practice. The evolution of design knowledge and praxis compels studio education and representation to change.

Not completing the argument of paper representation of architecture/architectural knowledge we are discussing digital/computational representation of it. Certainly, the most challenging point is derived from the representation of architectural knowledge in artificial media. The root of the problem lies in the nature of architectural knowledge and its representation. Still the representation argumentations are in progress on the other hand we are struggling to go one level forward from using computers just as a design partners. Since, the adaptation of digital thinking and design has already started. As a result of these changes, design studio practice has been evolving towards this digital medium.

In this route we have many questions waiting to be answered. One of the most interesting issues is the knowledge that is produced throughout the digital media. The question of how design learning system has been evolving worth searching on it. The context of the question is broad however the works about the subject can be examined within the course framework. The main aim is not to answer the question but to be aware of the implementations and their possible results that might lead us different perspectives.

Keywords: *Design, Representation, Studio, Digital media, Tacit knowledge, Explicit knowledge.*

DİJİTAL ÇAĞIN EŞİĞİNDE GRAFİK İLETİŞİM YOLUYLA ÖĞRENME

Özet

İçinde buluduğumuz dönemde, sayısal ve mimari düşüncenin, akademik ve pratik alanlarda, farklı kavramlar olarak ele alınmadığı; hatta bu kavramların, söz konusu alanlarda, birbirlerinin yerini alabilecek şekilde kullanıldığı ve düşünüldüğünü görüyoruz. Pratik ve teorik alandaki bu kavramsal kaosun uzuntasının tasarım stüdyo eğitimini etkileyerek bir değişime neden olduğunu söyleyebiliriz. Tartışma, mimarlık bilgisinin kağıt üzerindeki temsiliyetinden çok, bu bilginin sayısal temsiliyeti üzerine yoğunlaşmaktadır. Burada, zorlayıcı nokta, mimarlık bilgisini, sayısal ortamdaki temsiliyetinden kaynaklandığı düşünülmektedir. Bu nedenle, yanıtlanması gereken önemli sorulardan biri 'sayısal ortam yoluyla' üretilen bilginin ne tür bir bilgi olduğu ve bu bilginin nasıl üretildiği üzerinedir. Bunu anlayabilmek üzere, bu araştırma kapsamında, bu bilginin üretildiği ve karşılıklı paylaşıldığı stüdyo ortamında, 'teknik çizim stüdyo', mimarlık 3. sınıf öğrencileri ile dönem boyunca yapılan çalışmalar ele alınmıştır. Bu şekilde, sayısal ortam yolu ile ortaya konan (elde edilen) 'mimarlık bilgisi'ni anlamaya ışık tutacağı düşünülmektedir.

Anahtar Kelimeler: *Tasarım, Temsil, Stüdyo, Sayısal ortam, Örtük bilgi, Açık bilgi.*

1. INTRODUCTION

The drawing can be considered as the basis of a visual and mental transaction between the designer and the representation (Oxman, 1997)1. According to Schön, designer correlate in "graphical conversation with the design" or "the designer has a conversation with the drawing" according to Lawson (Schön 1983, Lawson 1980).

The human capacity to "transform knowledge into representational structures" underlies the ability to make novel modifications and changes in those representations (Oxman, 1997). Researchers have demonstrated that representations of drawings which are procedural are not flexible for innovative manipulations until they are turned into explicit declarative re-representational form (Oxman, 1997).

On the other hand the graphical representation of drawing depends on medium/tool that is employed. When the medium/tool is changed the representation paradigm shifts. Also one can ask how knowledge that is gained through drawing differs if the medium is changed.

In this paper the study tries to shed more light on the paradigm shift of the different drawing media from the knowledge point of view. This perspective leads us to split up the question into two sub-questions: first, which kinds of media underlie the development of knowledge in architectural representation, and second, if the media is changed/interrupted does knowledge shift?

To answer the first question the article will start by defining knowledge/knowing perspective from several disciplines, which might be useful to grasp on the issue. This results in a final framework, which distinguishes between passive knowledge and active knowing of components and concepts. The framework is then used in an experiment, which explores the role of the studio works in the development of this knowledge/knowing. Also we will focus on different types of representation to understand the nature of the studio works.

Afterwards, these will be used as a framework to examine the knowledge perspective(s) actively present in and during the constructional representation of designed project process.

2. KNOWLEDGE

Rather than focusing on how several knowledge perspectives in philosophy, economics, psychology and sociology differ, we will look for complementarities and overlaps between them. Afterwards, these will be used as a framework to examine the knowledge perspective(s) actively present in and during the design process.

2.1 Knowledge, Experience and Action

Unlike the empiricist argument, Kant (1966) acknowledged experience as the basis for knowledge, not only and unique root. Rather, he argued knowledge emerges from a co-operation between logical thinking and sensory experience. Marx (1961) declared that perception is an interaction between knower

(subject) and environment (object). In the pursuit of knowledge, subject and object are in a continual dialectic process of mutual adaptation as the object is being transformed in the process of being known (Heylighen, 1999).

Contrary to the Cartesian dualism of subject and object, of body and mind situates the pure essence of the human being in rational thinking itself, so that knowledge can be pursued by simply separating this thinking from the rest of the human experience (Blackburn,1994). Nonetheless, in seeking for knowledge, contemporary thinkers, such as Kierkegaard, Sartre.

Wilde, and Kimmel, challenges this division by emphasizing the importance of the interaction between the self and the environment. This is also stressed in the existentialist idea that if we want to know the world we must act towards it (Kierkegaard et al., 1962) or the pragmatic thesis which, unlike the spectator theory of knowledge, recognizes the interrelationship and interaction between theory and practice, knowledge and action (Dewey, 1957; James, 1971). Ignoring this interaction contributes to the divergence between how a task, as it unfolds over time, is perceived by someone working on it and how it looks with the hindsight of being finished. The latter view tends to see the action in terms of the task alone, yet remains blind to the constantly changing conditions of work and the world which actually structure the process of doing the task (Brown et al., 1996). Consequently, actual practice inevitably involves tricky interpolations between abstract accounts and situated demands (Orr, 1996). Therefore, a positivist epistemology of practices implies three dichotomies: the separation of means and ends, the separation of research and practice, and the separation of knowing and doing (Schön, 1983).

Schön's (1983) distinction between the model of technical rationality and the practitioner's reflective conversation nicely integrates these oppositions between subject and object on the one hand and between knowledge and action on the other hand. The model of technical rationality posits that an objectively knowable world exists, autonomous of the practitioner's values and beliefs. In order to obtain correct technical knowledge of this world, the practitioner must uphold a clear boundary between himself and the object of his inquiry. His stance is that of spectator/manipulator, observing the world and keeping his distance from it.

None of these holds for the reflective conversation where means and ends are interdependent, practice is seen as a kind of research, and the 'inquiry is a transaction with the situation in which knowing and doing are inseparable' (Schön, 1983). When adopting this perspective, the practitioner becomes an agent/experient who treats each situation he deals with as unique and uncertain. His interaction within and with the situation does not only shape it, but also makes himself a part of it. However, he knows that the situation 'having a life of its own distinct from his intentions, may foil his projects and reveal new meanings' (Schön, 1983). Thus, the reflective inquirer–practitioner tries to shape the situation to his frame and at the same time to keep open to the situation's back talk. Schön here speaks of double vision: the practitioner must not only act according to the view adopted to shape the situation, but also recognize and be able to break his view open and leave it behind. It is only by adopting this vision that he will grow in his work.

2.2 Tacit-explicit Knowledge

Another interesting issue is the contrast between explicit knowledge and implicit, c.q. tacit knowledge. Polanyi (1964, 1967) bases these categories on the degree to which knowledge can exist independently of a specific context or 'knower'. Tacit knowledge only arises when knower and knowing become one, also called 'indwelling' (Grene, 1969), since its acquisition tends to be staggered over time and rooted in experience. Hence, the frequent comparison of tacit with practical or empirical knowledge (Dewey, 1960; Sternberg, 1981), while explicit knowledge is brought into line with academic or theoretical knowledge. Given that the former is embedded in the knower whereas the latter can migrate easily among different knowers, it seems more suited to speak of personal/universal instead of tacit/explicit knowledge (Badocarro, 1991).

3. REPRESENTATION

Representation is a key concept in cognitive sciences and one, which has profound significance for design. An accessible way to understand what theories of mental representation and computation have contributed to the understanding of mind is provided by Thagard (1996). He views thinking as representational structures in mind which are operated upon by (computational) procedures. Mental representations go beyond the descriptive power of models. They constitute rigorous formulations of the symbolic content which in combination with certain operation, or procedural acts, can simulate and explain human thought processes.

A second meaning of the term refers explicitly to representation as the symbolic graphical representation of designs as a "language of design". The learning of the conventions of these graphical languages of representation is one of the central objectives of design education (Oxman, 2001).

3.1 Types of Representations in Design Communication

Brereton classifies four dimensions of representation when considering their use by designers.

Internal vs. external

Internal representations are the thoughts in the designer's mind to which researcher does not have direct access. External representations of design thinking are spoken utterances, written lists, drawings, prototypes, etc. These external representations are directly available to design researcher.

Transient vs. durable

Many design representations are transient, produced in the act of designing but never captured. Words articulated and gestures in a design discussion are transient external representations. On the other hand, durable representations are those sketches, drawings, and physical prototypes that endure and can be

kept and referred to. They are often used as communication devices at meetings and they form the basis for further design developments (Brereton, 2004).

Self-generated vs. ready-made

Self-generated representations are produced by designer in the act of designing, such as words articulated, sketches produced, and CAD (computer-aided design) drawings drawn (Brereton, 2004). Brereton states that in addition to generating their own representations, designers often search for ready-made pieces of hardware (material representations: raw materials such as string, cardboard, wood and steel) in their environment and use them in order to help them think through an idea.

Abstract vs. concrete

Designs are described by representations at various level of abstraction. Sketches are abstract because they leave much of the detail undefined. So that sketch representations can be interpreted in various ways. Sketches are often the preferred means of representation and communication at the idea generation stage, precisely because they do not force designers to pay attention to details that designer is not yet ready to consider, this is why it is so frustrating to use CAD system when one wants to sketch (Brereton, 2004).

On the other hand more concrete and specific properties are required in engineering drawings. In contrast to a sketch, an engineering drawing of a design is very specific. Engineering drawing conventions were established to ensure that a trained constructor can interpret a drawing in only one way that is what designer intends. Also a drawing specifies the materials to be used.

Although representations vary from abstract to concrete, this scale alone cannot characterize the level and quality of information in a representation (Brereton, 2004). Different representations make different kinds of information available.

It is important to refer a representation is “direct” or “indirect”. The only “direct” representation of a design would be the final built entity. All other representations would be “indirect”, allowing to what will be the final design.

4. DRAWING REPRESENTATIONS (EXPERIMENT)

This chapter focuses on two main issues:

• how drawing medium-digital and paper-are instrumental to representing what students know, and

• if the drawing media differs the knowledge is differentiated**.**

However, there is a need for empirical research to investigate how representation with the computer is possible where drawing ability is hindered rather than facilitated. It is also important to identify the

changes to the nature and structure of the drawing process that needs to be made if CAD is to be used as a representation tool about what is designed to be built precisely.

It might be better to focus on the dilemma of drawing on paper and digital media where all contradictions are originated. Both, paper and computers, serve as a representation medium of our description on how we think, interpret and instruct. Nevertheless, they are not equal while we are translating from what we think to drawings.

To exhibit this conflict an inquiry is offered. First, the conditions should be introduced. The class of inquiry participants (Thagard,1996) consists of third and fourth grade architecture students taking construction drawings studio. Students are asked to draw constructional application one of their own designed project. They are thoroughly forbidden to draw on the computer based medium. The nature of the studio is not a design problem. What required is to draw the structural and physical system and materials that are utilized of own designed project.

Therefore, the nature of the problem is more close to reflecting know-how by the representation rather than the creative nature of design problem. Within this context, if drawing on paper helps transforming our "tacit knowledge" into explicit knowledge? In addition, it can be argued that the drawing flow is interrupted when digital/computer media is used.

4.1 Nature of the Problem

According to author there are two contradictions: one is derived from the media used during the drawing process and the other is tools that are operated. Scope of the paper is to search for the knowledge shift in different representation mediums.

First, is the ready-made graphic representation offered from CAD softwares. To clarify the argument, some observations have made throughout the studio works. The ready-made graphical representations such as hatchings, material surfaces and line types are, when drawn in digital media, supposed to be decipherable or/and legible. In the studio students were asked to name the different hatchings from CAD softwares represented distinctly. The results are shown on Table1 and Table2. According to tables most of the students name the hatchings as they are named in the program softwares. However, most of same group of students could not draw most of the hatchings in a box named below. Compared their CAD drawings with pencil drawings, students usually draw as the draw in the CAD medium. When they draw in the CAD medium, although they are aware of the importance of the line thicknesses, material differences, they do not regard these differences. According to tables we can easily say that there are many gaps and different types of representations of architectural design construction in student minds. This inference might lead us another problem of architectural representation of our time, which is we are in.

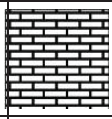
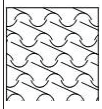
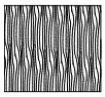
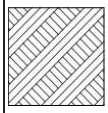
			brick	gravel	roof	wood	earth	r.concrete
		CAD hatchings from ArchiCAD						
3th grade	Length of digital medium usage	for 1 year (total number of st. in this part:6)	6	3	6	4	1	4
		for 2 years (total number of st. in this part:6)	6	3	6	3	2	3
4th grade	Length of digital medium usage	for 1 year (total number of st. in this part:3)	3	0	3	3	0	3
		for 2 year (total number of st. in this part:2)	2	0	2	2	0	2
		for 3 year (total number of st. in this part:1)	1	0	1	1	0	1
		for 4 year (total number of st. in this part:2)	2	1	2	2	2	2
Class total			20	7	20	15	5	15

Table 1. Number of students named hatchings from ArchiCAD tools depending on grades and length of any CAD program used.

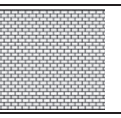
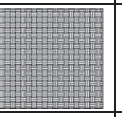
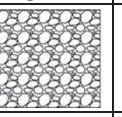
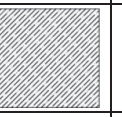
			brick	earth	gravel	r.concrete
		CAD hatchings from AutoCAD				
3th grade	Length of digital medium usage	for 1 year (total number of st. in this part:6)	6	0	3	2
		for 2 years (total number of st. in this part:6)	3	1	2	2
4th grade	Length of digital medium usage	for 1 year (total number of st. in this part:3)	1	0	0	1
		for 2 year (total number of st. in this part:2)	0	0	0	0
		for 3 year (total number of st. in this part:1)	0	0	0	0
		for 4 year (total number of st. in this part:2)	2	2	0	2
class total			12	3	5	7

Table 1. Number of students named hatchings from AutoCAD tools depending on grades and length of any CAD program used.

	Which medium do you prefer to draw application project?		What did you gain drawing by hand and paper instead of computer?					
	computer	pen/paper	learning by practicing	no difference	line, graphic representations of structure and materials	representation tech. depending on drawing scale	detailing	expertise
3th grade	18	-	1	4	1	2	3	3
4th grade				5		2	1	2

Table 3. Questionnaire and results.

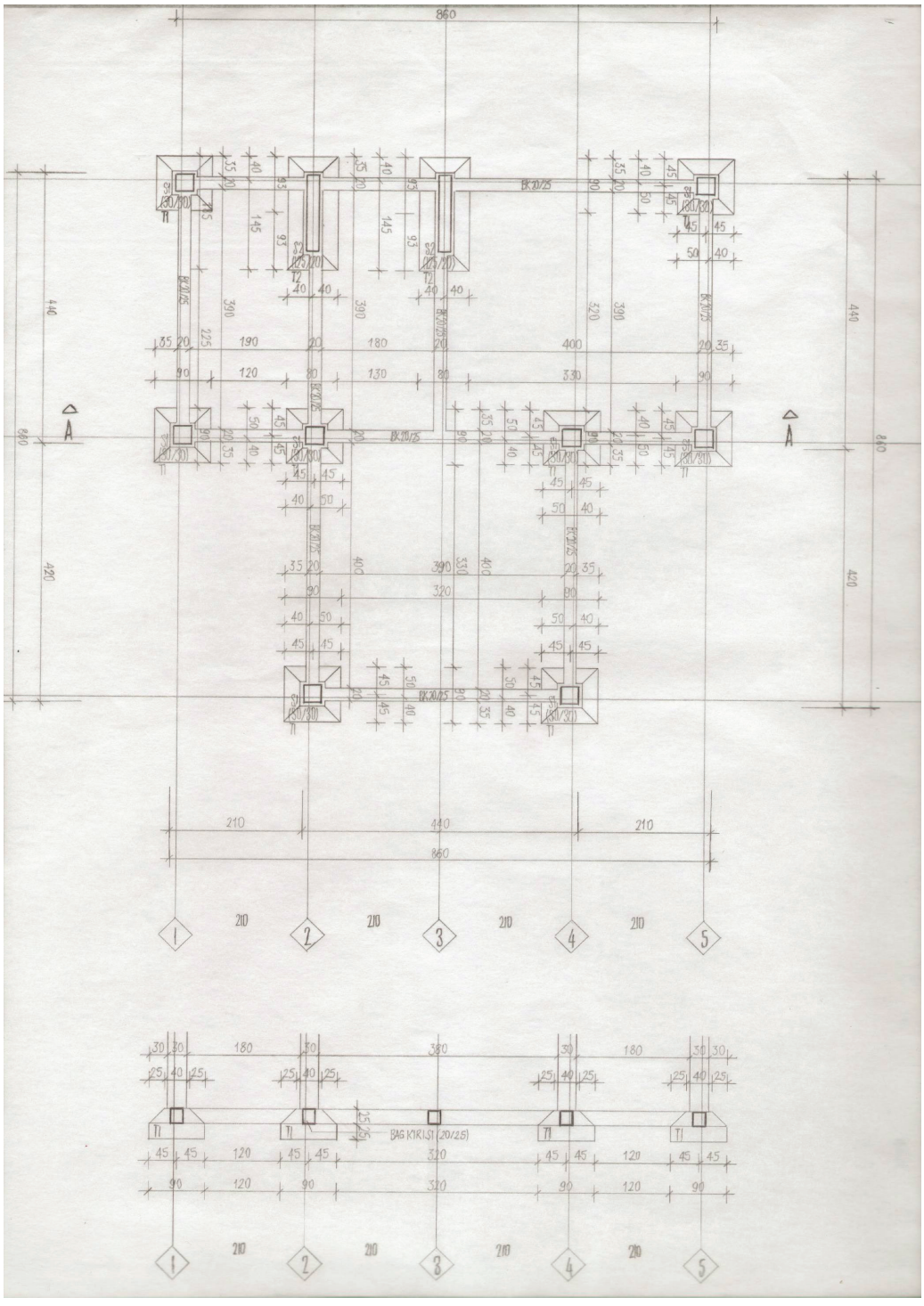


Figure 1. Drawing enise çelik, foundation plan, mid-term submission.

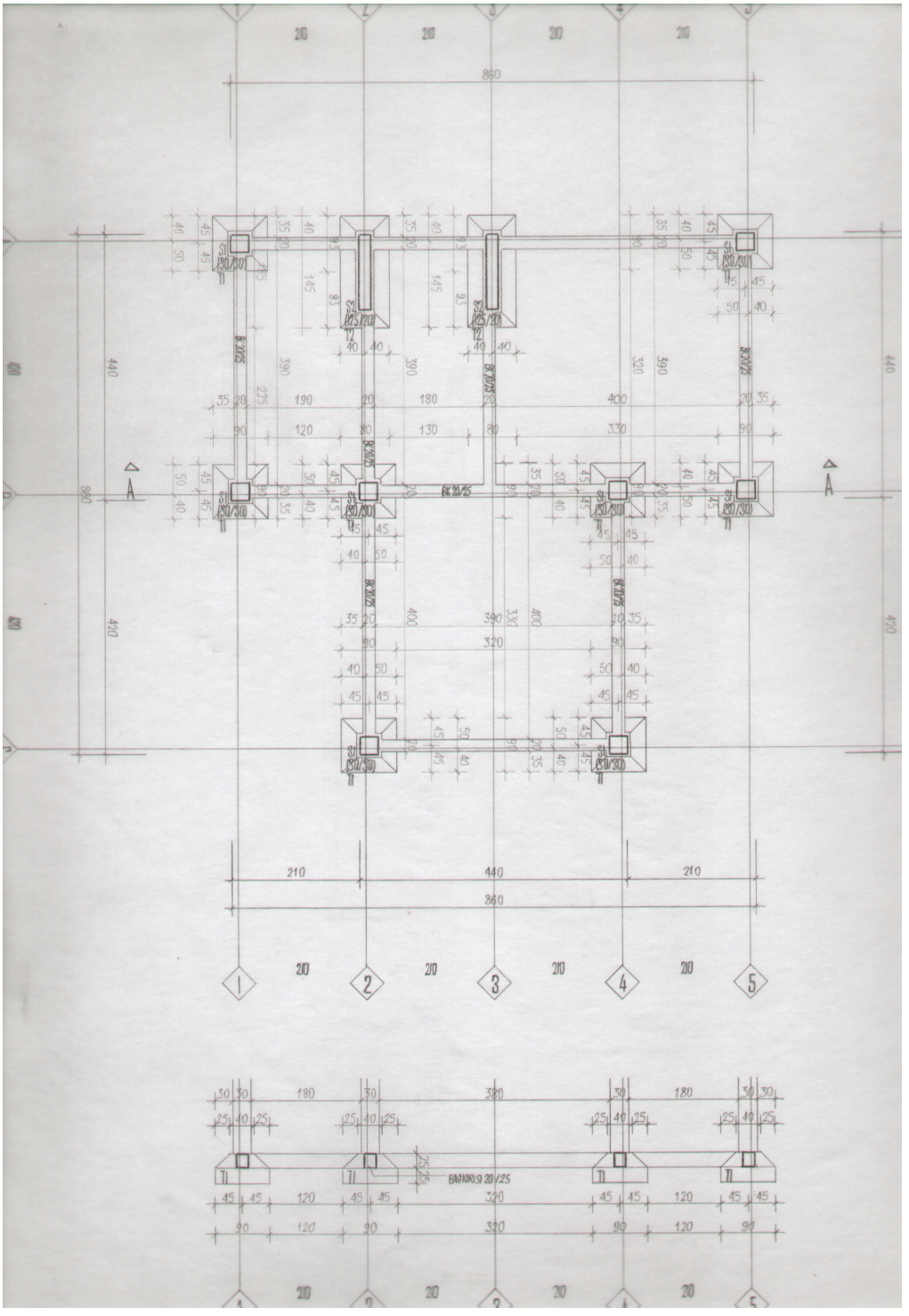


Figure 2. Drawing enise çelik, foundation plan, final submission.

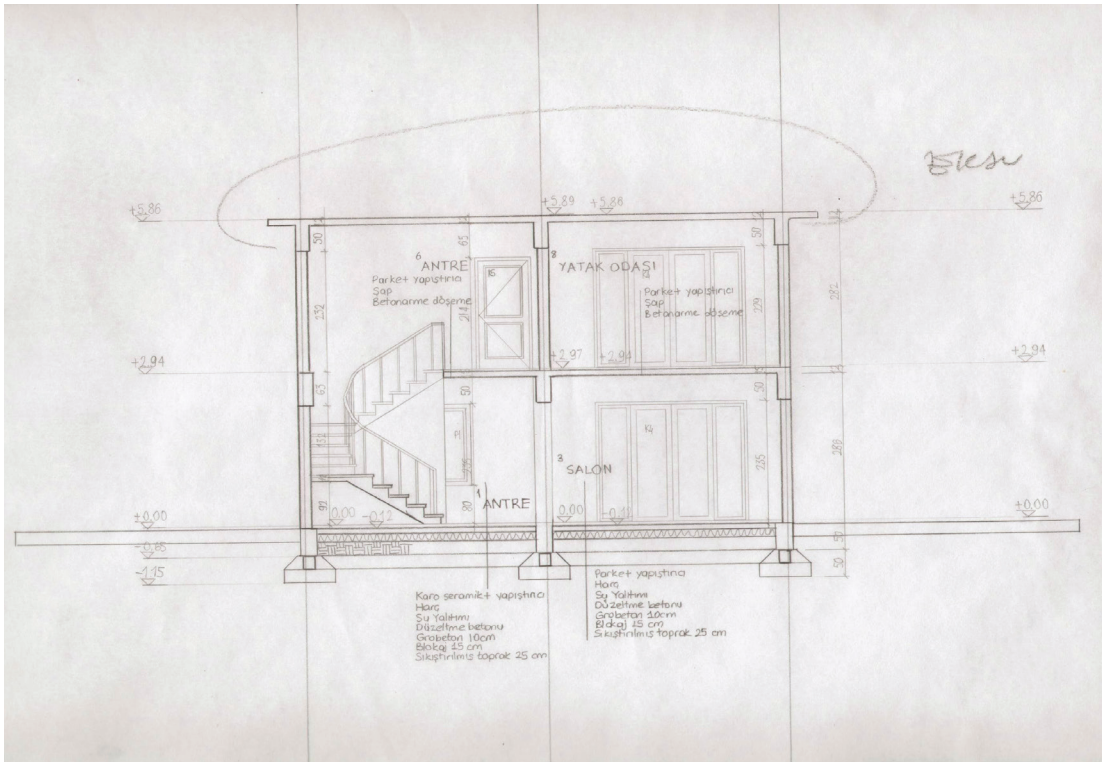


Figure 3. Drawing enise çelik, cection, mid-term submission.

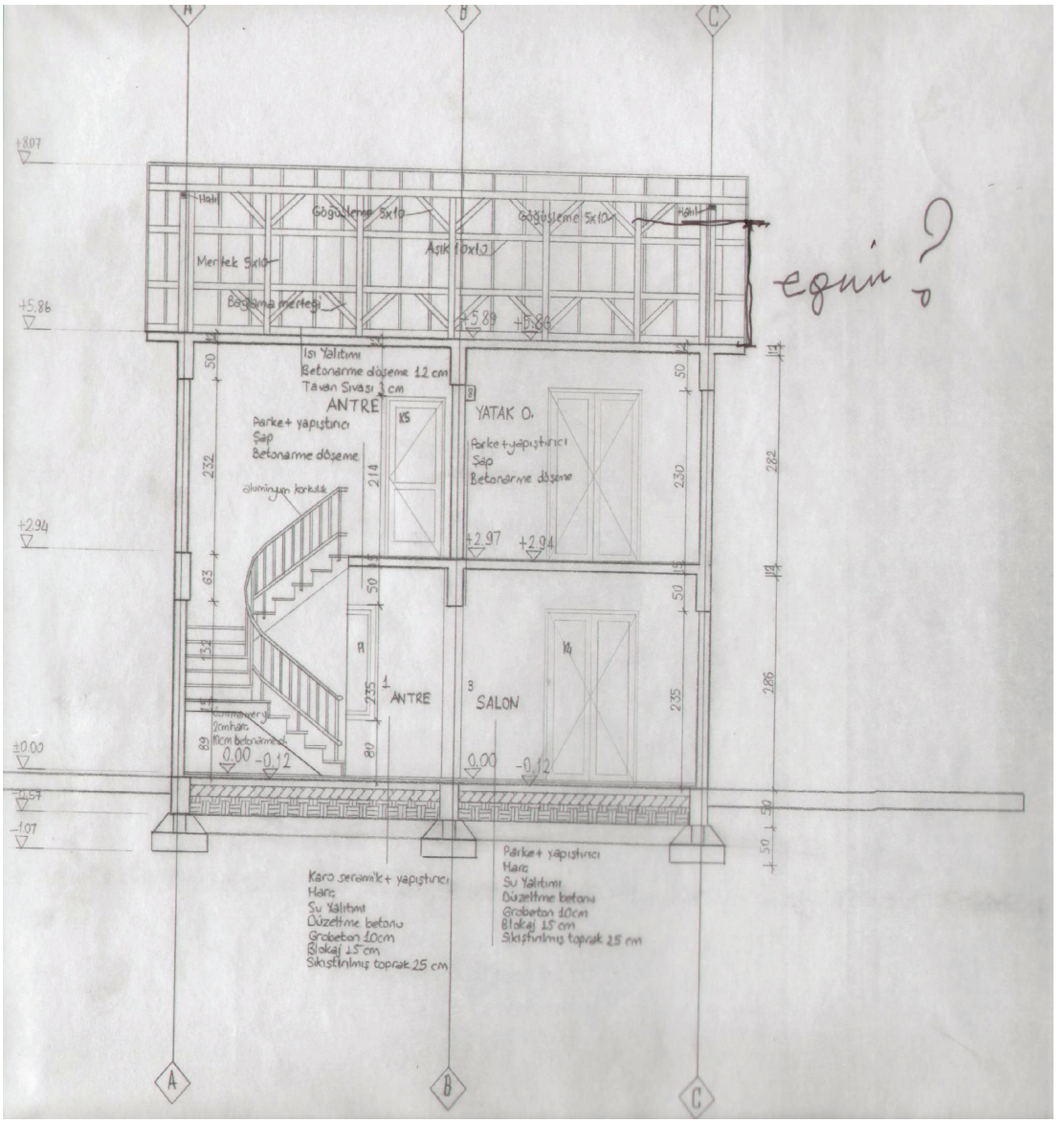


Figure 4. Drawing enise çelik, section, final submission.

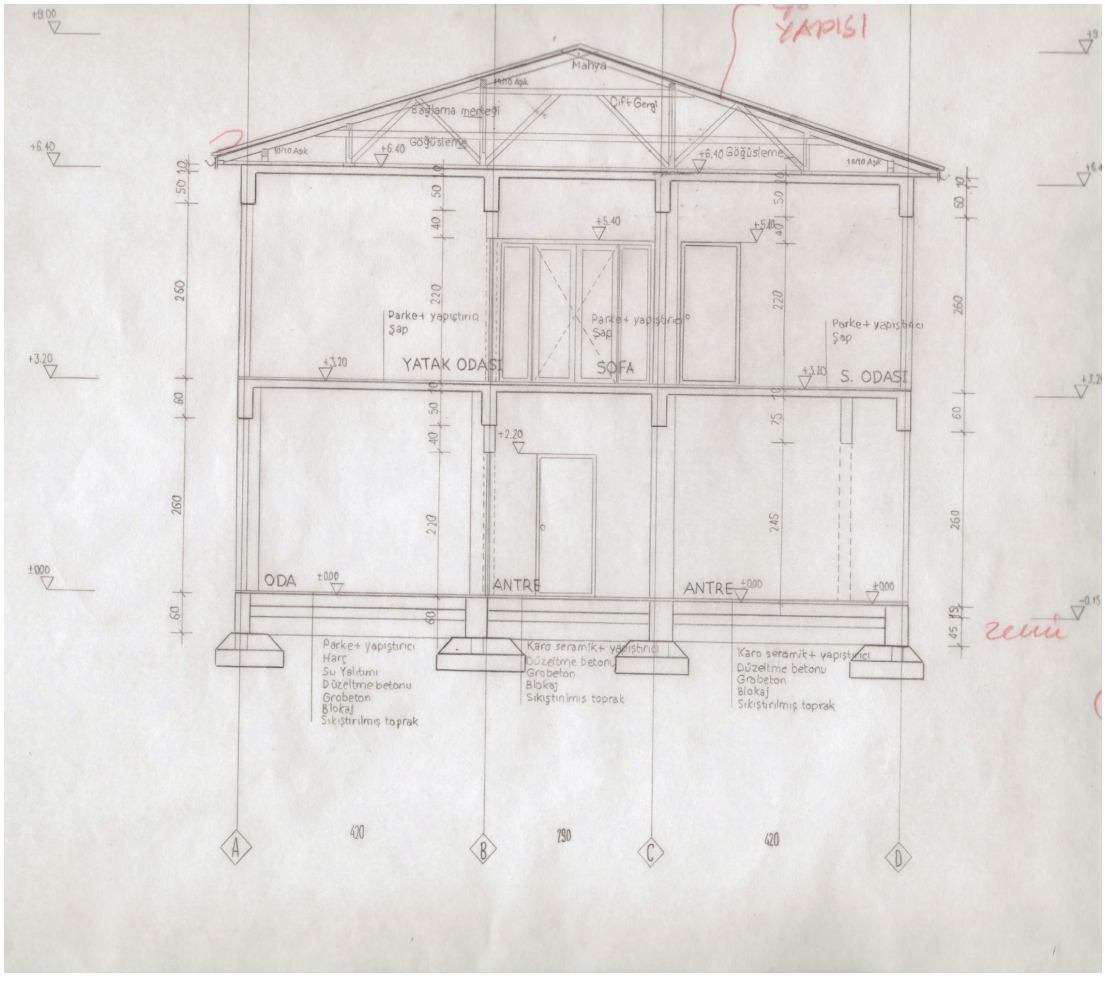


Figure 5. Drawing saadet gökçek, section, mid-term submission.

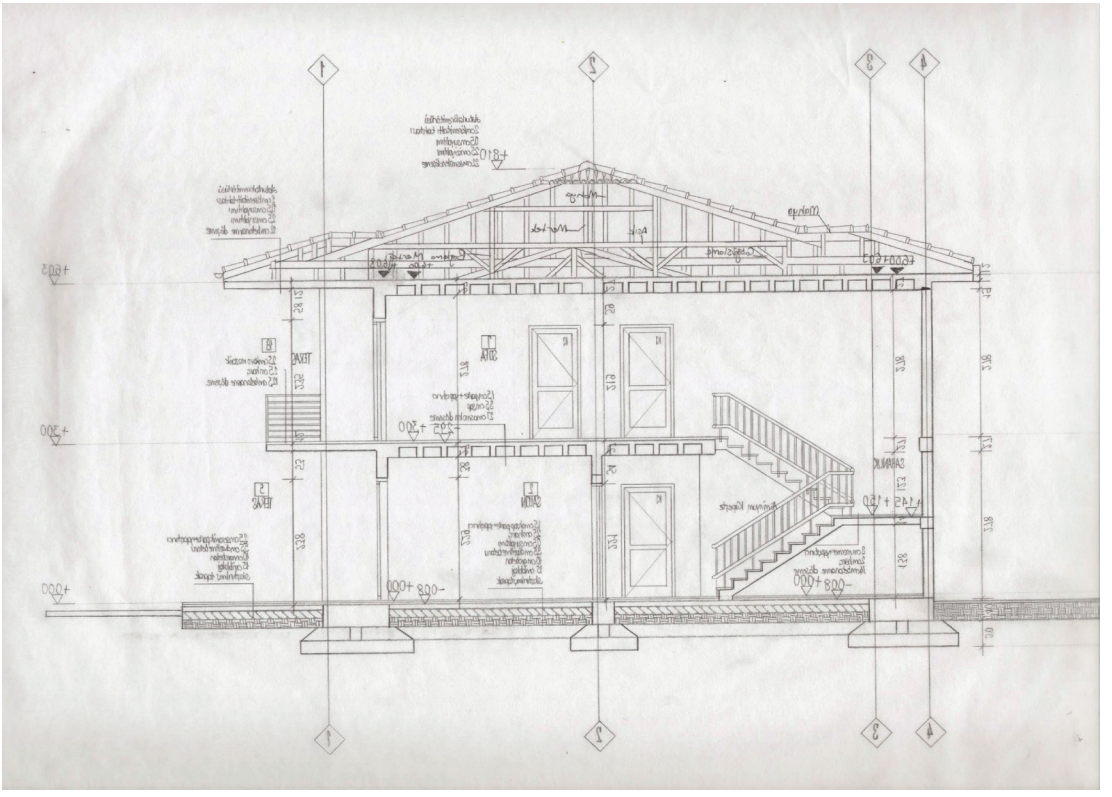


Figure 6. Drawing saadet gökçek, section, final submission.

5. CONCLUSION

In this paper drawing is a kind of experience so the more one draws the more he-she is experienced. Since the act of drawing turns into an experimental activity so the knowledge is gained throughout this experience.

In this study the followings as preliminary propositions are asserted:

1. Drawings in design are the acquisition of the cognitive ability to represent design knowledge and

2. once the medium is changed the knowledge is shifted.

Before concluding my paper I would like to share information from Mr. Branko Kolarevic presentation about: "Surface Effects and The Craft of Digital" (Kolarevic, 2009).

Generally, Kolarevic, (2009) represent what the digital knowledge is and how it is integrated and performed in "material" world. Also, he stated that since the enlightenment the academic world is behind the industry (he means by academic architectural schools and by industry the construction business). Since today, one can directly send the drawing to the construction field and with the help of the electronic tools,

what you have drawn can be built exactly on the 3D coordinate, where you want it to be. He was not presenting his future digital "from design to construction" process, there are architects and constructers who has already been working in this way although this technology is rather expensive. Furthermore he anticipates in the very close future all construction activities work this way. Than what makes Kolarevic's offer interesting to me and what is the relation with this paper. He offered new type of understanding in the architectural education, kind of "digital Bauhaus". Since the architectural representation mediums have been rapidly moving to digital media.

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