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**ARCHITECTURAL DESIGN TOOLS:
“Toward a non-linear design process”**

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“Just as you cannot do very much carpentry with your bare hands, there is not much thinking you can do with your bare brain.”

Bo Dahlbom and Lars-Erik Janlert, ext. D. Dennett, ‘Making Tools for Thinking’, 1997.

Abstract:

This paper is based on the research for an ongoing PhD. thesis. In this paper I will retry to answer a simple crucial question like; “How can we teach design, without creating copies of ourselves?”

First part of the question is the ultimate question of design education: “How can we teach design?” Looking for an answer for it we end up with another question “What should we teach in design education?” The architectural design is a socio-cultural cognitive activity. It is a part of a very unstable and ever changing context networked around history, economy, politics, ecology, esthetics etc. Under these circumstances trying to teach ‘what to design’ is obsolete. The design is a statement of the self as a product of its never-ending dialogue with its context; culture. Since every context and every individual are unique how can we be sure of a way of designing will work under all these non-stable circumstances? This brings us to the second part of the first question: ‘without creating copies of ourselves’. The goal of design education should be to improve freethinking independent individual minds qualitatively and quantitatively.

During the last couple of decades a number of ‘design methodology’, ‘design theory’ and ‘design strategy’ were proposed as an answer to how should we teach design, omitting a very important point: The design methodology is a design itself. It is a compilation of smaller experiences. It will work only under certain circumstances. Every individual possibly will design its own methodology at the end of the day but to institutionalize a design methodology is obsolete. The subject of design education should be how we think not the designed thing. In order to have better designers we must improve the way we think, not what we think. This is very true above all in the first year design studio.

If the methodologies and theories are large compilations of smaller carriers of actions and thoughts that can be called ‘tools for thinking’, why shouldn’t we teach ‘architectural design tools’ so they can be available for the young minds to be recompiled again for yet another strategy to design. The proposed design education model at the end of all these discussions is as follows:

We will teach architectural design tools and how we use them,
which will create a ‘design environment’,
which will instigate ‘architectural thinking mode’,
which will process yet another ‘design theory’,
which will produce a ‘design’.

The full paper will try to discuss all these concepts, their consequences and the benefits of design tools approach for the first year design studio in detail, using diagrams, texts and visuals based on the five years of first year design studio experience as a moderator in ITU Faculty of Architecture, architectural project studios.

Keywords: first year design studio, design tools, architecture culture, design education, cognitive studies, non-linear systems.

Discussion

This paper is based on the research for an ongoing PhD. thesis.ⁱ In this paper I will retry to answer a simple crucial question such as; “How can we teach design, without creating copies of ourselves?”ⁱⁱ

First part of the question is the ultimate question of design education: “How can we teach design?”. Looking for an answer for it we end up with another question “What should we teach in design education?”. The architectural design is a socio-cultural cognitive activity. It is a part of a very unstable and ever changing context networked around history, economy, politics, ecology, esthetics etc. Under these circumstances trying to teach ‘what to design’ is obsolete. The design is a statement of the self as a product of its never-ending dialogue with its context; culture. Since every context and every individual are unique how can we be sure of a way of designing will work under all these non-stable circumstances? This brings us to the second part of the first question: ‘without creating copies of ourselves’. The goal of design education should be to improve freethinking independent individual minds qualitatively and quantitatively.

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Motivation

The proposed design education model at the end of all these discussions is as follows. But first it would be wise to explain the motivation behind the model. First year design studio of ITU Faculty of Architecture is composed of more than 200 of interior design, landscape design and architectural design students. Their choice to be an architect or a landscape designer is rather unconscious due to the system to become eligible for higher studies. As a result their motivation to be an architect or a landscape designer is very low while their will to learn and commitments to their studies are very high. Sheer numbers makes it impossible to continue with master and pupil system. Same numbers creates a risk for a mass produced, identical, shallow crowd of designers. Same numbers makes it a perfect place to experience diversity and range of alternatives. Controlling all the inputs and outputs of the class is near to impossible.

The Model

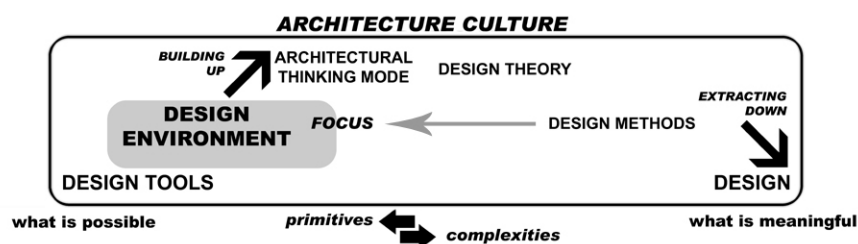


Figure 1. The Model “*Setting of Designing*”

We will teach architectural design tools and how we use them, which will create a ‘design environment’, which will instigate ‘architectural thinking mode’, which will process yet another ‘design theory’, which will produce a ‘design’.

Tools

In order to start contemplating about the model (Figure 1), one certainly needs a rough definition of a design tool. I say rough because in the root level where tools dwell within the cognitive machinery of our wet computers, things are prone to blend with another. They are volatile. They are many things at the same time and they are not stable, they change.

Description of a tool is a great discussion itself in cognitive studies.^{iv} To make it simple we can say that it is a thing that enables one to make other things. The trio of a subject, a tool and a thing is interconnected. Every one of the trios defines the others. They make a whole.^v Their relationships are complex and reciprocal. For example someone makes a tool, someone with the tool makes a thing. Someone is no longer is his/her old self; s/he is someone with the tool. The tool acts on the thing but it also acts on the user as well. We can say that the tool made by someone, makes someone somebody else.

Using tools is doing things with things. New things can be used to do new things as well. These things can be learned or discovered. They are compiled with time and experience and they form our personality (Dennett, 1992). They are not processed in a Cartesian theater somewhere in our brain. As Dennett suggests, there is no central processing unit at all within our cognitive system. In fact the tools may be the key elements in our thinking.

To design is doing things with things. We use design tools consciously or unconsciously when we are designing. So, what things are design tools? As always the answers lie in what are not. Designing is an iterative process (Hunt, 1997). One has to look to what s/he thinks in order to continue with the thinking. Or seeing random things related to what one is thinking about helps as well. Visualization and visual thinking are key concepts to design.^{vi} Because that is how we designers think. Drawing and model building are the two very important means to externalize ones thoughts and enabling him/her to look at them. I may radically suggest that drawing tools and model making tools are not design tools. And even if they are, they are indirectly influential in our understanding of the way we design. We may describe them as physical tools or hardware, like pens, compasses, rulers, cutters, papers, computer drafting programs, rapid prototyping etc.

Design tools are cognitive in essence. As a matter of fact, Baber (2003), specialized in ergonomics, in his book about physical tools suggest that even a hammer may be a cognitive tool.^{vii}

Cognitive tools may be very simple or complex. There are tools made from other tools in chain. There are tools compiled of other tools as in the concentric circles or clusters within clusters. We treat tools simple or complex in the same level to produce more tools like life treated primordial oceans of bacteria to produce more life. For example the grid is a design tool. Made in chain sequentially from line, surface, standard dimensioning to grid. The plan is

a complex design tool. We may call it a super tool. It is a compilation of other tools such as alignment, flux, fitting etc. Longer I think about one tool more tools I discover which it is made from. But we simplify, and treat them as one. The plan is a design tool, as the grid, the circle, the circulation, the module, the juxtaposition and the fold all are. There is an abundance of tools when we are tuned to *tool-ward thinking* mode.

If we continue contemplate with what is not a design tool, the other edge is much more ambiguous. As the tools get more and more complex, we leave behind the super tools and enter the realm of algorithms, tactics, strategies, methods and theories in order of complexity. They are not design tools. They are designs of high order like the design product we are aiming for.

Environment

Externalization of thought and ideas and being able to look at them in order to augment our capacity of thinking recalls Andy Clark's environmentally extended mind (Clark & Chalmers 1998). We think with our environment. Furthermore, Beth Preston (1998) who proposes to redefine tools as equipments based on her readings of Heidegger demonstrates that equipment use is a cooperative venture of the organism and the environment, not just that an active user does to a passive environment. Tools and environment are inseparable when we consider process involved in tool use. Even environment itself becomes a tool, like in the case of the fishing line. You set the scene and the environment works for you. Fish volunteers to be caught. You don't hit it with a spear and catch it. Environment catches it for you.

The second zone of the model, a design environment created by design tools, is the key part of it all. It may be a large studio as is the case ITU Faculty of Architecture or a small room. It is the setting where design education is possible. The teacher at best merely sets the scene and the students learn. Notice that focus is shifted in this model from the designed product to design environment. Teacher has no power over the student or what s/he or she will design. Teacher's kingdom is the design environment. In this environment teacher becomes the moderator, students become learners and knowledge producers simultaneously. Design environment is not merely tables, chairs and other physical hardware. It is also how a subject is given, what is talked and discussed, what is done and exhibited. All the things and actions in the design environment are created for a purpose and that is to tuning of the thinking of students in to the architectural thinking mode.

Mode

Our brain has a capacity to work in different disciplines. For example the characteristic difference between engineering design and architectural design is long discussed and evaluated. According to Akin (2001) architects tend towards creative design strategies while engineers tend to routine design.

I presume that there are different thinking modes used by engineers, architects, poets, sculptor, economist etc. With the help of a little motivation we can reprogram our brains from one to the other. Some of us are competent at switching quickly from one on other. These special kinds of thinking modes are the reason behind the characteristic behaviors of professional domains. For example one of the main issue of architectural thinking mode is the scale. Architect's ability to perform in smaller scale models is more sharpened for example from an industrial designer who is accustomed to one to one mock-ups. So the design environment should be reprogrammed to enhance student's performance in the smaller scale models. Further investigation is needed to increase these examples.

Thinking modes are mainly socially induced, learned from the environment. Many thinking modes are conveyed through families during the early periods of life. Some of them are inherent to the culture they generate.

Culture

We live in the culture. It is our natural environment. It is produced by us and we are produced by it. Culture is a super compilation of items, myths, concepts, discoveries, science, religion, artifacts, traditions and ceremonies, beliefs produced by us humans. Naturally architecture and all other design areas deal with cultural artifacts indeed they produce cultural artifacts. We may certainly think that 'Architecture Culture' influences every decision, choice and action that will give its final shape to a design (Ockman, 1993). Architecture Culture shape our decisions and our decisions and designs shape it in return. In order to understand how we design we have to consider the workings of culture on us, like we have to consider the way our brain works. The studio must reflect and create architecture culture.

Theory

The culture is a vast singularity. In order to find our way or feel a little bit secure with our actions we design or accept already existing steps of actions to reach to an end. We produce and use simple to complex set of actions e.g. tactics, strategies, methods, discourses, theories, ideologies.

Proposed model we are contemplating represents may be a little too ambitiously 'the setting of designing'. My observation so far is that in most of the design schools I have known education starts from 'theory' section of the model. We follow methods and set of action that we don't really know where they have come from. If we don't pursue to understand our cultural composition we may risk to act as the unconscious hand of culture.

We have to shift our attention tool ward. Students who are equipped with architectural thinking mode can wander through architecture culture without getting lost and choose or gather their own theory or set of actions.

Design

The ultimate goal of designing or design education is a good design. It draws all our attention righteously so, because design is the carrier of all the knowledge about designing. It is where self and culture come to terms. The design is a statement of the self as a product of its never-ending dialogue with culture.

My observations on design studios and design environments in architectural firms has lead me to some conclusions that we are practically enchanted by the end product and don't concentrate enough on the ontological aspects of the design process. During the design education I have witnessed so may times when the student were not coming up with good designs, instructors got panicked and took control of the 'crisis' and involved with the design so much that it was no more possible to separate the design of the student from the design of the instructor. These are the setbacks of design oriented or design ward thinking. I think good design should be expendable for the sake of conveying architectural thinking mode.

Statement

The *setting of designing* model is arranged from left to right but this does not represents a linear sequential occurrence. Environment is comprised from design tools but includes design methods and theory as well. During designing there is no precedence of any action. Design may start from a minute detail instead of contextual analysis. Smaller scale 1:20 decisions may be already made before larger scale 1:200 morphology. An experience from the past, an image from the memory takes central role in the design as well as the composition of the masses. To design is a non-linear activity.

What I am suggesting is to sail toward uncharted territory. I have experienced first hand that contemplating about design tools opens new horizons for designers. Classification and

cataloging of all the architectural design tools may be ultimately obsolete. But *tool ward thinking* potentially is more promising than *design ward thinking* when we consider how good we can teach design, without creating copies of ourselves.

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ⁱ Working title ‘Architectural Design Tools’, PhD thesis, Istanbul Technical University, Faculty of Architecture, Architectural Design Program, under the supervision of Dr. Arzu Erdem.

ⁱⁱ Although the verb to teach exists in our vocabulary I have not witnessed it as a phenomenon in practical life. Whether one agrees or disagrees with this observation depends on the frame of reference one is looking from to comprehend teaching-learning phenomenon. My understanding is that teaching is not possible whereas learning is. I could use the verbs ‘to convey’ or ‘to introduce’ instead. But I will stick with it to capture the general audience mostly thinking with the popular understanding of the concept; which is, one can teach someone else. There are circumstances that one can arrange with great care so the other might learn, but this cannot be called to teach.

ⁱⁱⁱ How we design or the way we design is greatly related to how we think and how far we have come in collecting during the millennia all the possible means to design. Therefore cognitive studies and design tools are crucial in design education.

^{iv} According to Beck (1980) for example, by definition a hammer is a tool but a fishing line is not. He has four requirements: a) An object (the tool) must be used to do something, or alter some conditions of the environment or the user, b) The object must be external and unattached to the user, c) The user must hold or carry the object in the process of using it, d) The user must be responsible for its effective orientation at the time of use.

^v Heidegger (1927) draws a distinction between things we think about and things which we use, i.e., between those objects which are *vorhanden* and those which are *zuhanden*. The implication is that tool use becomes a dance between *vorhanden* and *zuhanden*, between a practical, physical engagement between person and task and a theoretical understanding of the properties of the object (Baber, 2003).

^{vi} The Nobel award for physics laureate Richard P. Feynman explains how he envisioned the Feynman Diagrams that he just thought himself as an electron; if he were an electron what he would do (Gleick 1992).

^{vii} ‘My proposal is that, perhaps paradoxically physical tools also function as external representations in support of cognitive activity’ (Baber, 2003, pp 5).