ON THE RELEVANCE OF KARL POPPER’S EVOLUTIONARY EPISTEMOLOGY FOR ARCHITECTURAL EDUCATION

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ABSTRACT
The present study is based on the hypothesis that Popper’s epistemological model is relevant not only for artistic creation as it was investigated by Ernst Gombrich, but also for architectural creation. In fact there are a number of studies in architecture that point to the applicability of Popperian view of scientific discovery to architecture. To list a few, Colin Rowe, Stanford Anderson and Michael Brawne focus on various aspects of the creative process in architecture from this point of view. While taking these earlier studies as a line of inquiry to follow, the primary aim of this study is to summarize and discuss Karl Popper’s epistemological model, particularly focusing on his conception of the third world of forms or ideas, and his evolutionary epistemology for reconsidering its relevance especially for architectural education. Within the context of architectural creation, the study concentrates on the issue of the significance of starting from an initial schema if we use Gombrich’s words, developed from earlier solutions (paradigms or exemplars). From this point of view, finally the paper proposes a rough sketch of an approach that can be used for formulating a model for architectural design studio, and developing computer programs for utilizing them in the studio as supporting devices for learning (and teaching) how to design.

Keywords: Architectural Education, Computer-aided Design, Design Knowledge

INTRODUCTION
The design studio can be viewed as the essential organization in architectural education and in this sense central to it. It is a comprehensive and unique organization in the university where the students of architecture learn the modes of making, to think architecturally, to solve architectural problems, and it is one of the places where design knowledge is produced. It must be emphasized that the studio is a general organization which its potentialities and limitations, its success
and failure are dependent upon two interrelated issues: the design model that we take as a paradigm for teaching how to design, and the epistemological model for the production of architectural knowledge. For this purpose we can distinguish between two approaches to the architectural and urbanistic problem solving which point to two distinct models of design and through them to two distinct epistemological positions.

The first approach privileges the program as the legitimate and neutral source and origin from which the architectural form or solution is synthesized. From this point of view, architectural investigation begins with the analytical phase where the designer prepares a comprehensive program, a list of functional needs and requirements not only for the buildings and the city, but also for the people. So, on the one hand, there is the building program that typically possesses a matrix of relations between the precisely defined program elements, often a hierarchical tree-like manner. As such, the program is believed to imply the solution to the problem intrinsically, almost from a tabula rasa. In Reyner Banham’s words, a “genuine scientific program [...] would take in all aspects previously left to tradition [...] science would simply reveal and propose the best solutions to the design of shelter” (Vidler, 2003). This model of design is essentially influenced from the empiricist/inductivist conception of science and its method known as induction or analysis/synthesis. In epistemology, induction is regarded as the essential element of the scientific method, and observation as the ultimate source of our knowledge (Popper, 1965, 21). This view proposes that science starts from objective, unbiased and passive observation of facts and proceeds by analysis of these facts without any hypothesis or postulates, that will lead us, by inductive reasoning, to “… generalizations, and ultimately to theories” (Popper, 1956, 154). By taking this view of science as a model, architects claimed to free themselves from their prejudices and biases, and reach the ideal of “objective neutrality of physical scientist” (Rowe, 1994, 48). Now what they were concerned was “building rather than form [...] needs rather than wants [...] and] innovation rather than custom ...” (Rowe, 1994, 48). Following this model, the architecture was created by “the accumulation of objective reactions to external events and which, therefore, is pure and clean, authentic, valid, self-renewing, and self-perpetuating” (Rowe, 1994, 48).

On the other hand, there is the social program, or the blueprints prepared for engineering the future. Architecture from this point of view is an instrument of better human life, “the larger hope and the greater good” (Rowe & Koetter, 1978, 3).

The second approach proposes forms or ideas as the insuperable starting point for the architectural problem solving. These forms or ideas are derived from the typical or the typological...a reserve of collective memories, or Platonic forms. As
such, it puts its emphasis on the exemplars or paradigms (Rowe, 1996, 10). Referring Thomas Kuhn, Rowe gives the definition of paradigm as “universally recognized scientific achievements that for a time provide model problems and solutions to a community of practitioners” (Rowe, 1996, 10). For a better account of the concept of paradigm we may refer to Second Thoughts on Paradigms. Here Kuhn defines paradigms or exemplars as the concrete problems with their solutions those are accepted as paradigmatic or accepted as community’s standard examples which scientists study with care and upon which they model their own work (Kuhn, 1977, 298). In fact, in architectural design, the actual process which designers follow is to refer to earlier solutions or precedents for either adaptation of these solutions or application of the knowledge derived from these precedents to the new problems (Colquhoun, 1986, 47). In this sense, analogically, works of architecture, built or inbuilt, can be evaluated as paradigms.

So we may conclude that there are two main sources for the architectural and urbanistic problem solving: First one is the program, which links the solution or form with real life, empirical facts and also with the future. Second one is the paradigm, which links the solution or form with the world of forms and ideas, and also with architectural knowledge and architectural tradition. Reliance on only one of these couples or misplacement of them in a model is problematic. Both are indispensable, both are essential and they should be placed conveniently in a design model. The basic problem with the design models taking the empiricism/inductivism, or idealism as a model is that they lack these aspects (Rowe, 1996).

**PROGRAM BASED MODELS AND THE DESIGN STUDIO**

I will suggest that analysis/synthesis as a model has some problematic implications on design teaching. We may consider these implications as follows (Ledewitz, 1985).

Essentially, in analysis/synthesis model of design there will always be a disjunction between the constitution of an architectural program, and the synthesis of solution or form. In other words, there can be no formula, algorithm or method that will ensure and guarantee the direct translation of data (or program) into a successful architectural solution (Anay, 2005a). So in a design process, there has to be a leap, from the earlier analysis phase and the synthesis phase, or between the program and the solution or form. Consequently, no architectural solution can be capable of totally achieving the requirements, fulfilling the building program and the social program.

The architectural program cannot be taken as the only legitimate and neutral starting point for the architectural or urbanistic problem solving. This is so because
of various reasons: Firstly, the preparation of a comprehensive architectural program without an existence of an initial idea or form is impossible. Secondly, we cannot determine the scope of the data collection, and we cannot determine what is relevant, what is not relevant as data for a design problem. Data gathering will always be reductive (some issues preferred some omitted) and affected by our expectations and prejudices. As such, in Rowe’s words, “even with the greatest good will...the program will always be biased. It will never be the simple statement of the problem so much as the implication of a solution. It will be like almost any question” (Rowe, 1996).

In architectural education, the consequences of these problematic issues can be summarized as follows: graphical or diagrammatic representations of the requirements and program are often confused with the architectural solution. The most primitive and most widespread sample of this misunderstanding is students’ direct projection of the program elements (or matrix of relations between these elements) on the paper in the form of plan layouts while ignoring architecture’s spatial, and three dimensional character, as well as its material, constructional and structural aspects. Sections, elevations and the models are often ruled out from the -early- design process and the creative process. In addition, these plan layouts do not amount to the fulfillment of the spatial and programmatic requirements architecturally. In most cases they are just another form of graphical representation of the relational matrix between the programmatic elements.

The idea of freeing architecture from its tradition, and from the forms of the past (by replacing it with science as a new authority) is impossible to achieve and untenable in two grounds: First, in Popper’s conception, tradition and earlier knowledge in science is indispensable to make progress in science. So replacing tradition with science by taking the scientific method as a model does not make a sense since science is also dependent upon the existence of an earlier knowledge and tradition to operate. (Popper, 1965) Second, as it was stated by Alan Colquhoun, “we are not free from the forms of the past and from the availability of these forms as typological models...” Assuming that we were free means that “... we have lost control over a very active sector of our imagination and of our power to communicate with others” (Colquhoun, 1986, 49).

In education, students’ preoccupation with program, and its consequence, preoccupation with designing only in terms of combining and configuring plan elements while ignoring the ideas or forms derived from the earlier examples, prevents most of the students from finding a plausible initial idea and a possibility of developing this idea that is essential to architectural design. Especially in more comprehensive and complex building programs, where the plan layout organization and manipulation becomes almost impossible, this problem becomes more apparent. There is hardly a place for the utilization of earlier architectural solu-
tions and architectural knowledge in the analysis/synthesis model since it rejects any such approach.

PARADIGM BASED MODELS AND THE DESIGN STUDIO

Contrary to the previous model, beginning the design with forms, call it approximate configuration, primary generator (Lawson), initial discipline (Schön), or solution in principle (Ledewitz) is an insuperable starting point for architectural investigation. Beginning the process by making helps us to understand the problem, organize the constraints, the program and the requirements and put them in correct places to evaluate the initial approximate configuration for reconfiguring or remaking it. The design process proceeds in cycles, by making, evaluation, and remaking. This is clearly a heuristic process, an advanced version of trial-and-error or generate/test that intrinsically has a pedagogical dimension. In other words the students learn from their mistakes as well as from their good moves while developing their design.

The analysis and understanding of earlier solutions or precedents must be an important component of the studio organization for various reasons. First, they are good devices for illustrating already existing architectural solutions to students. In Ledewitz’s words, “the purpose of studying solution types is to enable students to see alternative form organizations, or design concepts, that suggest approaches to the problem-at-hand” (Ledewitz, 1985, 6). Second, precedents are invaluable sources for the production of architectural knowledge and learning how to design. For Ömer Akýn, “learning takes place through students’ examination, analysis and abstraction of the information contained in the case representations” (Akýn, 1997). These precedents are also good for distilling ideas and forms from them. These forms and ideas can be used as an approximate configuration, a plausible starting point for a new design, or they can help students create new forms and ideas. This is crucial for students of architecture because it can provide a tenable starting point for investigation and provide a strong link between form and program.

However, paradigm based approaches can also have problematic implications on design teaching: First, preoccupation with forms is often has a danger of falling into formalism in literal sense. There can be a tendency for taking the formal aspects of the architecture as the only entity, and ignore its content, function, or programmatic aspects. As such, the link between the present problem and the past solutions can be established only on the formal basis, and design can be easily reduced to formal manipulation, a problem very similar to designing in terms of arranging and manipulating programmatic elements, mentioned earlier in this paper. Second, working with historical forms and the tradition requires a distance and a critical position, otherwise it may either lead to mindless repetition of the
precedents, or to free quotation or citation of the elements collected from various precedents come together in a single object.

These issues point to a need for a rigorous foundation prior to development of a studio model, that is on the one hand capable of embracing the essence of the paradigm based approaches and has the power to evaluate their potentialities, on the other, capable of dealing with the possible problems created by it. There is such a foundation. That is Karl Popper’s epistemological model, well suits the paradigm-based approaches, and can be profitable for developing new studio models. For this reason, Popper’s model is already investigated in art and architecture from various points of views. Perhaps the most known and earliest one is Ernst Gombrich’s Mellon Lectures delivered in 1956 later published as Art and Illusion in 1960. In Art and Illusion Ernst Gombrich proposes that Popper’s conception of science is “eminently applicable to the story of visual discoveries in art.” For him, the artist starts with an already established schema, as “a starting point…in order to begin that process of making and matching and remaking which finally becomes embodied in the finished image” (Gombrich, 1960, 321). This schema is linked with earlier works of art, or with an established tradition: “the artist cannot start from scratch but he can criticize his forerunners” (Gombrich, 1960, 321). There are also a number of important studies in architecture that point to the applicability of Popperian view of scientific discovery to architecture. To list a few, Colin Rowe and Stanford Anderson focus on the problems of scientific, deterministic, and utopian approaches in architecture, and underline the indispensability of tradition and critical approach as two important components of architectural creation (Anderson, 1965; Anderson, 1984; Rowe & Koetter, 1978). In architectural methodology, there is also a well-known essay of Hillier Musgrove and O’Sullivan titled Knowledge and Design, which aims to adapt the Popperian conjecture/analysis model to design in the place of analysis/synthesis. Following this line, in her essay titled Models of Studio Teaching, Stefani Ledewitz mainly focuses on the applicability of the concept/test model to architectural education while particularly emphasizing the importance of solution type studies, in this approach (Ledewitz, 1985). A more recent study by Michael Brawne draws similarities and also some distinctions between the design process and Popper’s diagram of problem solving process and tries to reconfigure this diagram to be adapted to design (Brawne, 1992). A most recent paper by Greg Bamford summarizes the history of the conjecture/analysis in design, and proposes a framework for reconsidering it (Bamford, 2002).

As for the present study, its main intention is to focus on the issue of the use of precedents as an important component of conjecture/analysis model for the production of architectural knowledge and the derivation and creation of architectural ideas. It tries to address two main problems: what is existent and important in
the precedents themselves to be used for new works, how these are transferred to new and creative designs. Since the problem formulated till now is essentially epistemological, for the present purpose, Popper’s evolutionary epistemology and his three world ontology may provide a convenient model for coping with these issues.

FROM PRECEDENT HERMENEUTICS TO CREATIVE DESIGN

Popper divides the universe into three interacting but different worlds or sub-universes: The first world is the world of physical objects or physical states; “of stones and stars; of plants and of animals …” (Popper, 1978). Second world is “the mental or psychological world, the world of our feelings and of pleasure, of our thoughts, of our decisions, of our perceptions and our observations; in other words, the world of mental or psychological states or processes, or of subjective experiences” (Popper, 1978). Third world is the “world of the products of the human mind, such as languages; tales and stories and religious myths; scientific conjecture or theories, and mathematical constructions; songs and symphonies; painting and sculptures,” (Popper, 1978) it is the world of forms or ideas.

In architecture we may illustrate this tripartite structure as follows: For example, the physical being of the Barcelona Pavilion as it exists in the real world or the drawings of it belongs to the First World. Our (and Mies’) memories and thoughts about the pavilion, our subjective experiences of it, and its projections on our minds, belong to the Second World. But, Barcelona Pavilion is also a creation of Mies van der Rohe’s mind. In this sense it also belongs to the Third World.

Sketches, drawings, models, (and also computer models) are the First World embodiments of the Third World structures. They are based upon theories (or they are like theories); and only in this sense they are instrumental for changing the First World. What is particularly important for a work of architecture is not its physical being or its representation in the form of drawings or models, or our subjective experiences of these, but its thought content inherent in it. Thought content can be described as that which remains invariant between a work and a plausible interpretation of it. Equalizing the thought content of a structure to essences or as abstractions of thought processes is misleading. Essences are eternal and at the same time fixed entities. Contrarily, a third world object may yield thought contents which nobody has thought so far (including its creator), and perhaps nobody will ever think about.

Works of architecture as third world objects are only valuable in the sense that we can read or understand them. Only as such they yield power to change the first world. Only as such we may utilize them for developing better objects. Works of architecture in this sense can be improved by criticism, and their thought content
can be used for creation of new objects. As I’ve discussed previously, in fact this is typical for a design process. Any third world structure can be used as a precedent for either solving new problems by improving or adapting it, or making use of its thought content for developing new works. The improvement (or a new creation) does not have to come from the original creator of an object, but from anyone that has ability to understand or decipher the thought content of it.

CONCLUSION

In its present state the computers are used widely in storing and retrieving cases or precedents to be later used in design. It is obvious that there is a practical difference between browsing the archives (such as books, photographs, magazines, sketchbooks) to find a suitable precedent and searching it in a computer database. Nevertheless these are basically database applications that have no active role on the creative design. They essentially store information about works of architecture; they are not so different from stack of illustrations of buildings in the books or magazines.

A possible active contribution of computers to the use of precedents in creative design seems to be dependent upon its ability to store not only precedents, and the thought contents, inherent in them, but at the same time the ability to evaluate and evolve them.

I will propose an approach that can be used for developing a model for this purpose. At the end we’ll see that this can also be applied to architectural education directly, for the production of architectural knowledge and helping students to learn how to design.

My analogy comes from the studies in artificial intelligence. In 1955 Arthur Samuel, a research scientist in IBM, wrote a computer program that plays checkers. The first thing for him to solve was how to instruct the computer the rules of the game: that is to say, representing the basic process of legal checkers play in computational terms (Dennett, 1995). The second problem was to get the computer to evaluate the possible moves for selecting the better move. The trouble was to represent the evaluation function algorithmically that is typical for a computational approach. There were almost infinite possibilities that are at that time far beyond the capabilities of a computer to check and evaluate. Samuels thought that the only way to develop a feasible program was to utilize a different method. He replaced the algorithmic method with the heuristic method. The basic principle for the program was first to make a move, and play the game, then to evaluate it on the basis of its success or failure. But what was revolutionary for the program was its ability to learn. This could be achieved as follows:
The program had two identities: its first identity, called alpha, was a rapidly mutating pioneer, preferring to engage in new and risky moves and its second identity, called beta, a conservative, preferring to be tied to the existing or winning solutions. The tension between these two identities made the learning possible, to the degree that the program even beat its creators. (Dennett, 1995)

What is important in this approach is that on the one hand it utilized already existing solutions and existing knowledge, on the other, it tried to change these to find new (and better) solutions. It is obvious that the system will adapt itself to better players, will evolve by time by only playing, and it will possibly survive even if the rules of the checkers would be changed.

Now it is obvious that this approach can be both used for formulating a model for architectural design studio, and developing computer programs for utilizing them in the studio as supporting devices for learning (and teaching) how to design.

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