The assessing of how parametric architecture and algorithmic patterns in the process of educating architecture design in Iran. (the samples of students' projects in the Islamic Azad University of Architecture in Mashhad and Birjand cities)

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Abstract: The philosophy of education can be studied from different viewpoints of thought, containing the three important groups; Western, Eastern and Islamic philosophies. Regarding to this arrangement, there are several aspects that are not match with each other, whenever comparing these aspects within the comprehending of education itself, through the countries apart of this global nation. The idea and the conception of philosophy of education has been derived traditionally and modernly, became combined and simultaneously work on each other, in order to generate the best culture of education to the humanity. Thus, this paper attempts to perceive structural changes in architectural education system in Iran due to the effects of various factors such as hermeneutic mutations in parametric and algorithmic architectural education. As a result, the samples of design in 2 schools of architecture have been considered.

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Introduction

Computer simulation of evolutionary processes is well set up technique for the study of environmental, biological and economic dynamics. Use of algorithms for creation of virtual objects that will develop its practical and formal properties within the non-linear process of adjustment of complicated system is a foundation for new perspective in understanding architecture and education. This paper describes parametric approach in architectural education through elaboration of shift in paradigms in architecture that has brought to the idea of use of parametric modeling with emphasis on two different groups of parametric software and presents the possibilities of generative algorithms in showing architectural form.

The research has been considering the following:

What has been the structure of architectural education so far? What are the causes and features of changes and reforms in architectural constructivist education? How possible is the flexibility in architectural education environment? the design paradox in architectural education? What is Have the hermeneutic mutations made entry of parametric and algorithmic in education?What are the parametric design and algorithmic architecture?

1. The Comparison between Different educational methods in east and west

It could not be denied that different areas have their own different culture and background of the societies. As a rule, Western philosophy of education includes two schools, which are traditional and modern. It has its roots in Athens, Rome and Judeo-Christianity, although Eastern philosophy is derived from Islam, Confucianism, Taoism and Mahayana Buddhism. This, is basically influence the system of life, and surely creates their education system. By looking on Eastern and Western countries, both countries have distinct differences in their manners of developing and forming a personality, in terms of talents and viewpoints. Thus, different cultures will have different philosophies, which causes in different manners of doing things, remarkably in educating the next generation.

1.1 Students' Contribution:

Comparison between different philosophies can be made by looking at the students' contribution in the classroom. As a rule, it can be concluded that Westerners emphasize more on active learning among their learners, although the Easterners prefer passive learning. Westerners, since the ancient Greek, Western philosophers such as Aristotle, Plato and Socrates encouraged rational thinking. Otherwise, the Eastern typically obtained the knowledge directly from their teachings of religion, such as Islam, Buddhism, Confucianism, Hinduism and Taoism (Chia Mun Onn, 2009). This is more of a unilateral transmission of knowledge, wherever the belief prepared them with rules and regulations within their life. Students of the Western education philosophy appear as active learners in the classroom, as the teaching and learning process not focusing on teacher-centered, but more on are active learners in the classroom. It encourages the students to be active in giving and sharing the ideas, which is maximizing their role as a students than the teacher in producing the effective learning and teaching activity (Joyce Lin, 2008). For example, they are very much encouraged to think and express their views whenever they are involved in group discussion or did the given assignment. The students are then required to present it to the whole class. This allows them to participate not only during class time, but also to help them to be actively involved in the learning process even out of the classroom. Apart from that, the students are also has been given a chance to express their ability and talent by analyzing and solving their own problems. This is through the effort by the teachers in assigning them previously, to do research on their own, considering specific topics that will be discussed in the following lesson. By doing this, every student is given a chance to learn to search for appropriate information. Actually, according to Thornton (1995), the problem solving process becomes one of the bases on children for their critical mental development. Thus, it can be said that education development in the West containing thinking skill, problem solving and communication skill which has been integrated well in the western philosophy itself. On the other hand, the teaching and learning process through Eastern education philosophy emphasizes on the important outcomes from the teachers. It means that, teachers are fully responsible on the class effectiveness, by preparing and planning all the activities for their students. For example, the students are not trained or required to do anything, but every materials are given by the teachers. Usually, they are not required to do any research on the topics that are going to be discussed in the next lesson, but only responsible to receive input from their teachers. Besides, students are not trained or encouraged to express their own views and viewpoints. In certain cases, students are not allowed to even respond to the questions asked by the teacher as the questions are in a way meant only for teachers to answer stylistic questions (Joyce Lin, 2008). According to Rohaty (1999), one of the reasons why the teachers are hardly implementing various modern teaching strategies is due to the excessive attention on theory rather than in practical sense (Rohaty, 1999).

1.2 Teaching Methodology in East and West

The ways of teaching process can indicate how a philosophy influences its people through education system. From the view of Western education philosophy, the roles of students are recognized, by giving them the rights and respects within the teaching and learning process itself. They have the choice and rights to take charge of their own learning, as they are given the chance and freedom to manage their own learning process. Therefore, the teachers play their role as a facilitator than the knowledge producer to their students. Teachers are responsible to help and guide the students in their learning process rather than teaching them what to do. In this way, students are given the chance to take control of their own learning process. Moreover, schools of the Western education also support and encourage students in self management and in controlling their own learning process. This is where teachers come in to lead and guide the students by giving them guidelines in managing their learning process. In the classroom, children share more responsibility in their leaning process and evaluation and assessment is conducted to see their capability and also how they will apply into it (Teel etal. 2001). Teachers of the Western education do play a role in guiding students to find and develop their abilities and potentials. Compared to the Western education, Eastern education philosophy holds on to the concept of teaching. Students receive full knowledge from the teachers inside the classroom. Students in a way receive knowledge in a rigid way as they only seem to learn and study directly from the teachers. Thus, it is no doubt that a good teacher need to be very hardworking in transporting ideas,teaching and maintaining good relationship with their children (Gurney 2007).

1.3 Relationship between Teachers and Students

The relationship between teacher and students is very important for children. This is because children spend most of their time, approximately 6 to 8 hours in a school day with their teachers. Thus, the teacher-students relationship is important to provide better experience to children in school. A research conducted in Tajistan shows that Muslim children prefer teachers from the West compared to local teachers as they are friendlier, caring, and more knowledgeable and always assisting children to success Niyozov and Pluim (2009). Niyozov and Pluim added that they are all even willing to share the Muslim children's problem. It is because the Western education philosophy believes that student-teacher relationship is more open and the students are more willing to talk to their teachers. It is known that a teacher in a Western school does a good job of assessing their effectiveness in teaching (Garcia, 2000). In Eastern culture, the teacher-student relationship is a position of trust in which the teacher is in a position of power and the student is in the position of being obligated to obey with the legal directives of the adult (Chory & McCroskey, 1999). Teachers are meant to be respected and sometimes students even have to tolerate with teachers' bad mood. In fact, teachers do act as a big boss who does not talk with the workers (students) directly most of the time. This is contrast with several research and attitude that should be demonstrated by teacher as some researchers such

Chory & McCroskey suggest that teachers need to have more initiative to communicate with children, to increase the delegation of decisions to children and to be in the class more frequent.

It should be said that making unprecedented and quick educational changes in the field of practical architecture education in the east put extra pressure on the teachers since the students get used to unilateral relation to just receive subject contents. Due to the advent of parametric design and algorithmic architecture in architectural education of eastern schools in particular the third world countries has many complexities. In the meanwhile, making the changes in architectural education should not be neglected.

2. Reasons of the changes and reforms in the architectural education

a) To ameliorate an educational framework,
b) to transform its components in order to become more compatible with its social and cultural environment,
c) to inform its teaching with new principles and values,
d) to perform a new conception about the spatial manifestation of Life,
e) To ameliorate an existing educational environment,
f) to formulate new priorities and strategies,
g) to reconsider architecture,
h) to discuss and to exchange views and feelings about the changes that have happened or are happening,
i) to reconsider the way that the offered services would conform,
j) To the social demand,

In addition, the followings should be noted:

I. The changes in the architectural drill – new types of work organization; architectural interventions in both public and private area; new construction materials and methods; the quest for economic optimization of the projects; etc.
II. The change of the architect's approach to design activity – designers are faced with new questions, and this is mostly the case for architects who have to trust other disciplines that they no longer master themselves.
III. Completion of a single market in design and construction activity. New views and testimony on architecture, due to information technology, speed, images, networks, as well as personalization of new tools and media for design and representation, within the modern cultural, social, political and economic context.
IV. The pressure put by the publications and the mass media on the schools of architecture to compress new values and principles of innovative architecture to adjust their curriculum.
V. The new notion of the university, or the higher education institution - redefining its position in the modern society by becoming more open, less isolated, more interactive, less authoritarian, more collaborative, less detached, but the same time less autonomous, less supported by the public area and more dependent upon private funds.
VI. Need for simplification and consolidation of legislation.

The attention to constructivist education in the process of architectural education as a powerful tool for making appropriate changes is recommended. This method is mostly practical in architecture and computer influence on it. The followings are considered for more information.

3. Constructivist Education as a key to Lifelong Learning and Tacit Knowledge Acquisition

Since little research has been completed on tactic knowledge production (Koskinen 2003), it is difficult to recommend an exact response to the question seeking an appropriate educational approach that would be able to promote tactic knowledge and lifelong acquisition. This problem with tactic knowledge is essentially due to its implicit nature making it difficult to scientifically discuss and explain explicit knowledge. While the coherent manner of explicit knowledge makes it possible to be obtained through formal education, writings and books, tacit knowledge when transferred by sight, 'is either obtained through an "intimate" relationship between a "master" and an "apprentice, or through learned experience over time' (Busch 2004, 17). Despite the dilemmas that exist over the acquisition of tacit knowledge, and despite the silence of educational literature, a reflective analysis of the available text exposes some points about the implicitly recommended approaches to creating tacit knowledge. One such suggested approach is the study by Chisholm and Holifield (2004) regarding tacit knowledge and professional development. The authors, after reviewing the role of tacit knowledge in companies and its importance for lifelong learning, conclude by demonstrating that a work-based learning model is the most effective way to deliver lifelong learning supported by the emphasis on tacit knowledge acquisition. The work-based learning model can be associated with lifelong learning policies and knowledge construction by individuals. One of the educational approaches supporting the work-based learning model as defined in their study is constructivist educational theory. Constructivism is based on the doctrine that learning takes place in contexts, and that learners form or construct much of their learning as a function of their experiences in various situations (Schunk 2000). More recently, researchers (e.g. Lave 1990; Saxe, Guberman & Gearheart 1987) have presented more qualitative documentation of learning in context. Consequently, this approach can be simulated to the work-based model of learning, which was previously introduced as a key to tacit knowledge and lifelong learning. This tendency of work-based learning and constructivist educational theory to provide tacit knowledge and lifelong learning has been expressed implicitly in other studies as well (von Krogh & Roos 1996, von Krogh, Ichijo & Nonaka 2000, Atherton 2002, Burns 2001, Chisholm 2002, Saint-Onge 1996). A review of the above literature on tacit knowledge may lead to the conclusion that constructivist educational theory is one of the key approaches to acquiring tacit knowledge and lifelong learning, as it is consequent in both educational and professional environments. Before coming to the specific concentrate of the paper, which addresses architecture education and acquisition of tacit design knowledge, an analytical discussion on constructivist educational theory in general is presented.

3.1 Constructivist Design Process and its Relevance to Computer-Aided Design

Before arriving at the experimental section of the study, it is necessary to achieve a practical framework for architectural design education based on constructivist educational theory. For the purposes of this article, reference is made to the relevance of computer-aided design in constructivism in terms of the three major stages of architecture design process, as defined by Lang (1987)—the information gathering stage (preparation for design), the design development stage (establishing the design solutions), and the evaluation stage (choosing). These three dimensions are used here as poles for further discussion.

3.2 The first stage: Information Gathering (preparation for design)

Throughout this stage of the design process, students gather an abundance of information relevant to different aspects of the design problem. In the constructivist approach and in the content of required information, this stage cannot be pre-specified (Karagiorgi & Symeou 2005, Gül et al. 2008). Constructivist instruction of design avoids the failure of context into component parts, as traditional design instruction does, and is instead in favor of environments in which design knowledge and solution can come out naturally. Designers (here, students) in this stage distinguish between various needs and requirements of the given design problem, which their proposing design solution aims to fulfill. As design problems have no absolute solution, the task in this stage is one of providing a rich context within which specific objectives of understanding the environment, for proposing the best design solution, can emerge (Al-Ali 2007). The goal, for instance, is not to gather information on different forms of traditional architecture to be imitated, but to make students understand the context and environment in which a specific form of architecture has emerged, and the requirements it must have fulfilled. To achieve such goals, designers (here, students) refer to different sources in order to understand concepts important to the design of the problem. This in-depth research enables students to identify design tasks, clients, and legal constraints. As students work to develop the requirements of a design problem, the teacher helps the students by providing them with the opportunity to adapt the acquired information to their needs, to make choices with which to direct their learning, and to construct their own understanding of the information. This constructivist approach aims to help students develop useful knowledge rather than inert knowledge (Russell & Schneiderheinze 2005, Al-Ali 2007). In this stage of the design process, students require access to information such as text documents, videos, sound files and graphics to begin formulating meaning about the problem, as well as related cases to represent the complexity of the problem from multiple perspectives. The teacher can help to establish the meaningful context by providing students with opportunities to gather information and question the relevance of that information to their community and the problem. Consequently, the teacher can provide opportunities for students to analyze case studies (Shulman 1992) about other projects related to design problem-solving in order to enrich the context for students to apply expertise and identify interrelationships among those areas of expertise. The application of computer-aided technologies into this stage of the design process offers significant potential for design schools, through their capacity of advancing research and development, to prepare students for designing in the next stage of the design process. Computer-aided design tools also support the so-called library-based design method which comprises a set of objects, materials, textures and light sources provided by the object library of the design platform (Gül et al. 2008). Based on the above discussion, technology application can extract more meaning from the design problem and can be helpful in supporting the research in the design studio. It is further able to foster the development of a design solution in the following step of the design process.

3.3 The second phase: Design Development + Evaluation

Based on literature reviewed above regarding architectural design education (see for example Salama 1995), it could be cited that in the traditional instruction of design, which is teacher centered and teacher-directed, the stage of design development stands completely apart from the stage of design evaluation. This is primarily due to the fact that these two tasks are expected to be carried out by separate individuals—the role of the students is only to propose alternatives and design solutions, while that of the instructor is as the main center of instruction, with the role in evaluating and judging the students' designs. But these two stages, in the constructivist approach of design education, are interwoven. Since constructivists points to student-centered, student directed and collaborative environments based on interactive learning, both stages should be accomplished through students' self-relied activities. Students may evaluate their design solutions in terms of whether they do what they claim to do (Spiro et al. 1991b). The students' ability to promote insight into alternative perspectives is an important element of evaluation, and is related to the development of their critical thinking skills and self-reflective processes (Karagiorgi & Symeou 2005). Such a learning environment requires an abundance of tools to confront students with opportunities to experience the critical thinking inherent in design education. Computer-aided design tools and 3D-modeling tools can be helpful in providing such an environment (Al-Ali 2007). As computer-aided design tools can support different viewpoints, such as first-person and third-person, they offer many possibilities for understanding the spatial arrangement of the objects and developing the student's spatial abilities (Gül etal. 2008). Thus, to modify a design, the students are able to rely heavily on their own judgment of the finished proposed design, which is visible now through the aids of technology. From these studies it is clear that designing with the help of 3D virtual worlds encourages immediate and detailed design decisions for students. While they decide on a particular concept or design alternative, both its construction and testing occurs simultaneously. Hence this method has the potential to facilitate self-reliance among students in the design process, due to the fact that computer-aided design tools allow learners to develop, compare, and understand multiple perspectives of an issue with the goal of achieving the rigorous process of reflective thinking, multiple perspectives, developing and evaluating the arguments by self-mentoring to guide learning (Bednar et al., 1992, Gül et al. 2008). As a result, students are capable of experiencing the evaluation stage of the design process along with the development of design. By applying computer-aided design tools, teachers can plan a constructivist instruction in architectural design education that goes beyond routine learning toward meaningful learning that is more likely to lead to deeper and longer lasting understandings.

4. The Design Paradox in Architectural Drill and Education

The little interest in coping with the future, our own future, is really a significant paradox: the importance of thinking about the future in a future oriented field. This "Design Paradox" clearly cannot and has not worked in our favor. As the role of anticipation becomes progressively vital for responding to our fast changing civilization, "futuring " needs to be formally included within architectural drill and education. Paying attention to the future means at least two things for architectural education:

(1) It means to look at the future of our discipline without the curriculum to inform the way we should be educating our students. This is a top-bottom approach. Certain image of the future may demand changes in our educational structure to 'produce' a particular profile of the future architect. The clearest example of this adjustment has been the incorporation of computing within the architecture schools. The top-bottom approach is conservative, reactive, slow, and does not include any action to incorporate futures thinking within the curriculum. Nevertheless, it is obviously a necessary approach.

(2) It means to look at the future of our discipline within the curriculum. This is a bottom up approach not very common. Most of the discussion about the future has remained at the administrative or theoretical level and, with few exceptions, has not permeated into actual teaching. A bottom-up approach that considers and/or simulate future architectural practices and challenges may do more to point at the real future of architecture than any top-bottom approach constructed as response to the pressing needs of the present.

5. Hermeneutics

Philosophical hermeneutics provided the means of examining the readings that were produced by my students. It gave invaluable understandings into the reason for their readings, aiding me in comprehending that the opinions the students expressed about the story did not come out of nowhere, but were an essential part of their horizons. It also provided a way of viewing the class as a place in which the students' readings are emerging as the hermeneutical conversation occurs. In other words, the students are under no obligation to come in class with a fixed reading. Nor are they under the obligation to acquire the "correct" authoritative" reading in the course of the class. Rather, the class is a place to question not only the text that is being studied, but their own readings and prejudices as well as the readings produced by others. The class becomes a place of movement and growth as a result of a probing of the text and of the readings produced. In conclusion, philosophical hermeneutics provided not only the means of hearing and understanding the cultural component that presented itself in the students' interpretations of the text, but also meaningful goals for class in terms that were relevant to the particular socio-cultural situation. Finding new position of the parametric and algorithmic concept in architectural education, in general sense the modern hermeneutic has provided suitable conditions. Since the reader and interpreter are more important than the author. Various Viewpoints and interpretations are accepted. This step can open new horizon in architectural education.

In this part of the paper algorithmic architecture, one of the nowadays issues in the architectural education, is described.

6. Algorithmic architecture

What should be the exact scope of computer involvement in architecture design? What ways of thinking should we use in order to completely utilize computer programming possibilities? There is a notion of observing nature and using its ways of coping in architectural design. We, architects could perform design techniques closely similar to those observed in natural processes. Evolution, natural selection and effectiveness could be phrases used in reference to architectural design. Architecture is an art of meeting people's needs, an art that creates different styles and trends. There are always human related topics in that kind of design. Is technology able to meet its needs? There is a growing computer involvement with architectural design nowadays. What should be the exact scope of it and what influence will it have on our future and space around us? For the last five decades architects have been increasingly interested in computer's use in the process of design, beginning with CAD programs, through object based software (i.e. Architecture CAD) to building information modeling software (Autodesk Revit). Moreover, architects took interest in the spectacular development of computer graphics and some sort of fascination arouse about strange forms and blobs, that could be possible due to development of scripting languages available in 3D packages (i.e. Rhino script, 3dMaxScript). The dominant way of utilizing computers in architecture, already briefly described could be called computerization. That is a process of drawing and creating 3D models for already existing solutions (in the architect's mind). It means that the results are predictable. The opposite way of using computer power is to take advantage of its computational possibilities. Computation is a process of calculating - determining something by mathematical or logical methods. There are a small number of architects and researchers who think that it has become unavoidable to get further into programming and to creatively use the computer and its real possibilities. In order to be able to use programming in architectural design one must become familiar with the term algorithm. It's a set of instructions that is given to a machine by a human to accomplish a given task in a finite number of steps. Algorithms are already widely used among recent designers. Experiments that are advertised as an imitation of biological processes are nothing more than clever tricks performed with the use of computer programming to receive nature-like patterns. Benjamin Aranda and Chis Lasch widely known modern architects create interesting forms that are inspired by nature observations in algorithm using processes, which can be unfortunately considered only as tools for architectural design process not as the process itself. An interesting trend of using genetic algorithms occurs in the contemporary architecture. It can be the solution to the problem of creative and full usage of computation possibilities.

6.1 Genetic algorithms : Genetic algorithms were invented by John Holland in the 1960s and were developed at the University of Michigan in the 1960s and the 1970s. Original goal was to study the phenomenon of adaptation as it occurs in nature and to develop ways in which mechanisms of natural adaptation might be imported into computer systems. Later it was discovered that genetic algorithms can be used in problem solving and optimization. Genetic algorithm derives its structure from the observation of nature. The simplest genetic algorithm contains three kinds of operations: selection, mutation and crossover. Genetic algorithms are already used in architectural design, but the processes are variations of mating of few already designed solutions in order to receive interesting outcome. Typical example is Martin Jameson's 'Genetically Modified Terrace House' in Blackpool, UK. The real opportunity for architects is to use advanced programming techniques such as genetic algorithms in the real design process. In order to do that one must consider some philosophical ideas, which can be traced to the work of Gilles Deleuze. Three ways of thinking present in Deleuze's works and described by Manuel DeLanda in reference to architectural design are: population thinking, intensive thinking and topological thinking.

6.2 Population thinking : Population thinking is a style of reasoning created in the 1930's by the biologists who brought together Darwin's and Mendel's theories and synthesized the modern version of evolutionary theory. Its main concept is that the population is a sort of a matrix necessary for a natural selection to occur. Natural selection is a process discovered by Charles Darwin. We know that it is the explanation of both the existence and the apparent purposefulness of all the life forms. It works without a goal, it has neither an imagination nor a brain, however it leads to results that make sense and often are optimal for given environment. In order to design a building using genetic algorithm we have to create a population of virtual buildings that will mate with each other leading to next populations, which will provide better outcome optimal building. With increasing concerns for sustainability and efficiency, the need to optimize performance in terms of environmental, structural, economic and other concerns, demarcates a new ethical horizon of possibilities. Once a performative logic has been written into a script, the results are already optimized.

6.3 Intensive thinking : Intensive thinking is derived from thermodynamics. The modern definition of an intensive quantity refers to magnitudes that are spatially not dividable (i.e. temperature. pressure or speed). In architectural design we deal with extensive quantities like lengths, areas or volumes. It is crucial to refer to intensive quantities while creating virtual populations of buildings, since their differences are productive, as they drive processes in which the diversity of form is produced. It is a real challenge to create a virtual environment that will constitute a canvass for evolution of buildings, and will be able to substitute reality for the sake of the process, which obviously couldn't be performed in reality.

6.4 Topological thinking : Topological thinking is a common notion among recent architects. It is a way of describing buildings as a set of parameters and relations between them, so that we don't get a final form, just the necessary rules of creating it. An important feature of genetic algorithms concerning form production has been discovered - once a few interesting forms have been generated; the evolutionary process seems to run out of possibilities. In the contrary there is a great productivity of natural evolution. The possible solution to this concern may be the topological way of thinking, creating a 'body plan'. It refers to an abstract diagram, with which we can describe i.e. every vertebrate on the planet (certain organs which are the products of evolution and are similar for different types of animals). Reason for existing of the 'body plan' is the cumulative selection. In the process of cumulative selection given population always starts with the results of the previous population selection's outcome.

6.5 Architect's role : It is crucial to understand what outcome this revolution can have on architect's role in the process of design. Architect may become only a breeder of virtual buildings, which can be considered as a form of art, but hardly the kind of creativity that one identifies with the development of a personal artistic style. This way architect's taste would become another parameter, or gene of a virtual building. Probably the most of architects will defend their previous role, but it is important to answer to a question of what are we willing to sacrifice in order to accomplish efficiency and perfect (or close to perfect) form and function for given conditions. Another possible approach is that the architect's mind is enhanced, complemented or synergized with an intellectual entity of a computational nature, independent of a human presence. It's existence starts where human mind fails. Armed with such allo-reasoning the human mind can be described as a cyborg in the intellectual sense.

6.6 Will we kill building's 'soul'? Once we use high-end technology to design, we can be able to receive optimal form, function, insolation, energy self-efficiency etc., but is that all that buildings consist of? What about the genius loci? What about the human nature that should be the prime concern for architects? It is a matter unsolved whether it would make a difference for a user to live in a building designed by a machine. Simply because there is no such building. It seems like a fascinating opportunity to create energy self-efficient buildings, which would be designed to be perfect in every matter that we want them to be. Still, there is a question about human nature and higher needs, which can't be expressed in numbers (or can they?). It is probably our future to find out answers to all these questions.

7. Parametric design

'Parametric design (…) is a method that can, in whole or in part, defines the design process.' Parametric models allow the user to set up a hierarchy of relationships that can be defined rules, in which the whole adjusts and changes when a rule is modified. In short a group of elements interacting according to a set of rules can trigger a generative process in which the elements will be deployed in always different fashions. This fractal logic is highly appropriated for computer processes but parametric design can also be performed manually. Can parametric design be applied to MMC and generate built environment with high environmental performance? Parametric design has been widely used in Environmental design. In a way Ian L. McHarg has pioneered the parametric logic in his multilayered processes in which environments were mapped and redefined according to environmental rules and parameters. Established rules encompass site conditions, targets given by the initial brief or anything that is essential to any given context. At best, prefabricated houses sell a kit of parts that can be assembled in a wide variety of shapes and finishes. Buyers select the most suitable shape or format according to their personal taste and needs. What if the kit of part can be assembled only through binding rules and these rules embody essential conditions to shape dwellings with a high level of environmental performance, essential features for a building a better environment and a high level of differentiation in the building fabric? The project this paper introduces investigates this subject.

7.1 Design through Parametric Design for Users Choice.

What is essential to people when designing residential developments? It is assumed that the majority of people worldwide live in cities and this trend at the moment seems irreversible. As global population grows, so grows a compelling need for an urban context that is more human, better designed and more integrated with open space . This last point is particularly important. Although it essential for cities to densify their fabric, built environments require private and public open spaces. Jules Pretty, Professor of Environment and Society at the University of Essex, has led research into measuring the degree of well-being of people that lead open air activities compared to sedentary people. Gardening, room with views or simply the presence of vegetation by the dwellings increases physical health, decreases health-related expenditure, and improves concentration at work. There is also a compelling need of each human to identify with the place he lives in. This can be achieved through a process of participation. However, these processes involve many stakeholders and require long time scales. The design of a toolkit for home owners that is easy and fast to use can be precious and help joining all the dots while speeding up processes. Environmental performance needs to be at the core of the toolkit, as well as rules that can improve the well-being of communities and standards of design for prefabricated dwellings. In my design of a pattern book, I made certain decisions in keeping with these aims:

A - High densities of dwellings per hectare;

B –open space attached to each dwelling;

C – Kit of parts with a high degree of 'embedded' Environmental features;

D – use of low embodied energy materials;

E – Flexibility that allows high level of customisation and modification over time.

7.2 Parameters

My 'kit of parts' is designed to deliver self build dwellings in a constantly varied fashion . Each user's choice in composing his/her dwelling within the elements of a flexible abacus, combined with the constraints given by the set of rules, will automatically determine a varied configuration for each building. Flexibility is made possible by the industrial processes that lay behind MMC. The kit of parts delivers lightweight buildings designed according to Passive Solar principles. Each dwelling would have interior finishes with high thermal mass, the choice of a wide window that could be plugged in as a sun-space, and, wherever possible, orientation to provide sufficient solar gain. Though my design rules encourage high densities in each development, it is possible to mix typologies to provide a choice of single house, terraced house or flat, in the interests of creating a mixed community. Space heat through direct solar gain is encouraged. However, is up to the dwellers to choose among an array of energy efficient possibilities, and the orientation of their dwelling will obviously be a contributing factor. They can select the sun space from the kit of parts or decide that energy should be supplied partly through renewable and partly through a district CHP power station. The power station is part of the infrastructure supplied by developers, while renewable can be plugged into the roof of the building. Single dwellings plug into a structural skin. The structural skin contains fixed vertical circulation and bathrooms. Users can compose their dwelling by selecting the number and sizes of rooms they want. Rooms are built off-site, each one already provided with appropriate insulation and necessary cabling and plumbing. Once rooms are inserted in the structure, external cladding on panels, additional insulation and windows are added. Cladding is varied and the composition of the façade is therefore also varied, as a result of the user's choices of finishing materials and number and size of rooms. To save energy and money, no lifts are provided; consequently the building block is limited to three or four storey's. This system allows dwellings of every size: from studio flats to three bedroom flats, and includes also maisonettes with pitched roofs on top floors. The roofs themselves are used for PV panels and evacuated tubes. A binding rule is that each dwelling has an open space attached either as a garden, balcony or terrace. Open air life is encouraged as well as a small cultivation of crops on terraces and roofs. Each building is equipped for rainwater harvesting and grey water recycling. Composting facilities and living machines are integrated in the general planning.

7.3 Kit of parts and set of rules : The construction materials specified have low embodied energy and come from sustainably managed sources:

A. Superstructure in engineered cross laminated timber.

B. Rooms made of SIP insulated panels. The room size is modular and can expand or reduce in one direction. In doing so, facades modify over time.

C. External cladding mounted on cross laminated panels in different finishes: timber tiles, clay tiles, slate. D. Sun space composed with a frame of cross laminated engineered timber, timber frames and double glazing. The sun space is provided with automatic exterior curtains that shade from the sun in the hot months. E. Greenhouses that can be attached sideways or mounted on the roof. The structure is composed with timber profiles.

G. Selection of finishing materials for interior with high thermal mass. Interior walls and floors are clad with light concrete tiles of several colors and sizes. Clay tiles are mounted below timber beams at ceiling. Homeowners, when selecting the size and shape of their dwelling would be required to follow the Design-generating rules:

Rule a : Each dwelling is composed from a kit of parts with embedded environmental features that can be combined into a variety of sizes, from studios to marionettes to houses.

Rule b : The kit of parts is prefabricated.

Rule c : Each user selects their desired combination of parts and 'plugs in' the unit to the building block.

Rule d : Each user selects an appropriate terrace, green roof, garden and/or greenhouse .

Rule e : Environmental and passive solar features determine the orientation of the building and the distance between buildings.

Rule f : The relationship and distance between buildings generate public spaces that favor casual encounters and a sense of place. This represents only a summary of the possible set of rules and there is little doubt the rules, kit of parts and general conditions of interaction of the several parties need to be investigated further but a first hypothetical deployment demonstrates the potential of environmentally-led parametric design for user choice.

7.4 Parametric Design :

During the past fifteen years digital media in architecture was used in different ways and influenced the hole field of construction and design. At the beginning digital media was applied only as a representational tool. With emerging digital technology architecture has found a new tool for conceptual design in digital media. On the one hand architectural design was inspired by the various possibilities of digital technology itself. On the other hand many topics from different fields influenced the design. Former "invisible" mathematical and geometrical algorithms, forms and structures are now visible and spatial understandable for architects and, therefore, usable. Using new technique architectural design has established computational concepts such as: topological space (topological architectures), isomorphic surfaces (isomorphic architectures), motion kinematics and dynamics (animate architectures), keyshape animation (metamorphic architectures), parametric design (parametric architectures), genetic algorithms (evolutionary architectures) or fractal geometry (fractal architecture) as discussed in Kolarevic. Generally in parametric design form is shaped by values of parameters and equations are used to describe the relationships between the forms. Hence, interdependencies between forms can be established and their behavior under transformation can be defined (mathematically and geometrically). Since about 1990 parametric design has influenced the development of digital architectural design, where we can distinguish between:

- Architectural Conceptual parametric design and
- Architectural Constructive parametric design.

7.5 Conceptual Parametric Design : In conceptual parametric design, it is the parameters of a particular design that are declared, not its shape. By assigning different values to the parameters different objects or configurations can be easily created. Rosenman and Gero, Prousalidou analyze parametric and generative representations of buildings, whether based on orthogonal or curvilinear geometry (DeCOi). They are powerful owing to their ability to capture a high degree of variation in a few numerical values. Software like Maya or Rhinoceros (with Mel or Rhino Script) offers such script editors for parametric design. Maya is software developed for film industry (primarily for animation and capturing) but lately many architects have used it for conceptual design.

7.6 Constructive Parametric Design Constructive

Parametric design refers to data embedded within a predetermined 3D object. This parametric concept is realized in various CAD packages like Autodesk Revit, Soft Plan, Nemetschek, ArchiCAD or Chief Architect. Instead of drawing lines, arcs, etc. designers can insert pre-drawn components, doors, windows, load elements, stairs or roofs etc.

This results in 3D models instead of 2D drawings, which is already standard in ship-building industry. The objective of such technology is to reduce the drafting time and corrections to 2D drawings. We detected some limitations in such software tools. First, it is not possible to consider a wide range of different building materials to make one standard for all manufactures of building materials and components with the aim to provide an "intelligent" model. Second, these software tools are originally designed for standard building elements, whereas non-standard elements of contemporary digital architecture cannot be implemented. In contemporary architectural practice there are some successful examples of using parametric design and we will discuss some of the projects. Nicholas Grimshaw & Partners used parametric design for the arched roof of the train shed at the international terminal at Waterloo Station in 1993. Each arch and its related cladding are different as the roof width changes along the curved track. In this project only a single parametric model of one arch is modeled and different parametric controlled variations define the whole roof. A bigger-scale project is the Hessing Cockpit Building within the alliance of the Acoustic Barrier in Utrecht, Holland.

Kas Oosterhuis and Sander Boer proposed one parameterized universal detail for the whole structure, One Building – One Detail. Oosterhuis/Boer provided a digital control model to the contractors, which allowed them to build all constructive details on top of this control structure. All steps are described as an Autolisp routine. The Swiss Federal Institute of Technology has realized three projects of complex forms: Swissbau Pavilion, Inventioneering Architecture, Libeskind's Futuropolis in timber by implementing parametric design as early as at the beginning of the design process. Frank O. Gehry went one step further using fully parametric support for a whole building – from design to manufacturing. Frank Gehry and Associates formed 2002 Gehry Technologies (GT) to provide integrated, digitally driven constructions and methodologies for the building industries. Frank Gehry starts projects by sketching and manipulating physical models. Using inverse engineering physical models are translated into Catia and projects are controlled and manufactured using computer-generated construction plans. At GT it is known what it will be, how it will be made and who will build it right from the beginning of the project. Teams of architects, engineers, and consultants work together in the same Catia database. The accuracy of the information and the elimination of middlemen reduce everyone's cost and risk, and make nonstandard objects buildable. Gehry Technology is serviceable for big project teams working with the same database. This oversized technology is not useful in the case of standard architectural practice. The whole projects were geometrically well elaborated and this enabled their realization within a digital chain process (from CAD to CAM). All three of them are very different in design and building strategies but they show the advantages of using parametric design methods.

8. The sample consideration of architecture students' projects of Mashhad and Birjand

In this survey two topics of residential complex design and an educational complex design were given to the students desirably and it was found that 70 percent of them incline to the parametric architecture. 40 percent of them mentioned more attraction and variation for their choice. 20 percent the quickness of project implementation and 15 percent believed that being innovative with the 3d max software is more convenient than manual design. The rest of the students answered the similar responds to the following headings.

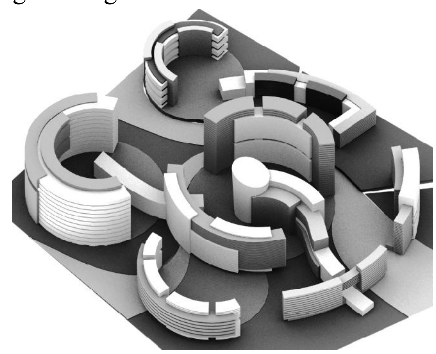

Fig.1. The chosen images of *residential* projects with parametric approach.

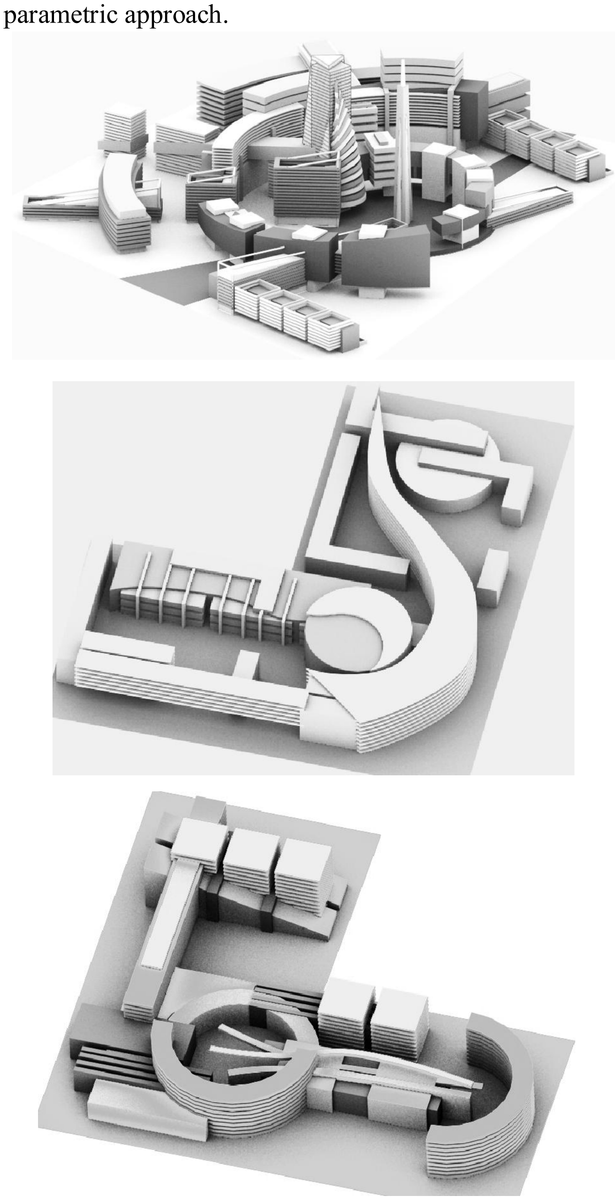

Fig.2. The chosen images of *educational* projects with parametric approach.

The outcome manifests structural changes in the architectural education system will come true in the future and operation-oriented education will not suffice anymore. This movement has begun greatly about 10 years and its main reason is the development of graphic softwares such as AutoCAD, 3d max, ArchiCAD and other graphic softwares. This parametric and algorithmic revolution will be a risk for challenging architecture teachers unless they take precautions measures.

Conclusion :

Despite the efforts of many architects like Dr. Kamran Diba who believes the Persian architecture pattern doesn't much correspond with the European counterpart and it cannot be imitated (architecture magazine No.43). And the acceptance of this principle which cultural collision help us to be mature. If you don't accept this collision you will remain rustic forever. (Cahrles Koorha)

It should be accepted this cultural collision, but the main condition is that you shouldn't lose ourselves. In nowadays circumstances, since the great number of law breaking in architectural education it must be witness unfavorable future. It must be referred to the speech of some Iranian scientists' architects for the Leaving and striving with this ambush in **large scale**.

1-Reaching to Cultural-Economical and Industrial relative stability (Soleimani)

2- Insight Sharing of determiners-architects and industry experts with research (Nader Ardalan)

3-Returing to yourself (Yaghoob Danesh Doost)

4-Awareness and supporting the determiners (Darab Diba)

5-Creative redefining of Iranian architecture features (Haeri)

6- Keeping some content -symbolic-cultural themes with new changes (Hossein Soltan Zadeh)

7- The presence of expert architects who will make a connection among the past, now and future (Saremi)

In **small scale** in the field of architectural education are essential. The attention to the followings

1- Define real-world problems and support the essential research to redefine the design problem

2- Guide students to gather the required information relevant to the design problem

3- Establish critical arguments regarding the design problem

4- Familiarize students with the different aspects of the design context and environment

5- Allow learners to develop, compare, and understand multiple perspectives on an issue

6- Emphasize knowledge construction and not reproduction during the design process

7- Emphasize problem-solving, exploration, critical thinking skills and deep understanding in knowledge construction

8- Display 3D modeling of the proposed design

9- Direct students to self-criticize and self-mentor their design

10- Synchronize the design phase with the evaluation phase of the design process, as assessment is authentic and interwoven with teaching in the constructivist view.

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