The Role of the Digital Revolution in Developing Creativity in the Interior Architecture

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Abstract:
This work deals with the study of skills and the ability to develop the imagination and creativity of students of the arts and the role of digital revolution and design ideas for virtual architecture where virtual spaces are defined by spaces designed electronically and presented in the form of competitions, including businesses-some of which has been implemented and others have not been implemented. However, they reflect an attempt to turn fantasy into reality with the creation of more flexible solutions for the design of future non-traditional spaces with new design ideas. The problem of the research is to link the technical development to the development of the design thoughts of young people and students of internal architecture through the testing of new design ideas. The study cast light on the design hypothetical thought and the effect of imagination as a derive in the development of creative ability of design for the students of internal architecture according to the rules and conditions governing the design process using modern digital techniques to reach the best results, where creativity is currently an industry that can be applied to the student of arts in general and interior architecture in particular, to stimulate and develop them and unleash their imagination to reach the best results in addition to the rehabilitation of a new generation of talented designers to cope with the design development around us since the skills are a gift that needs a continuous development. By studying the elements of creativity, the ratio of creative works did not exceed 4% which calls for re-examining the mechanisms of the development of design ideas to stimulate the creative ideas of the youth. The digital revolution has succeeded in integrating many technological applications and launching them into more complex applications, resulting in a dramatic shift in the media used in architecture and interior design, either as a system or a practice from sketches to design. The design process, which until recently seemed to be unaffected by the intrusion of electronic means now appear ready to redefine its methodology to integrate and unite with the computer. The changes in the design cannot be considered as a transient and fleeting phenomenon. Computer will occupy a prominent place as part of the design environment that characterizes the twenty first century. In addition, the development of the art of design will closely connect with the computer in the coming years.

➢ Introduction

The theme of creativity and imagination is the interest of those in charge of design education systems in the field of architecture and interior architecture. The research deals with the study of skills and the ability to develop the imagination and creativity of the students of the arts and the role of digital revolution and design ideas for virtual architecture where virtual spaces are defined by spaces designed electronically and presented in the form of competitions, including businesses- some of which has been implemented and others have not been implemented. However, they reflect an attempt to turn fantasy into reality with the creation of more flexible solutions for the design of future non-traditional spaces with new design ideas.

To develop the design skills of students of interior architecture, there is no doubt that the freedom of creativity and the process of imagination and design imagination have an important role in the development of creative thinking among young people to get a generation of young designers leading the design process in line with contemporary intellectual trends, where we find that what we have witnessed of the change in the components and the formation of a lot of design ideas is the product of a successive creative process ruled by unleashing imagination according to the principles and mechanisms of modern design.

The research sheds light on the study of design hypothetical thought and the effect of imagination as a derive in the development of creative ability

of design for the students of internal architecture according to the rules and conditions governing the design process using modern digital techniques to reach the best results, where creativity is currently an industry that can be applied to the student of arts in general and interior architecture in particular, to stimulate and develop them and unleash their imagination to reach the best results in addition to the rehabilitation of a new generation of talented designers to cope with the design development around us since the skills are a gift that needs a continuous development. By studying the elements of creativity, the ratio of creative works did not exceed 4% which calls for re-examining the mechanisms of the development of design ideas to stimulate the creative ideas of the youth.

The technological breakthroughs we are witnessing now make it clear that the future is going beyond the limits of unreasonableness, which appears clearly to the followers of the history of technology and architectural creativity as well as the reader of current developments, which is clearly reflected in the most prominent works of current architects and designers and the most important architectural projects over the past few years that are dominated by the free and unconventional shapes. These changes coincided with the increase of the applications of technology in architecture, especially digital technology. The digital revolution has succeeded in integrating many technological applications and launching them into more complex applications, resulting in a dramatic shift in the media used in architecture and interior design, either as a system or a practice from sketches to design. The design process, which until recently seemed to be unaffected by the intrusion of electronic means now appear ready to redefine its methodology to integrate and unite with the computer. The changes in the design cannot be considered as a transient and fleeting phenomenon. Computer will occupy a prominent place as part of the design environment that characterizes the twenty first century. In addition, the development of the art of design will closely connect with the computer in the coming years.

The problem of the research is to link the technical development to the development of the design thoughts of young people and students of internal architecture through the testing of new design ideas.

➢ **1. Research Problem:**
The research problem is due to the attempt to activate the creative abilities of young designers and students of interior architecture and to motivate them towards change and development of creativity by linking digital technologies and virtual design thought by developing creative thoughts of young people to get a creative generation of young designers and students of arts.

➢ **2. Research Objective:**
Studying the impact of imagination as a derive in the development of design creative ability of young designers in the field of internal architecture according to the rules and conditions governing the design process using modern digital techniques to reach the best results, and build intellectual and creative skills and turn the design ideas of young people from the stage of ideas to expressive forms and design analyzes and the attempt to apply them.

➢ **3. Research Methodology:**
The research was based on the applied analytical approach through the analysis of the design ideas of virtual thinking and the analysis of the case studies and its role in the development of creative imagination. Moreover, it was possible to link the application analysis and the virtual space on some models of the graduation projects of interior design students as an attempt to reformulate design ideas of young people and unleash the freedom of creativity and trying to apply it.

➢ **Theoretical Background:**
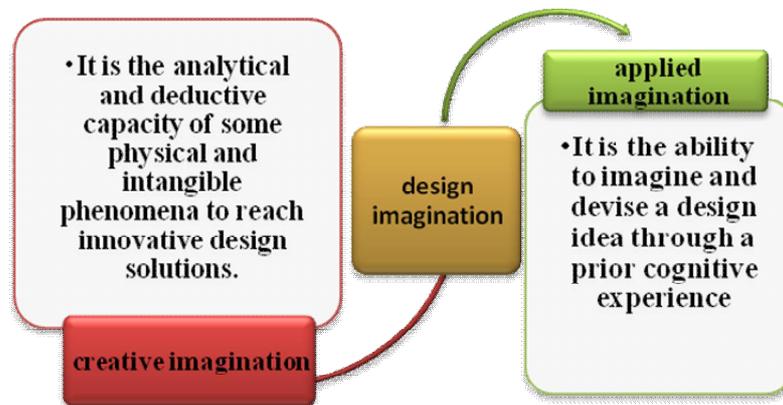
The process of the digital interior design of spaces and spreads is considered to be the designers'

dream, which is ultimately a subjective experiment on the new space or spread, without taking into account the feasibility of implementation and turning the design into reality. It may remain as a documentation and monitoring stage of the idea, or a case study that had an impact on the development of design or a case design which is implemented individually in the form of an embodied model of the idea. In this case, the nature of design creativity and its conditions may change, as well as the methods used to create the design and develop the imagination of designers, so that imagination is the main engine for the development of the concept of design and to convey the vision of the designer and his ability to imagine the design solutions and to understand the philosophical and symbolic elements of the design work, which represents a stimulus for creative imagination.

Therefore, digital interior architecture represents a virtual vision, an intellectual vision, a philosophical concept, a research case, or a design methodology, to test and monitor new ideas, using digital technology to produce future design ideas, to maximize comfort and perfection and meet changing human needs.

Thus, the design product is not limited to the traditional methods by producing them as engineering drawings by computer programs. Rather, they have become a product of digital design with a digital effect in various digital media. As we discussed the academic level of the digital media in our local and academic society, we notice the lack of information and knowledge. The research paper will discuss the design and design features of digital architecture and its impact on the development of creative interior design thought by analyzing some of the internal digital designs.

➢ **Digital Forms in Interior Architecture:**

Digital revolution produced what is known as digital forms, which can be included in the concept of modern plastic theories that meet the requirements of the time, including the trends and the renewable design theories based on the digital programs to develop the design form and create an intellectual breakthrough, whether design forms are static or mobile to enable the designer of developing and making design modifications. Thus, the concept of digital interior architecture is developed to produce dynamic forms that give life to the interior design.

Fig. 1 (a- b- c) Composed by integrated furniture and space separators, the set looks to be in movement.

The digital forms are known as designs based on the use of digital language and computer programs as the basis of design, resulting in a design revolution in architecture and interior architecture, which produced distinctive design experiments that were intellectually based on the design creative element of the architectural designer. Thus, a new design thought is developed that is

represented in design works that are considered as a revolution against the traditional design approaches.

➢ **The most important reasons for the emergence of digital architecture include the following:**

- Continuous development in computer technology and software.
- Technological contributions in the development of new design and operational systems and techniques.

- The emergence of new materials such as platinum, which represents one of the most important reasons for the successful implementation of works with digital forms, which helped to show the physical and tangible impact of digital architecture.

- Culture of digitalism and accepting the receiver of the design and his response and assimilation of ideas and the new operational design approaches, which led to the spread of digital forms, which led to the emergence of a new generation of internal architecture in line with the new thought.

This led to the development of plastic language, which enabled and unleashed imagination and creative design and gave freedom of formation without taking into account the systems and techniques of implementation and resulted in designs known as Virtual Experimental space. Virtual Experimental space is defined as virtual spaces designed to participate in competitions without taking into account the possibility of implementation. Virtual spaces represent an attempt by the designer to break the design rules to transform imagination into reality and to find more innovative solutions for futuristic spaces using the highest technologies and materials.

Virtual design is a means to exploit the technological progress and digital revolution and to reflect them in the field of architecture and internal architecture to promote the thinking of youth and students of architecture and interior architecture. The projects, models and virtual spaces express the study of the experiment and the way of using this technical, philosophical and scientific progress in architecture and interior architecture. **Figure (2)**

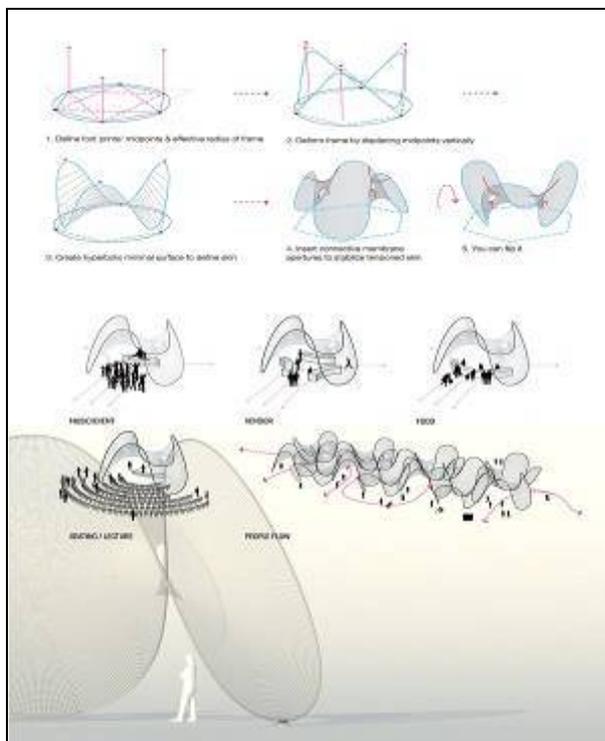**Figure 2 (A - B - C)** Model of one of the virtual spaces - a virtual museum of Ergonomics

Figure (3) shows the dependence on the plastic elements, the lines and the points for the production of free concrete forms with innovative formations.

When focusing on the digital virtual spaces, it is found that they are concerned with the internal architecture, in terms of the specialized study of the components of architectural spaces, the reduction of spaces to lesser ones, the multiplicity of jobs and the exploitation of technology to achieve that, which is an expression of the revolution on the usual design traditions to find spaces that provide maximum comfort in the future.

In the following, the most important types of digital spaces are presented by explaining and analyzing the main characteristics that clearly distinguish between them and how to benefit from the teaching and application of these ideas to young people to enhance the level of imagination and creative design and change the traditional designs.

➢ **First: Characteristics of the form in the digital revolution**

The design concept in the digital environment often evolves from the ideas provided by dynamic process methods, which illustrates the relationship between technical manipulation by using new design programs and the evolution of form, as well as the ability to select materials, components and

construction systems of digital form, and enables the designer to make decisions in order to form in the digital environment and control the manipulations or the kinetic design maneuvering where the change can be made on the element directly and the creative design. Replacing traditional design habits, the designer observes the importance of design and digital production in creating virtual spaces by combining natural organic forms and unclear geometry with relations like chemical-biological bonding relations to generate free forms representing the future pattern, as well as the effectiveness of architectural elements depending on points to generate physical forms that link shape, materials and space.

The digital virtual spaces represent a design system that does not resemble the traditional spaces that have long been inhabited by human beings. However, they produce designs and ideas with different features and characteristics that deviate from the usual design traditions. Thus, the functional activities of the space are analyzed and transformed into design maps that make a flowing space with horizontal and vertical activities, and sometimes the vertical contact units are absent or changed. This creates a dynamic flow, giving a sense of the self-movement of the space.
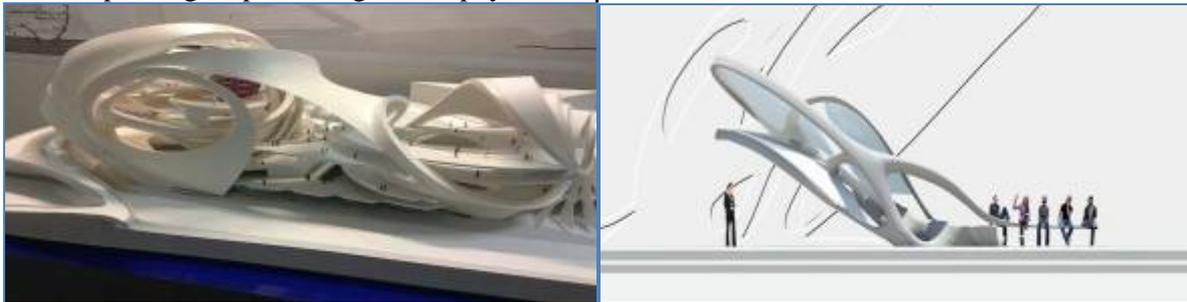

Figure 4 (A - B) Digital technologies produced designs and ideas with different features and characteristics that deviate from the usual design traditions.

Sources of digital inspiration can be classified into three categories		
(A)	(B)	(C)
Forms inspired by physical digital components (such as digital devices and tools).	Forms inspired by the models that can be produced by digital programs, especially 3D programs such as 3D Studio Max and others	Forms inspired by another vital field, such as nature.
In (A - B) inspiration is from a digital source, whether concrete or a drawn form.		(c) borrowed from outside the digital medium such as nature

> **Characteristics of digital forms: -**

The study of the characteristics of digital forms is the study of the items that expresses the concept of the unity of form in interior architecture such as the elements of the unity of form that include different aspects of form, body, size, material, texture, light and color and studying these aspects in terms of their effect on the design.
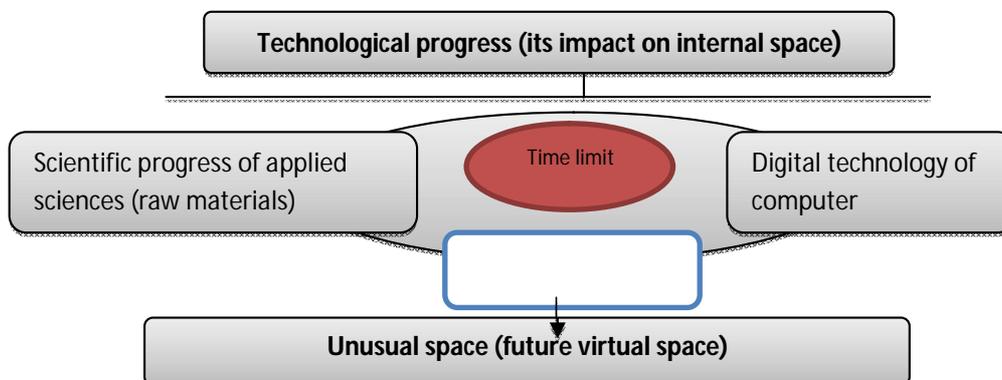
Digital design is not just the implementation of a form, or a body in the designer's mind, but it is an idea that grows and evolves from the deliberate change of a set of selected dimensions in a series of experiments. The interaction of the designer with the computer turns that information into a body. Thus, design programs play the role of the simulator for the physical environment through an intangible environment, to provide an innovative method of design as well as the ability to

transform spatial information into symbols that can be manipulated to give design alternatives or to modify the process of design, which may change the path of the proposed design thought.

Therefore, it is a necessary to refer to the Performative architecture, as an expression of how to use the computer with its digital technology and its impact on the design thought. **Figure (5)**
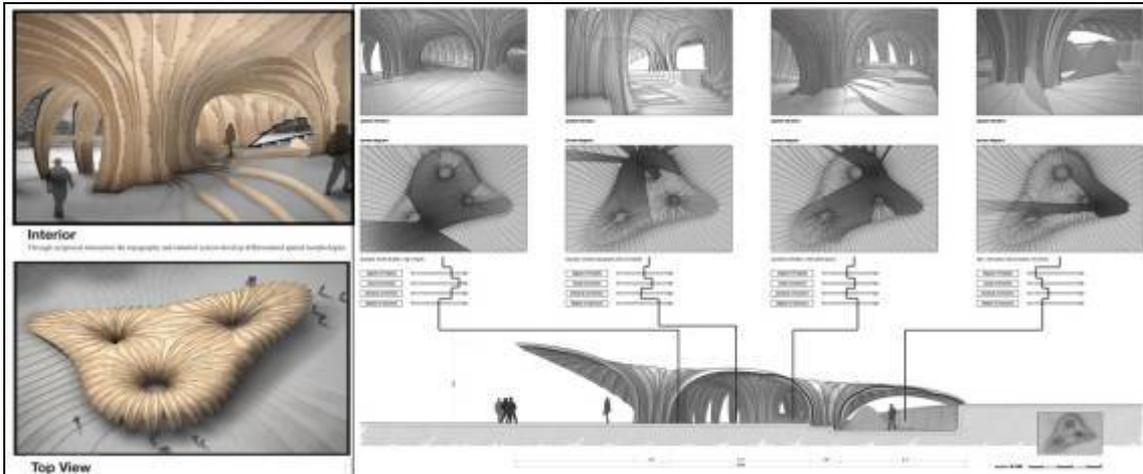

Figure (5) A model of the Per-formative architecture. A Formation of lightweight plywood timber. The design demonstrates the possibilities of using digital design techniques as well as the integrated biomimetic design methods.

The design of the virtual digital architecture depends on the search for a new intellectual concept and the exploration of new and innovative philosophical possibilities in an attempt to change the concept of the internal design of the relationship between the mass and the space and the surrounding area and to try to highlight and prove the ideas and creative design capabilities. Some of yesterday's imagination became the reality of today, and here comes the question of today's imagination, and the possibility of becoming a reality that can be dealt with traditionally in the future.

  Many digital designs have been rejected by those who are afraid to conquer the field of virtual space as a means and experimental method, because they combine everything that is static (concrete) and all that is imaginable to create potential internal design models done through computer programs for future spaces to become as a formulation of the art of electronic technology. Many of the pioneers of digital architecture have tried to classify the fields of this trend and to embody the theories of nature during the digital design, the most important of which is the philosophy of folding to produce what is known as the spaces and folded bodies, which provided new opportunities and possibilities to form the spaces and change their nature. Several types of classification have been reached, which are based on the analysis of the presented empirical models. **Figure (6)**
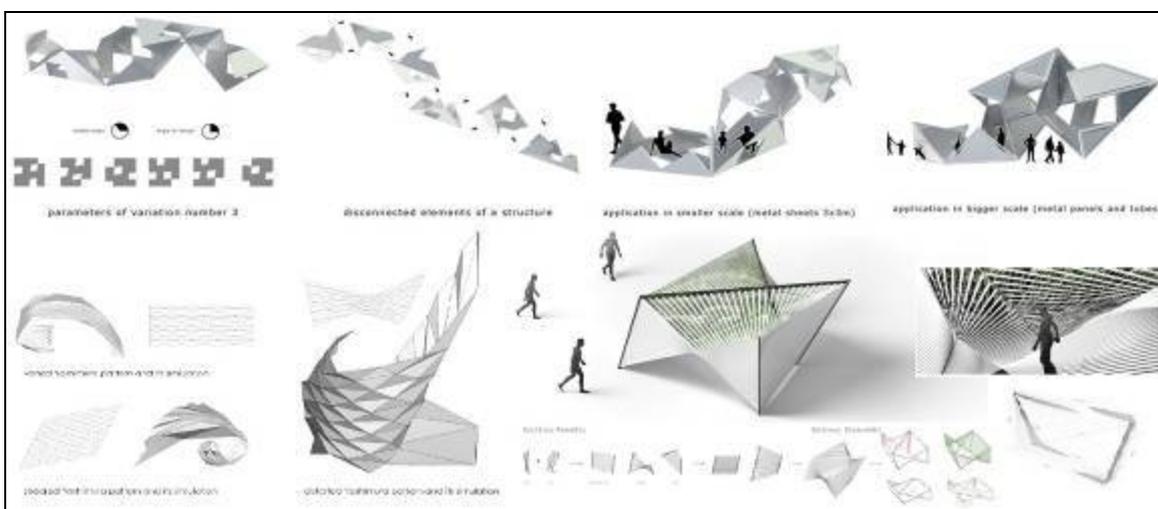

Figure (6) The philosophy of folding, which provided opportunities and new possibilities to form spaces and change their nature.

Design methods have changed radically over the last 10 years. They have become almost entirely dependent on the complex technology of the computer. Responsive designs have emerged, which were the starting point to the logic of algorithms, open-ended systems which are mechanisms for problem solving used by computer programmers, which have become useful as a means of describing future conditions in response environments. This has led to the production of cellular automata models, complexity, origination and emergence. These ideas and others helped the world of design to keep abreast of the rapid growth of Computer Technology, which made a revolution in the design and quality of the spaces.

The impact of digital thought appears on future spaces, which appear in the evolution of thought and fantasy the post-digital architecture and the analysis of atypical digital virtual models, by trying to apply some of the intellectual concepts of the post-digital architecture in the form of a multi-purpose experimental model that can adapt to the space of interior architecture in all its forms and types, whether in the near or distant future to produce a new generation of young designers capable to formulate creative concepts and unleash the imagination to produce design projects based on creativity. The following design is the applied part of the transformation of the concept of the design thought of the Interior architecture of the study of a multi-purpose partition of virtual space.

Virtual unit controls the climate within the internal space or area where it is placed and interacts with the movement of the space users as if to pursue and follow them. Thus, a reciprocal relationship grows between the user and the partition. In addition, a kind of intimacy that generates interaction with the elements of internal space in the future appears. Therefore, the partition can be dealt with as a semi-living creature and not just a space limit and a part of it. The parts of the partition turn and change depending on their movement and change of their activity or behavioral performance, to fit into the space area in which they are placed, and the number of users. If the number becomes less, they remain small sized. However, if the number increases, they grow larger, and increased their surface area which is folded and bent and continue being connected, and may be integral to perform multiple functions as it turns to reflect a positive effect on the user. **Figure (7)**
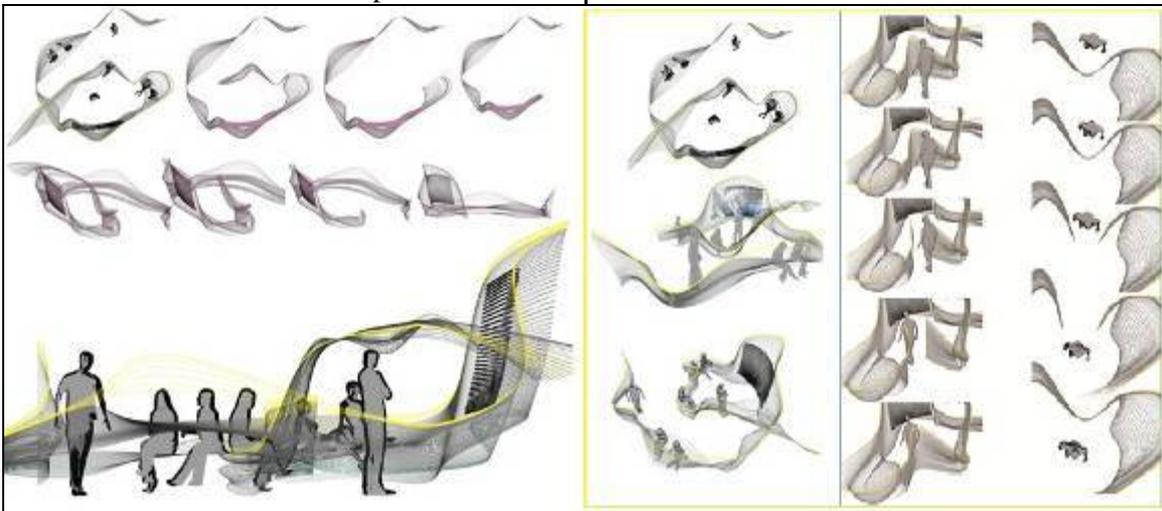

Figure (7) shows the horizontal projections and the corresponding vertical interfaces in the various stages of the growth of experimental partition according to the needs of its users

The design of the partition is composed of a transparent surface made of thin slices joined by magnetic forces between them. Each of these slides is composed of a transparent, soft material that combines its design with a set of characteristics or points that characterize virtual architecture such as: the application of the philosophy of folding and the connection of one surface and its continuity and the lack of consideration of gravity, or the rigidity of raw materials and the transformation of form and function, and interaction in response to users of the unit and borrowing from biotechnology with the unpredictability of the final form of the virtual unit due to its permanent change in form and function.

The development of furniture design reflects the clear impact of the digital revolution and its impact on the raw materials. The process of furniture design is not only depended on the function, materials, or aesthetic considerations of the design. However, it depended on the

technology of Manufacturing and modern technologies and applying the latest techniques of design and digital form **(Figure 8).**

Figure 8   A table designed by Chris Boss and a Schizlung designed by Timothy Schreiber, an aluminum alloy, where the whole process of design and implementation is digital to provide comfort and compatibility with the human body.

Laser cutting is one of the most prominent new uses of the digital revolution. The pieces of furniture appeared as if have been carved form centuries, but it is a product of the laser cutting technology that allows the designer to create forms of materials that do not usually allow manipulation and flexibility. **Figure (9)**

Figure 9- Slice Ply Chair by Mathias Bengtsson Using laser technology to produce the twisted shape.

The second model is the Bone Chair, a design inspired by organic forms that mimics bone growth and the design principles underlying the process. The chair is designed by the German designer Joris Laarman after he studied a scientific research published by the German scientist Claus Mattheck on how to design car parts to be more powerful and lighter by using the least materials by developing the design structure using two computer programs called CAO and SKO, which he innovated in order to study the design principles governing the growth of trees and bones. Mattheck has put these studies and research of the biomechanics of trees and bones in two computer programs to apply these principles to the design of any structure designed by man. In fact,

Opel GM has adopted and developed these programs and designed the first car parts with light weight and power with the least materials used.

*CAO (computer-aided optimization) and SKO (soft kill option) = Light-weighting software reduces resource use, saves energy

Joris Laarman started the design of the chair as a mass and determined the places of pressure and resistance to obtain the ideal structure of the lightweight chair with the lowest proportion of materials used, where the materials are placed in places that are under pressure and resistance and are removed from places that do not experience the same pressure. The German designer (Joris Laarman) designed a table and a bookcase also inspired by the growth of trees. The result was

another ideal structure that reflects the principles of design followed by nature in constructing and building its structures and shapes and the role of digital techniques in implementation**. Figure (10)**

Figure (10) The Bone Chair inspired by the growth of bones and the Leaf Table made of aluminum.

➢ **Digital manufacturing and 3D Printers: -**

CAM- Computer aided manufacturing- saves time and cost by converting computer CAD designs into a precise physical model that allows the creation of various designs with intricate details quickly, by directing machines digitally and automatically to achieve integration between design and manufacturing and the integrated computer system CAD-CAM. The design is based on the use of the information and data generated by the CAD Process and starts directly in the computer manufacturing processes CAM. There are many industries that benefited from the amazing progress of digital technology. In addition, the designers can determine the parts of the picture in a precise manner, in addition to the possibility of moving from the stage of visualization and imagination to a concrete form and putting it into operation, whether as an initial model or as a product of use, reducing the hard manual labor and improving continuity, development and accuracy in design and manufacturing. 3D Printers is considered one of the most popular digital technologies that is compatible with most CAD programs in addition to special programs related to the machine. The following is a presentation of some models where digital technology played an important role in their formation starting from the design phase and ending with the implementation phase.

The following model is the best design in TEX-FAB REPEAT Digital Fabrication Competition for Vlad Tinovlad Latino is a Roman architect in London. The current research focuses on the integration of science and technology in the architectural design process, involving generating mathematical methods, digital manufacturing techniques and interactive design.

The design was chosen due to the structural strength and material efficiency using the idea of assembling moduler units. The minimum surface structure is created by repeating 16 removable, extensible, expanding, openning and closing units, while changing its edges in a dynamic balance. His latest project, Minimal Complexity, was presented as part of the Facts Building Exhibition ARUP Phase2 Gallery London 2010. In addition, Vlad presented a research paper entitled "Minimum surfaces as self-regulating systems" at the ACADIA Conference held at the Cooper Union in New York 2010. Figure 11:
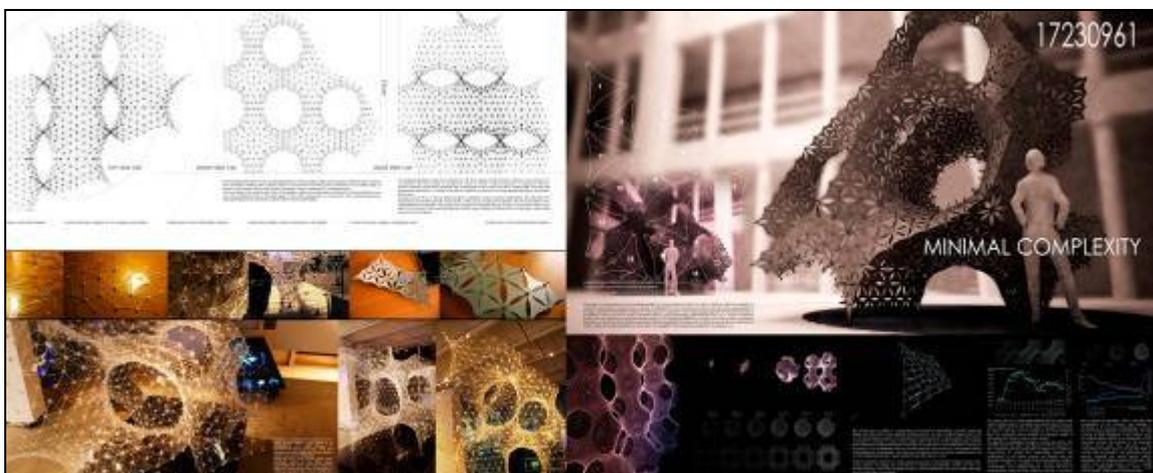

Figure (11) the winner Design Project in TEX-FAB REPEAT Digital Fabrication Competition.

The following design of MOET & CHANDON suite was designed by Chris Bosse in 2005. The design idea is to achieve a three dimensional design and replace the space to form a light weight design that stretches freely between the ceilings, walls and floors where the curves are interpreted into a 3D interior space, The designer used the latest digital technologies from the initial drawings to the final stages of implementation. The design depended on the integration of natural lighting in the design where the digitally manufactured Taiyo-Lycra was used in order to give the ability to generate space from a lightweight material in the shortest time. The computer based model depended on simulating the complexity and development of digital manufacturing techniques, which creates non-traditional spaces with lively projection and light. Natural light goes through the construction of tissue where the perforated ceiling filters the natural light and directs it through the fabric of Taiyo-Lycra to create depth and transparency of space. **Figure (12)**
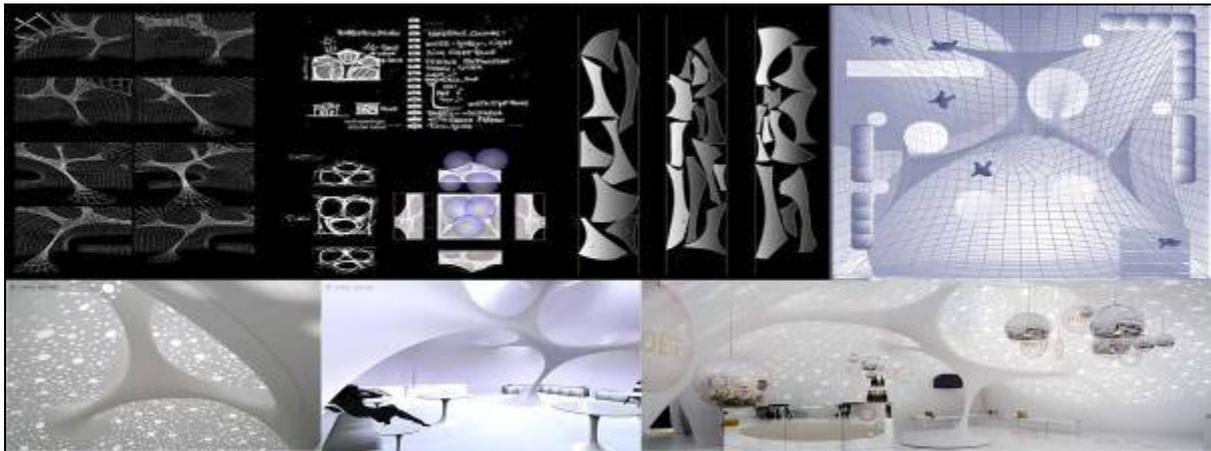

Figure (12) Interior design, horizontal projection and design idea of MOET & CHANDON Suite Designed by PTW Group based on the simulation of natural systems using digital manufacturing techniques and interactive design

C-Wall, 2006, is a digital project, which blends architecture and with biological engineering science and digital technology is the last model in the research paper. The idea of design in this project is based on studying the development in the field of research that studied Honeycomb and the geometries of honeybee hives, as well as its optimum ability to perform structurally and thermally. The project was presented at the Banvard Gallery, Nolton School of Architecture, Ohio State University, Columbus, Ohio.
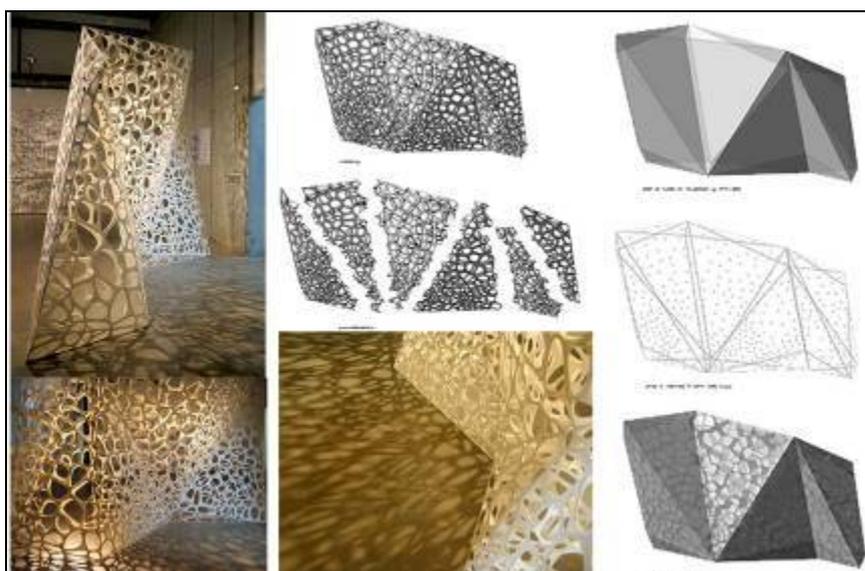

Figure (13)- Different shots of **C-Wall** that show the density of its units and its 2D and 3D. Illustrative drawings of digital manufacturing sectors of the parts and cellular units of the wall, the thin soft paper material, as well as the integration of the shadows and light and its reflection on the floor.

The size of the wall is 12 '$\times$ 4' $\times$ 8 '. It can easily adapt to the circumstances surrounding it and is used as a tool to facilitate the illustration and the embodiment of data from simulations of the particles and the worlds of the exact nature, and other data, which turn out to be the basis, the center and the starting ideas through this process. The points are converted into different-sized cells in the form of units. It can be freely changed and converted into blocks of different sizes. It has been fully manufactured by computer, and assembled into larger blocks. C- Wall is considered as one of the small digital projects. The model has evolved from its 2D to 3D. Although it has been built from layers of lightweight thin paper, it displays a strong structure with extreme hardness in relation to its real weight. The Wall consists of about 500 individual cells, and the image has been used as an integrated and balanced picture integrated with the floor by using the required density of cells in the wall size, as well as different sizes of cells, producing interesting patterns of light and shade.

After reviewing some aspects of the impact of the digital revolution on interior design and interior architecture, a set of conclusions and recommendations were drawn in an attempt to upgrade the design process through the following:

> **First: The Conclusions**

1) Identifying the basic items and its possible values for the analysis and characterization of digital architectural forms.

2) Determining the most important indicators of digital architecture on the interior architecture and illustrating the distinctive characteristics of digital architecture as these characteristics are prominently manifested in unleashing creative designing.

3) Virtual space is a reflection and a stage of study to prove the theories in the field of architecture and internal architecture. Linking the imagination and reality is an expression of a design vision and not a tool; however, it develops as the tool develops

4) Each set of digital projects is a reflection of the technological progress of the era, which affected the nature of thinking and design in an attempt to exploit this progress in interior architecture.

5) Identifying the items of form appearances in light of the cognitive variables of the design characteristics of digital architecture, which is represented by both balance and vitality and freedom of design and implementation.

6) Most of the projects are characterized by a state of closure, which does not refer to a lack of transparency, but the vagueness and definition of openings and motor outlets for the recipient, whether spectator or user, to enjoy the pleasure of searching and survey to the extent that he can explore and use the ports according to his own method in finding these outlets. It was aimed at digital forms to give the fun to the recipient and move from the traditional elements in terms of circulation.

7) Digital forms are characterized by being free geometric shapes and axial incomplete symmetry and incomplete symmetry, which gives them an implicit clear balance. In addition, digital figures mostly possess the feature of unrealism.

8) The nature of digital design is characterized by a high degree of accuracy of details, and the complexity of the shape of the section and the external shape is always inclined to embodiment. It is always noticeable that the arches, for example, are not flat but take a certain depth and are at a certain angle. Also, these forms are characterized by the many details that they contain, which stick out in different directions to give the impression of roughness of texture.

9) In terms of harmony, the proportionality is the most prominent in digital design, taking account of computational or engineering calculations, which confirms the nature of free forms that are not subject to computational calculations and the like.

10) Digital design is characterized by regular or irregular continuity, in the case of rhythmic harmony, where complete repetitions, gradations or regular succession disappear.

11) Most projects are characterized by a final expressive stage of form, representing the design uniqueness of a designer of digital architecture.

12) Digital designs with dynamic action that is simulated and interacted by digital forms, where the motor act appears and this shows that the most obvious feature in digital forms is the continuity of time.

13) The results also revealed the emergence of a balanced natural dynamic value in terms of the nature of the optical motion as concerning the nature of the virtual space relations represented in the relationship of seam, overlap and intersection.

14) The spaces of digital interiors have developed a special nature, changing the standards, design values, and the order of functions.

They have even been integrated into a set of computer techniques, to be immaterial and intangible spaces free of all design traditions.

15) The computer is a means of creativity for a performance architecture, which expresses how the structure of the spaces performs, and the spatial masses to guide the design, and to adopt the priorities and the foundations of the new performance of the design, to give an endless room for the formation of structures, and spatial blocks and to find their forms and manufacture.

16) Future spaces are the formulations of electronic art, and many of the pioneers of digital architecture have tried to classify them and embody the theories of nature through digital design.

> **Second: The Recommendations:**

1) The necessity to support cooperation and communication between the interior designer and researchers in the scientific and technological fields of architectural construction and its internal components, as part of the team work to cover the scientific side needed to complete the design and support its success.

2) The necessity to follow up all the latest developments in the fields of technology and science, and follow their applications in internal architecture, for further intellectual development and broad imagination.

3) The need to pay attention to the development of thought and design concepts of internal architecture, especially the development of the minds of students of internal architecture to develop the way of design and creativity, so as to expand imagination, and deal with a new type of internal architecture will be prevailing and most likely in the near future, including its different standards and dimensions.

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