

# "BEAUTY OF WHOLESNESS AND BEAUTY OF PARTIALITY." NEW TERMS DEFINING THE CONCEPT OF BEAUTY IN ARCHITECTURE IN TERMS OF SUSTAINABILITY AND COMPUTER AIDED DESIGN

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## ABSTRACT

The great shift in sustainability and computer aided design in the field of architecture caused a remarkable change in the architecture philosophy, new aspects of beauty and aesthetic values are being introduced, and traditional definitions for beauty cannot fully cover this aspects, which causes a gap between; new architecture works criticism and its practice, even architecture education has witnessed this gap. This research coins a term concerning architecture as the beauty of wholeness(Beauty by capital B) and the beauty of the partiality of wholeness (beauty by small b) , where Beauty is an alternative term to aesthetic values with a wider range, and it is concerned with all aspects of beauty of the architecture work form, performance, durability, culture values, while the beauty will be concerned with a particular aspect of beauty concerning the architecture work such as its ecological value, structure innovation, its reduction in energy consumption, both together can redefine architecture and can reinterpret its nature, this would open the gate for a new era of architecture criticism, education, and practice. The research will introduce scientific beauty - a beauty of the partiality of wholeness- as an example related to beauty in terms of sustainability and will use a theoretical case study to illustrate it.

## KEYWORDS

Beauty - beauty - Scientific beauty - Sustainable design development - Sustainability.

## 1. INTRODUCTION

Beauty can be considered as a universal theme, debates concerning the interpretation of how to define it are many, different thought and trials were held by thinkers, philosophers, artists and even scientists in order to investigate such issue. However, Plato dialogues concerning beauty and aesthetic values are considered to be one of the most significant interpretations to this field among history, he was seeking actually the aspects of aesthetic values through discovering and defining its vocabulary, that's why he has more than one definition for beauty through his various dialogs. He considered aesthetic values a term wider than beauty, aesthetic has its core define through understanding beauty, imitation, and inspiration. Artistically and philosophically, aesthetic has a wider meaning (Stanford Encyclopedia of Philosophy,2012), and it is the contemporary definition for beauty.

In the field of architecture, the beauty can be measured in terms of form morphology, appearance, and its form values, actually architecture has different perspectives defining its beauty, many definitions where held to formalize the meaning of its beauty, the fifteenth properties of architecture beauty by Christopher Alexander in Nature of Order applied in architecture, all were related to the form composition and scale, even when Huib Koman, Stephan Luijks, and Arno Pronk (Huib Koman, S. L. 2014) tried to define aesthetics and beauty in architecture in a mathematical order named mathematical beauty contributed from previous works for same trials, all defined beauty in the form of equations but at the same values related to form and proportions .

Architecture in the last decades has witnessed a great development accompanied by a change in architecture design thinking methods, tools, and trends. This development took place in a very repaid way, and a new architecture language is being created for a new architectural era and may be a new paradigm (F.Mclennan, 2004), different design qualities and values are introduced, calling for a new elements and aspects defining its beauty and language, where this can redefine architecture, and open the gate for a new era of architecture criticism, architectural education, and better understanding of practice and architects role.

In terms of sustainability; as well as different computer form generation designs methods, side by side algorithms, parametrism as defined by Patrik Schumacher (Jabi, W. 2013), all has shifted architecture thinking into a new era, where traditional aspects of beauty wouldn't be enough to fully define aesthetic meanings and values of this type of architecture, beauty should regard a complex set of new aesthetic aspects related to economic, environmental, social values and scientific technical values. The research purpose is to coin a new term for the Beauty with the capital (B) as an alternative term to aesthetic values and to define beauty with the small (b) as a partial beauty defining an aspect or an element concerning the Beauty. the aim of coining such terms is to assure that aesthetic measurements are no more enough to measure beauty in architecture

The research is important as it helps in defining how can we criticize architecture today, and what are those qualities of architecture that are not considered during education, and how this can help in edging the gap between education and practice, as a result this would help in understanding the nature of architecture of today, how to learn, practice and criticize it.

## 2. THE RESEARCH HYPOTHESIS

The great progress architecture is witnessing - *related to sustainability and computer aided design* - has introduced new qualities for beauty, traditional definitions for beauty or aesthetic values are not enough to judge or completely understand it. And with any new progress there would be new introduced values, as a result beauty has to be defined on two levels; that would both cover the wholeness and the partiality as follow: A domination level: Where this research is proposing to coin it as the Beauty by capital B and A sublevel: which is related to a certain kind of progress and named as beauty by small b, in order to judge a certain architecture work as being completely beautiful, and has almost a complete set of aesthetic values. It should verify both levels of wholeness and subs(partiality).

## 3. THE RESEARCH PROBLEM

The research asks what the elements are defining the new term of beauty of wholeness and partiality. and How it can be understood? The second research question is related to new contemporary architecture can we introduce scientific beauty as a sub definition added to the major term Beauty with capital B and how it can be defined.

## 4. THE RESEARCH OBJECTIVES

The research major objective is to coin the new terms Beauty of wholeness and beauty of partiality as follow:

- To give a full definitions to the meaning of each with regard to its elements.
- To design a model diagram illustrating the concept of the new terms to be as a blue print.
- To compare through a theoretical case study on the comparative methods, the major difference between regarding an architecture work with the new introduced perspective of beauty if compared to the traditional one (the chosen case study is a comparison between the SwissRe Building, and the Turning Torso with a new interpretation). This will give a spark for other researches to follow this approach for deeper understanding and further studies.

## 5. THE METHOD AND DESIGN

The research is studying a philosophical meaning and term **beauty in architecture** so it is non-experimental research as it seeks analysis of the term itself, so it is explanatory and descriptive, as it describes beauty in architecture on two levels and scales and explains how this defines the new language of contemporary architecture.

### 5.1 The Research Variables

- Beauty by capital B: Where it is a dependent variable on quality of design, it is the beauty of wholeness, where it regards all aspects of beauty in architecture as form shape, structure performance, philosophy, culture value, sustainable aspects.
- Beauty by small b: Where it is considered as a partial aspect of beauty such as the form only, the structure innovation, so it is concerned with a particular aspect of beauty in architecture.

## 6. ARCHITECTURE AESTHIC VALUES ARE CHANGING IN THE NEW MILLINUM

*"The mother art is architecture. Without an architecture of our own, we have no soul of our own civilization."* Frank Lloyd Wright . (Francis D. K. Ching, a. J. 2013).

The quotation of Frank Lloyd Wright represents the belief of many peoples, where architecture is considered as the mother of arts, but what makes architecture unique is that it is concerned with the physical properties of space, its arrangement, and design proportions. Not like other forms of art, it provides a space for daily life activities, then architecture in addition to its artistic form it carries functionality as an another aspect defining it, architectural products represent its society politics and culture.

*"We shape our buildings, and afterward our buildings shape us."*—Winston Churchill, 1943. (committee, P. u. 2002).

Among history, architecture aesthetic aspects were discussed in terms of form, and space arrangements in addition to architectural elements proportions, classic architecture in old Ancient Roman and Greek had its own rules regarding classic orders named the five classic orders (Fletcher, S. B. 1924)Fig.(1-a), all we seeking how to find a certain ratio regarding the relationship between spaces, and architectural elements. In classic architecture, ornaments were considered an aspect of beauty; the same was in Islamic architecture. The Renaissance age represents the revival of old Ancient Roman and Greek classic proportions in terms of humanism, that was the basic concept controlling everything in early Renaissance age, it represented a culture shift, art and architecture; both together were completely affected by this philosophy, human was the center of life and the center of thinking Fig.(1-b); the paintings were always pointing on human features body and flesh, colors were very dynamic, artists wanted art that shows joy in life, this helped in deeper thinking of art; on the other hand architecture was also affected by humanism; architects began to look for architecture that focuses on human, architecture with smooth joy features and dynamic colors (Fletcher, S. B. 1924); this movement was based on some principles like the mathematical sequence generated by the mathematician Leonardo Fibonacci, which led to the theory of golden ration Fig.(1-c), (Ushakov, I. 2012). Renaissance artists and architects used the Golden Ratio to determine beautiful proportions in buildings and their painting compositions.

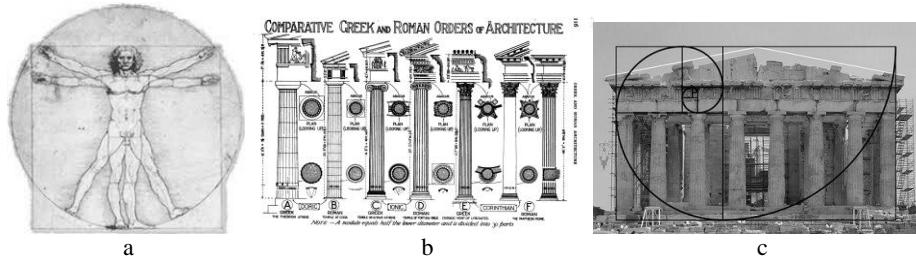


Figure 1. (a) The vitruvian man by michelangelo(humanism in Renaissance),(b)The five classic orders between roman and greek ,(c) Appling the goldent ration on architecture forms.

Starting from the middle of the nineteenth century followed by the twentieth century, architecture witnessed great changes in its ideas and perspectives; this was due to the modern movement, the different avant-gardes, and the concept of modernism, futurism, and constructivism. All were a reason for massive changes in architectural conceptual design forms (Demartini, F. P. 2006), ornaments became a crime (Loos, A. 1997); his was the argument of Adolf Loos. Minimalism was introduced under the expression of Less is More; even architecture was considered as a machine, after the middle of the twentieth century, the death of modernism was declared, and the new schools of late-modernism and post modernism were introduced, but yet all different changes in architectural thinking did not face problem in criticizing its beauty and aesthetic values.

The age of High-Tech followed by De-Constructivism in parallel to the movement toward sustainability -since 1987; when Brundtland report in Our Common Future coined the term of sustainable development-represents a transition phase towards Contemporary Architecture of the new millennium (Brundtland, G.H. 1987) & (Bartlett, A. A. 1994). New aspects for beauty has started to appear in terms of performance, energy consumption reduction, it became quite clear with the great development in technology and the introduction of computer aided design tools to the scene of architecture, algorithms, parametrism; that all were calling for new aspects measuring their aesthetic values.

## 7. BETWEEN CHRISTOPHER ALEXANDER'S NATURE OF ORDER AND MATHEMATICAL BEAUTY IN ARCHITECTURE

In 2002, Alexander's Christopher proposed fifteen rules for good and beautiful architecture, he spoke about wholeness and center properties, and this was his interpretation to architectural beauty his rules were as follow (Alexander, C. 2002):

1. Levels of scale: It shows how strong centers are created through strong centers of smaller parts defining an architecture particular composition.
2. Strong centers: Where centers play a fundamental role in defining architecture beauty.
3. Boundaries: Where living centers become stronger when surrounded and defined by boundaries, where boundaries create a field of force around its center.
4. Alternating repetition: Where total compositions can be reinforced and strengthen through the repetition of centers in a defined way.
5. Positive space: Where positive spaces are geometry related to the mass from which the space is resultant in a strong way.
6. Good shape: When all elements of the architectural composition are complementary and define the goal of the whole composition the shape would be good, as the centers of all elements will be reinforcing each other.
7. Local symmetries: This would happen when symmetry is achieved on different levels of scale, that means having a composition of different elements that have a local symmetry
8. Deep interlock an ambiguity: The creation of a new unity through the interlocking of different elements, this would create a new center.
9. Contrast: Through combining different elements of different shapes, colors, and textures in order to emphasis a certain composition.
10. Gradients: It is the remarkable similarity at a mathematical function.

11. Roughness: Roughness can be defined as a pre-defined grid, which has certain imperfections, which are related to the pattern composition, their contrast results in a more comprehensive and unified whole.

12. Echoes: It is the repetition of a base object with different possibilities and alternations; it depends on angles and families of angles.

13. The void: It can be considered as an empty center, a void can be used to develop activities at empty spaces.

14. Simplicity and inner calm: It represents the use of simple geometry forms that can be easily understood and defined.

15. Non-separateness: It represents the unseen connections between forms and centers.

Christopher Alexander's rules were discussed mathematically through a research work by Huib Koman, Stephan Luijks, and Arno Pronk; that is named Mathematical Beauty in Architecture, this was not the first trial to define beauty in a mathematical form; but many mathematicians' tried to define beauty mathematically. Bertrand Russell was one of the most influential mathematicians and philosophers known in the twentieth century has expressed his interpretation to mathematical beauty in some word as follow: "Mathematics, rightly viewed, possesses not only truth, but supreme beauty - a beauty cold and austere, like that of sculpture, without appeal to any part of our weaker nature, without the gorgeous trappings of painting or music, yet sublimely pure, and capable of a stern perfection such as only the greatest art can show. The true spirit of delight, the exaltation, the sense of being more than Man, which is the touchstone of the highest excellence, is to be found in mathematics as surely as poetry." (Russell, B. 1918).

However, all attempts to define beauty were always targeting the appearance, which is an aspect of beauty, but to call something beautiful there might be many other characteristics, similarly in architecture. For the structure innovation how can we define it as beautiful, the building performance, all these qualities and others were the reason to let us call the traditional defined beauty is an incomplete beauty; then its partial, that what makes the research propose a new term Beauty by capital B to be a universal beauty that carries all alternatives and aspects of beauty measurement and to classify the beauty related to appearance, colors and proportions as one of many partial beauties by small b; that all together would define the "Beauty"

## 8. "BEAUTY" BY CAPITAL B IN ARCHITECTURE

This term in architecture represents the beauty of wholeness, thus everything; where it can see all aspects of beauty regarding aesthetic values, performance, quality of space, and environmental aspects, whatever. "Beauty" is composed of a set of partial beauties that define the aspects of the field.

In art Beauty would be much more different than in architecture or music, each field should be measured in terms of its aspects defined by its purpose, in the field of architecture the research propose three partial beauties; that define the beauty of wholeness as follow:

1. The beauty of form (artistic beauty): " It is the beauty that is concerned with the building form appearance (shape, color, proportions...etc). This type of beauty is the well-known type; where it can be felt by any nonprofessional viewer to the architecture work, it's based on culture of the viewer, his education and his perception, so it measures visual qualities".

2. The beauty of conceptual idea (philosophical beauty): " It is the beauty that is concerned with the philosophical background affecting the form generation and architecture solutions"; as a real architecture work should have its own philosophy; that can define a certain kind of beauty, and it is not necessary to be related to form appearance, but in way or another it should be linked. So it measures the quality of idea(meanings-architects message to users-language....etc)

3. The beauty of functional performance(scientific beauty): " It is the beauty that has a scientific value, where it represents a scientific innovation solution in terms of form, the form here would not be targeting a good appearance only; but it would be solving a functional problem.

For example Sustainability in architecture design may have to be measured with the third partial beauty as the major scale taking in considerations the other aspects of beauty, when a building is capable of reducing the usage of a certain forms of energy or can provide a better performance of space this would be beautiful.

It is recommended in next research work to study what indicators should measure each term(the three partial beauties); those indicators can be inspired from the sustainable development indicators in addition to social and economic indicators. By understanding that beauty of architecture has changed, the education and evaluation and criticizing methods should change. This would make the understanding of contemporary architecture much better.

## 9. THE NEW MODEL OF "BEAUTY" IN ARCHITECTURE

The beauty of wholeness interactive model Fig.(2), is proposed to solve the inter correlation between the three partial beauties of architecture, it is designed in a three dimensional form composed of three interlocking cylinders embed with in one form, each represents one of the three partial beauties, not like the three circles of sustainability. The three cylinders are characterized by height, which is an indicator to the degree of effectiveness of the type of beauty in the proposed designed architecture product; normally there would be no absolute beauty or optimum beauty, which means there is no 100% beautiful; so the importance of height is that it can indicate an effective value of beauty if compared to the optimum model(100%).

Each type of beauty should be measured and defined through indicators, the future research work will work on determining these set of indicators and their relationship, by defining the indicators affecting each cylinder (type of partial beauty) through further researches this can be an effective measurement tool to Beauty, this would introduce a new term the degree of Beauty.

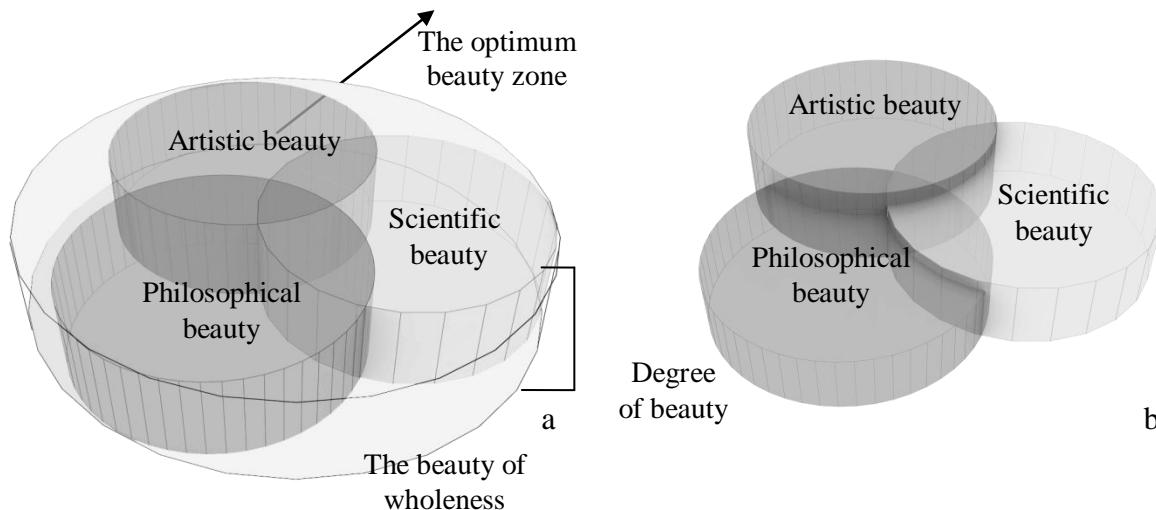


Figure 2. (a) The new model if beauty in architecture      (b) The relationship between partial beauties

### 9.1 The Partial Beauty Effective Value (bv)

"It is the value measured through the partial beauty Indicators to indicate the degree of the partial beauty effectiveness" each cylinder represents a measurement scale to the type of beauty, the measurement scale can be divided into set of indicator and by calculating the sum of degrees of each indicator value the effective value can be known. The bv is proposed to be measured in 100.

### 9.2 The Degree "Beauty"

The degree of beauty represent the percentage of beauty compared to the absolute Beauty of wholeness, it is measured by applying the equation of beauty as follow:

$$\frac{\sum (bv^1 + bv^2 + bv^3)}{(Three) \text{ the number of partial beauties}} = \text{the degree of beauty}%$$

Where  $bv^1$  = the beauty of form (artistic beauty) **effective value**.

Where  $bv^2$  = the beauty of conceptual idea (philosophical beauty) **effective value**.

Where  $bv^3$  = the beauty of functional performance (scientific beauty) **effective value**.

## 10. THE TURNING TORSO AND SWISS RE BUIDLING IN TERMS OF BEAUTY

This comparative analysis represents the research new approach to define beauty, as it represents two different perspectives for beauty represented in the design of two towers, the Swiss -rebuilding Fig.(3-c&d) (180m height); design by Norman Foster, and the Turning Torso (190m height) Fig.(3-a&b); designed by Santiago Calatrava, the research is comparing both towers in terms of "Beauty" where both are equivalent in height, twisted in somehow, and considered as vertical tall structures.

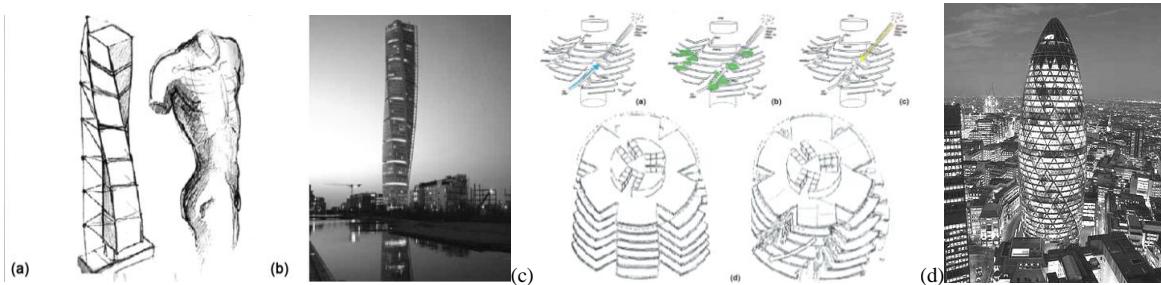


Figure 3. (a),(b) The turning torso, (c),(d) the Swiss Re-building tower

### 10.1 Swiss Re Building Tower

It is a tall structure of 180 m height having a diagrid; as a structure system to its form; it is considered to be from the first ecological buildings designed in London, it added a special and unique character to London's sky line; the form is designed through the twist of a circular plan having six triangular cuts, the circular plan widens from bottom to the middle of the tower then tapers toward its peak, this form is designed to overcome lateral forces and vortex shedding phenomenon, the tower is a sustainable structure where the twist of the circular plan with a five degrees creates a spiral cavity with a multifunction's as follow (Wells, M. 2005):

- 1- Providing natural day lighting.
- 2- The use of sky gardens to bring spatial quality.
- 3- Providing natural ventilation and reducing CO<sub>2</sub> by using natural systems to control the climate inside the building.

Although the twisted form shows many aesthetic values visually, this design used to hide the twisted floor plates, with a diagrid skin ,where performance of the form was much more important than showing the twist its self, the beautiful value here was through the :

- 1- The innovation of structural form.
- 2- The use of spiral cavities created from the twist to be a sustainable treatment.
- 3- The tapering of the form to overcome the wind.

So in addition to the creative form the hidden dimension of beauty was a scientific beauty rather than being an artistic one.

### 10.2 The Turning Torso Tower

The design is inspired from a previous sculpture work by Santiago Calatrava, when he was convinced to design a tower based on the same concept of the sculpture work, this high rise structure of 190 m height formed of nine similar cubes twisting through 900 from top to bottom, echoing the form of human body see fig (3-a). It is a concrete shear wall core carrying cantilevered floor plates twisting around the core and supported with an outside exoskeleton steel spine. In the Turning torso design the twisting form is emphasized in the contradiction to the case of Swiss re-building, which shows that the artistic and aesthetic values inspired from the proportions of the human body; were the major motivation in the creation of the designed form, the structure innovation of the mix between exoskeleton and the core with cantilever structure were used as a tool to express the form, so it is quite clear that the artistic philosophical beauties are stronger than the scientific beauties as values (Lepik, A. 2008).

## 11. CONCLUSION

The meaning of beauty in architecture should be redefined; as the beauty of wholeness (Beauty by capital B) where it is composed of three partial beauties defined as the beauty of form (artistic beauty), the beauty of conceptual idea (philosophical beauty), and the beauty of functional performance (scientific beauty). The "Beauty" of an architecture work is measured in terms of the three partial beauties.

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