The concept of self-organization and its applications in the field of architecture

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Abstract:

Digital technology has helped the designer to explain of the morphological natural phenomena by analyzing and learning from them, such as approaches of self-organization as an input into design, as well as by understanding the different morphogenesis systems and their applications in digital design, through which we can obtain infinite shapes in design.

In recent years, many scientists have started to gain the advantages of self-organizing systems in nature through their computational models in areas such as telecommunication networks and robotics. Main advantages of such systems are robustness, flexibility, adaptability, concurrency, and distributedness. Self-organization is a large group of free formation processes based on repeating a pattern in physical, biological, and chemical systems, etc., such as sand grains that gather in waves sand dunes, chemical reactants that form spiral vortices, and cells in a living organism that form highly organized tissues. All of these examples share the same school, as the common feature between these different systems is the way in which their system and structure are formed, as a pattern is formed through the internal interactions of the system, without the intervention of external influences (humans).

All natural systems have explained self-organization as an automatic self-process that occurs over time based on the interaction and interconnection between a group of components and elements that result in many changes in the composition, structure, and coordination of the form resulting from the interaction and interconnection.

Patterns in nature are visible regularities of form found in the natural world. These patterns recur in different contexts and can sometimes be modelled mathematically. Natural patterns include symmetries, trees, spirals, meanders, waves, foams, tessellations, cracks and stripes .

Research problem: To what extent this contributes to the self-organization approach in living and non-living natural systems, with the influence of external and internal factors on their structure, help in finding architectural design solutions? -.

Research Objectives: - A review on the concept of self-organization, its history, relationship to digital design and modern design trends, a presentation of some architectural models that illustrate its use as an approach to design. An investigation into the relationship between self-organization in design by using living and non-living natural systems and the field of architecture.

Significance: The importance of this research Explains and Analyz the self-organization approach in living and non-living natural systems and using it to arrive at architectural designs.

Research Methodology: The research uses descriptive analytical method .

Results: Advanced studies have focused on the concept of self-organization and have explained many natural systems such as cosmic and biological systems, in addition to other scientific fields such as chemistry, geology, sociology and information technology. They have also addressed the connection of this concept to many theories that have explained it by describing it as an automatic self-organization process based on the interaction between the secondary elements that make up the larger system. Thus, it has been possible to benefit from these systems in many different sciences due to their durability, flexibility and great ability to adapt to environmental variables. In different design methodologies, the designer can know all the current and future design requirements and potential changes before building it, which enables him to solve all problems through a fixed

solution, but he may not be able to adapt to environmental changes. This requires the use of four-dimensional design strategies based on space and time. As four-dimensional design thinking not only allows for more flexible and adaptable construction, but it also expands the scope of design to include system problems. Which assumes that computational strategies inspired by the self-organization approach are a promising direction for creating such systems. Through digital technology, the designer was able to interpret some of the phenomena of formation found in nature by analyzing them and learning from them, such as the phenomenon of self-organization as an input into design, as well as by understanding the different systems of genetic formation (Morphogenesis) and their applications in digital design through the use of patterns and their repetitions to obtain infinite models and shapes of designs.

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