FINDING FRACTALS IN DESIGNING PARDIS TECHNOLOGY PARK IN TEHRAN

*Shabnam Akbari Namdar and Saeid Rahmatabadi
Department of Architecture, College of Art and Architecture, Tabriz Branch, Islamic Azad University, Tabriz, Iran
*Author for Correspondence

ABSTRACT

Life is born from chaos; while discipline arises from the habit. The key concept in Chaos Theory is that an order is laid in any disorder. This means that discipline should not be sought only in a scale. Chaos is a theory that considers various issues, but requires a language for its concepts visualization and this was an area that created Geometry of Chaos or Fractals. Fractal geometry provides us a tool for seeing the infinite and these forms have a very important feature, and it is all of a shape is made of the components similar to the original shape. Fractal geometry as a critique tool, a designing tool compatible with the nature is in the wake of analysis and simulation of irregularities, and expresses in irregularities also discipline is hidden that due to the excessive complexity, we do not understand it. It is interesting that in many works the observance of fractal geometry have been done without knowledge. That is in these works the designer has tried to find the relationships and harmonious proportions and the geometry inspired by nature and has achieved fractals unconsciously. The main purpose of this research is to find fractal designs in designing Pardis Technology Park in Tehran. In fact, we are seeking fractals in designing this work that has three characteristics of self-similarity, formation through repetition and lack of correct dimension. In this study we explaining chaos theory and fractal geometry we will deal to examine examples of this theory in designing Pardis Science and Technology Park in Tehran. The research methods are qualitative with interpretation - oriented approach, case studies and based on theoretical studies. In this project, from the view of the author the site has two fractals, one is H- form and other one is tree form that they are used in the plan and the plan form.

Keywords: Order and Disorder, Chaos Theory, Fractal Geometry, Pardis Technology Park of Tehran

INTRODUCTION

Untapped and wild nature with its wide range does not seem chaotic. In the movement of the seasons, night and day, and sea waves order can be seen clearly. The stones, rivers, plants and insects structures can be seen. These display an order next to each other that in our desired visual scale cannot be measured. We accept diversity and praise it. However, humans according to their traditions have imposed the city on the face of nature with a measureable discipline. Lloyd Wright states that “I wish a long life; that I could discover the rhythm of the great nature”. Chaos is a “kind of order without alternation”, apparently, a random and repetitive behavior in a simple and determining system. Chaos represents a world that in the same of determinability, following of the fundamental physics rules probably are chaotic, complex and unpredictable, etc. there is order in the chaos and there is chaos in the order. The key concept in Chaos theory is that in any disarray, there is a discipline in the sense that order should not be sought only in a scale. A phenomenon appears to be completely random and unpredictable at the local scale, perhaps be very stable and predictable on a larger scale. (English Wikipedia) Chaos theory is considered various social, political, economic and artistic subjects but it requires a language for visualizing its concepts and it was an arena creates the fractals or chaos geometry (Barnsley, 1993). Fractal geometry has provided a tool for us to see the infinite (Mandel, 1983) and these forms have a very important feature, and it is a complete shape is formed of similar components to the first shape. In other words, constitutive small parts are repeated in large structures. The main purpose of this research is to find the fractal patterns of Pardis
Science and Technology Park in Tehran. Indeed, we are looking for fractals in designing of this work that have its three features self-similarity (similarity while the sizes are different) forming through repetition and lack of correct dimension (if the dimension of line, is one; the dimension of page, is two; and dimension of space to be introduced with three, fractals do not have right dimension and their dimensions are a fractional number) that the distribution of fractals can be used for creating in the design of complex rhythms and the fractal dimension of the measured plan can be used as a review tool. In summary, it can be said that the architecture who knows the fractal can give the plan which all feel its compatibility with the nature but few people discover this compatibility with this method he can stroke the nature with his architecture and respects to his cradle, the earth. In this study we examine the theoretical principles of the architecture designing of science and technology parks in three formats of motion, physical and functional disciplines.

**MATERIALS AND METHODS**

**Pardis Technology Park (PTP)**

Pardis Technology Park (PTP) as the region’s paradise of technology, under supervision of Presidency Deputy for science and technology and a fourteen-entity Board of Trustees comprising of corporate and real bodies from ministries, science centers and academies, headed by the First Vice President, pursuing the goals of commercialization of the research results and, establishing sustainable ties between University and Industry, is located in a now 38 hectares area, in two phases, (expandable to 1000 hectares) at 20 km distance to the northeast vicinity of Tehran. PTP is located at Iran’s commercial and academic intersection point and 45 km distance to Imam Khomeini Int’l Airport (IKIA). PTP is placed alongside of the north-south fiber optics artery and close to internationally reputable research and academic institutions.

PTP provides a proper environment for small and medium-sized tech-companies, R&D units of industrial companies and research institutions to locate and professionally appear in the region. Pardis of Innovation (phase No. 1) in a 20 hectares area and Pardis of Knowledge (phase No. 2) in 18 hectares are two existing phases in the Park besides future phases that constitute the future stages in the expansion plan of the Park. There are 140 companies in the shape of Small & Medium Enterprises and incubators in the fields of IT, ICT, nanotechnology, biotechnology, electronics, mechanics and etc. in PTP.

**Chaos Theory**

Chaos is the science of shocks, of the nonlinear and the unpredictable. It shows us to anticipate the unexpected. While most old-fashioned science deals with allegedly predictable phenomena like seriousness, energy, or substance responses, Chaos Theory deals with nonlinear issues that are successfully difficult to anticipate or control, like turbulence, climate, the stock market, our head claims, and therefore on. These phenomena in many cases are explained by fractal mathematics, which reflects the endless difficulty of nature. Many normal things exhibit fractal properties, including areas, clouds, woods, organs, rivers and so forth, and many of the systems may be complicated, disorderly behavior. Knowing the disorderly, fractal nature of our world will give us new understanding, power, and wisdom. For instance, by knowledge the complicated, disorderly makeup of the environment, a mechanism pilot may “steer” a mechanism to a desired location. Life is born from chaos; while discipline arises from the habit. By knowledge our ecosystems, our cultural systems, and our economic systems are interconnected, we are able to wish to avoid activities which might turn out to be detrimental to your long-term well-being.

**Rules of Chaos**

- The Butterfly Effect: This effect grants the ability to cause a storm in China to a butterfly flapping their wings in New Mexico. It could take an extended time, but the text is real. If the butterfly hadn't flapped their wings at the ideal stage in space/time, the storm would not have happened. A far more rigorous method to express that is that little improvements in the initial problems cause drastic improvements in the results. Our lives are a continuous exhibition of the principle. Who understands what the long-term effects of training millions of kiddies about chaos and fractals is likely to be?
Research Article

- Unpredictability: Since we are able to never know all the initial problems of a sophisticated process in sufficient detail, we cannot aspire to anticipate the ultimate fate of a sophisticated system. Also slight problems in measuring the state of something are likely to be amplified significantly, rendering any forecast useless. Because it is difficult to measure the consequences of all of the butterflies (etc) in the Earth, accurate long-range climate forecast will always stay impossible.

- Order / Disorder Chaos is not merely disorder. Chaos explores the changes between order and disorder, which frequently occur in shocking ways.

- Mixing: Turbulence guarantees that two surrounding details in a sophisticated process will eventually end up in different jobs as time passes has elapsed. Instances: Two neighboring water molecules may possibly end up in various parts of the ocean as well as in different oceans. A small grouping of helium balloons that release together will eventually land in significantly various places. Mixing is complete because turbulence happens at all scales. It can also be nonlinear: liquids cannot be unmixed.

- Feedback: Systems frequently become disorderly when there is feedback present.

- Fractals: A fractal is a never-ending pattern. Fractals are greatly complicated designs that are self-similar across various scales. They’re produced by saying a straightforward process around and around within an ongoing feedback loop. Driven by recursion, fractals are photos of active systems — the pictures of Chaos. Geometrically, they occur between our familiar dimensions. Fractal patterns are really familiar, since nature is packed with fractals. As an example: woods, rivers, coastlines, mountains, clouds, seashells, hurricanes, etc. (Fractal Foundation site; Peitgen et al., 1992; Steward, 1990; Steele, 1997; Rubinowicz, 1998; Rahmatabadi, 2014; Paszkowski and Rubinowicz, 1996).

Research Hypotheses
1. There is fractal in designing plan of Pardis Science and Technology Park.
2. Fractals found in the designing plan of Pardis Science and Technology Park possesses three characteristics of a fractal (Rahmatabadi, 2014).

Objectives

Scientific Purposes
Fractal geometry studies mathematical shapes which represent the stream of self-homologous, endless and winding components. In this study, fractal is a mathematical criterion for determining the degree of complexity. It is used for displaying texture (Rahmatabadi, 2014).

Practical Purposes
- The use of fractal as a tool in architectural works critique
- Distribution of fractal in designing and creating complex rhythmic

Necessity of Research
The architecture who knows the fractal can give the plans which all feel its compatibility with the nature but few people discover this compatibility with this method he can stroke the nature with his architecture and respects to his cradle, the earth (Rahmatabadi, 2014).

Method of Research
The research methods are qualitative with interpretation -oriented approach, case studies and based on theoretical studies. In other words, in this method by utilizing a semiotic approach-which is a subset of the quantitative methods- the desired samples and data are analyzed (Rahmatabadi, 2014).

Data Collection
The research methods are qualitative with interpretation holistic approach, case studies and based on theoretical studies. In other words, in this method by utilizing a semiotic approach-which is a subset of the quantitative methods the desired samples and data are analyzed. In this devise the researcher prepared checklists among the books, documents, articles and dissertations as well as the scientific sites to collect data (Rahmatabadi, 2014).

Data Collection Instruments
In this study data collection tools are 6 parts documents, “archival information, interview, direct observation, participant observation, physical and cultural artifacts” and three data collection principles: using multiple sources of evidence for the purpose of pluralism, creating a case study database, and the
chain maintenance of evidence (Fractal Foundation site; Peitgen et al., 1992; Steward, 1990; Steele, 1997; Rubinowicz, 1998; Rahmatabadi, 2014; Paszkowski and Rubinowicz, 1996).

RESULTS AND DISCUSSION

Results

First Fractal

Second Fractal
Conclusion
Geometric order and chaos are the basic components of the composition of architectural and urban structures. We have found fractal designs in designing Pardis Technology Park in Tehran. In fact, we are seeking fractals in designing this work that has three characteristics of self-similarity, formation through repetition and lack of correct dimension. In this project, from the view of the author the site has two fractals, one is H-form and other one is tree form that they are used in the plan and the plan form.

ACKNOWLEDGEMENT
We are grateful to Islamic Azad University, Tabriz branch, and Dr. Reza Toushmalani, for their useful collaboration.

REFERENCES