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InspireDesign Grids byFractal ForFurniture Design

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Introduction

Recently, there is a lot of theories that searching in the mathematics field, which began to applied in several branches. Also, due to the mathematics science revolution, there is more attention to mathematics basics and its relationship with other components of the natural sciences. So the elements in nature have its naturalistic characteristics addition to its geometric from it.

For that, there was a discovery of a new type of geometric structure called the Fractal Geometry, it means the studding of partial components for nature shapes and geometric forms. Fractal Geometric has been applied in the architecture and design. Fractal Geometrid's concept is aimed to design with analytical scientific method, to get to basics and rules, which provide us with aesthetic forms related to complex and organization nature that around us, to develop the designer creativity and imagination.

Thus, we wonder in this study what is the Fractal Geometric?.. Is there a relationship between Fractal Geometric and Design Grids?.. How could be used to get a new design ideas with fractional rhythm? ... How it could be applied to design a furniture?..

The aim of this paper is explained the Fractal Geometric as an entry point to get to architecture and interior design. Also create new design grids that inspired by Fractal Geometric to provide a new visions to design a furniture.

Keywords : Fractal Geometric – Golden Ratio – Grids.

Statement problem

1. Shortage in forming of a conceptual framework for Fractal Geometric and ignoring analyzes its patterns.

2. Is it possible to inspire design grids from Fractal Geometric…?

Objectives

1. **Analytical study of the philosophical concept of Fractal Geometric, from an architectural viewpoint.**
2. **Inspired design grids from the Nature Geometric to be used in furniture design.**

What is Fractal Geometric..?

By the ending of the twentieth century. ithas been a development of mathematics education , also it shown its role in the development of thinking way. That development led us to be more attention about the cognitive structure of mathematics, so there is a relationship between the components of natural sciences and mathematics.

Where Mandelbrot began thinking about what are natural elements and tried to discover the amazing geometric structure which he called fractalgeometric.

Fractal Geometricis: -

-It is an overlapbetween thepartsof an infinitegeometricirregularshapesin different sizes.
-Create imagesas a result ofsuccessionandrepetitionof linear equations.
-The changing of the basic shapeby developed it or added some new shapes to it, these processes canbe repeatedwith an infinite timesby the application ofsome mathematicalrules.
-Composition ofgeometric shapesby splittingthe basic forminto smallparts, and eachpartis a microcosmofthe basic form.

Fractals are important becausethey CHANGE the most basicways we analyze and understandexperimental data.

- **Where do we can find Fractal Geometric..?**

  We can find Fractal Geometric around us , in nature , in geometry and in Algebra.

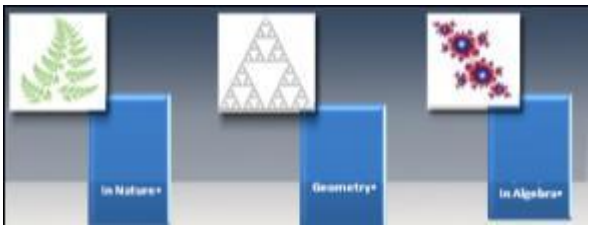


Fig. 1 : Where we can find fractal in our world.

- **Fractal Geometric in nature:-** Fractal in nature, are two types , the first is branching type and the second is spirals type .

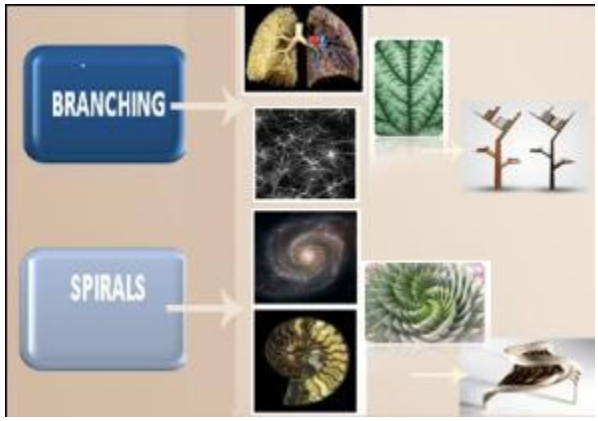


Fig. 2 : Examples of fractal types in nature and how it used to design furniture.

- **Properties of Fractal Objects**

Self-Similarity.

The little pieces are smaller copies of the larger pieces.

Scaling.

The values measured depend on the resolution used tomake the measurement.

Statistics.

The "average" size depends on the resolution used tomake the measurement.

Fig. 3 : Tree is fractal, it has fractal propertiesin thenature, whichself-similarity, that we believethesmall branchesaresmallerversionsoflargebranches.Scaling: thelength and thicknessof

each branchdepends onthe thickness ofthe branch thatwe measure. There is noaveragesizeofbranches:Thereis an inverse relationshipbetweenthe number of smallbranches andthicknessand length, the morethe number of branchesand small, the thicknessand the length will be less.

Discuss the search results, that we can concluded: -

- Fractal consists of irregular geometric shapes, parts of endless overlapping various and scaling.
- Fractal Geometric shapes grow as a result of the application of the mathematics rules. These forms result from the division of the basic shape into small parts, and each part is a microcosm of the basic form.
-Fractal Geometric has characteristics which are self-symmetry and dimension , structure, size and irregular.

Researcher depend on the descriptive analytical study method in achieving the search objectives, where that Fractal Geometric supposed to give designers a new elements reference to analysis architectural, design and natural forms.

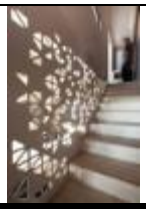
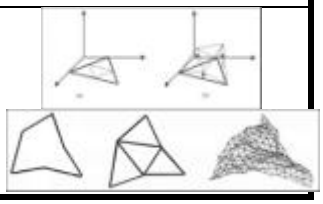
q Proposal project through applied search objectives :

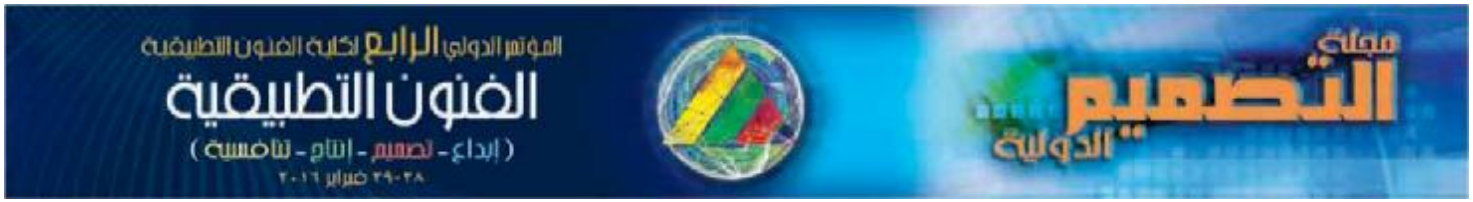
The search aims to create a relationship between fractal geometric and design grids to be as one of the effective methods of teaching for furniture design, and also as a reference for designers to create characteristics shapes and formations taken from fractional geometric.

The final part, discusses the steps to achieving the aim of research, starting with getting a primary and secondary characteristics of fractional characteristics through some design models analysis,create agrids design models inspired from the previous characteristics analysis, and how itbe appliedin furniture design.

1 . Inspiring basic and secondary characteristics of Fractal Geometric.

Inspired a new fractal characteristic	Basic characteri-stics	Secondary characteri-stics	An analysis of fractal designs to get new properties.	
	Organizing of forms	Regular gradient	Regular gradient occurs in fractal design through simple organized leads to no loss of the original design concept. (These are included the scale and a change in direction.)	 Fractal Table by Platform WertelOberfell 
		Random gradient	Fractal applied random gradient, as a result of the random shapes formation, depending on the multiplicity and, overlapping shapes Scale or direction	 Fractal LED by Arik Levy
		Complexity	complexity is resulting of links between various elements that are integrated many of the units with each other in the system design	

		Dynamic design	That is achieving changes in the design various levels of forms .	 Designed by - ArandaLasch
	Morpholo-gical	Duplication	Repeating the smallest modules in the design system.	 William Knight] - Milan[Designed by
		Spreading	Fractals system designed with centers or axes to achieve the relationships between each other, and between the other and all looking for spreading.	
	Mass configurat-ion	Direction	Fractal has overlapping to different forms, to achieve three-dimensional surfaces.	
		Limitation	Borders are formed through modules that interconnected with each other and not between the elements.	 Designed by - Matthew Richie , Aranda/Lasch and Arup AGU.
	Formal of elements	Geometric shapes	Fractal shapes inspired by nature, including various geometric shapes, such as square, circle, triangle	
		Curved shapes	Using characteristic curved shapes in harmonious .	
		Fractional formats	Simplify fractional forms in order to access to a new type of fractional geometry shapes in the design.	



2. Relations between fractional properties and inspired characteristics from previous analysis to get a endless design grids.

Fractal properties (vertical level)	Design grids inspired form fractal		Inspired new characteristics(horizontal level)														
			Proportionality Ratio		Formal of elements			Mass configuration		Morphological					Organizing of forms				
			Golden ratio 17	Ratio 16	Fractal 15	Carved 14	Geometric shapes 13	Limitation 12	Direction 11	Unity 10	Varied 9	Spreading 8	Duplication	Rhythm 6	Dynamic 5	Complexity 4	Irregular gradient 3	Random gradient 2	Regular gradient 1
	A	Regularforms	A 17	A 16	A 15	A 14	A 13	A 12	A 11	A 10	A 9	A 8	A 7	A 6	A 5	A 4	A 3	A 2	A 1
	B	Irregularforms	B 17	B 16	B 15	B 14	B 13	B 12	B 11	B 10	B 9	B 8	B 7	B 6	B 5	B 4	B 3	B 2	B 1
	C	Overlapping	C 17	C 16	C 15	C 14	C 13	C 12	C 11	C 10	C 9	C 8	C 7	C 6	C 5	C 4	C3	C 2	C 1
	D	Scaling	D 17	D 16	D 15	D 14	D 13	D 12	D 11	D 10	D 9	D 8	D 7	D 6	D5	D 4	D 3	D 2	D 1
	E	Self-Similarity (Ascending)	E 17	E 16	E 15	E 14	E 13	E 12	E 11	E 10	E 9	E 8	E 7	E 6	E 5	E 4	E 3	E 2	E 1
	F	Self-Similarity (Descending)	F 17	F 16	F 15	F 14	F 13	F 12	F 11	F 10	F 9	F 8	F 7	F 6	F 5	F 4	F 3	F 2	F 1
	G	Branching	G 17	G 16	G 15	G 14	G 13	G 12	G 11	G 10	G 9	G 8	G 7	G 6	G 5	G 4	G 3	G 2	G 1
	H	Spiral	H 17	H 16	H 15	H 14	H 13	H 12	H 11	H 10	H 9	H 8	H 7	H 6	H 5	H 4	H 3	H 2	H 1
	I	Fractal 3D	I 17	I 16	I 15	I 14	I 13	I 12	I 11	I 10	I 9	I 8	I 7	I 6	I 5	I 4	I 3	I 2	I 1

Results of previousanalytical table:-

- § Previous table helps to increase designers creativity and imagination; where can get around (153) reticular pattern proposed by applying the iterative processes at both vertical and horizontal, using only one alternative in the horizontal or vertical level.
- § The greater increasing of relationships between shapes,the more complexion , and we get an infinite number of design grids which havefractal properties .
- § Also it can be used to apply some mathematical relationships to develop new grids from one stage to another .

3. Design grids inspired by fractional properties and characteristics inspired.

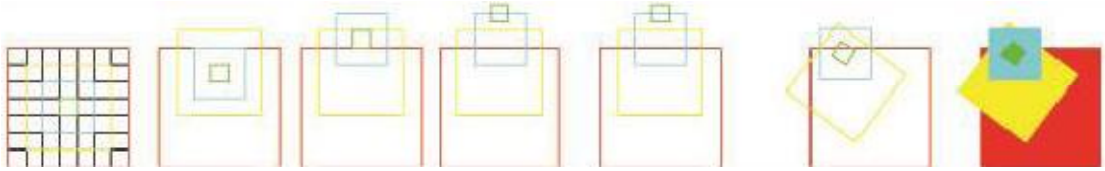
Proposal (1) -Table reference(B- 1-5-11-G)

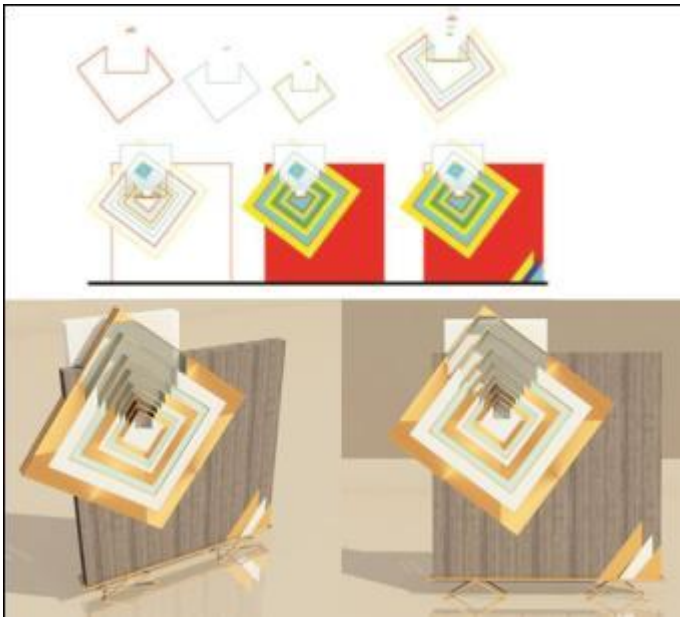
Steps :-

- The use of are perpendicular geometric grid and the work of a regular square mainly. (1)
- Making semi Fractal, by condescending of square scalein 3 times. (1)
- Removing the square in Yaxis, to the top of the form. (2 to 4)

-Making a rotation to the second and fourth square by angle. 53 ° (6)

-Final get grid form fome overlapping squares with descending with some change of direction.(7)



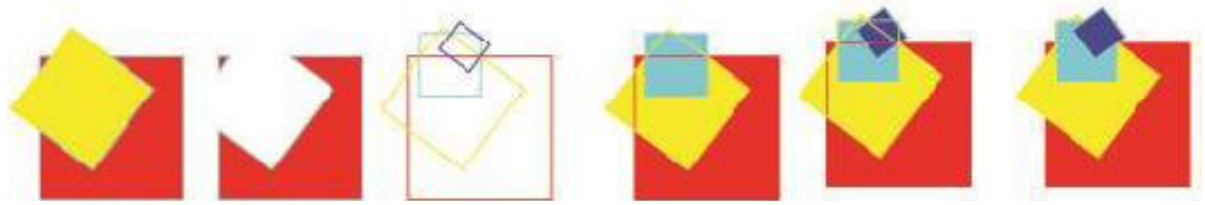


Proposal (٢) -Table reference(B-1-7-H-6)

Steps :-

- Starting with square 2.1 in the previous experiment.
- Deleting from the basic square 1 .
- Repeat and minimize descending.
- Change the direction of square no. 2 and 4.

-Applied in partition design.



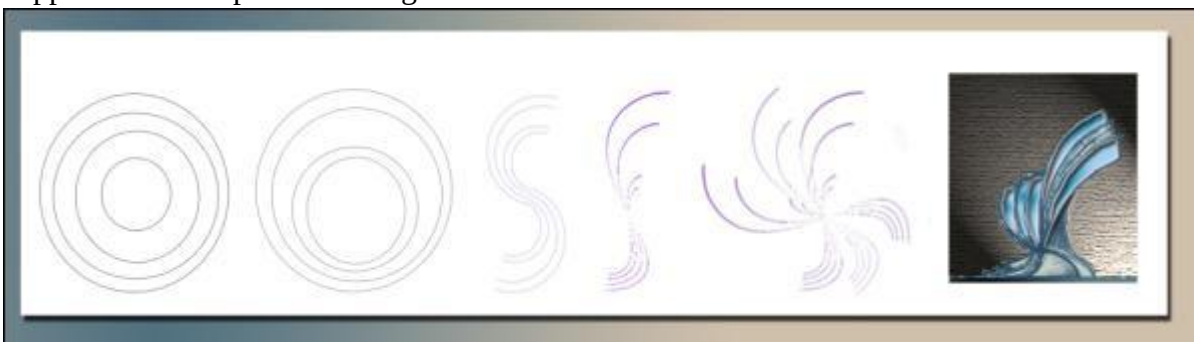
Proposal (3) -Table reference(B-3-11-14-H)

Steps :-

- Usingthe central geometric grid.
- Making fractal grid condescending in scale of the circle 3 times . (1)
- Removing in Yaxis, to the top.
- Changing in direction, changed into the shape to a varied organization . (3.11)
- Making a rotation , change the curve direction, turning fractal shape to spiral direction (14-H)
- Repeat shape.

-Finally, get acurved grid overlapped ,with regular gradient and change of direction. (7)

-Applied in metal partition design.



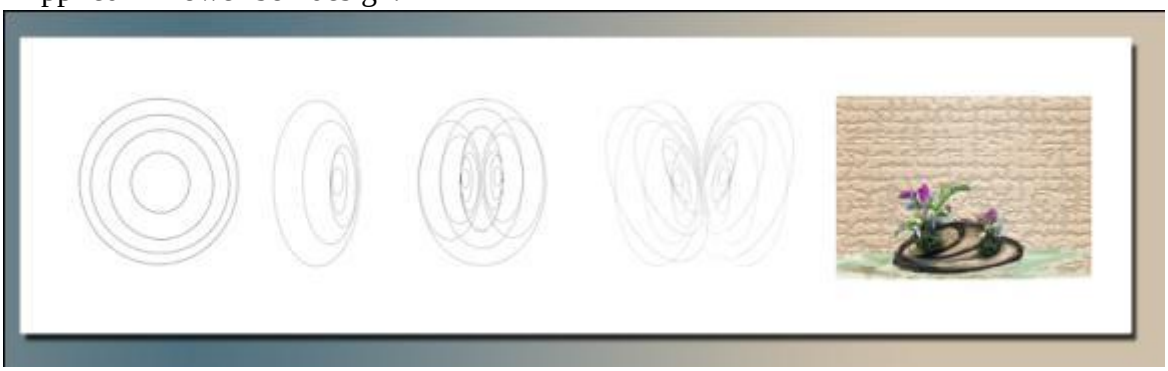
Proposal (4) -Table reference(B-G-1-4-11-I)

Steps :-

- Usingthe central geometric grid.
- Making fractal grid condescending in scale of the circle 4 times . (1)
- Removing in Xaxis to the top (branching direction).(G)
- Changing the curve direction, that will be turn to becomplexity form.(4-11)
- Repeat shape.(I)

-Finally, get acurved grid overlapped ,with decreasing style and change in direction.

- Applied in flower box design.



Proposal (5) -Table reference(B -2-11-14-H)

Steps :-

- Usingthe central geometric grid.
- Making fractal grid condescending in scale of the circle 3 times . (2)
- Deleting a half of shape.
- Changing the curve direction.(2)
- Repeat shape.(11)
- Making rotation ,that will be turned to spiral fractal.(H)

-Finally, get acurved grid .(14)

- Applied in lighting unit and console design .

Results and Discussion

- Fractal helps designers to know a new design reference which explains the architectural and natural forms.

- Fractal highlights beauty in mathematicsrules.

-Search themes is wondered … is there a relationship between fractal and previous civilizations styles ? ..The search concluded throughanalytical studies of architecture, interior design and models of furniture pieces,there was an application of Fractal in architecture and design since ancient Egyptian civilization tillnow .

-Search aims to inspire design grids to be used in furniture design.

- Grid-inspired table helps to increase the designer creativity, where they can get about (153) patterns of grids, through the application of redundancy between vertical and horizontal properties.

- The more increasing ofcorrelation between properties, the more complexity is achieved ,so we get an infinite numbers of forms , which is fractal.

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