Online Journal of Art and Design
volume 13, issue 3, July 2025
DOI: https://doi.org/10.30935/ojad/2513044

Evaluation of Traditional Diyarbakır House with Fractal Analysis Method: The Case of Cahit Sıtkı Tarancı House

Evin İLİŞER[1], Dr. Öğr. Üyesi Meltem ERBAŞ ÖZİL[2]
[1]Dicle Üniversitesi, Mimarlık Fakültesi, Mimarlık Anabilim Dalı, Diyarbakır, Türkiye. eviniliser@gmail.com
[2]Dicle Üniversitesi, Mimarlık Fakültesi, Mimarlık Anabilim Dalı, Diyarbakır, Türkiye. meltemerbas@gmail.com

ABSTRACT
Different design principles are used in the design phase of architectural structures built from past to present. When today's buildings are examined, it is seen that Euclidean geometry is widely used in architectural designs created using simple geometric shapes. On the other hand, there are also designs that utilize fractal geometry in order to transfer the complexity of nature and nature, which traditional Euclidean geometry is insufficient to measure, to architectural designs. At this point, it is possible to come across examples where fractal geometry, inspired by nature, is embodied in architectural designs. The aim of this study is to examine the plan and façade of Cahit Sıtkı Tarancı House, one of the most beautiful examples of traditional Diyarbakır houses, using the box counting method, one of the fractal analysis methods. First of all, a detailed literature research was conducted by utilizing national and international sources and the concept of fractal and its historical development, the usage areas of fractal geometry, fractal dimension and calculation methods were explained. Then, the history and architectural features of the Cahit Sıtkı Tarancı House, which will be analyzed fractally, are mentioned. In this context, fractal dimensions were calculated by using the formulas used in the box counting method over the plan and facade drawings of the building. The values resulting from these calculations are given in tables. As a result, analyzes and evaluations were made in the light of the data in these tables.
Keywords: Fractal Analysis, Traditional Diyarbakır Houses, Box Counting Method, Fractals in Architecture, Cahit Sıtkı Tarancı House.

Geleneksel Diyarbakır Evinin Fraktal Analiz Metodu ile Değerlendirilmesi: Cahit Sıtkı Tarancı Evi Örneği

ÖZET
Geçmişten günümüze inşa edilen mimari yapıların tasarım aşamasında farklı tasarım prensipleri kullanılmaktadır. Günümüz yapıları incelendiğinde basit geometrik şekiller kullanılarak oluşturulan mimari tasarımlarda Öklid geometrisinden yaygın olarak faydalanıldığı görülmektedir. Öte yandan geleneksel Öklid geometrisinin ölçmekte yetersiz kaldığı doğa ve doğada var olan karmaşıklığı mimari tasarımlara aktarabilmek amacıyla fraktal geometriden faydalanan tasarımlar da mevcuttur. Bu noktada doğadan esinlenilerek kullanılan fraktal geometrisinin mimari tasarımlarda vücut bulduğu örneklere rastlamak mümkündür. Bu çalışmanın amacı geleneksel Diyarbakır evlerinin en güzel örneklerinden biri olan Cahit Sıtkı Tarancı Evi'nin plan ve cephe kurgusu üzerinden fraktal analiz metotlarından biri olan kutu sayma metodu kullanılarak incelemeler yapmaktır. Öncelikle ulusal ve uluslararası kaynaklardan faydalanılarak detaylı literatür araştırması yapılmış olup fraktal kavramı ve tarihsel gelişimi, fraktal geometrinin kullanım alanları, fraktal boyut ve hesaplama metotları açıklanmıştır. Daha sonra fraktal analizler yapılacak olan Cahit Sıtkı Tarancı Evi'nin tarihçesinden ve mimari özelliklerinden bahsedilmiştir. Bu bağlamda yapının plan ve cephe çizimleri üzerinden kutu sayma metodunda kullanılan formüllerden yararlanılarak fraktal boyutları hesaplanmıştır. Bu hesaplamalar sonucunda ortaya çıkan değerler tablo oluşturularak verilmiştir. Sonuç olarak oluşturulan bu tablolardaki veriler ışığında analizler ve değerlendirmeler yapılmıştır.

Anahtar Kelimeler: Fraktal Analiz, Geleneksel Diyarbakır Evleri, Kutu Sayma Metodu, Mimaride Fraktaller, Cahit Sıtkı Tarancı Evi.

1. INTRODUCTION

While architectural design is being made, a path is followed within the framework of rules based on methods that reflect different design approaches and processes. After Mandelbrot, a Polish physicist, coined the term "Fractal" in 1982, it was discovered that fractal geometry, which opposes traditional approaches, exists in different forms in nature. Today, the structures of organisms in nature can benefit from the method of determining fractal values in order to use a new design method. Although the concept of fractal has taken its place in scientific sources after the 1970s, there are architectural structures consisting of similar elements in past ages. As can be understood from this, fractals have been used in architecture even in ancient times (Alik, 2015). It is possible to see fractal geometry in Gothic, Baroque and Renaissance architecture, which were once common in Europe, especially in religious buildings. Today, the use of fractals is also seen in examples that make more organic designs by trying to establish a relationship with nature.

When the plan and façade fiction of an architectural design is analyzed; it is seen that the structure can be examined up to the occupancy - emptiness ratios of the building, and if it is to be further elaborated, the door and window details. From this point of view, the fractal feature of an architectural element becomes evident in the continuity of the details created throughout the building. The main purpose of this study is to examine the extent to which Cahit Sıtkı Tarancı House has fractal characteristics by utilizing a mathematical analysis method. The fact that such a study on Traditional Diyarbakır Houses has not been conducted before indicates the importance of this study. Defining this building, which is one of the most beautiful examples of traditional Diyarbakır houses, through fractal geometry constitutes the scope of this study. The reason for choosing Cahit Sıtkı Tarancı House among the traditional houses in the historical texture is that the masses of the building surround the courtyard from four sides, have more detailed ornaments and facades, and most importantly, it is possible to access all of the plan and facade drawings at once and make detailed analysis.

2. MATERIAL AND METHOD

Cahit Sıtkı Tarancı House located in the Suriçi District of Diyarbakır constitutes the material of this study (Figure 1).

Figure 1. Cahit Sıtkı Tarancı House selected for the study (Google Earth)

First of all, a detailed literature research was conducted by making use of national and international sources and the concept of fractal and its historical development, fractal design approaches in architecture, fractal dimension and calculation methods were explained. While conducting literature research, it was supported with visuals by making use of magazines, books, articles, theses, google earth and photographs taken on site. Then, the history and architectural features of Cahit Sıtkı Tarancı House, where fractal analyzes will be made, are mentioned. In this context, plan and facade drawings were created through AUTOCAD (2-dimensional drawing program) on the plan and facade pictures of the building. Then, the fractal dimension of the building was calculated by using the box counting method, one of the fractal dimension calculation methods. In this method, the structure is overlapped with grids of different sizes on the obtained drawings and the logarithm of the box size, which expresses the ratio between the size of the structural element and the number of overlapping grids, is used. The formula of this calculation method and the procedure to be followed are as follows;

- First, a two-dimensional drawing of the facade and plan of the building is made.
- A rectangle is placed on the drawings to form the boundaries of the drawing.
- The rectangle placed on the drawing is divided into grids to form equal squares and the boxes in the grids containing any line of the drawing are counted and noted.
- The same method is continued by gradually reducing the size of the grids available for analysis and the number of boxes for each stage is noted.
- As a result of the fractal value calculated by the box counting method, the number of full boxes in the first grid is compared with the number of full boxes in the next grid by using the formula below.

$$\mathbf{D} = \frac{\log(x) - \log(y)}{\log(z) - \log(q)} \qquad \text{(Bovill, 1996, p. 194.)}$$

D: Fractal value
x: number of full boxes counted in the next cycle
y: number of full boxes counted in the previous cycle
z: number of boxes in the bottom row in the next cycle
q: number of boxes in the bottom row in the previous cycle

- Each grid of varying size forms a loop. The fractal values in each cycle are calculated separately. (Aykal, Erbaş Özil & Hızar, 2020).

2.1. Fractal Concept and Historical Development

Although the term fractal was initially coined by mathematicians such as G. Cantor, G. Peano, D. Hilbert, H. Koch, W. Serpinski, the first time these ideas were brought together was in 1975 by the American scientist and mathematician Benoit B. Mandelbrot. Mandelbrot argued that fractals can be used to describe objects. This concept is derived from the word "fractus", which is derived from the verb "Frangere", which means "to create irregular parts" (Mandelbrot, 1983). The concepts of uncertainty and disorder derived from chaos theory are considered to be fundamental concepts in the formation of fractals. Fractals are characterized by uncertainty and irregularity instead of the precision and rigidity of traditional Euclidean geometry. These features play an important role in defining fractals as natural and complex structures (Çağdaş, Gözübüyük & Ediz, 2006). In this respect, it is possible to understand the difference between Euclidean geometry and fractal geometry in the light of the data in Table 1 (Alik, 2015).

Table 1. Differences between Euclidean geometry and fractal geometry

Euclidean Geometry	Fractal Geometry
They have a certain ratio and size.	They do not have a specific ratio and size.
They are expressed in mathematical formulas.	They are the result of rules of repetition.
They have finite structures and limited dimensions.	The patterns found in nature are formed by infinite repetitions.
Their shapes are regular.	While the shapes described in Euclidean geometry are generally regular and methodical, the shapes found in nature are often irregular and complex.
It has integer dimensions.	In general, they have fractional dimensions.

They do not have self-similarity.	They have self-similarity and can show different types of self-similarity.
Traditional	Modern
Applicable for simple objects.	Applicable to shapes in nature.
Mathematical	Algoritmic
Organized	It is stochastic, meaning random.
They scale numerically	They scale statistically
They are expressed in integers	They are expressed in fractions
As the circumference of a shape increases, its area increases in direct proportion.	As the circumference of a shape increases, its area usually does not increase linearly.

Benoit Mandelbrot built on the findings of ancient mathematicians and developed theories on fractals. The fractal geometry described by Mandelbrot has a rough, wavy and curved structure. In fractal geometry, parts or components of an object resemble the whole object and irregular details and motifs are repeated in smaller sizes. In the light of all this information, systems such as snowflakes, trees, rivers spreading over large areas, airways in the lungs, neuron networks are the best examples of fractal structures in nature. When a tree in nature is examined, it is seen that it has a trunk, main branches and thin branches on these main branches. When a branch of a tree with a complex structure is broken off, it is possible to realize that this branch is a small copy of the tree (Figure 2) (URL-1).

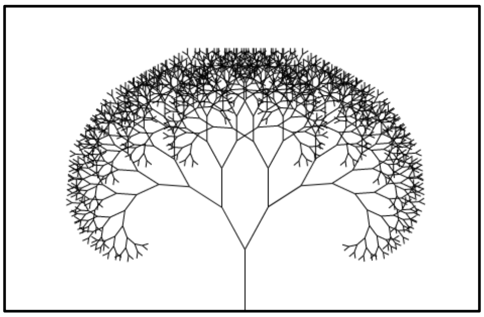


Figure 2. Tree Branches

Self-similarity, one of the concepts encountered in fractal geometry, can be defined as the repetition of the same shapes and textures at different scales. The first of the two basic approaches used to create fractal structures is to enlarge the unit structure by repeating it (Figure3) (URL-1). The second approach is to create a fractal structure by dividing the initial shapes, such as the Sierpinski triangle, into smaller units (Figure 4) (Bovill, 1996).

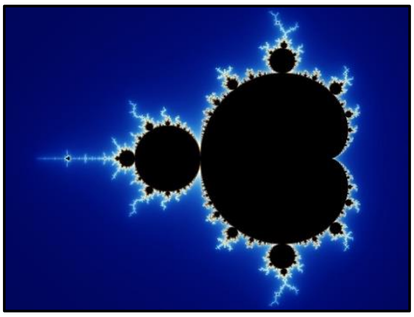


Figure 3. Mandelbrot Set

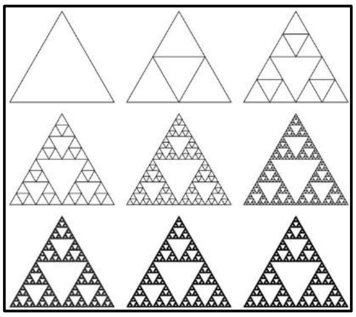


Figure 4. Sierpinski Triangle

Fractals are considered to be objects that repeat themselves infinitely with similar shapes and whose parts have the properties of the whole. Zooming in on a cross-section of a fractal and seeing the details of the whole fractal shows how complex and infinitely detailed these shapes are. These shapes are described as repetitive, and the small sections are

DOI: https://doi.org/10.30935/ojad/2513044

identical to the whole. If fractals are considered as a function, the operation of this function can be iterated infinitely as x, f(x), f(f(x)), ... and is open- ended.

2.2. Fractal Design Approaches in Architecture

It is possible to encounter fractals in architectural design examples, architectural ideas and local architecture that have survived from the past to the present. The most important reason why architectural products from various eras, cultures and regions throughout the history of architecture show fractal features is the richness of detail in the design. Fractals and fractal geometry, which were introduced in the 1970s, were newly used concepts at that time. While these concepts had not yet been discovered, it is seen that many architectural products have fractal features throughout the history of architecture. It is seen that the structures w i t h fractal features are mostly inspired by nature in their formation. Local architectural products, architectural movements and various structures designed by repeating a shape can be given as examples of these formations (Gözübüyük, 2007).

An architectural design can be analyzed at different scales; it can be detailed from the general volume understanding of the building to the occupancy-void relations, even to the details of doors and windows. The fractal quality of an architectural formation expresses the approach to the building, the entrance and the continuity of the details seen throughout the building (Aykal, Erbaş Özil & Hızar, 2020). Architecture can be experienced by observing the general profile of a building from a certain distance. As you get closer to the building, the general outlines of the windows and façade become noticeable; as you get closer, the details of the door and window frames, up to how the doorknob looks, become noticeable. This phase then continues inside the building in the same way. The fractal characteristic of an architectural formation is the presentation of an interesting detail as we approach it, as we move through a building and through its use (Bovill, 1996). For example, the Kandariya Mahadeva Temple, one of the most beautiful examples of Central Indian temple architecture, is composed of images with rhythmic architectural features, whose exterior surfaces are completely covered with sculptures in vertical layers (Figure 5) (URL-2).

Figure 5. Kandariya Mahadeva Temple and Facade Detail

Fractal geometry can also be seen in modern architectural structures. Federation Square, designed by Lab Architecture Studio, was designed by developing a grid system with a specific design algorithm. These pieces, whose proportions are designed as a single tile, combine to form larger modules and these modules combine to form the structure itself (Figure 6) (URL-3).

DOI: https://doi.org/10.30935/ojad/2513044

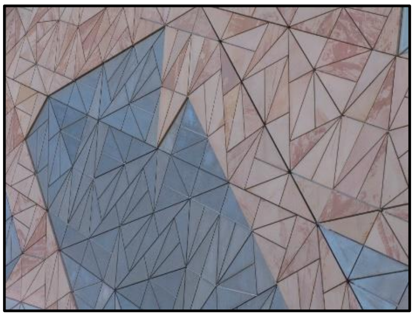


Figure 6. Federation Square Building and Facade Detail

2.3. Fractal Dimension Calculation Methods

Thanks to the rapid development of technology and computers that have gained a big place in our lives, numerical methods are also used in the field of architecture. Different calculation methods are used to make quantitative measurements in the field of architecture. The acceleration of progress in the field of computing enables new measurement methods and various researches in architecture. In this way, numerical approaches can be used to produce new types of architectural designs and analyze existing architectural designs with new methods (Lionar, 2021). It is also possible to make analyzes using different methods to calculate the fractal dimension in architecture. The methods used are created within the framework of specific rules and expressed in different ways.

2.3.1. Self Similarity Dimension (Ds)

When a basic shape is repeated continuously, this is referred to as self-similarity. Self-similarity refers to the similarity relationship between the existing structure and the smallest unit of the structure (Bovill, 1996).

a=1/(s)D=(1/s)D (a: piece quantity, s: shrinkage factor)

The existence of smaller parts of a formation that are copied from itself can be said to indicate that this formation is similar to itself. Thus, it is seen that the small parts obtained from the whole of this formation are accessed by the similarity transformation method. In order to better understand the transformation that occurs with this copying method, the feature of the photocopying machine to reproduce by shrinking can be considered (Ursavaş, 2022).

2.3.2. Measured Dimension (d)

Both the method used and the process of the measured sequence of measurements are very important when applying the Calculated Measurement dimension. This method can be used to numerically analyze the complexity levels of natural formations. For example, coastlines, which are one of the natural formations, are measured using the calculated measurement dimension (Kanatlar, 2012).

2.3.3 Box Counting Dimension (Db)

The box counting method is preferred to reach the fractal value in any architectural construct (Bovill, 1996). Thanks to this method, comparisons can be made at different scales of drawings of architectural constructions. The box counting method, which is one of the fractal dimension calculation methods, is widely used in architecture and planning as well as in different fields (Yılmaz, 2021).

In this study, the box counting method was utilized and detailed calculations and analyses were made.

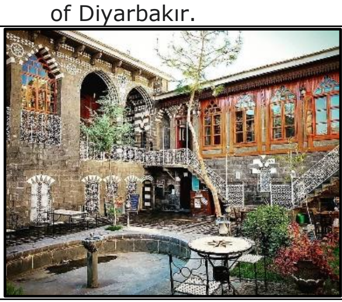
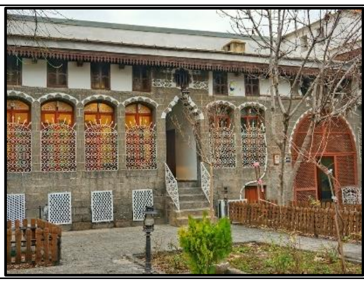
3. RESEARCH FINDINGS

Within the scope of the study, Cahit Sıtkı Tarancı House, located in the Camii Kebir Neighborhood in the Suriçi District of Diyarbakır, is discussed. Cahit Sıtkı Tarancı House, which preserves the characteristics of traditional Diyarbakır residential architecture in the

Online Journal of Art and Design
volume 13, issue 3, July 2025
DOI: https://doi.org/10.30935/ojad/2513044

most original way, was built in 1733. General information and related visuals of the building are given in detail in Table 2:

Table 2. Building Identification Card of Cahit Sıtkı Tarancı House (Google Maps Photos)

Building Identity Card of Cahit Sıtkı Taranci House	
Location	   • Cahit Sıtkı Tarancı House is located in the Camii Kebir neighborhood in the Suriçi district of Diyarbakır.
Visuals	  
General Informations	• The construction date of Cahit Sıtkı Tarancı House is recorded as 1733. • Formerly known as the Trachoma Hospital, the building was later transferred to Cahit Sıtkı Tarancı's family and the poet was born in this house on October 2, 1910. • Purchased and restored by the Ministry of Culture in 1973, the building was openedas a museum on October 29, 1973, the 50th anniversary of the Republic, in order to perpetuate the memory of Cahit Sıtkı Tarancı and perpetuate his name. • On May 18th, Museum Day, Diyarbakır Cahit Sıtkı Tarancı Museum was openedto visitors as the Diyarbakır Cahit Sıtkı Tarancı Museum following the restoration and renovation works that began on May 1, 2011 and were completed on August 1, 2012 (URL-4). • Today, work has begun on the building in order to restore it again.
Architectural Features	• The Cahit Sıtkı Tarancı House, which consists of four wings arranged around a central courtyard, consists of two floors, a ground floor and a floor above it, andwas built using basalt stone, the traditional material of Diyarbakır. • The building consists of a courtyard surrounded by summer (to the north), winter (to the south), spring (to the east) and fall (to the west) sections with a pool in the middle. This layout provides a structural layout suitable for the climatic conditions. • The building has 14 rooms, except for a toilet, kitchen and pantry. • The most important part of the building is the two-storeyed summer part, and on the second floor of this part, there is a large room with a double arched iwan in front of it, also called the head room or the mabeyn room (URL-5).

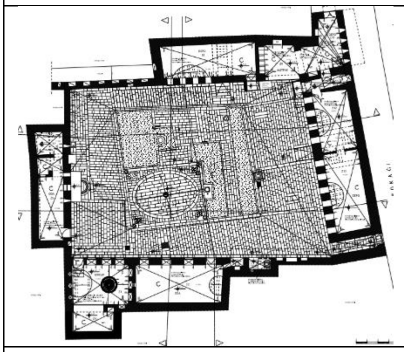
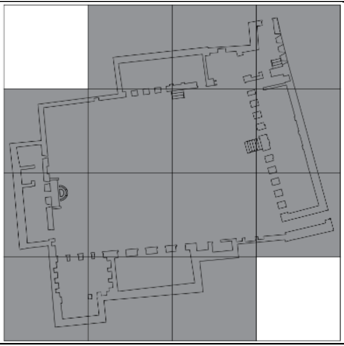
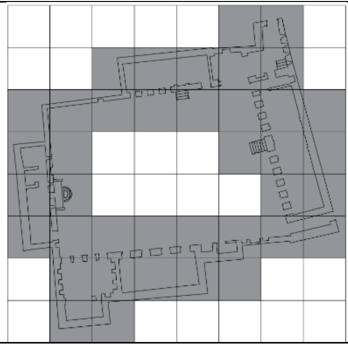
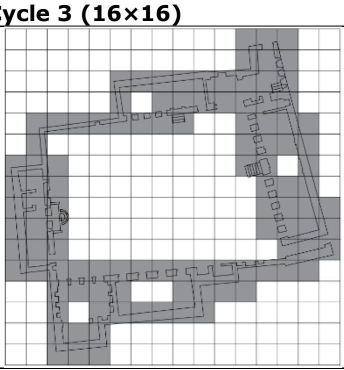
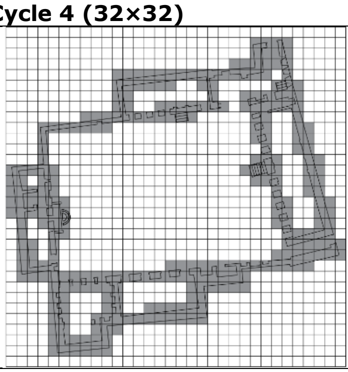
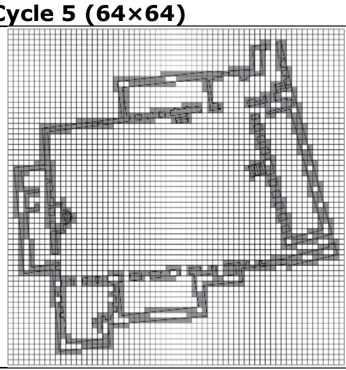
Detailed fractal dimension calculations of the plans and facades of Cahit Sıtkı Tarancı House were made and tables were created.

3.1 Ground Floor Plan

The ground floor spaces of Cahit Sıtkı Tarancı House are arranged around the courtyard and consist of kitchen, toilet and rooms. The fractal dimension calculation of the ground floor plan is as follows (Table 3).

DOI: https://doi.org/10.30935/ojad/2513044

Table 3. Application of the box counting method to the ground floor plan

Ground Floor Plan	Cycle 1 (4×4)	Cycle 2 (8×8)
		
Cycle 3 (16×16)	**Cycle 4 (32×32)**	**Cycle 5 (64×64)**
		

Calculations for Ground Floor Plan

Number of Cycles	Grid Size	Number of Full Boxes	Number of Empty Boxes
1	4×4	14	2
2	8×8	39	25
3	16×16	109	147
4	32×32	287	737
5	64×64	738	3358

Ground Floor Plan

Cycles	1-2 Cycles	2-3 Cycles	3-4 Cycles	4-5 Cycles
Fractal Dimension	1,5	1,46	1,4	1,36
Average Fractal Size	**1,43**			

Calculation of 1-2 Cycles

$$\frac{\log(39)-\log(14)}{\log(8)-\log(4)}=\frac{1{,}59-1{,}14}{0{,}9-0{,}6}=\mathbf{1{,}5}$$

Calculation of 2-3 Cycles

$$\frac{\log(109)-\log(39)}{\log(16)-\log(8)}=\frac{2{,}03-1{,}59}{1{,}2-0{,}9}=\mathbf{1{,}46}$$

Calculation of 3-4 Cycles

$$\frac{\log(287)-\log(109)}{\log(32)-\log(16)}=\frac{2{,}45-2{,}03}{1{,}5-1{,}2}=\mathbf{1{,}4}$$

Calculation of 4-5 Cycles

$$\frac{\log(738)-\log(287)}{\log(64)-\log(32)}=\frac{2{,}86-2{,}45}{1{,}8-1{,}5}=\mathbf{1{,}36}$$

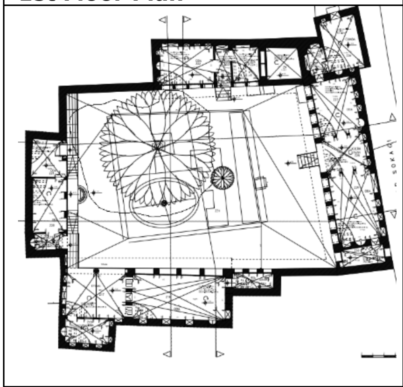
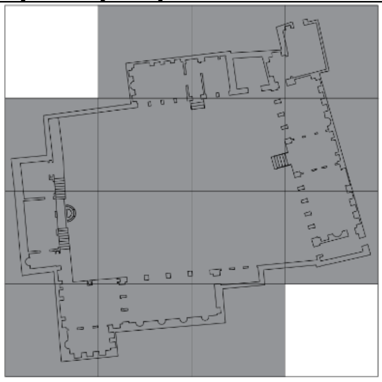
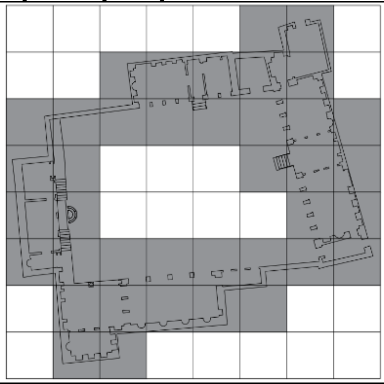
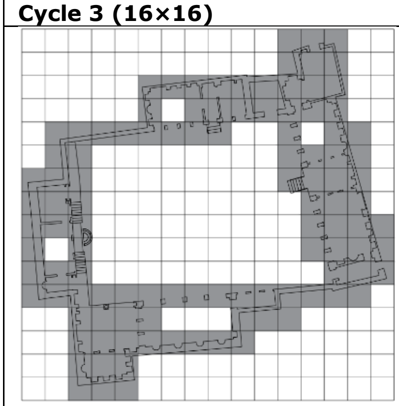
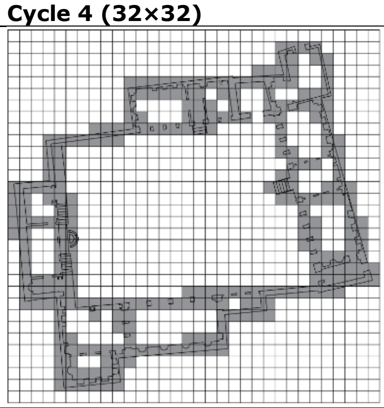
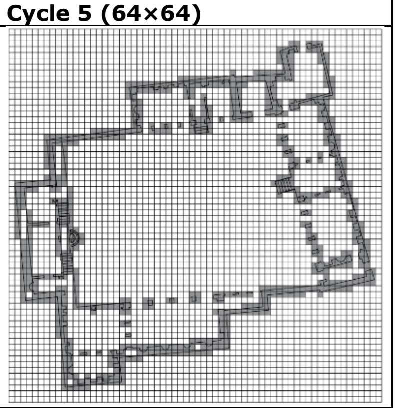
AVERAGE: 1,43

3.2. 1st Floor Plan

The spaces on the 1st floor of Cahit Sıtkı Tarancı House are arranged around the courtyard and consist of rooms arranged according to the seasons. The 1st floor plan fractal dimension calculation is as follows (Table 4).

Online Journal of Art and Design
volume 13, issue 3, July 2025
DOI: https://doi.org/10.30935/ojad/2513044

Table 4. Application of the box counting method to the 1st floor plan

1st Floor Plan	Cycle 1 (4×4)	Cycle 2 (8×8)
		
Cycle 3 (16×16)	**Cycle 4 (32×32)**	**Cycle 5 (64×64)**
		

Calculations for 1st Floor Plan

Number of Cycles	Grid Size	Number of Full Boxes	Number of Empty Boxes
1	4×4	14	2
2	8×8	39	25
3	16×16	108	148
4	32×32	268	756
5	64×64	688	3408

1st Floor Plan

Cycles	1-2 Cycles	2-3 Cycles	3-4 Cycles	4-5 Cycles
Fractal Dimension	1,5	1,46	1,3	1,36
Average Fractal Size	**1,4**			

Calculation of 1-2 Cycles

$$\frac{\log(39) - \log(14)}{\log(8) - \log(4)} = \frac{1{,}59 - 1{,}14}{0{,}9 - 0{,}6} = \mathbf{1,5}$$

Calculation of 2-3 Cycles

$$\frac{\log(108) - \log(39)}{\log(16) - \log(8)} = \frac{2{,}03 - 1{,}59}{1{,}2 - 0{,}9} = \mathbf{1,46}$$

Calculation of 3-4 Cycles

$$\frac{\log(268) - \log(108)}{\log(32) - \log(16)} = \frac{2{,}42 - 2{,}03}{1{,}5 - 1{,}2} = \mathbf{1,3}$$

Calculation of 4-5 Cycles

$$\frac{\log(688) - \log(268)}{\log(64) - \log(32)} = \frac{2{,}83 - 2{,}42}{1{,}8 - 1{,}5} = \mathbf{1,36}$$

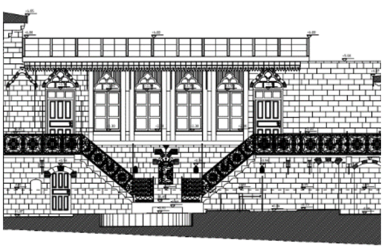
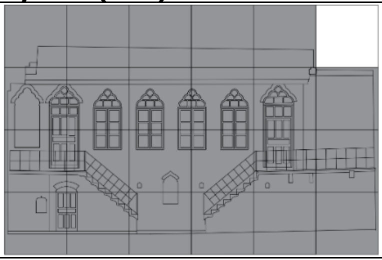
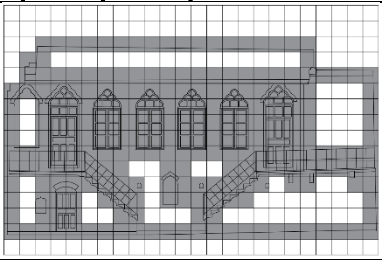
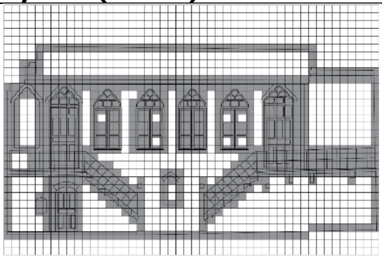
AVERAGE: 1,4

3.3. West Facade

The spaces on the west facade of the Cahit Sıtkı Tarancı House were used as autumn rooms in order to adapt to the climatic conditions. The window and door designs of this façade utilize segmented arches and access to the first floor is provided by two stairs, one from the right and one from the left. The fractal dimension calculation of the west facade is as follows (Table 5).

DOI: https://doi.org/10.30935/ojad/2513044

Table 5. Application of the box counting method to the west facade

West Facade	Cycle 1 (3×2)	Cycle 2 (6×4)
		
Cycle 3 (12×8)	**Cycle 4 (24×16)**	**Cycle 5 (48×32)**
		

Calculations for the West Facade

Number of Cycles	Grid Size	Number of Full Boxes	Number of Empty Boxes
1	3×2	6	0
2	6×4	23	1
3	12×8	78	18
4	24×16	330	54
5	48×32	677	859

West Facade

Cycles	1-2 Cycles	2-3 Cycles	3-4 Cycles	4-5 Cycles
Fractal Dimension	1,96	1,76	2	1,06
Average Fractal Size	**1,69**			

Calculation of 1-2 Cycles

$$\frac{\log(23)-\log(6)}{\log(6)-\log(3)}=\frac{1{,}36-0{,}77}{0{,}77-0{,}47}=\mathbf{1{,}96}$$

Calculation of 2-3 Cycles

$$\frac{\log(78)-\log(23)}{\log(12)-\log(6)}=\frac{1{,}89-1{,}36}{1{,}07-0{,}77}=\mathbf{1{,}76}$$

Calculation of 3-4 Cycles

$$\frac{\log(330)-\log(78)}{\log(24)-\log(12)}=\frac{2{,}51-1{,}89}{1{,}38-1{,}07}=\mathbf{2}$$

Calculation of 4-5 Cycles

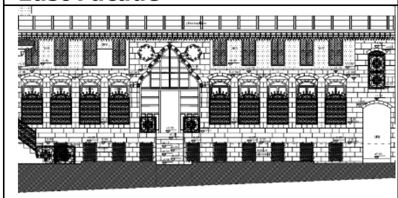
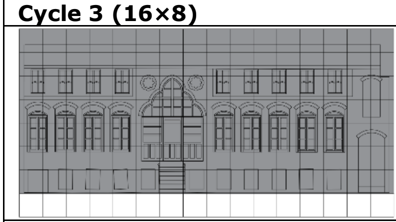
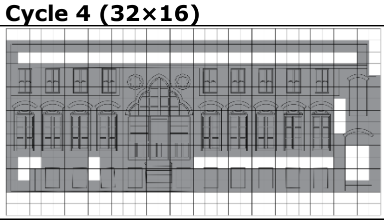
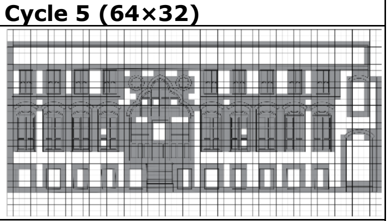
$$\frac{\log(677)-\log(330)}{\log(48)-\log(24)}=\frac{2{,}83-2{,}51}{1{,}68-1{,}38}=\mathbf{1{,}06}$$

AVERAGE: 1,69

3.4. East Facade

The spaces on the eastern facade of Cahit Sıtkı Tarancı House were used as spring rooms in order to adapt to the climatic conditions. It is seen that flat arches were used in the design of the floor windows of this facade and the skylights, which were used to make maximum use of natural light due to the high height of the 1st floor, were designed in a rectangular shape. The 1st floor is accessed by a staircase and the wide door opening to this staircase is designed with segmented arches. The fractal dimension calculation of the east facade is as follows (Table 6).

Table 6. Application of the box counting method to the east facade

East Facade	Cycle 1 (4×2)	Cycle 2 (8×4)
		
Cycle 3 (16×8)	**Cycle 4 (32×16)**	**Cycle 5 (64×32)**
		

Calculations for the East Facade

Number of Cycles	Grid Size	Number of Full Boxes	Number of Empty Boxes
1	4×2	8	0
2	8×4	32	0
3	16×8	112	16
4	32×16	358	154
5	64×32	1099	949

East Facade

Cycles	1-2 Cycles	2-3 Cycles	3-4 Cycles	4-5 Cycles
Fractal Dimension	2	1,8	1,7	1,63
Average Fractal Size	**1,78**			

Calculation of 1-2 Cycles

$$\frac{\log(32)-\log(8)}{\log(8)-\log(4)}=\frac{1{,}5-0{,}9}{0{,}9-0{,}6}=\mathbf{2}$$

Calculation of 2-3 Cycles

$$\frac{\log(112)-\log(32)}{\log(16)-\log(8)}=\frac{2{,}04-1{,}5}{1{,}2-0{,}9}=\mathbf{1{,}8}$$

Calculation of 3-4 Cycles

$$\frac{\log(358)-\log(112)}{\log(32)-\log(16)}=\frac{2{,}55-2{,}04}{1{,}5-1{,}2}=\mathbf{1{,}7}$$

Calculation of 4-5 Cycles

$$\frac{\log(1099)-\log(358)}{\log(64)-\log(32)}=\frac{3{,}04-2{,}55}{1{,}8-1{,}5}=\mathbf{1{,}63}$$

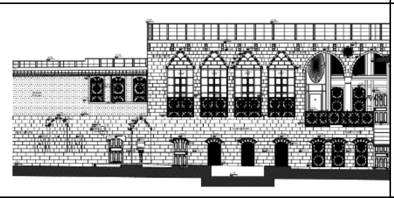
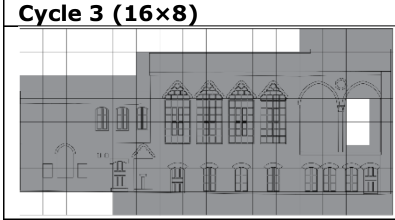
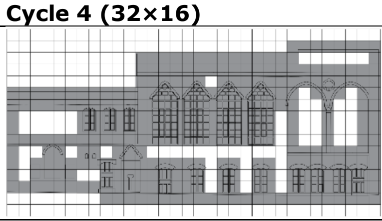
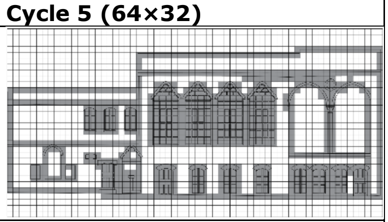
AVERAGE: 1,78

3.5. South Facade

The spaces on the south facade of Cahit Sıtkı Tarancı House were used as winter quarters in order to adapt to climatic conditions. It is seen that flat arches were used in the door and window design of the ground floor of this facade, while the window sizes were increased on the first floor and designed with segmented arches. It is also seen that columns and arches are used in the design of the iwan, which is used as a semi-open space on the first floor. The fractal dimension calculation of the south facade is as follows (Table 7).

Online Journal of Art and Design
volume 13, issue 3, July 2025
DOI: https://doi.org/10.30935/ojad/2513044

Table 7. Application of the box counting method to the south facade

South Facade	Cycle 1 (4×2)	Cycle 2 (8×4)
		
Cycle 3 (16×8)	**Cycle 4 (32×16)**	**Cycle 5 (64×32)**
		

Calculations for the South Facade			
Number of Cycles	**Grid Size**	**Number of Full Boxes**	**Number of Empty Boxes**
1	4×2	8	0
2	8×4	30	2
3	16×8	105	23
4	32×16	316	196
5	64×32	852	1196

South Facade				
Cycles	**1-2 Cycles**	**2-3 Cycles**	**3-4 Cycles**	**4-5 Cycles**
Fractal Dimension	1,9	1,83	1,56	1,46
Average Fractal Size	**1,68**			

Calculation of 1-2 Cycles

$$\frac{\log(30)-\log(8)}{\log(8)-\log(4)}=\frac{1{,}47-0{,}9}{0{,}9-0{,}6}=\mathbf{1{,}9}$$

Calculation of 2-3 Cycles

$$\frac{\log(105)-\log(30)}{\log(16)-\log(8)}=\frac{2{,}02-1{,}47}{1{,}2-0{,}9}=\mathbf{1{,}83}$$

Calculation of 3-4 Cycles

$$\frac{\log(316)-\log(105)}{\log(32)-\log(16)}=\frac{2{,}49-2{,}02}{1{,}5-1{,}2}=\mathbf{1{,}56}$$

Calculation of 4-5 Cycles

$$\frac{\log(852)-\log(316)}{\log(64)-\log(32)}=\frac{2{,}93-2{,}49}{1{,}8-1{,}5}=\mathbf{1{,}46}$$

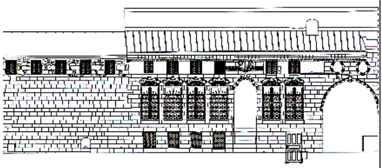
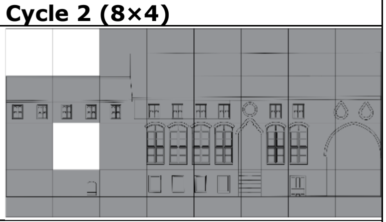
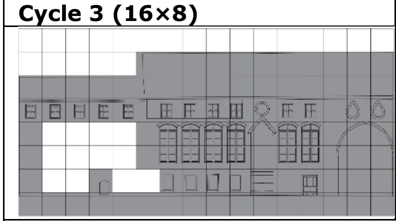
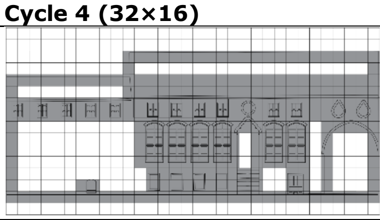
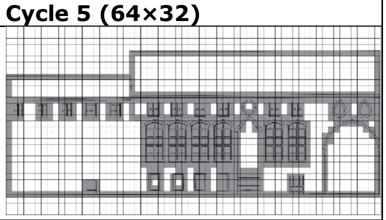
AVERAGE: 1,68

3.6. North Facade

The spaces on the north facade of Cahit Sıtkı Tarancı House were used as summer houses in order to adapt to the climatic conditions. It is seen that flat arches are used in the design of the windows on this facade and the skylights are designed in rectangular shapes. It is seen that the opening created to provide access to the spaces on the ground floor is designed in the form of an arch and at the entrance of the staircase extending towards the first floor, there is an opening designed with segmented arches. The fractal dimension calculation of the north facade is as follows (Table 8).

Online Journal of Art and Design
volume 13, issue 3, July 2025
DOI: https://doi.org/10.30935/ojad/2513044

Table 8. Application of the box counting method to the north facade

North Facade	Cycle 1 (4×2)	Cycle 2 (8×4)
		
Cycle 3 (16×8)	**Cycle 4 (32×16)**	**Cycle 5 (64×32)**
		

Calculations for the North Facade

Number of Cycles	Grid Size	Number of Full Boxes	Number of Empty Boxes
1	4×2	8	0
2	8×4	29	3
3	16×8	95	33
4	32×16	279	233
5	64×32	732	1316

North Facade

Cycles	1-2 Cycles	2-3 Cycles	3-4 Cycles	4-5 Cycles
Fractal Dimension	1,86	1,7	1,56	1,4
Average Fractal Size	**1,63**			

Calculation of 1-2 Cycles

$$\frac{\log(29)-\log(8)}{\log(8)-\log(4)}=\frac{1{,}46-0{,}9}{0{,}9-0{,}6}=\mathbf{1{,}86}$$

Calculation of 2-3 Cycles

$$\frac{\log(95)-\log(29)}{\log(16)-\log(8)}=\frac{1{,}97-1{,}46}{1{,}2-0{,}9}=\mathbf{1{,}7}$$

Calculation of 3-4 Cycles

$$\frac{\log(279)-\log(95)}{\log(32)-\log(16)}=\frac{2{,}44-1{,}97}{1{,}5-1{,}2}=\mathbf{1{,}56}$$

Calculation of 4-5 Cycles

$$\frac{\log(732)-\log(279)}{\log(64)-\log(32)}=\frac{2{,}86-2{,}44}{1{,}8-1{,}5}=\mathbf{1{,}4}$$

AVERAGE: 1,63

4. CONCLUSION AND EVALUATION

The fractal value obtained with the box counting method can have any value between 1 and 2. If the value obtained as a result of the analysis is close to 2, it is understood that the texture has an intense richness of detail. On the other hand, if the value is close to 1, it is understood that the texture is simpler and does not have a richness of detail (Mohtasib, 2021). When Cahit Sıtkı Tarancı House is evaluated within the scope of this statement, it can be said that the simplest in terms of plan is the first floor plan with a value of 1.4 and the ground floor plan is more complex with a value of 1.43. However, the fact that the value obtained in both plans is closer to 1 shows that the texture does not have a richness of detail and is simpler. When the facades of the building are compared among themselves, it can be said that the northern facade is the simplest with a value of 1.63 and the eastern facade is more complex with a value of 1.78.

If the ground floor plan (1,43) and the first floor plan (1,4) are evaluated within themselves, it is seen that these plans have equal levels of complexity. It is seen that the plan organization on both floors has a similar ratio of occupancy and emptiness.

When the west facade (1.69), east facade (1.78), south facade (1.68) and north facade (1.63) are evaluated within themselves, it is seen that the facades have similar levels of complexity. It can be said that the occupancy-void ratios on the facades are also close to each other. The fact that the proportions and dimensions of the gaps formed by the wooden joinery used in the windows and doors on the facades of the building are close to each other can be seen as the reason for the close fractal values. The closeness of the fractal values obtained when the plan and facades are evaluated within themselves as a result of the analyzes shows that the building is designed with a similar language horizontally and vertically.

Within the scope of the study, it has been seen that the fractal dimensions of different architectural elements of a building can be examined by using the fractal dimension as an analysis method. Thanks to fractal geometry, a different mathematical field other than classical geometry, namely Euclidean geometry, has been defined. It has been seen that it can be used as a different method in the analysis of architectural structures that Euclidean geometry is insufficient to measure. On the other hand, fractal geometry and fractal dimension concepts can be utilized not only on an existing architectural fiction but also in the development of new designs. In buildings such as Cahit Sıtkı Tarancı House, which have been worn out over the years or whose facade features cannot be preserved, fractal dimension analysis can benefit restoration efforts. If we think more comprehensively, it can be considered that the change of cities from past to present and even the new buildings to be designed in cities can be designed with fractal analysis methods.

REFERENCES

Alik, B. (2015). Mimarlıkta Tasarlama Yöntemleri Ve Fraktal Tasarımlar Üzerine Bir İnceleme. Yüksek Lisans Tezi, Kocaeli Üniversitesi, Fen Bilimleri Enstitüsü, Kocaeli.

Aykal, F.D., Erbaş Özil, M. & Hızar, M. (2020). Architectural analysis based on fractal dimension on diyarbakir mosques. *Online Journal of Art and Design*, 8(1), 41-57.

Bovill, C. (1996). *Fractal geometry in architecture and design*. Birkhauser, Boston.

Çağdaş, G., Gözübüyük, G. & Ediz, Ö. (2006). Mimari tasarımda fraktal kurguya dayalı form üretimi. *Journal of İstanbul Kültür University*, 2, 1-12.

Gözübüyük, G. (2007). Farklı Mimari Dillerde Fraktallere Dayalı Form Üretimi. Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi, Fen Bilimleri Enstitüsü, İstanbul.

Kanatlar, Z. (2012). Fraktal Boyuta Dayalı Mimari Bir Analiz: Sedad Hakkı Eldem ve Konut Mimarisi. Yüksek Lisans Tezi, Uludağ Üniversitesi, Fen Bilimleri Enstitüsü, Bursa.

Lionar, M.L. (2021). Fraktal Boyuta Dayalı Çok Katmanlı Bir Analiz: Eldem ve Doshi Mimarlığı. Doktora Tezi, Uludağ Üniversitesi, Fen Bilimleri Enstitüsü, Bursa.

Mandelbrot, B. B. (1983). *The fractal geometry of natüre*. W. H. Freeman and Company, New York.

Mohtasib, I. (2021). Çok Katmanlı Fraktal Analiz Yöntemi: Şehzade Camisi Örneği. Yüksek Lisans Tezi, Uludağ Üniversitesi, Fen Bilimleri Enstitüsü, Bursa.

URL-1. https://en.wikipedia.org/wiki/Fractal (last access: 06.01.2024)

URL-2. https://en.wikipedia.org/wiki/Kandariya_Mahadeva_Temple (last access: 06.01.2024)

URL3. https://en.wikipedia.org/wiki/Federation_Square (last access: 06.01.2024)

URL-4. https://tr.wikipedia.org/wiki/Cahit_Sıtkı_Tarancı_Müzesi (last access: 06.01.2024)

URL-5. https://www.kulturportali.gov.tr/turkiye/diyarbakir/gezilecekyer/caht-siki-taranci-muzes (last access: 06.01.2024)

Ursavaş, N.B. (2022). Fraktal Boyut ve Lakunarite Hesaplamaları ile Parkların Dönemsel Analizleri ve Değerlendirmeleri. Yüksek Lisans Tezi, İstanbul Teknik Üniversitesi, Lisansüstü Eğitim Enstitüsü, İstanbul.

Yıldırım, M., Dalkılıç, N., Halifeoğlu, F.M., Dağtekin, E. & Payaslı Oğuz, G. (2012). *Rölöve teknikleri dersi öğrenci çalışmaları*, TMMOB Mimarlar Odası Diyarbakır Şubesi Yayınları.

Yılmaz, D. (2021). Kentsel İmge Açısından Önemli Olan Sokakların Fraktal Geometri ile İrdelenmesi. Yüksek Lisans Tezi, Kastamonu Üniversitesi, Fen Bilimleri Enstitüsü, Kastamonu.