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The Nexus of the Objective Assessment of Beauty and the Subjective Aesthetic Cognition

[1] Dr. Salar Salah Muhy Al-Din, [2] Sarvenaz Pakravan

[1]Department of Architecture- Girne American University, Kyrenia, N.Cyprus via Mersin- Turkey.
email: salarmuhyaldin@gau.edu.tr
https://orcid.org/0000-0002-0365-8452

[2] Ph. D. Candidate, Department of Interior Architecture- Girne American University, Kyrenia, N.Cyprus via Mersin- Turkey.
email: sarvenazpakravan@gau.edu.tr
https://orcid.org/0000-0002-0206-3617

Abstract

Exploring the aesthetic appraisal of surfaces through texture and the balance of the shapes and colors is a significant issue in reaching aesthetic evaluation, and setting the evaluators on common ground and a solid reference point in judging aesthetic values. This paper aims to find a guideline for designers to understand the characteristic of beautiful texture of surfaces for human well-being in inner spaces. Moreover, the study approached case study methodology to evaluate the aesthetic value of the texture in inner spaces objectively and subjectively. The objective method was conducted by using Birkhoff's aesthetic measure, and subjective method through asking for the personal opinions of the professionals. Hence, three works of interior architectural students have been selected as case studies for this purpose. The comparison of the result from both objective and subjective methods has been carried out and the results have been extrapolated. The results showed positive credibility for Birkhoff's aesthetic measure tool in comparing different case studies aesthetically with the aesthetic cognition of the professionals. The study also, concluded, that the aesthetic value of surface texture is prompted by enhancing order and decreasing complexity.

Keywords*:* Aesthetics; Objective beauty; Birkhoff's Aesthetic Measure; Aesthetic Cognition.

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1. Introduction

It is a time to remove any ambiguity that hinders a taste of obvious aesthetic merit of inner surfaces. The design of surfaces inspired many architects to don't see the surfaces in a building as a rigid element. The surfaces are an essential element in the building's aesthetic, where it enriches the inner/outer spaces and show their visual influence to the occupants and beholders, and improve the well-being of the occupants. Brooker and Stone (2010), states that the cordial detailed design of each element can be known as the tactics. Texture is one of the significant tactics in designing components and constituents of the building. Commonly, texture, lighting and shading, material, and color create our circumstances (Nebraske, 1997). It is worth saying, textures, form, materials, lighting, and colors all inoculate the quality of space (Ching, 2007). The texture is an important element to be considered in the design because it affects the visual (perceptual) quality in any space. Hence, it is one of the primary tactics for designing surfaces, which can affect human perception.

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Commonly, the act of assessing or judging the nature or value of an object or anyone is known as an appraisal (Oxford Language, 2022). However, still, there is great difficulty in evaluating the Aesthetics in the texture of the surfaces. One of the types of evidence behind the implementation of Aesthetics in objects is basically standing on the fact that the object that follows the universal laws of nature, follows its order and hierarchy, understands the cross-cultural aesthetic appreciation, gains the life of architecture, (Alexander, 2003; Salingaros, 1995). The idea of architecture life legitimizes why individuals share a comparative inclination for a few works of design overall like the Taj Mahal, Notre Dame Cathedral, and Hagia Sophia, regardless of their different societies' peculiarities, (Salingaros, 1995; Salingaros, 1997).

Nowadays, designers use many various ways to design surfaces. However, most of them do not know how to evaluate the aesthetic value of the texture as a tactic of the design; it may be because of the low level of awareness and knowledge about the aesthetic assessment of texture and the ways it is created. Hence, there was a great difficulty and dilemma in evaluating the aesthetic value of the texture of surfaces. The paper aims to reach a comprehensive understanding of the notion of aesthetic assessment based on the modern view of beauty. Moreover, to evaluate the character and credibility of the implication of Birkhoff's aesthetic measure in evaluating of the aesthetic value of texture in architecture. The paper tries to answer the following question; how can aesthetic value be measured? And how the aesthetic value could be evaluated in the process of design?

The objectives of this study are; to explore the most significant elements in the surfaces textures that affect aesthetic value in surfaces in buildings and evaluate them objectively and subjectively. This is through "Birkhoff's" aesthetic measurement as an objective way, and professionals' aesthetic judgment as a subjective way. The comparison between both ways will be addressed, to determine the extent of convergence or divergence between professionals' aesthetic judgment, and "Birkhoff's" aesthetic measurement. Interior architectural design principles is one of the fundamental courses for students of interior architecture. The course provides the main principles of beauty in interior surfaces and discusses the balance among texture, colors, the balance of the objects, and lighting and shading. The outcome of this course is a project that should be developed by each student to reflect their understanding of those principles. Hence, three projects of interior architectural students in the INT 131 course (The principles of Interior Architecture), at Girne American University (GAU) have been selected as case studies. The projects are the combination of several objects to reflect the aesthetics of the surfaces. Birkhoff's aesthetic measure has been used, which considers the aesthetic value as a ratio between "Order" and "Complexity". This measure will be taken as an analytic tool for the assessment of aesthetic value in the students' projects objectively. Academic professionals' aesthetic cognition and judgment have been approached in the faculty of Architecture, Design, and Fine Arts at Girne American University in Northern Cyprus. This is through exposing the projects to them to examine their aesthetic judgment subjectively and to test the validity of Birkhoff's aesthetic measure, through the comparison of the results from both ways.

2. Literature Review

2.1 The Notion of Beauty and Aesthetics

"Beauty", the philosophers gave many definitions to the meaning of beauty. Plato (427-347 BC) divided beauty into two types: the first is the beauty in nature and in living objects and, the second is the beauty in geometry, straight lines, and circles. He introduced natural beauty as proportional, and what is created by humans as absolute (Mahdavinejada et al., 2013). Beauty, for Thomas Aquinas (1225-1275) that in existent things is objectively or really perceived by a cognitive process of seeing or hearing. Hence, 'Beauty' in his view has three essential conditions; integrity, proportion, and clarity. He believes that beauty is not completely sensuous, despite beauty acquired through cognitive senses, eyes, and ears. Talks about beautiful sights and sounds are more general and comprehensive, whereas, beautiful tastes and beautiful odors are not very comprehensive. Thomas recognizes between the beauty of the form (proportion and clarity) and the beauty of the soul 'virtue or honesty' (Aquinas, 2006). Immanuel Kant (1724-1804) stated that our potential for judgment lets us experience beauty. Also argues that aesthetic judgments are prior to pleasure and are both universal and necessary. They have a purposive appearance despite they are not conceptually final. The judgment of taste, therefore, is not a cognitive judgment (Ward, 2012; Archie and Archie, 2006). Beauty for George Santayana (1863-1952) is a type of experience that originates from the essential emotional interest in perception and is not a derivative quality from the perceptual process. Hence, he believes that beauty is an emotional element, a pleasure of ours, which nevertheless we regard as a quality of things. The conditions of beauty come through material (sensation), shape or form (measure), or expression. In sum, Santayana describes beauty as "pleasure objectified", he says beauty is "pleasure regarded as the quality of a thing." (Archie and Archie, 2006). Beauty is a part of aesthetics philosophy, which is the experience of pleasure. Regarding 'Aesthetic', it is a concern with beauty, appreciation of beauty, artistic impact, and appearance (Kumar and Garg, 2010). The aesthetics field is falling into two

interrelated but different zones: ‘primary aesthetics', which consists of philosophical activity whose object is the beautiful and the experience of beauty; and ‘aesthetics' in the modern and specialized sense which is both practical and theoretical knowledge of artistic creation (Gonzalez, 2001). Birkhoff addressed that aesthetic value can be measured and it is the ratio between ‘order and complexity’ (Gifford et al., 2000).

2.2 Objective and Subjective View of "Beauty"

The words "Objectivity" and "subjectivity," are semi-technical. They are holding multiple overlapping meanings in the mind of professional philosophers and in the opinion of non-professionals and non-philosophers (Mandik, 2000). "Objective" is a reality, independent of our mind. An objective feature of the universe is something that does relate to our own beliefs or feelings on the matter (Hegelund, 2005, P.648). "Subjective" is exactly the opposite of objective. Subjective beliefs depend on the individual’s mind. It is mind-dependent (Mandik, 2009, P.601). Aesthetics subjectivity is a concern of philosophers; non-philosophers are rarely focused on it. Criticisms consider beauty from an objective point of view; they believe that we like things because they are beautiful and not because we see them beautiful. They take the objective beauty of things for granted and above any argument as John Laird. In his opinion is that the sky, clouds, and sea hold beauty, why then should be belonging to us, not to them...! (Rolston, 1982, P.126). The early philosophical trends, such as Pythagorean (3rd Century B.C.), tend to objectivity while the other, the Sophist (5th Century B.C.), open the debate on the theory of subjectivity (Mills, 2009). Subjective and objective theories of beauty existed in early ‘Antiquity' and in the Middle Ages. It can be delineated that in ancient and medieval aesthetics, the objective and subjective theories were in dialect. Some opinions claim that aesthetics was an objective theory of beauty at the origin. It became subjective since modem times, and such kind of opinions lack accuracy, based on literature review (Muhy Al-Din, and Ahmad Nia, 2017).

2.3 Aesthetic Cognition (Subjective Evaluation)

Cognition is the methodology of acquiring, representing, manipulating, and using information from the environment in order to judge objects. Cognition is not only a process but a "mental" process (Neisser, 1976). ‘Any realistic experience resulting from prompting of a specific sensory organ, or sensory area of the brain” (Britannica, 2022). ‘Perception’ is "the act of using only one's own sense organs to gain knowledge about, interact with, and experience the environment" (Boothe, 2002). ‘Conception’ is related to culture and individual background. It is the stage that let the observer understand the meaning of the object. Aesthetic Cognition has three stages starting with sensation, conception, and perception to reach finally to aesthetic evaluation (Ahmad Nia and Atun, 2015). See Figure ‘1’.

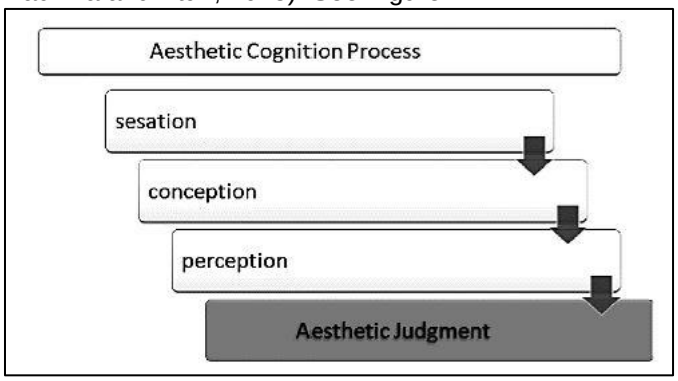

Figure 1. The process of (Subjective) Aesthetic judgment through cognition. (Ahmad Nia and Atun, 2015)

2.4 Aesthetic Measurement (Objective Evaluation)

As of not long ago, there was a significant problem in objectively assessing the aesthetics in architecture and architecture. However, the proof behind the presence of objective aesthetics is fundamentally remaining based on the reality that the buildings pursue the all-inclusive laws of nature, apply its order and chain of importance, and understand the multifaceted stylish profound respect thus secure the life of architecture (According to Salingaros, the architectural life refers to the degree that one connects with a building in the same way that one connects emotionally to trees, animals, and people), (Alexander, 2003; Salingaros, 1995). The idea of architecture life legitimizes why individuals share a comparative inclination for a few works of design overall like the Taj Mahal, Notre Dame Cathedral, and Hagia Sophia, regardless of their different societies' peculiarities (Salingaros, 1997).

2.4.1 Birkhoff’s aesthetic measurement

Far from the argument of subjective aesthetic estimation, Birkhoff's measure of aesthetics is one of the objective ways to examine the formal aesthetic which is identified with the surface, texture, structure of the

frame, and its mathematical relations which can be quantitatively evaluated. (Gifford et al., 2000). Birkhoff and his supporters introduced a scientific elucidation of the formal aesthetic evaluation for the objects through a converse connection between the Order and Complexity of themes' structures as; The Aesthetic value = Order/Complexity, (Eysenck, 1941; Greenfield, 2005; Robert, 2007; Staudek, 1999, 2002) as cited in (Katsenelinboigen, 1997). Birkhoff's formula can be utilized in by identifying the condition's parameters; Order and Complexity, which goes about as an index of the natural beauty/architecture life that the building possesses. Important that this measure avoids the functionality and historical value of the buildings, and other influencing factors under the thought of seeking just the formal parts of the building (Gifford et al., 2000; Roberts, 2007). Birkhoff's formula can be employed in Architecture by redefining the equation's parameters; Order and Complexity.

A. Order is the certificate that the object owns geometrical relations in its synthesis, (Arnheim, 1977). The features of order commonly, produce positive feelings, while imperfection, ambiguity, and unnecessary repetition, produce negative feelings (Staudek, 1999). The Order in architecture is measured by five items; Symmetry, Repetition, Equilibrium, Disposition, and Color harmony, as well as Randomness, which it is a negative factor affecting Order, (Arnheim, 1977; Salingaros, 2007; Staudek, 1999).

B. Complexity in Birkhoff's terms stands for the preparatory effort of attentiveness and it is stimulating the perception. It is the factor in charge of growing the tension feeling and attention effort. Architecturally, Complexity is measured by Ornament, form complexity, Silhouette differentiation, and color contrast (Roberts, 2007; Staudek, 1999).

2.5 Surface Texture in Architecture

Texture is defined as tactile surface quality and it is "the quality of something that can be decided by touch; the degree to which something is rough or smooth, or soft or hard", (Cambridge Dictionary, 2018). Furthermore, it is defined as "the way the different parts of a piece of writing, music, art, etc. are combined in order to produce a final effect" (Longman Dictionary, 2018). Natalie (2012) mentions that the texture indicates the surface's quality, may it be soft, hard, smooth, coarse, solid, or reflective". It displays the sense of the surface by touching the objects; people can understand whether its surface is rough or it just looks as it is. Texture can be everywhere and on everything; each thing has its own texture regardless if it is smooth or rough. It can be "soft or solid, smooth or coarse, loose or dense, light or heavy. Texture is an essential feature of everything (Oei & Dekegel, 2002).

Generally, texture could be categorized based on its existence into two types; natural and artificial existence. Nature is rich in textures, and there is a very strong relationship between nature and texture; it exists all around the world such as on trees, leaves, grasses, sky, ground, sea animates, seashells, animals, birds, and all the natural things around the world have their special texture. See Figure '2'.

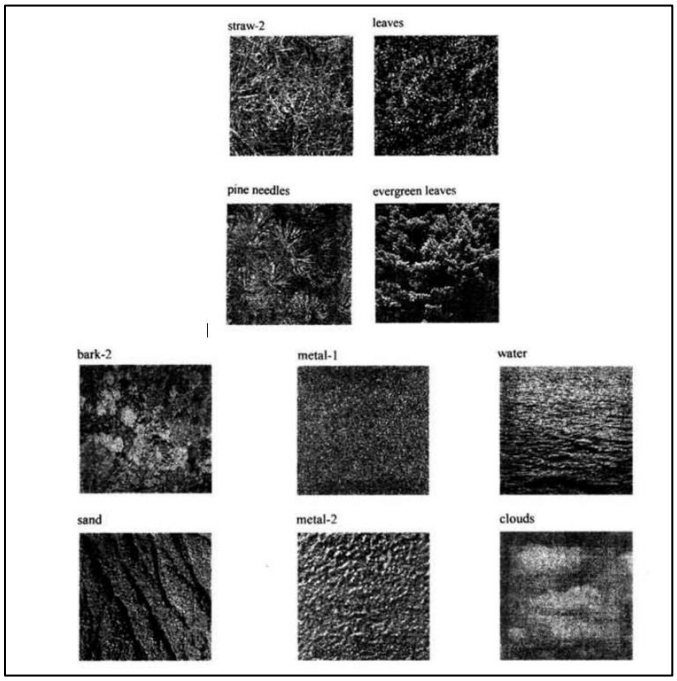

Figure 2. Texture in Nature (Heap and Handel, 1999).

In the same context, an artificial texture is synthetic by man-hand by using different tools to shape materials in different ways. Instances are the concrete surface that may make texture on surfaces, and glasses are sometimes manufactured by textured quality. The way arranging bricks or stones in different may create texture artificially. Commonly, for artificial texture creation, the type and techniques of the materials are very important. Like Fabric, iron, plastic, wood, etc. (Gagg, 2012). See Figure '3'.

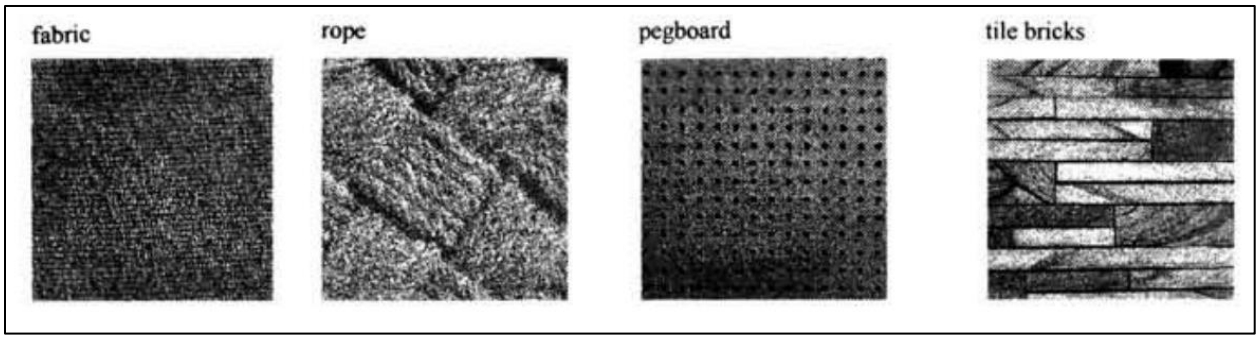

Figure 3. Artificial Texture (Heap and Handel, 1999).

As mentioned previously, texture has been introduced as one of the important design tactics, so designers should think about its design and also the ways in which to create it. There are many ways to create or design texture; it can be created by single materials ordering, shapes, and forms. Using materials or objects in a special way may also create texture. In design, texture can be categorized into two parts: two-dimensional and three-dimensional textures, (Coles & House, 2007).

3. Methodology

Through literature review and theoretical framework, the paper tried to identify key information that could help in identifying the aesthetic value of the surfaces for in or out of buildings based on the influence of texture. Birkhoff's aesthetic measure which refers to the aesthetic value as the ratio between Order and Complexity will be taken as an analytic tool for the assessment of aesthetic value; buildings with lower, average, and higher aesthetic value.

A. First phase: to analyze the surface texture for the three students' projects as case studies based on Birkhoff's aesthetic measure. The findings are an index of how much the surface's texture carries beauty according to the terms of order and complexity. The parameters of order have been identified by the following five items, as seen in Table '1'.

Table 1: Order evaluation parameters based on Brikhoff's aesthetic measurement.

No.	Items of Order (Staudek, 1999, 2002; Robert, 2007; Greenfield, 2005; Eysenck, 1941; Katsenelinboigen, 1997).	References
1	Symmetry,	(Arnheim, 1977); (Staudek, 1999); (Salingaros, 2007)
2	Repetition,	(Arnheim, 1977); (Staudek, 1999); (Salingaros, 2007)
3	Equilibrium	(Arnheim, 1977); (Staudek, 1999); (Salingaros, 2007)
4	Disposition	(Arnheim, 1977); (Staudek, 1999); (Salingaros, 2007)
4	Randomness (presence of this Item affecting "Order" negatively)	(Arnheim, 1977); (Staudek, 1999); (Salingaros, 2007)
6	Color harmony	(Salingaros, 2007)

Bellow the definition of each of the order items as found in literature;

1. Symmetry is the reflection of shared shapes, forms, and angles across a central point or line called the axis (Hargittai, and Hargittai, 1994).
2. Repetition is meaning to reuse the same shape or elements throughout the entire design (Jackson, 2016).
3. Equilibrium is a "state in which opposing forces or influences are balanced" (Oxford Dictionary, 2018). Here can be known as the property of visual stability of masses.

4. Disposition is referring to the relationship among vertical, horizontal, and diagonal lattices (Megahed, 2010).
5. Randomness is the quality or state of lacking a pattern or principle of the organization; unpredictability (Verbeeck, 2006).
6. Color Harmony is referring to the condition of colors that are thought to match, and be pleasing when placed side-by-side (Westland, et al., 2007).
On the other hand, Complexity in Birkhoff's terms stands for the preliminary effort of attention that is necessary for the act of perception. It represents the factors responsible for increasing the feeling of tension and effort of attention, through the following items, as seen in Table '2'.

Table 2: Complexity evaluation parameters based on Brikhoff's aesthetic measurement.

No.	Items of Complexity (Staudek, 1999, 2002; Robert, 2007; Greenfield, 2005; Eysenck, 1941; Katsenelinboigen, 1997).	References
1	Form or shape complexity (contain many items in one place)	(Staudek, 1999); Roberts, 2007)
2	Ornament	(Staudek, 1999); Roberts, 2007)
3	Silhouette differentiation	(Staudek, 1999); Roberts, 2007)
4	Color Contrast	(Staudek, 1999); Roberts, 2007)

The definition of each of the Complexity items have been found in the literature as follow;
1. Shape Complexity is representing the existence of items that raise the tension of the mind such as curves, and mass differentiation. In another word, it is the creation of shape or form through interacting in various ways and following local rules, without the presence of higher instruction to define the various possible interactions (Johnson, 2001).
2. Ornament is defined as something used to make things look more attractive but does not have a practical purpose, particularly a small object such as a figurine (Elrayies, 2017).
3. Silhouette differentiation is "a silhouette is the solid dark shape that you see when someone or something has a bright light or pale background behind them." (Collins Dictionary, 2018). Here it is referring to the number of turns and shade or brightness in every façade of the building (Megahed, 2010).
4. Color Contrast it is referred to the contrast in color hue and saturation. (Salingaros, 2007).
B. Second Phase: to determine these values in the case studies, a preference test was executed by different sets of aesthetic judges; Thirty of the academic staff in GAU have been selected to give their aesthetic judgment on case studies. Judges were asked to rate the students' projects according to a (likert's scale) ranging from very ugly (1), ugly (2), average (3), beautiful (4), and very beautiful (5).
The comparison has been carried out between the findings from the aesthetic evaluation in this way and the aesthetic judge (architects, and architecture students), for each case study and the results have been extrapolated to reach the conclusion. See Figure '4'.

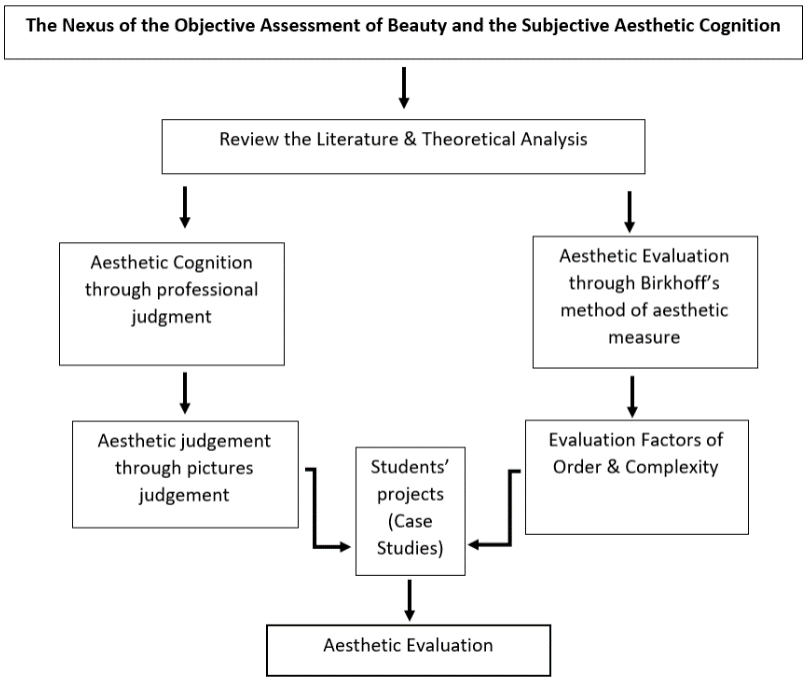

Figure 4. Methodology framework and the outline of the research.

Three case studies were selected, as seen in Table '3', to be aesthetically measured by;

a. Birkhoff's measure, and

b. Thirty professional participants (architects and architecture students) have been asked to judge aesthetic value based on the Likert scale. Assessment occurred by introducing the case studies to the participants.

Table 3. The detail pictures of case studies.

Case Study name & Location	Project of INT-131 (The principles of Interior Architecture)
Student 1	
Student 2	
Student 3	

4. Results and Discussion

A checklist has been prepared to test the availability of Order and Complexity for Birkhoff's aesthetic measure based on identified items. The availability (presence or absence) of these items has been analyzed in the case studies (architectural students' projects) in order to assess aesthetic value.

A. 1st Student's Project

Aesthetic value for this case study based on Birkhoff's aesthetic measure has been approached, as seen in Tables '4 & 5';

Table 4: Order evaluation in 1st case study, based on Brikhoff's aesthetic measurement.

No.	Items of Order	Present	Not present
1	Symmetry,		✓
2	Repetition,	✓	
3	Equilibrium	✓	
4	Disposition		✓
5	Randomness (presence of this Item affecting "Order" negatively)	✓	
6	Color harmony		✓

The Order has been found Three out of six (3/6), including 'Randomness' which gives a negative effect. The missing items were only 'color harmony, and 'Deposition'. Therefore, Order = [(Repetition+ Equilibrium – Randomness) / Total number of Items], hence, Order = [(1+1-1)/6] = [1/6] = 0.17. In the same context, the evaluation of Complexity through its items has been carried out as seen in Table '5'.

Table 5: Complexity evaluation in 1st case study, based on Brikhoff's aesthetic measurement.

No.	Items of Order	Present	Not present
1	Form or shape complexity (contain many items in one place)	✓	
2	Ornament	✓	
3	Silhouette differentiation	✓	
4	Color Contrast	✓	

The Complexity in the case study has been found equal to 1, because all the items of complexity have been found present, where;

Complexity = [(Form or shape complexity + Ornament + Silhouette differentiation+ Color Contrast) / Total number of Items]. Hence, Complexity = [(1+1+1+1)/4] = [4/4] = 1. Based on Birkhoff's aesthetic measure; Aesthetic value = Order/ Complexity, Thus, the Aesthetic Value for (1st case study) = 0.17/1= 0.17 the rate of beauty according to Birkhoff's Aesthetic measure.

B. 2nd Student's Project

In the same way and steps followed in the first case study, the Order and Complexity have been found in the second case study. See Tables '6 &7'.

Table 6: Order evaluation for the 2nd case study, based on Brikhoff's aesthetic measurement.

No.	Items of Order	Present	Not present
1	Symmetry,		✓
2	Repetition,	✓	
3	Equilibrium	✓	
4	Disposition	✓	
5	Randomness (presence of this Item affecting "Order" negatively)		✓
6	Color harmony	✓	

Thus, the order in 2nd case study has been found 0.67, while the complexity has been analyzed in this case study, as seen in Table '7'.

Table 7: Complexity evaluation in 2nd case study, based on Brikhoff's aesthetic measurement.

No.	Items of Order	Present	Not present
1	Form or shape complexity (contain many items in one place)	✓	
2	Ornament		✓
3	Silhouette differentiation		✓
4	Color Contrast		✓

The Complexity has been found 0.25. Thus, according to Brikhoff's formulae, the Aesthetic value has been found as follows; Aesthetic value = 0.67/0.25= 2.7 the rating of beauty in the second case study.

C. 3rd Student's Project

The Order and Complexity have been examined in the third case study, as shown in Tables '8 & 9'.

Table 8: Order evaluation in 3rd case study, based on Brikhoff's aesthetic measurement.

No.	Items of Order	Present	Not present
1	Symmetry,		✓
2	Repetition,	✓	
3	Equilibrium	✓	
4	Disposition	✓	
5	Randomness (presence of this Item affecting "Order" negatively)	✓	
6	Color harmony	✓	

Thus, the order in 3rd case study has been found 0.50. The complexity has been examined in this case study, as seen in Table '9'.

Table 9: Complexity evaluation in 3rd case study, based on Brikhoff's aesthetic measurement.

No.	Items of Order	Present	Not present
1	Form or shape complexity (contain many items in one place)	✓	
2	Ornament	✓	✓
3	Silhouette differentiation		✓
4	Color Contrast		

The Complexity in the third case study has been found 0.5, therefore, the aesthetic value in this case study according to Brikhoff's formulae, Aesthetic value = 0.5/0.5= 1.0 the rating of beauty.

In another phase, thirty professionals have been asked to make an aesthetic judgment for the selected projects. The participants have been asked to evaluate each case study according to a Likert scale ranging

from very ugly (1), ugly (2), average (3), beautiful (4), and very beautiful (5). The aesthetic judgment of the thirty professionals on the evaluation list in 'Appendix A' is found, as demonstrated in Table 10'.

Table 10: Aesthetic Judgment of the participants, based on the questionnaire.

No.	Participants	1. V. Ugly	2. Ugly	3. Average	4. Beautiful	5. V. Beautiful
1	Case study 1	11	16	2	1	0
2	Case study 2	0	3	0	18	9
3	Case study 3	2	9	8	8	3

The aesthetic value measurement in the three case studies has been carried out according to Birkhoff's aesthetic measure, which is depending on the ratio of order over complexity. The analysis of presence or absence of order and complexity factors have been analyzed based on the physical (visual) assessment of the projects. The findings demonstrated that the second project gained the highest aesthetic value based on the (Order to Complexity) ratio. The second one in the evaluation was the third project, and less aesthetic value have been obtained by the first project, as seen in Table 11'.

Table 11: The aesthetic value based on Brikhoff's formulae.

Case study Number	Aesthetic Value
1. First Student's Project (case study 1)	0.17
2. Second Student's Project (case study 2)	2.7
3. Third Student's Project (case study 3)	1.0

The collected data for the aesthetic judgment of 30 professionals have been analyzed statistically based on Likert's scale method, and the result demonstrated that the first case study judged ugly. The second case study has been judged by professionals as beautiful. In the same context, the third case study has been judged as average, as seen in Table '12'.

Table 12: Professionals' aesthetic judgment results as per Likert's formulae.

Thermal Sensation	1 V.Ugly	2 Ugly	3 Average	4. Beautiful	5 V. Beautiful	Likert Formula	Result	Scale	Judgment
Lobby									
Case Study 1	11	16	2	1	0	53	1.76667	2	**Ugly**
Case Study 2	0	3	0	18	9	123	3.84375	4	**Beautiful**
Case Study 3	2	9	8	8	3	91	2.84375	3	**Average**

5. Conclusion

The research tried to reach the possibility to evaluate the aesthetic value of the surface texture. Hence, the study adopts a point of view of evaluating the aesthetic value based on Birkhoff's aesthetic measure for beauty. The comparison of the result for this evaluation with the aesthetic judgment of a group of professionals (thirty of the academic staff in GAU) was carried out to find the range of credibility in applying Birkhoff's aesthetic measure in evaluating beauty. The results demonstrated positive credibility for Birkhoff's aesthetic measure as a tool to evaluate the aesthetic value of the surface texture. The findings demonstrated harmony between aesthetic assessment by Brikhoff's formulae and aesthetic judgment by the professionals in evaluating the beauty in surface texture, as demonstrated in Table '13'.

Table 13: The convergence in the result between Brikhoff's method and the results of professionals' judgement for evaluating aesthetics in the surfaces texture based on the students' projects.

No.	Case Studies	Aesthetic Value by Brikhoff's Aesthetic Measure	Aesthetic cognition through assessment Table and answers of the professionals
1	Case Study 1		
		0.17	Ugly
2	Case Study 2		
		2.7	Beautiful
3	Case Study 3		
		1.00	Average

The study also, demonstrated that the texture aesthetic value on the surfaces increases with the increasing of the factors of order, which are, symmetry, repetition, equilibrium, disposition, and color harmony. Furthermore, the aesthetic value will be increased with decreasing randomness and reduction of complexity factors which are; form or shape complexity, ornament, silhouette differentiation, and color contrast. The outcomes of this study enable decision makers even in the practical fields or in the academic fields to classify and assess the beauty, especially in the evaluation of the student's projects.

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Conflicts of interest

The Author(s) declares(s) that there is no conflict of interest.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author/s.

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