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Appreciation of Siri Dungun Paintings in Ethnomathematics Context

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Abstract

This research aims to examine the meaning allude to appreciation of paintings which oriented with Siri Dungun painting in the context of mathematical thinking. By focusing on factors that support the relation between formalistic contexts to describe the existing of symmetry concept in ethomathematic approach. This research involves analytical study of paintings through qualitative approach with the implementation of descriptive inter-disciplinary. The symmetry properties are examined meticulously in order to classify the paintings via transformations which involve four basic repetitions via such as translation, rotation, reflection and glide reflection. This process will build a structure known as symmetry group frieze. Frieze pattern is a pattern in two dimensional surfaces that repeat in one direction. Written and visual data information is collected through documentation, visual recording and observation methods. The findings of the research showed the understanding of mapping the conceptual framework which taken from art appreciation and symmetry concept were underlying pattern and design in the studied paintings. Hence, the inter-relationship between art and mathematics cannot be denied through the beauty of paintings as well as its beauty ini mathematical aspect. The implication of this research is to appreciate paintings not only from the art appreciation point but can also be extended to various fields of philosophy perspective especially in mathematical aspect.

Keywords: Symmetry, Art Appreciation, Painting, Siri Dungun, Frieze Pattern, Ethnomathematic

Introduction

The history of the Malay community proves that their mathematical thinking is born within the culture and the system value of a racial or ethnic group. Nowadays, it manages to get a place among local researchers. This mathematical tradition has just emerged in the history of mathematical education when then cultures and mathematics were studied by some western researchers. The combination of these two aspects were called ethnomathematics (Ismail, 2004).

Ethnomathematic is defined as a built-up mathematics accompanied by a system of values, cultures and the views of a society. This means that the mathematical values are supported by the mathematical knowledge's itself and the culture of the society in which mathematics is taught and developed. It links cultures and mathematics from various aspects such that arts, literature, religious education and thought (Ismail et. al, 2012).

Ariffin and Ismail (2010) stated that the applications of mathematics are helpful in providing solutions in everyday life including arts. Mathematics is an art which embraces geometric forms that are processed and diversified to produce an attractive and perfect pattern.

Previous Studies

Previous studies mostly examine the production in terms of shapes and functions of symmetry that exist in the art of woodcarving, songket, craft, pottery through a system of mathematical notation. Although there have been many studies between mathematical and artistic studies conducted, but in artwork has not been widely studied, either through books, journals, articles or theses. Past research is based only on mathematical thinking in artistic arts including woodcarving, textiles and pottery.

Research conducted by Ruzaiika Omar Basaree that relates on art and mathematics can be detected in her writing which focus on the relationship of geometric principles in Malay wood carving art on traditional houses. It is to examine the settlement factors that dominate the relationship between the cosmological and geometric principles in the traditional Malay house sculpture (Basaree, 2008).

Meanwhile, Aziz & Embong (2016) in her research focus on mathematical concept, mathematical practice and trustworthiness of Malay songket weaver especially the songket woven process, motifs and pattern designs. The findings show that songket weaving not only requires specific special skills and creativity, but mathematical knowledge and mathematical thinking are also embedded in the creative and artistic mind of the Malay songket weaver.

Previous paper works or researches mostly examine the fundamental factors of art appreciation which affecting subjects, forms and meanings. Therefore, this study aims to look at the ethnomathematic context through formalistic analysis aspects that can be found in traditional Malay art.

The Purpose of the Study

This paper was conducted to identify the existence of the concept of art appreciation through traditional Malay cinematographic work on the aspects and ethnographic points of mind. Analytical work is carried out to classify mathematical notation symbols to classify symmetry in pattern design to create a good study. Its purpose is

to examine the factors that support the relationship between the formalistic and symmetrical principles in the paperwork. This research contributes new information to existing knowledge in art. It is seen from a different philosophy of knowledge which is through the mathematical concept.

Theoretical Framework

The combination of interdisciplinary approaches using the concepts in ethnomathematics as the main theory (grand theory) is known as the extra-aesthetic. Meanwhile intra-aesthetic explanations involve the concept of artistic (formalistic) appreciation and the concept of symmetry transformation to see the design of subgroups of seven basic patterns of frieze patterns which is used to analyse the works of the Siri Dungun. The framework of this study is used as a reference to reveal the questions in the study. Through this combination, the concepts that involved can be adapted into the framework of this study.

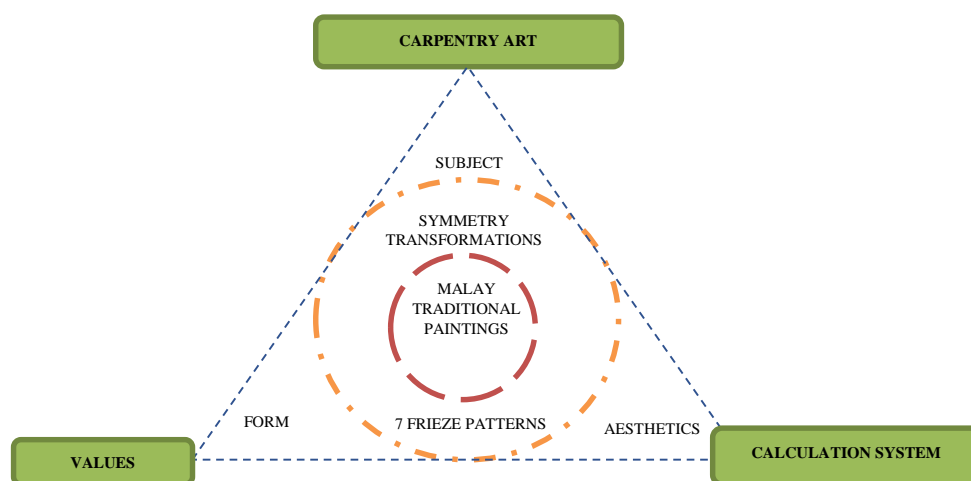


Figure 1. Theoretical framework is adapted from the concept of artistic appreciation, formalistic, symmetric transformation, frieze patterns and ethnomatematical patterns

Theoretical framework must be in line with the research questions, as they are derived from the concepts studied. A deep understanding of the fundamental framework concept mapping which is taken from art appreciation and symmetry concepts is underlying the pattern design in the paintings of the Malay tradition studied. The combination of these concepts is adapted to form a conceptual framework that is thought to be in line with the analysis for this research. In addition, this study also focuses on detailing the analysis of the relationship of symmetry concept and the meaning of appreciation through the ethnomathematic context in the Siri Dungun paintings.


Research Methodology

The approach of the study is descriptive qualitative which is through the process and the understanding of the meaning via the writing and visual data obtained from the field research. The design of this research uses the analysis of content case study

method based on field empirical data work. There are three methods of data collection used in this research: observation, visual recording and documentation analysis. The use of all these three methods is a process that can yield more accurate and convincing findings of the concepts studied.

Analysis of the Siri Dungun Artwork

Table 1. Siri Dungun Artwork

	<p>Siri Dungun (1981) Ruzaiika Omar Basaree Wood carving and emulsion paint 203 cm × 81 cm Source: Balai Seni Visual Negara</p>
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The Meaning of Art Appreciation in the Context of Ethnomathematics

The meaning of art appreciation in the context of ethnomathematics in Siri Dungun is linked through several related concepts:

Calculation System

States that the cultural relation of Malay art and numerical concepts in the methodology occurred when the mechanism of production of the Siri Dungun of paintings uses rules and calculation systems as artistic expression. The melody and movement of the design patterns have relationships with the concept of number calculation as it exists in the paintings. This rule is defined as a moving subject through repetition in pattern order. Siri Dungun paintings show consistent rhythm movements because they have the same form of motifs, the same size, the same distance, the shape and the same space. The motifs repetition uses a continuous, serial, translational, shifting and rotational mapping symmetry concept to produce an interesting pattern. Most of the artworks comply with the general principles of mathematical concepts that use symmetry concepts that assert balance and harmony. The symmetry pattern forms an axis line in the center of a vertical, horizontal, half-circle or circle. It will produce a balance left side with the right side as well as the top with the bottom. So, the creation of the image will requires a precise calculation system that includes rotation angle, reflection or translation (Ismail et. al, 2012).

Arts (Crafts)

Ismail et. al (2012) described ethnomatematics as connecting the arts involving carpentry through carving arts. The use of various measurement and calculations system in Malay craftsmanship to produce harmonious geometrical shapes applied. It has been suggested that the mathematical elements have long been practiced through carpentry art. Siri Dungun artworks applying the *kerawang*-shaped concept

that uses woodwork instead of canvas. Wood is used to shape the building structure and carving motifs, it requires a lot of mathematical operation skills to produce a combination of beautiful patterns and symmetry. The composition and originality of traditional carving artwork that applied geometrical motifs design is recognized by the fineness and unique arrangement pattern (Shepard, 1980). The mastery of craftsmanship by the early societies resulted from the idea of exploiting the material from the environment and being used as a production of art work. Skilled craftsmanship and creativity make their art works produced good 3D artworks.

Value (Philosophy and Religion)





Ismail et al (2012) mentioned etnomathematic thinking influenced by the Malay-Islamic cultural system; it was an attempt to show that mathematics is well-known in Malay society. It has been rooted in various mathematical branches as a result of the continued expansion of the master of Islamic civilization flowing in the region. It connects the mathematical values from various aspects such that arts, culture and other philosophical thinking (Zain, 2004). The paintings of the Malay-Islamic concept of Siri Dungun is processed to convey its artistic and decorative language. The characteristics of the Malay culture are referred to the application of motifs that illustrates the combination of Islamic geometry and floral Malay which are interpreted in a decorative and symbolic way. Looking in terms of the techniques and materials used by the authors has led us to a sense of Malay-worth; it is the result of the beauty of symmetry carving art motifs.

Formalistic Analysis in Symmetrical Concept

Paintings of Siri Dungun 1981 highlighted the Malay-Islamic cultural style that applied geometrical motifs. This art work is presented symmetrically by repetitive methods in accordance with the Malay-Islamic aesthetic principles that give a clear and implied meaning to the concept of *awan larat* (Omar, 2016).

The beauty of mathematical processing in geometric measurements as the main component of this art work, it highlights the balance in the motif arrangement which shows the continuous mapping concept. The component of geometric carving fulfils the majority of the space in art work that has symmetry measures where each carving showed is balanced and equal. Window door leaf is symmetrical where door leaf can be opened and closed.

Table 2. Formalistic Analysis in Symmetrical Concept

Siri Dungun			
			
Symmetry balance of one axis line	Symmetry balance of one axis line	Symmetry balance of one axis line	Diagonal symmetry balance (symmetrical balance composition)

The presentation of the paintings art work through the geometric principles gives us the picture that the pattern element design is set in the same form, the same number, the size on the left and on the right of the art work (Ismail, 2014). The symmetry equilibrium can be seen on a two divider plane which is a mirror reflection through a vertical line at the center of the painting art work, in order to ensure both sides have similarities. So that every move that happens in the painting art work yields the same size and design rules. The composition balance can be seen on the design of the arrangement of the motifs in harmoniously produced art work to illustrate the perspective space and symmetry balance in Siri Dungun art works.

The union in the art works are made out of a horizontal and vertical structured layout that produces uniform and systematic symmetry repetitions. It is a composition to get the beauty of the aesthetic values.



	
horizontal repetition of motifs	vertical repetition of motifs

Table 3. Formalistic Analysis in Symmetrical Concept





The unions of the art work are formed through the recurrence of rhythm, diversity by sizes and composition of harmony in the plane, shape, appearance and colour. The use of geometric motifs in image processing reflects unity through the arrangement of motifs produced in horizontal and vertical order. The repetition of the motif shows the design of a neatness arranged in the framework of symmetry reflecting the sensitivity and the ability to produce beautiful art works (Ismail, 2014).

Analysis of Symmetry Elements in Siri Dungun Art Work

The symmetry element is an entity in geometry and its use is so widespread in nature and in our environment. Symmetry is a transformation that allows the object or pattern to remain unchanged by maintaining the order of the original shape and size of the motif during the reversal process. It is also capable of matching between one

motifs with another motif along the plane line by using the transformation process. There are four repetition bases through the transformation process, namely translation, reflection, rotation and glider reflection. These processes that determines the object and design of the pattern remains unchanged while at the same time forming a mathematical structure known as the symmetry group (Basaree, 2008).

Table 4. Analysis of Symmetry Elements

Category	Descriptions	Diagram
Translation	Repetition of pattern or motif in a row of symmetry plane, Pattern moving with fixed distance in linear direction.	
Reflection	The pattern moves as a reflection of a mirror over a line.	
Rotation	The pattern is rotated at a given corner and center.	
Glider Reflection	The patterns are translated in one direction and reflects along the lines parallel to the translation direction.	

There are three categories of symmetrical groups that are widely known among them are *rosette* symmetry, *wallpaper* and *frieze*. Of the three categories found in the symmetry group, *frieze* is one of the most suitable features used to analyse the design of motifs or patterns in the art work because it is one of the ongoing cultures in mathematics (Alicia & Jessica, 2006).

Muay & Asklesen (2002) stated that *friezes* are also defined as carved or decorative patterns in a horizontal lane, this recurring carving or pattern can be found in the motif arrangement. It aims to classify patterns on a two-dimensional surface that is repetitive in one direction based on symmetry in the pattern. The patterns that are classified through *frieze* are strip-shaped. The strip is in a straight line to create the path. Gallian (1998) stated that the formation of symmetry group structure in *frieze* is classified into seven types of friezes pattern:



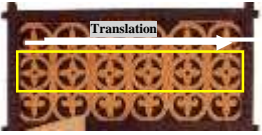

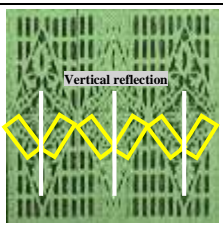

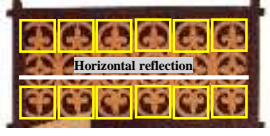

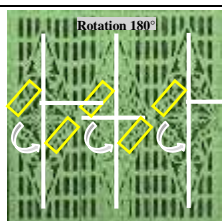
The system used to classify this symmetry group is by using a number code scheme to and key to categorize this frieze pattern. Two notations are used to classify frieze which are *four symbol-notation* (p, x, y, z) and *two symbol-notation* (x, y). These notations will make it simple and easy to understand about the symmetry operation used in each of the seven friezes categories which are:


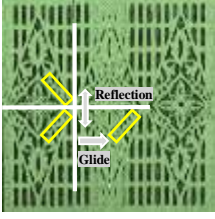

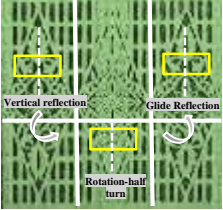

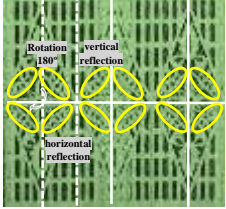
Table 5. Analysis of Symmetry Elements

No.	Symmetr	Keterangan	Ilustrasi
1.	Pmm2/11	translation	b b b b b b b
2.	P112/12	Translation and rotation	b q b q b q b
3.	P1a1/1g	Translation and vertical reflection	b p b p b p b
4.	Pm11/m1	Translation and horizontal reflection	b d b d b d b
5.	P1m1/1m	Translation and glide reflection	b b b b b b b
6.	Pmm2/m	Translation, glide reflection and	b d b d b d b
7.	Pma2/mg	Horizontal reflection, vertical	b q p d b q p

Table on the page shows the analysis obtained from Siri Dungun Art Work (1981) by using symmetry elements through the transformation process. It forms a symmetry group to analyze pattern designs that are classified through seven frieze patterns.

Table 6. Analyse model friezes table

ANALYSE MODEL FRIEZES TABLE			
Paintings	Types of <i>Frieze Pattern</i>	Pattern Design	Analyses
	Translation (p111/1)		
	Translation and vertical reflection (pm11/m)		
	Translation and horizontal reflection (p1m1/1m)		
	Translation and 180° rotation (p112/12)		

	Translation and glide reflection (p1a1/1g)		
	Translation, glide reflection, vertical reflection, horizontal reflection and rotation (pma2/mg)		
	Translation, glide reflection, vertical reflection, horizontal reflection and rotation (pma2/mg)		

Conclusion

This research will encourage the public to appreciate the beauty of the art work from a different perspectives such that in terms of the beauty of concepts, practices and mathematical values. The beauty of it can be seen in the motives and patterns embodied in the paintings as well as the mathematical abilities that are expressed and implied on the arts themselves.

This research contributes new information's to existing knowledge in arts. It can be seen from various philosophies of knowledge's and explored using various methods of art elements seen through the concept of mathematics. A deep understanding towards fundamental mapping framework concept which were taken from art appreciations and symmetry concepts underlined the pattern design in the paintings of the Malay tradition of the studied. The combinations of these concepts were adapted to form a conceptual framework that thought to be in line with the analysis in this research.

Hence, by referring to this correlation, the mathematical concept is indeed applied to the art field is irrefutable. Mathematical thinking and skills have long existed among the artists in the production of the beautiful and symmetrical motif combinations.

The processing of artistic outcomes and mathematical thinking were an attempt to show that mathematics is very familiar and well established in Malay artistry, which had even been rooted in various mathematical branches. The awareness of the relationship of these two areas were existed from the observation that the uniqueness and beauty of the art also contained the beauty and uniqueness of its mathematical aspects.

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