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GLIMPSES OF GEOMETRICAL PRINCIPLES IN MALAY ORNAMENTS

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Abstract

The research will examine the link between art and mathematics in the development of Malay ornaments based on the geometrical concepts of symmetry and patterns, which includes the study on the identification of motifs and the significance of repetition, which is a mathematical classification of a two-dimentional repetitive pattern. This paper specifically focuses on a method for classifying Malay ornaments according to mathematical notation system as found in one, the seven frieze patterns to classify the symmetry of the traditional patterns of the Malay woodcarving, which is linear and has symmetry placed like a band of repeated design. Second through the concept of symmetry found in the plane crystallographic group, consisting of seventeen distinct approaches that comprise repetitive patterns, which spread across the plane. This group can be used to categorize traditional Malay songket where the patterns are look at as a whole and not as individual parts. Malay artists, designers and craftsmen usually without realizing it, make use of the practical applications of geometric principles to execute a wide range of geometrical patterns that they use in their work. Most Malay ornamental designs have geometrical basis and no matter how complex they are, will definitely fall into one of the number of symmetry groups of either the frieze pattern or the seventeen patterns of the crystallographic groups. The principle of organization in Malay ornaments are aimed at finding certain solutions for unity, which attempt to create a unified whole out of diverse elements resulting in a balance between harmony and variety.

Keywords: Malay ornaments; geometrical principal; frieze patterns.

1. Malay Traditional Art

The philosophy of Malay traditional art emphasizes the creative expressions of the craftsmen and artists, which influenced by moral ethical values that are connected with the worldviews of the Malays. Malay traditional art is very much motivated by the act of total devotion and act of submission by the craftsmen to the Creator of the Universe, who they regard as the Source and Origin of all creations.

Just as in the traditional art of Islam, Malay traditional art is rooted in the spirit of the religion where the main emphasis is on the varieties of form having a common features that reflect the manifestation of Unity or (*Tawhid*), which refers to the principles that bind man to Heaven. It is also interesting to note that man lives in a universe, where one finds on one hand the cosmos reflecting the Divine Principle and on the other hand so does man, as Ardalan and Bakhtiar put it:

> **...He is the microcosm and, like the cosmos, reflects the Metacosmic Reality...which binds the different levels of man's existence to the corresponding levels of cosmic existence.[i]**

In the Malay traditional art, the concept beauty does not come ethnic genius but from the religion of Islam itself, where it is hidden and only portrays the individual talent, which is very much disciplined and intermingled naturally in the creative process of the tradition as a whole. The idea of the original artist never existed in Malay traditional art because it is only God, Who is the Supreme Artist and man is merely the work of art created by Him.

The important images in Malay traditional art are usually symbolic, where the visual language used are mostly mystical and allegorial, which are always pointing and leading up to a higher reality. As a result the art always

reaffirms the truth that is executed in a holistic manner that takes into consideration the religious, aesthetic and functional aspects of things.

It is interesting to note that Malay traditional art is sometimes embodied in the Malay *syair*, *pantun* and *peribahasa*. These are the expressions of the culture, civilization and sensitiveness of the Malay race, from the simplest and humbliest circles of the society to the highest and most refined group of people. They reflect a perfect mirror of the Malay soul where life to them is always a constant communication between the elements of God's creation. The *syair, pantun* and *peribahasa,* besides being anonymous, are considered a fine mixture of artistic achievement and conception of the Malays, as shown in some of the examples below:

Ilmu Haqiqat tiadakan sukar
Bukan di mata kaupusar-pusar!
Urat pusat kauputar-putar
Olehnya itu Mahbuhmu gusar

Knowledge of the Truth is not really difficult
It is not achieved by rolling the eyes!
You rotate the muscles of the navel
That is why your Beloved is wrathful[ii]

Mula segala tiada ada
Pertengahan masa kita bersua
Ketika tiga bercerai ramai
Di waktu tertentu berpandang terang

Primordially there was nothing
Then we met (Him) in time's midst
At the third instance there was multiplicity
At the appointed time clear will be our vision[iii]

Kalau tidak kerana bulan
Masakan bintang terbit tinggi
Kalau tidak kerana Tuhan
Masakan saya berada di sini

Without the moon to see
Stars won't rise in space
If not because of Thee
We won't come to this place

Pisang emas bawa belayar
Masak sebiji di atas peti
Hutang emas boleh di bayar
Hutang budi dibawa mati

With dates of gold we sail away
A ripe one on a chest we save
Our debts of gold we can repay
A debt of heart we take to the grave[iv]

Nature was the main source of inspiration and the design motifs of Malay traditional art as found in the woodcarving, songket textile and metal work often reflected the principles of harmony that existed between man and his environment. The design motifs of these arts are the result of a transformation of nature through changes in

features that conform to suitable patterns, which emphasize aspects of beauty and norms of the Malay culture. the ethics and moral values which is again connected with a worldview of the people. Their intricate designs depict the element of repetition, that constitute the Malay concept of Beauty regarding the idea of flexibility *(lembut),* refinement *(halus),* balance *(seimbang),* unity *(kesatuan),* functionality *(berguna)* and symbolism *(bersimbol).*

2. Analysis of Geometrical Concepts

"Geometry enlightens the intellect and sets one's mind right. All its proofs are very clear and orderly. It is hardly possible for errors to enter into geometrical reasoning because it is well arranged and orderly. Thus the mind that constantly applies itself to geometry is not likely to fall into error".[v]

Geometry as a branch of mathematics involves the study of shape, size and position of both flat-plane figures like circles, triangles and rectangles plus the solid three-dimensional figures like cubes, cones and spheres. The applications of geometry are central to the study of mathematics because of its various theories, techniques and viewpoints that are included for the betterment of other branches of knowledge. Artists and designers make use of the practical applications of geometric principles to study and analyze the wide range of geometrical patterns they use in their art and design work.

Symmetrical patterns can be studied and analyzed into three different classes of a point, line or plane. By using the examples from various cultures we are able to understand and classify repeat patterns. The description of the geometric symmetries would systematically study the meaning and function of these repeat patterns within their cultural context. Even though human beings possess an innate ability to perceive symmetry, it is very important to evolve a language to study and understand patterns systematically. The group theory is the art of mathematical abstraction, which is used to describe and analyze symmetry. A mathematical theory of frieze group[vi] is being used in this research to analyze and classify patterns, which are symmetrically designed.

3. Geometrical Concepts of Symmetry and Transformation

Symmetry is central to everything because it governs the natural forces of the Universe. Geometrical form in the area of symmetry offers the most exciting principles in mathematics. Mathematicians define symmetry as transformations that allow an object and a pattern to stay unchanged and at the same time form a mathematical structure which act as the symmetry group of patterns. Patterns are ornamental designs made up of repeated or combined motifs. Patterns have geometrical basis and no matter how complex these patterns are, they will fall into one of the symmetry groups of either the frieze patterns for the linear design motifs while the seventeen wallpaper patterns for the flat overall design.

Symmetry is important in this study because it is related to pattern, which centers on the notion of repeated designs found in the frieze patterns. In terms of visual organization, symmetry can be considered as the preservation of configuration and form, which exist either across a point, a line or a plane. In fact it has the ability to match a motif exactly to another motif, which on the other hand can be repeated in not more than four different ways. The word symmetry actually originates from the Greek word '*sum metri*a' meaning, same measure. It probably brings to mind ideas like balance, order and harmony found in nature, art and mathematics. According to Abas and Salman:

> **"Symmetry, like pattern is omnipresent. It is the glue that binds the Universe. It is physically, aesthetically, morally and in all kinds of other ways – some obvious, some remaining mysterious".**[vii]

The techniques that are used for these four types of repetition are called transformations which include one *translations,* that is when a repeating pattern or motif slides up or down, right or left or diagonally while still maintaining the same orientation; it will definitely fall back upon itself with all the motifs matching exactly.

Fig.1. Vertical, Horizontal**,** Diagonal

Two, is ***rotations*** that happens whe a point. The angle of rotation can be 60^o, 90^o, 120^o or 180^o only. The order of a rotation is the number of times it has to be performed to bring the plane back to where is stated

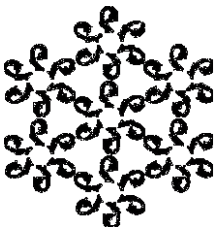


Fig. 2. 60º Rotation

Fig.3. 90° Rotation

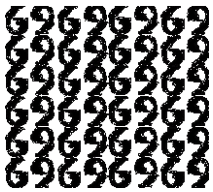


Fig. 4. 120° Rotation

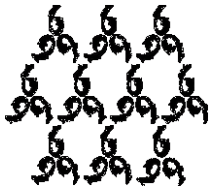


Fig. 5. 180° Rotation

Three, is ***reflections*** that is when a reflection fixes one line in the plane, it is called the axis of reflection. A reflection occurs when a motif reflects and the image reverses as in a mirror.

Fig.6. Vertical Reflection

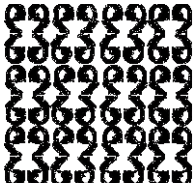


Fig.7. Vertical & Horizontal Reflection

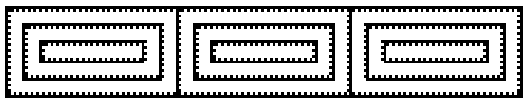
Four, it is known as ***glide reflections***, this happens when a motif translates along the axis while at the same time reflects across an axis.

Fig.8. Glide Reflection

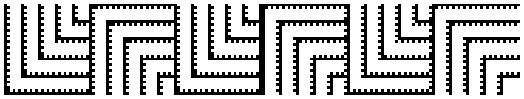
4. Classification of the Seven Frieze Patterns

Most of the line symmetry groups and to a certain extent some of the point symmetry groups can be classified as border patterns also known as frieze or band patterns. Based on their symmetry properties, these symmetry groups are classified under seven types of frieze patterns.

SEVEN TYPES OF FRIEZE PATTERNS*



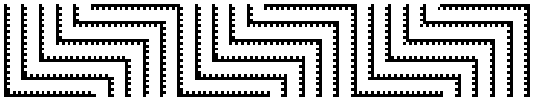
Type mm: Vertical and Horizontal Reflections



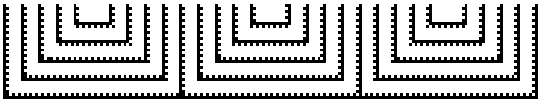
Type 1g: Glide Reflection

Type 1m: Horizontal Reflection

Type mg: Half turn



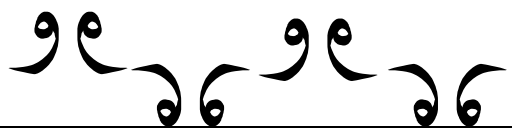
Type 12: Two Half Turns



Type m1: Vertical Reflection

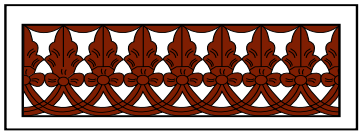
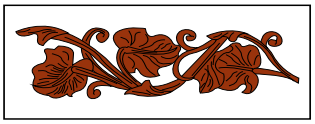
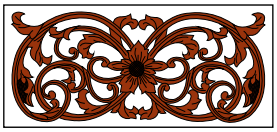
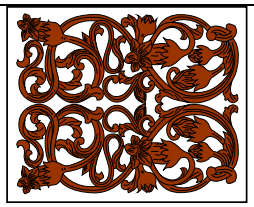
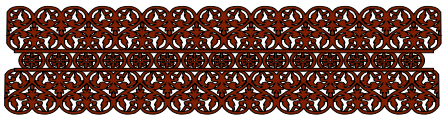
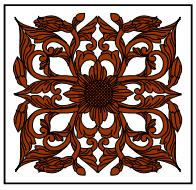
Type 11: Translation

FRIEZE PATTERN TYPE AND STRUCTURE

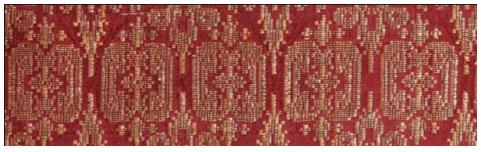
NO	STRUCTURE	TYPES
1		**11**
2		**12**
3		**1g**
4		**m1**
5		**1m**
6		**mg**
7		**Mm**

(Ruzaika & Norwani 2012)

CLASSIFICATION OF FRIEZE PATTERNS IN WOODCARVING

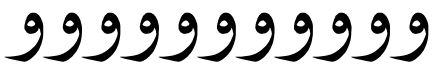
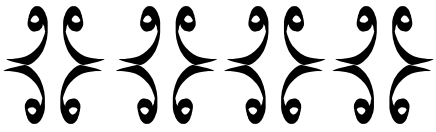
TYPES	STRUCTURES	WOODCURVING
11		
12		
1g		
m1		
1m		
mg		
mm		 **(Ruzaika & Norwani 2012)**

CLASSIFICATION OF FRIEZE PATTERNS IN SONGKET

TYPES	STRUCTURES	SONGKET PATTERNS
11		
12		
1g		
m1		
1m		
mg		
mm		

(Ruzaika & Norwani 2012)

CLASSIFICATION OF FRIEZE PATTERNS IN MALAY JEWELLERY

TYPES	STRUCTURES	PATTERNS IN JEWELLERY
11		
12		
1g		
m1		
1m		
mg		
mm		 **(Ruzaika & Norwani 2012)**

CONCLUSION

Geometrical principles of traditional Malay ornaments show clearly that Malay craftsmen and artists address themselves spiritually and intellectually to the issues of unity in diversity. The design patterns used are symbolic and abstract deriving mostly from the vegetal motifs where the transformation of nature is its essence. These motifs are beautifully stylized and executed in repeated patterns emphasizing the concept of infinity, where there is no beginning and ending. Everything in the design is interrelated through the contemplation of the repeated patterns, as often found in the practice of the zikir, where certain words or names of God are repeated as litanies after prayer, which direct our mind to turn towards the Divine.

From our study, it shows that there is a concrete application of the expression of Beauty as a Unity in Diversity. Unity is understood in terms of common attitudes and belief while diversity is reflected in terms of approaches and expressions. While at the same time a mathematical language is needed to classify and categorize the design patterns of the Malay ornaments.

In this research we would like to give attention to the use of symmetry as a tool for insight into various aspects of ethnic design motifs, where these works provide basic understanding for people with a mathematical tendency. It is interesting to use mathematics to know what symmetry pattern is involved for various interpretations in analyzing designs. Most of these patterns are pleasing to the eye because they are symmetrical in a mathematical sense and can be studied systematically.

Throughout history, the transformational geometry found in the frieze pattern has been used by different cultures to create art works, which has tremendously help the historians as well as anthropologists in their study of different cultures and their artistic traditions. Transformational geometry is important in many fields, such as the study of architecture, anthropology and art, just to name a few. This study helps to distinguish time frames for artifacts and also to illustrate which cultures may have made the item that are being studied.

In this exploratory study, it is hoped that not only will it provide a useful tool for the exact cataloguing of design patterns used in Malay ornaments, but also offer new insights into the underlying intellectual, philosophical, spiritual and devotional dynamics that helped shape their artistic process.

Wassalam.

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