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Kampus Sultan Abdul Jalil Shah



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UNIVERSITI TEKNOLOGI MARA

**GEOMETRY MOTIFS AND
SYMMETRY CHARACTERISTICS
ON MALAY SONGKET
VOL. I**



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NORAKMAL BINTI ABDULLAH

PhD

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NORAKMAL BINTI ABDULLAH

Thesis submitted in fulfillment
of the requirements for the degree of
Doctor of Art and Design
(Art and Design)

Faculty of Art and Design

November 2019



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Kampus Sultan Abdul Jalil Shah



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CONFIRMATION BY PANEL OF EXAMINERS

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I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Songket is an aesthetics fabric which is showed from the complexity of songket patterns which encourage the Malay weavers to be more patient, diligent, and creative in ideas and furthermore, becoming excellent in mathematics. Songket and mathematics cannot be separated as it is needed in all the processes as to produce the beautiful results of songket patterns. This research is about the analysis of Malaysian songket motifs through the technique of transformation or symmetry operation group patterns with the combination of mathematical concepts which are two-dimensional plane method which are the frieze patterns groups and wallpaper patterns groups and also from visual art concept through structural designs technique. This research is also based on the classification of Malaysian songket patterns which are from four main structure of songket which are *badan kain*, *kepalakain* and *pengapitkain*, *kaki kain* and *tepi kain* of sarong and *kainlepas / selendang* (shawl), where these are based on their geometric symmetries on the plane. This research seeks to identify early Malay songket textiles within the context of mathematical pattern groups and visual arts concepts (structural designs) in the twentieth century, which may have been influenced or been influenced by, technical development in the production of pattern-woven textiles from Islamic world. It constitutes an extremely valuable tool for this research because it enables researcher to identify the characterization of songket patterns triggered from transformations, frieze patterns, wallpaper patterns and structural designs. The significance of this research is to be documented and catalogued as useful guidelines for related professions and as database for future references. It is also to serve as evidence of the existence of geometric and symmetry patterns on Malaysian songket patterns as a useful contribution to the songket design industry and finally as examples for other Malaysian arts or crafts in having design ideas in an effective way.



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CHAPTER ONE

INTRODUCTION

1.1 Introduction

Songket fabric is often described as “*Tidak lapuk dek hujan tidak lekang dek panas,*” which literally means it does not fade in the rain nor tear in the heat. This Malay proverb symbolises the enduring quality of Malay tradition and heritage, such as songket fabrics. The term *songket* comes from the Malay verb ‘*menyongket*’, which means uplifting the warps as to insert the gold and metallic threads through the warps. “*Kain songket*” was previously made for the royal families that live in the palace. However, nowadays, the *kain songket* (a sarong that is made from the songket technique) is worn not only by the royal families, but also commoners (Malaysians), who wear it for certain occasions such as weddings, festivities and state ceremonies. The woven art that is created by the songket technique displays a philosophy and aesthetic which contains meaning or symbols that are associated with society, nature and culture. (Hussin, 2009). Geometry is a main feature that occurs in Malay songket design. In fact, the formulation of geometric elements in songket motifs are derived from the triangle, square, polygon, hexagon and other shapes, within the symmetric context. In this study, there are four ways of developing a symmetrical arrangement, whereby the most common practices are translation, reflection, rotation and glide reflection. The symmetrical group consists of two types of periodic patterns, which are based on a two-dimensional plane pattern (wallpaper patterns group and frieze patterns group) and three-dimensional plane pattern (crystal patterns). In mathematical concepts, when referring to visual art, the use of patterns is based on structural design. Structural design is a basic configuration of patterns that are relevant in the art field.

This research is about the classification of songket patterns in Malaysia, which are based on three types of analysis. The first part of this study focuses only on motifs which use transformation groups, and then they are classified and analysed from the selected example of songket motifs. The second attempt is concentrated on patterns only, in which the process involves two main groups of patterns (the mathematical concepts and the visual art concept). In the mathematical concept, the researcher is





using the two-dimensional wallpaper pattern group, and frieze pattern group, including the border patterns. Meanwhile, in the visual art concept, the researcher uses structural designs with the three processes that are only used to classify and analyse the patterns of songket. All motifs and patterns that have been classified and analysed are within the songket layout, which consists of the *badan kain* (body of the sarong), *kepala kain* (head of the sarong) and *pengapit kepala kain* (border at the head cloth), *kaki kain* or *tepi kain* (border or selvedge of the cloth), *kain lepas* or *selendang* (shawl) and *tanjak* (head cloth).

These are based on their geometric symmetries on the plane. It constitutes an extremely valuable tool for this research, because it enables the characterisation of *songket* patterns into the transformation group, wallpaper patterns group, frieze patterns group and structural designs. This research has been developed due to a high concern and to overcome fears of an extinction of Malay craft heritage in Malaysia. Songket textiles, as a Malay craft heritage, will be continuously developed with the compilation of Malaysian traditional songket weaving patterns that have resulted from this study. The result will be documented and catalogued as useful references for related professions, a database for future reference, and it may also be patented to serve as evidence of the existence of geometric and symmetrical patterns in the songket of Terengganu and Kelantan. In this chapter, this research will explain and clarify to the viewer about the details of the study for the whole research. The contents of the research consist of a background of the study, problem statement, aim and objectives, research questions, the significance of the study, the scope of the study, as well as limitation and delimitation of the study.

1.2 The Background of the Study

Songket weaving involve an additional weft thread, whereby gold threads are inserted into plain weave to create motifs and patterns on the woven fabric. The additional weft threads can be of gold, silver and metallic coloured threads. The structure of the *songket* fabric is mainly in the form of *sarong* and *kainlepas* (shawls). “*Kain sarong*” is a “*kain*” that is sewn to merge the ends into a tube and is worn from the waist to the ankles. The structure of *sarong songket* consists of ‘*kepala kain*’, ‘*badan kain*’ and ‘*kaki kain*’ which include the ‘*pengapit kepala kain*’ and the



'*kendik*'. The '*kendik*' is the smaller border pattern at the '*pengapit kepala kain*' or the border of *kaki kain sarong*. "*Kain songket lepas*" is used to wrap the chest and "*punca kain*" is where the end of the "*kain*" is pleated and allowed to fall on the centre of the chest to the waist. The belt is fastened together with a *pending* at the waist to become a "*baju kembangan*". The structure of *kain songket lepas* consists of *punca kain*, *badan kain*, *pengapit badan kain* and *kaki kain* (Nawawi, 2003). The motif is the main element in designing songket patterns. When several motifs are arranged within part of a songket without any gaps, patterns are created on the songket cloth. Hussin (2009) said motifs that are often used in songket weaving are sourced from plants, the cosmos, Earth, animals and nature, while the design of songket is more focused on geometry, abstraction, stylization and realism. Then, the songket motifs are composed of elements from the environment, such as *bunga cempaka* (*Magnolia champaca*), *bunga cengkih* (clove), *bunga lawang* (anistar), *bunga tanjung* (jasmine), *tampuk manggis* (mangosteen), *pucuk rebung* (bamboo shoot), *lawi ayam* (cockerel's tail), *gigi yu* (shark's teeth), *kupu-kupu* (moths), *burung merak* (peacock), *siku keluang* (bat's wing), *pucuk paku* (fern's shoot), and *bunga padi* (paddy) (Ismail, 1986). In fact, Selvanayagam (1991) and Nawawi (1989) have stated that six basic textile patterns had been used in creating the structure of songket patterns. The six basic textile patterns consist of rhomboid patterns (*corak songket teluk berantai*) or full patterned songket (*corak songket bunga penuh*), spotted, scattered or isolated pattern (*corak songket bunga bertabur*), striped or banded patterns (*corak songket jalur berdiri & corak jalur melintang*), chevron pattern or zig-zag pattern (*corak songket corak siku keluang*), checked pattern (*corak songket tapak catur*) and bamboo shoot patterned songket (*corak songket pucuk rebung*). Symmetry is a concept that has inspired the creative works of artists and scientist; and it is a common root of artistic endeavour.

To an artist or architect, symmetry refers to a sense of harmonious and beautiful proportion and balance. On the other hand, making this notion useful to a mathematician or scientist requires definition. Although such of a definition may make the idea of symmetry less flexible than the artist's intuitive feeling for it, that precision can help designers unravel the complexities of design and see greater possibilities for symmetry in their work (Kapraff, 1991). The nature of weaving



techniques tends to turn the motifs into geometric motifs. The motifs automatically already have a line of symmetry. Symmetry is one of elements in geometry. The word transformation and symmetry operations are commonly related to the process of moving a motif to another position in the pattern. These processes are involved with motifs and patterns which may be classified with respect to their symmetrical characteristics, such as translation, reflection, rotation and glide reflection. Meanwhile, frieze and wallpaper pattern groups were discovered and studied more than one hundred years ago. There is a small set of symmetry groups needed to characterise a pattern structure. In 2D space, there were seventeen wallpaper groups for a pattern that repeat along two linearly independent directions to tile the plane and seven *frieze groups* describing monochrome patterns that repeat along one direction (Yanxi, 2004).

The wallpaper patterns group and frieze patterns group can be found either in the *corak songket teluk berantai* (rhomboid patterns), *corak songket bunga penuh* (full patterned songket rhomboid patterns (*corak songket teluk berantai*) or full patterned songket (*corak songket bunga penuh*), spotted, scattered or isolated pattern (*corak songket bunga bertabur*), striped or banded patterns (*corak songket jalur berdiri & corak jalur melintang*), chevron pattern or zig-zag pattern (*corak songket corak siku keluang*), checked pattern (*corak songket tapak catur*) and bamboo shoot patterned songket (*corak songket pucuk rebung*). In *songket*, almost all the designs in the *badan kain* and *kepala kain* consist of wallpaper patterns. Meanwhile, almost all the designs in the *punca kain*, *kepala kain*, *kaki kain* and *pengapit kepala kain* consist of these frieze patterns with a different arrangement of repeats. At the same time, in visual art concepts, the patterns of songket can also be found in rhomboid patterns (*corak songket teluk berantai*) or full patterned songket (*corak songket bunga penuh*), spotted, scattered or isolated pattern (*corak songket bunga bertabur*), striped or banded patterns (*corak songket jalur berdiri & corak jalur melintang*), chevron pattern or zig-zag pattern (*corak songket corak siku keluang*), checkered pattern (*corak songket tapak catur*) and bamboo shoot patterned songket (*corak songket pucuk rebung*) through structural designs.

It is interesting to identify the mathematical classification (regarding symmetry groups) and visual art concept of repeated motifs and patterns into finitely countable





classes where very few researchers have studied on the local textile especially in *songket*. Furthermore, the motifs in *songket* weaving are traditionally composed of geometrical patterns, and the research on the geometry of *songket* textiles involves the motifs' composition. Therefore, it is essential to fill the gap in geometry and symmetry research, particularly on the elements of *songket* pattern designs.

1.3 Problem Statement

In Malaysia's National Education Philosophy, it has been stated that to produce a balanced and harmonious individuals potential, it must be applied with intellectual, spiritual, emotional and physical values. These values are used as guides in the development of the standard education curriculum content in Malaysia (Rashid, 2016). Along with this, *Dokumen Standard Kurikulum dan Pentaksiran* (DSKP), *Kurikulum Standard Sekolah Menengah* (KSSM) Visual Arts Education has been implementing six key trends in the development of its curriculum content standards namely communication, spiritually, attitudes and values, humanity, self-esteem, physical and aesthetic development as well as science and technology (KPM, 2019). In strengthening the standard of curriculum content and teaching and learning (PdP), a new added value is the Cross-Element Curriculum or *Elemen Merentas Kurikulum* (EMK). This Cross-Element Curriculum is a continuation of the six major pillars in the development of curriculum content standards. Cross Element Curriculum aims to strengthen the skills and talent of human capital that is intended and able to address current and future challenges. The elements in the Cross-Element Curriculum are language, nature preservation, noble values, science and technology, patriotism, creativity and innovation, entrepreneurship, information and communication technology, global sustainability and finance. This cross-disciplinary issue has led researcher to the current educational developments. The study of geometry motifs and symmetry characteristics on Malay *songket* is indirectly involves with the KBAT (High Level Thinking Skill) element; critical, creative and clamouring and thinking strategy, that makes the study not only studied from aesthetic perspective but also relate with the cross disciplinary such as mathematical knowledge (geometry and symmetry), scientific skills (thinking processes and manipulative skills) and scientific attitude (accuracy and honesty).





It has been reported that most songket imports from Pakistan and India have many features in common with traditional local songket. In fact, ninety-eight percent have been discovered to have similar motifs, patterns, designs and concepts to local songket, which had simply been copied (Ismail, 2014). Songket is the only industry that is dominated by Malays, in the East-Coast of Malaysia. Today, the latest issues that is being hotly debated in the songket industry, is the influx of imported songket from abroad. Competition from imported songket, such as from Pakistan and India, which are made using machines, raise fears and degrade the quality of Malay songket itself. The artistic beauty and the high value of local songket must be preserved before it becomes extinct, disappear and be forgotten. Moreover, previous local studies focused mainly on the history and technique of songket (Nawawi, 2007, Selvanagam, 1991, Hussin, 2009), the application of songket (Aziz, 2009) and a comprehensive study about patterns on songket sarongs. Another study in Indonesia concentrated more on the reflection of songket as a representation of their regional culture and practices, either their technique or pattern.

Many scholars have studied and concentrated on geometric ideas in the process of developing traditional patterns. For example, Professor Keith Critchlow, is a leading expert in sacred architecture, founder of Kairos, co-founder of the *Temenos* journal and author of several books on Islamic patterns. A renowned expert on local geometry and patterns is the late Dato' Syed Ahmad Jamal. As a visual artist, the art laureate studied geometry through his paintings. His painting *GumungLedang* showed the grand geometric designs infused with Islamic elements, panorama, grandeur and beauty, even when the subjects are dire and dreadful. Another work, *Tumpal* (1975), comprises of the bold colors, clean geometry and textures of his works, which are also transmuted into songket scrolls. In Malaysia, most of the research is done by textiles artists or researchers, especially on songket like Norwani Md Nawawi, Sharifah Azah Mohammad Alsagoff or Azah Aziz, Haziyah Hussin, Grace Selvanayagam and others. They have documented and carried out research mainly about history, aesthetics, the meaning of motifs, development of songket designs and cosmology within songket. Most of the traditional Malay songkets, especially their patterns, are involved with a symmetrical character and link with the elements of geometry. The function of wallpaper and frieze pattern groups are as a basic scheme for indexing repeated two-





dimensional image patterns (songket patterns). The pattern's image (songket patterns) is guided by the symmetry groups. The repeated two-dimensional pattern is to classify, which one of the seven groups of frieze pattern or seventeen wallpaper patterns belong to the groups. So, the visual art known as Malaysian songket patterns consists of features of structural design. Structural design is named as a main structure in visual art. It is closely associated with the elements of art and principles of design. The concept of structural design is the main point in the decoration of design. Structural design has a wide application especially in the activities of visual arts, where patterns are arranged to become a pattern. Textiles are one of the fields that use structural designs as a basic arrangement for making patterns.

The outcome of research is a mathematical classification (regarding symmetry groups) of repeated patterns into finitely countable classes, where the research is less studied by researchers in local studies particularly related to songket. Furthermore, the motifs of songket are traditionally composed in a geometric pattern. Research on the geometry of songket textiles is involved with motif composition. Therefore, it is essential to fill the gaps lacking in geometry and symmetry research, particularly on the elements of songket patterns. Moreover, the compilation of patterns that result from the research will be documented, catalogued and patented to preserve the original identity of local songket from being duplicated by others. This will improve and promote our local songket industry to the international level.

1.4 Aim

This study aims to examine and analyse the Malay songket produced in Terengganu and Kelantan during 1900 to the 2005, including the motif designs and how the symmetries are embedded in the patterns.

1.5 Objectives

The objectives of this study are as follows:

- a) To identify the geometric patterns in Malay songket designs made from the 1900 to 2005 in terms of basic textile patterns.





- b) To classify the geometric patterns in Malay songket designs based on the techniques of transformation and symmetry operations (the four ways of moving a motif to another position or repetition in the pattern: translation, reflection, rotation and glide reflection).
- c) To analyse and classify Terengganu and Kelantan Malay songket pattern structures.

1.6 Research Questions

- a) What are the geometric patterns that can be found in Malay songket weaving from 1900-2005 in terms of basic textile patterns?
- b) How do we classify the geometric patterns in Malay songket design through the techniques of transformation or symmetry operations?
- c) How do we analyse and categorise Terengganu and Kelantan Malay songket pattern structures?



1.7 Significance of Study

The purpose is to examine and analyse Malay songket from Terengganu and Kelantan (1900-2005), as well as the motifs and symmetries that form patterns as a traditional value among Malay textile heritage that may disappear with time. Here, the research will establish a set of motifs and a set of patterns from Malay songkets of Terengganu and Kelantan between eras of 1900-2005. Then, the compilation of Malay songket weaving patterns that have resulted from this study will be documented and catalogued as useful guidelines for related professions and a database for future reference. In fact, this research will serve as a useful contribution whereby Malay songket weavers can use the grid system to make motifs and patterns. This research will assist as evidence of the existence of geometric and symmetrical patterns that will be patented for Terengganu and Kelantan songket patterns. The role of this study also contributes to the songket design industry and also as a model for other Malaysian arts or crafts in how the designer or the fine art practices reflect through their concept,





context and ideas in design.

1.8 Methodology

This research is conducted in a qualitative approach, as an explorative and descriptive research. Qualitative research was selected as the main research design in this study. This research was conducted through observation, interview and analysis of artefact. The first method is through observation. The observation focused only on the physicality of Malay songket. The second method was interviews. The researcher conducted interviews with songket makers (weavers), textile designers, museums experts and academicians. The third method is the main method that yielded the results for the research, which is analysing through the material culture or artefacts (Malay songket). The Malay songket was taken from museums, songket makers, producers and personal collections. The data is comprised of field notes, transcripts of interviews, artifacts of Malay songket, as well as audio and video recordings. The data obtained will be identified, classified and analysed in a descriptive and inductive approach.

In this research, the main population of research is on Malay songket. The target population in this research is in the East Coast of Malaysia, which are Terengganu and Kelantan. The researcher chose to use a non-probability sampling or non-random sampling method for the research. Among the types of non-probability sampling or non-random sampling methods, the researcher had used purposive sampling as the method to select the samples. The researcher had chosen 100 Malay songket as an accessible population or samples for the research. Of the 100 samples of Malay songket gathered, 50 samples were from Terengganu songket weaving and 50 samples were from Kelantan songket weaving. The research then selected 50 samples for the purpose of identifying design characteristics in terms of patterns. 50 samples had gathered through 25 samples of songket weaving from Terengganu and 25 samples from Kelantan. These 50 samples are for the purpose of identifying the geometric pattern in songket design from *kain sarung*, *tanjak*, *kain lepas / selendang* (shawl) and clothes in terms of local textile patterns.

The researcher had been using the merger of two scientific disciplines in this



research. The two areas of discipline that have been used by the researcher are from the fields of visual arts and the field of mathematics. The combination of these two areas is called an interdisciplinary study. The researcher used two theories to represent both of these fields. The theory representing the field of visual arts is culture approach and gestalt theory while the theory representing the field of mathematics is group theory. Both of these theories were used as the main theory of study, because it has the characteristics that concentrate on the formation of a motif or pattern in woven Malay songket.

1.9 Scope of Study

The researcher has been using the merger of two scientific disciplines in this research. The two areas of discipline that have been used by the researcher are from the fields of visual arts and the field of mathematics. The research will focus only on songket weaving patterns from Terengganu and Kelantan in Malaysia. The collection of Malay songket weaving patterns will be obtained via museums, songket makers, producers, songket collectors and personal collections. The researcher will only focus on Malay songket weaving patterns from 1900 to 2005. The period is chosen because this is the era where many traditional Malay songket were produced, and they are also the most beautiful and interesting. The selected examples of Malay songket weaving are *kain sarung*, *tanjak*, *kain lepas*, *selendang* (shawl) and clothes. The selected samples of Malay songket weaving are *kain sarung*, *tanjak*, *kain lepas*, *selendang* (shawl) and clothes. The researcher chose 50 samples of Malay songket weaving from two states, which are 25 samples from Terengganu and another 25 samples from Kelantan. The researcher chose these 50 selected samples of Malay songket weaving to analyse the motifs and patterns within the contexts of symmetrical order. The motifs are categorised and then analysed through symmetrical operations group and order. The process includes the categorising the pattern structure and then analysing them with the seventeen wallpaper patterns groups for the selected segment of the *badan kain*, and the *kepala kain*. The seven frieze patterns group is appropriate for border designs, like the *punca kain*, the *kepala kain*, the *kaki kain* and the *pengapit kepala kain*. Malay songket weaving patterns are only based on local Malay weaving, which comprise of six basic textile patterns. They are the rhomboid patterns (*corak songket*



teluk berantai) or full patterned songket (*corak songket bunga penuh*), spotted, scattered or isolated pattern (*corak songket bunga bertabur*), striped or banded patterns (*corak songket jalur berdiri & corak jalur melintang*), chevron pattern or zig-zag pattern (*corak songket corak siku keluang*), checkered pattern (*corak songket tapak catur*) and bamboo shoot patterned songket (*corak songket pucuk rebung*) by Nawawi (2007).

1.10 Limitation of Study

This study has its limitations. The researcher faced difficulties in collecting all the Malay songket fabrics; therefore. This research is based on only the Malay songket produced from the year 1900 to 2005. Exact dates for older songket are difficult to obtain, as museums often estimate those dates. Only the motifs and patterns from Terengganu and Kelantan were analysed in this study. The songket fabrics produced in Sarawak, East Malaysia, are more similar to the Indonesian design in motif, style, and technique, and it is not included in this research.



1.11 Thesis Outline

- a) **Chapter 1**, describes aim, objectives of the study, research questions, and scope of the research, limitation, delimitation and thesis outline.
- b) **Chapter 2**, describes the five main pillars in this research, which are mathematical ideas (geometry and symmetry), mathematical concepts (transformation or symmetry operation group, wallpaper patterns group and frieze patterns group), visual art concept (structural designs), songket (history, influences of Islamic and Malay concepts and songket designs), Malay crafts, culture, aesthetics and beauty, Islamic arts and Islam and Malay aesthetics.
- c) **Chapter 3**, describes the methodology as qualitative research, which is conducted as descriptive research.
- d) Three methods:





- i- Observations - looking at the material culture or artefacts of Malay songket (obtained from Terengganu museum and Kelantan Museum, songket makers, producers, songket collectors and personal collections)
 - ii- Interviews: unstructured interview (weavers, songket collectors, textile designer, academicians and museum expertise).
 - iii- Analyzing artefacts of Malay songket
- e) **Chapter 4**, describes the result from 50 samples gathered through 25 samples of songket weaving from Terengganu and 25 samples from Kelantan. These 50 samples are to identify the geometric pattern in songket design from kain sarung, tanjak, kain lepas / selendang (shawl) and clothes in term of local textile patterns. There are three steps of classifying the geometry pattern in songket design. Firstly, identify the geometric pattern in Malay songket design in terms of basic textile patterns. Secondly, the research will classify the geometry pattern in songket design through four types of symmetry operations. Thirdly, the samples will classify Terengganu and Kelantan songket patterns structure through symmetry groups and structural designs.
- f) **Chapter 5**, is consisting of the discussion sessions from analysis data (chapter 4).
- g) **Chapter 6**, finally concludes and provides a recommendation for future research.

