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SARONG PELIKAT PATTERN ON CONTEMPORARY BATIK DESIGN: AN ETHNOMATHEMATICS STUDY

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Abstract. *Sarong Pelikat is synonymous with men's clothing and has been widely worn since the time of Malacca Sultanate around 15th century. Sarong Pelikat is a woven fabric of horizontal benang pakan (weft thread) and vertical benang loseng (warp thread). There is various polygonal shape on Sarong Pelikat such as rectangular, square, and striped pattern designs. The unique color and pattern of Sarong Pelikat have sparked the idea to be inspired on contemporary batik design. It can be analyzed through the lens of ethnomathematics, a research domain that highlights the relationship between mathematics and cultural arts. This study starts with the experimental work by one of the authors that imply the Sarong Pelikat pattern in batik design. This is a qualitative-explorative research study by employing triangulation method to collect data consisting of observation, analysis, and interview. The result of this study shows that in the design of Sarong Pelikat pattern, there are three shapes that can be observed. The shapes are stripes, squares, and rectangles. The arrangement of stripes is in vertical, combination of vertical and horizontal and enlargement. The squares are fixed in the triangles which is arranged in tessellation. The philosophy behind Sarong Pelikat pattern is the faithfulness of Muslim to Allah and the obligation to the society. It also reveals the assimilation of Indian-Muslim and Malay culture. In future, further studies on shapes and its arrangements using Sarong Pelikat patterns can be made.*

Keywords: *Contemporary Batik Design, Ethnomathematics, Sarong Pelikat Pattern*

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
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Introduction

Sarong Pelikat is the sarong worn by Malay men. *Sarong Pelikat* often has woven plain or checkered patterns or maybe brightly colored using batik or ikat dyeing. Usually, the geometrical motifs on *Sarong Pelikat* are squares, rectangles, and stripes. *Sarong Pelikat* is believed to be originated from India and was brought into the country along with Hindu customs before the advent of Islam. *Sarong Pelikat* was used by Malay people during the reign of Malacca Sultanate in the 15th century (Yusoff, 2017). Tracing the history of trade in Malacca, white cloth is the basic material to make *Sarong Pelikat* and it is the main commodity in Malacca. Therefore, *Sarong Pelikat* is a very valuable heritage, and it dominated the development of homeland fashion. The unique color and pattern of *Sarong Pelikat* have sparked the idea to be inspired in batik work.

Literature Review

Batik is a method of applying colored designs on textile using wax and the designs produced are geometric and organic motifs. The geometric motifs are circles, ellipses, and polygons. The organic motifs are floral patterns that are common in batik, decorating textiles with curves, colors, and looser lines. Flowers, which are frequent favorites; include hibiscus, lilies, and frangipani. The geometric motifs too, are inspired by other shapes that can be seen around us. It can be transformed into beautiful designs on batik.

There are three types of batik thare traditional batik design comprises of traditional craftmanship, contemporary batik which still preserve the identity of local design and slightly design new innovation and modern batik which is different in new motives.

Batik design in Malaysia is contemporary and versatile. Contemporary means preserving the work of batik design in the middle of 20th century or the 21st century (Smith, 2009), and, versatile is the ability to adapt to many different function, activities or time. . For the reason that, the pattern design produced are more versatile and follow current trends. It does not use motifs from flora and fauna alone, but the designers are free to explore various themes such as celestial pattern, cartoon character pattern or geometric patterns.

Research on contemporary batik design showed that in Malaysia the motif designs are mainly based on indigenous culture, flora, fauna, geometric and Islamic design concept (Syed Shaharuddin et al., 2021).
(Legino, 2004), made research and found that there is an existence of Islamic concept on batik design in Kelantan and Terengganu. (Sudardi, 2018) in his study on batik stated that there is an Islamic influence on Batik Besurek Indonesia in the 16th century.

Few researchers from different field in the universities showed their interested in contributing new ideas to the batik designers. (Ishak, 2017) from the field of architecture proposed new method to develop batik design by using quadratic and cubic rational Bezier curve. The quartic Bezier Method was developed in designing Spiral Batik. (Mustapha, Md Yasin, Awang, Abd Rhani, & Wan Yusof, 2020) from the field of mathematics applied new design known as Koch Snowflake, a kind of earliest geometrical shape of fractal. Fractal is a fragmented geometric shape that can be subdivided into parts, each is reduced the size copy of the whole.

Isnanto, Hidayatno, & Zahra, (2020) from the field of computer has designed a system that can produced Batik Fractals motifs using Julia Set. The process of generating fractal batik images consists of three steps, first determining the set of Julia Set Function. Secondly, visualizing the

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

result of first step by using a phyton based programme. Thirdly, designing fractal batik motifs. (Yasin, 2019) from the field of mathematics extended the research of fractals transformation on batik design. They suggested the process of designing three new motifs of textile design based on Mandelbrot Set which is one of the mathematical fractals. The fractal is formed by plotting the infinite number of fractals called as Julia Set.

The beauty of Malaysian Batik is their art and craft, representing history and character of nation's identity. The work of local batik designers and producers is highly original and has an aesthetic value in their design. The tenacity of the batik is because of its ability to survive by adapting to new situations is reflected in the way it has been successfully applied to new direction and, style. Batik design which inspired by *Sarong Pelikat* pattern is unique example of exploring contemporary batik design by highlighting the line elements that form a specific geometric property.

Sarong Pelikat patterns on batik design can be analyzed using geometrical concepts in the field of Ethnomathematics, which is perceived as a lens to see and understand mathematics as a culture. Ethnomathematics is a research domain that highlights the relationship between mathematics and cultural arts (D'Ambrosio, 2007).'Ethno' refers to members of a group within a cultural environment identified by cultural traditions, codes, symbols, myths, and specific ways used to reason and to infer. 'Mathema' means to explain and understand the world in order to transcend, manage and cope with reality so that the members of group can survive and 'tic means the techniques of counting, ordering, sorting, measuring, weighing, classifying, inferring, and modelling (Rosa, Shirley, Gavarrete, & Alangui, 2017). Ethnomathematics create a meaningful world to the culture of the community (Ulum, 2018).

The geometrical concept concerned is the shapes, size, relative position of figures, and properties of space (Rosa et al., 2017). The important elements of geometry that can be considered in Ethnomathematical study are the use of tessellation and symmetry. Tessellation is the covering of a plane using one or more geometric shapes with no overlaps or gaps. Symmetry is represented by the congruence and rigid motion of two figures. Other important aspects in geometry are translation and reflection. A translation means moving without rotating or resizing. Every point of shape must move in the same direction and same distance (Law, Bauin, Courtial, & Whittaker, 1988).

There are few geometrical analyses on designs that can be found. One of them is a study done on Kelantan geometrical design on Malay *mengkuang* weaving motifs (Wan Norliza Wan Bakar, Rahaidah Muhammad, Rozita Shamsuddin, Raja Norazila Raja Mohd Yusof, & Syahirah Afiqah Mohd Taufik, 2017). Researchers found that the Kelantan *mengkuang* weavers have a very keen sense of observation of their natural surroundings and produced design can be analyzed using geometrical analysis such as rhombus shaped, triangular shaped and rectangular shaped. These shapes were arranged in tessellation and rotation form.

Another study done on the geometrical design of houses in Banyuwangi, Indonesia where they implement the concept of Pythagoras theorem and similarity (Hariastuti, Budiarto, & Manuharawati, 2019). Few researchers studied the cultural and mathematical symmetry in Māori meeting house (Wharenui) and few symbolisms found in various artifacts in Māori meeting house in Germany. The artifacts are found to have Mathematical symmetry (Trinick & Meaney, 2020).

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

Few Indonesian researchers did research on Batik Solo and found that Batik Solo contains few geometrical elements and were arranged in tessellation, translation, and reflection (Trinick & Meaney, 2020). The research done in Semarang Indonesia on the geometrical analysis of Ngawen Temple in Magelang Indonesia shown that the Ngawen Temple consists of 5 temples that line from north to south. The shapes of Ngawen Temple are the cuboid, rectangular pyramidal frustrum and cuboids (Magita & Zaenuri, 2021).

Methodology

Since the research objective is to explore the *Sarong Pelikat* pattern on contemporary batik design (Mohd Ali et al., 2012), a qualitative design study was employed. At first, the experimental effort started on October 2011 until November 2011 by one of the authors in this research team to produce the batik design which was inspired by *Sarong Pelikat.* Then, the triangulation method that consists of observation, interview, and analysis of the data was applied in this research. The observation on the geometrical and symmetrical concept was made. Later the comparison of the motifs and designs were made with the geometrical concepts.

Data Analysis

An analysis on the motifs of *Sarong Pelikat* pattern on contemporary batik design was made. The selected motifs were analyzed to identify the geometrical designs on them. An interview with the author who designed the *Sarong Pelikat* pattern on contemporary batik design is made. Interview was carried out to gain information on the motifs and the philosophy behind it. Finally, conclusions were made based on this analysis.

The Shapes on *Sarong Pelikat* Pattern

Figure 1(a): *Sarong Pelikat* pattern on batik design as a soft finishing in a hotel room. (Source: (Mohd Ali, Doss, Omar, Ramakrishnan, & Abd Rahman, 2012)

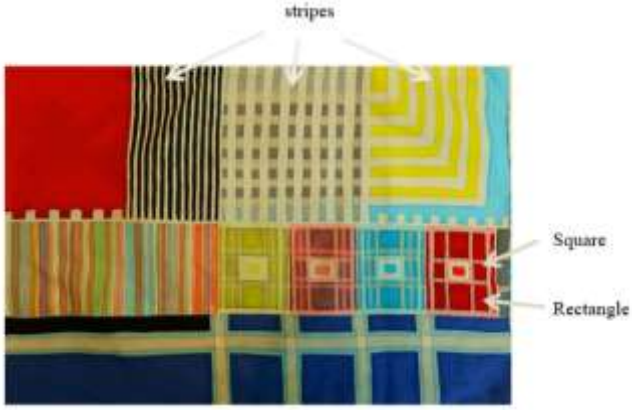

Figure 1(b): Different Shapes of Stripes, Squares and Rectangles.

Sarong pelikat is usually worn by Muslim men to go the mosque. The uniqueness of sarong pelikat is its brightly checkered pattern (Abdullah, 1990). The attractive sarong pelikat pattern too can be used on other designs in a house or hotel room. Figure 1(a) shows that a sarong pelikat pattern on batik design can be used as a soft finishing in a hotel room.

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

Few shapes found on *Sarong Pelikat* pattern of contemporary batik design. They are stripes, squares, and rectangles. Figure 1(b) shows *Sarong Pelikat* pattern that consists of different shapes of stripes, squares, and rectangle. They are arranged in many ways. As for the stripes, it is identified three shapes of stripes which being discussed in the following subsections.

Vertical Stripes

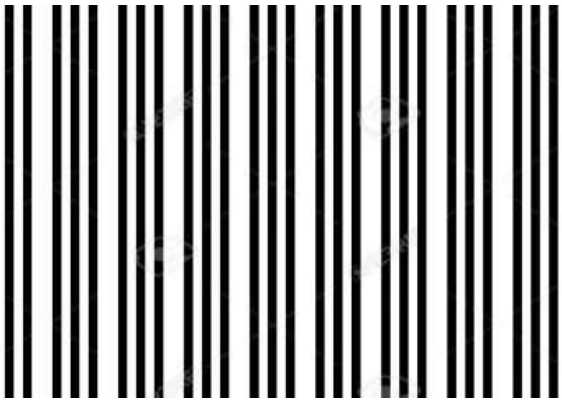

Figure 2: Vertical Stripe shape

The first shape that can be identified is stripe shape. Stripe shape is a long narrow band or a row of closely spaced dots that will look like a continuous line. Stripe shape can be arranged in horizontally or vertically. Figure 2 shows the stripe that is arranged vertically which illustrated as parallel to *y*-axis.

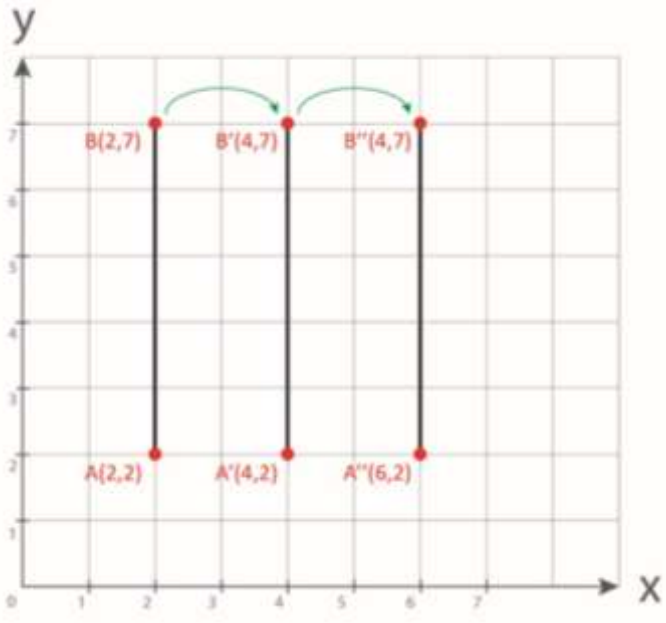

Figure 3: Translation by vector, $a = (2 \quad 0)$

The arrangement of the bands is identified as the collection of geometrical transformation of one tick vertical line which undergoes the process of multiplication and translation.

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

Combination of Vertical and Horizontal Stripes

The second shape that can be identified as a combination of vertical and horizontal stripes. It can be seen at Figure 4.

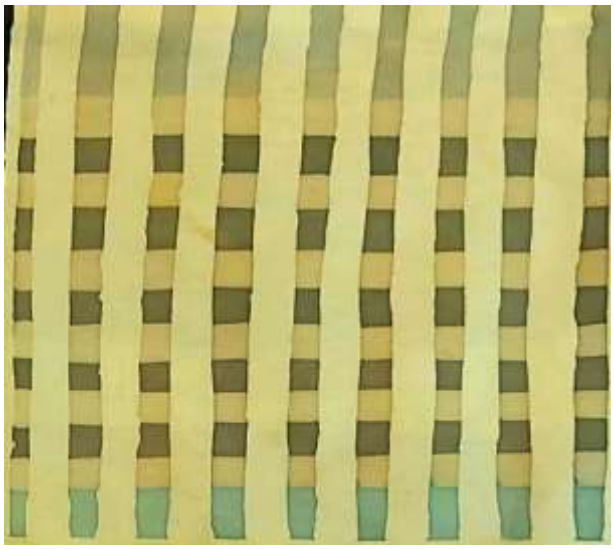

Figure 4: Combination of both vertical and horizontal striped shape

Figure 4 shows the arrangement of both vertical and horizontal striped shape. The arrangement of vertical striped is similar to the description in Figure 3.

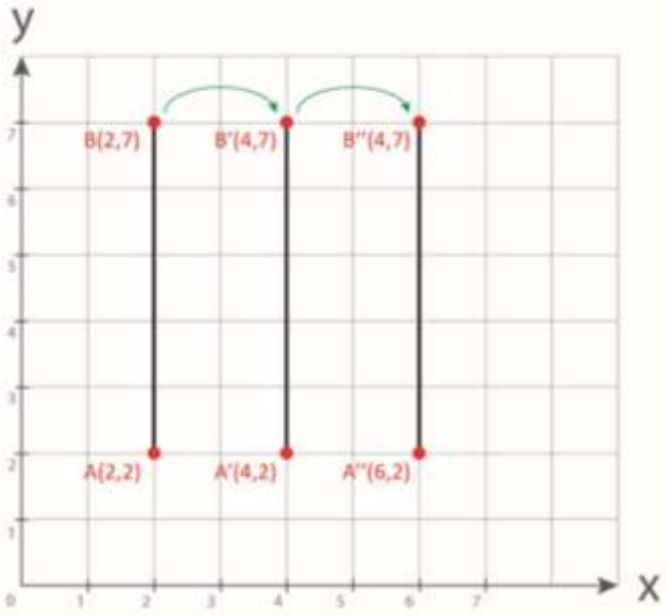

Figure 5: Vertical stripes arranged with a translation by vector b (2 0)

Then, the lateral stripes were arranged at a translation of vector *b*. It can be depicted in Figure 5.

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

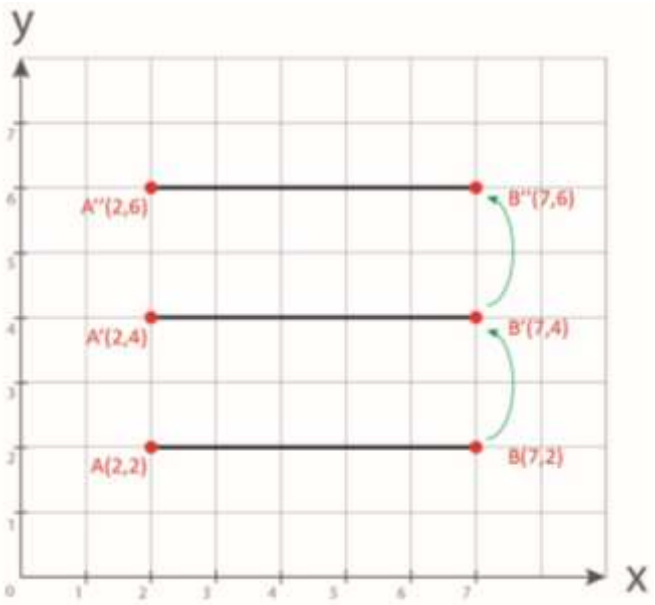

Figure 5: Lateral stripes arranged by translation of vector, c= $\begin{pmatrix} 0 \\ 2 \end{pmatrix}$

Figure 6 illustrates the arrangement of the bands which is identified as the collection of geometrical transformation of one tick vertical and one tick horizontal line which undergo the process of multiplication and translation.

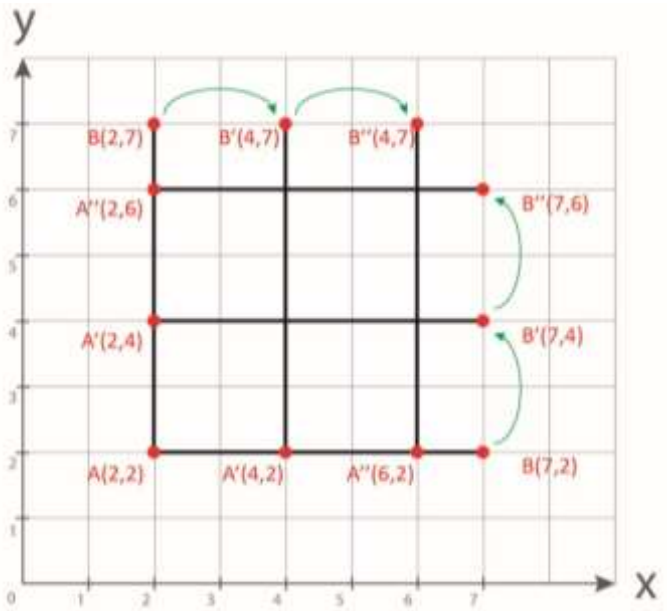

Figure 6: Combination of vertical and horizontal stripes

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

Stripes in enlargement or magnification process

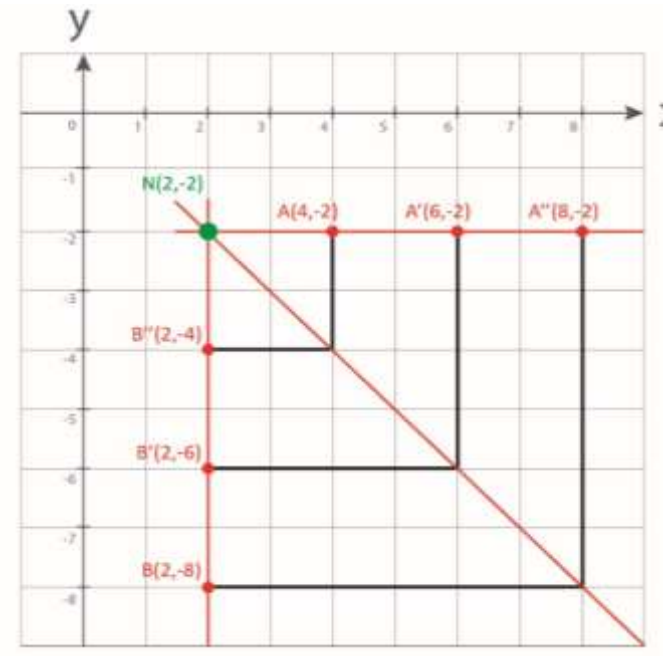

Figure 7: Stripes in enlargement or magnification

Figure 7 shows that the vertical and horizontal stripes are arranged in such a way it forms flipped L-shape. The enlargement is a transformation of changing the size of the smallest flipped L-shape. The centre of enlargement is labelled as point N.

Rectangle that has been arranged in tessellation

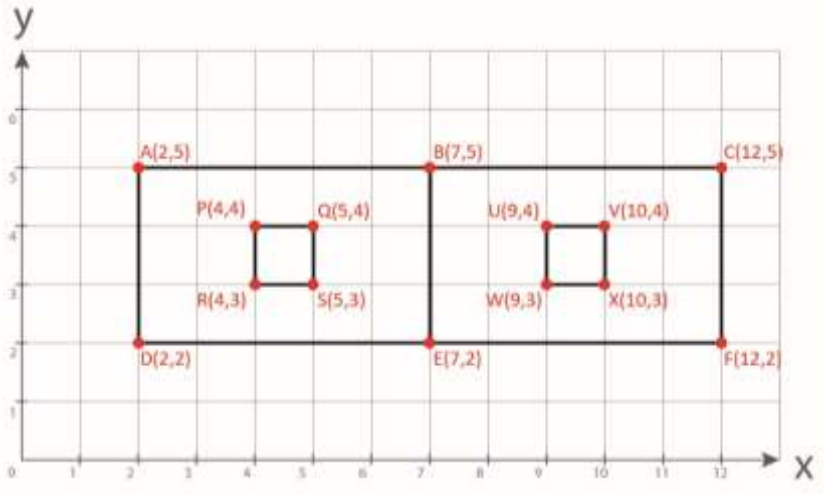

Figure 8: The arrangement of rectangle in a tessellation

Figure 8 shows that the square shape is fixed in the rectangular shape. It is called as square shape because it has four equal size and congruent to each other. It is addressed as a rectangular shape because it has its own properties that clearly be seen which are four sides, the opposite side of the rectangle is equal in size and parallel to each other. All the angles of a rectangle are

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

equal and parallel to each other. All the angle of a rectangle are 90 degrees and diagonals bisect to each other. The arrangement of the rectangle is tessellation because they are closely together in repeated patterns.

Result of An Interview with The Designer

An interview with the designer who designed the *Sarong Pelikat* pattern on contemporary batik design is made. He explained that the philosophy of his invention is related with culture assimilation due to the fact that *Sarong Pelikat* that is believed to be originated from India and was brought to this country and were used by the Malay people during the Malacca sultanate.

The transcribed interview is as follows:

Question: Describe two types of lines and the philosophy behind it.
Answer: Lines are divided into 2 types. They are vertical and horizontal. Repeating lines will become pattern.
Question: What is the philosophy of vertical lines and horizontal lines?
Answer: Vertical lines means the concept of the total hope to Allah. Horizontal lines mean the obligation to the community.
Question: What is actually the meaning of this design?
Answer: This is the pelikat design and originated from India whose religion is Muslim. So, they came here, and the assimilation of culture happened.

From the above interview, the significant excerpts that can be revealed is the deep meaning that lies in the design which shows the faithfulness of Muslim to Allah and the obligation to the society. It also reveals the assimilation of Indian-Muslim and Malay culture.

Conclusion

Arts and mathematics are like rhythm and song. It is because there exists a very close relationship between *Sarong Pelikat* pattern and the geometrical design on it. In the *Sarong Pelikat* pattern, there are three shapes that can be observed. The shapes are stripes, squares, and rectangles. The arrangement of stripes is in vertical, combination of vertical and horizontal and enlargement. The squares are fixed in the triangles which is arranged in tessellation. The philosophical values behind the creation of *Sarong Pelikat* pattern on contemporary batik designs were related to the faithfulness of Muslim to Allah and the obligation to the society, it also reveals the assimilation of Indian-Muslim and Malay culture. It is hoped that further studies can be carried out on different types of design that can be interpreted through the lens of ethnomathematics and simultaneously through the lens of arts.

Volume: 4 Issues: 13 [December, 2021] pp. 142 - 151]
Jurnal Penyelidikan Sains Sosial (JOSSR)
eISSN: 2637 -0956
Journal Website: www.jossr.com

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