Javanologi: International Journal of Javanese Studies
Vol.6 (1), Desember 2022, pp. 1139-1145
ISSN: 2580-6122, DOI https://dx.doi.org/10.20961/javanologi.v6i1.71408

JAVANESE BATIK MOTIFS AND ORNAMENTATION AS OBJECTS OF AESTHETICS AND GENERATIVE ART WITH PSEUDO-ALGORITHM

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ABSTRACT

The batik patterns that are known to be fractal are the reality that there are alternative perspectives that exist among Indonesian society and civilization which are unique relative to the general modern perspective. This uniqueness is important considering that fractals are a form of understanding geometry and system complexity. Pseudo-algorithm in batik is an ornamentation process: klowongan-isen-harmonization which starts from the smallest fractional elements of batik motifs (fractals), has self-similarity and is carried out through iterative computational methods. Batik as a patterned aesthetic object has pseudo-algorithmic depiction rules that can be treated as a generative art form. Batik that can be developed as fractal batik is batik with geometric motifs. Fractals have initiated a change and presented scientific creativity and progressivity in several fields in the form of interdisciplinary. All computational patterns growth to find fractal character in batik can turn into the sources of creativity to create new motifs.

Keywords: Javanese; Batik Motives; Ormenation

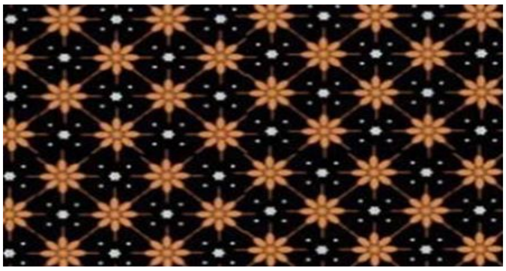
A. INTRODUCTION

Batik is defined as a fabric printed by a special technique of applying wax on fabric and by typical process of making (Great Dictionary of the Indonesian Language, 2016). Indonesian batik as the whole techniques, technologies, and development of motives and related culture has been admitted by UNESCO as masterpieces of the oral and intangible heritage of humanity since October 2, 2009. Batik has been closely related to Javanese culture in Indonesia, even since Majapahit period under the reign of Raden Wijaya (1294-1309). Several clothing materials, however, have batik patterns of islands outside Java such as Sumatera (particularly Jambi), Kalimantan, and Sulawesi (Situngkir and Dahlan, 2009). The interesting thing from batik is that it is not a simple concept, even from etymological perspective, and it represents unique ornamentation and complex in style and colors, as well as geometric shapes of the display.

Batik making (or so-called mbatik) is not as simple as interpretation of a painting. Batik is not always associated with traditional arts. It takes the forms of hand-drawn batik, and block-printed batik; both are processed by hand. In its development, by using mathematical computation, batik motifs can be created through computer programs in relatively short period of time with pseudo-algorithm. The 21st century decades mark the rapid development of computer technologies. The creation of artworks, either fine art or vocal art, starts to involve the use of such technologies to expand scope and the unlimitation of humans' imagination and creativity. One of aspects includes the understanding of generative art. Modern generative visual art begins with the formulation of repeated (iterative) rules of visualization, and visualization of simple patterns to obtain complex one. Patterns in art depend on repetition of similar patterns and forms on media—a creation of an artwork in the history of modern fine pioneered art by a Dutch artist, G. Escher (1898-1972). Clearly, repeating (iterative) patterns can generate fractal forms as simple repeating patterns in arithmetic series can produce chaotic patterns (Hariadi et al., 2007).

The use of fractals in batik is not accidental, but several studies have proved that fractal elements exist in batik (Hariadi et al., 2013). The characteristics of fractals in batik are measured using fractal dimension including box-counting method and Fourier transform (Heurteaux and Jaffard, 2007). Fractal batik is batik of which design (patterns and a variety of decorative motifs) is created with the uses of mathematics formulas and computer technologies (Kompas, 2017). The article discusses Javanese batik motifs and ornamentation as objects of aesthetics and generative art with pseudo-algorithm. The aesthetics of drawing daily seen objects is the basic asset for the design of batik motifs. Batik making process is represented by the term 'mbatik', which is etimologically derived from Javanese phrase 'amba titik', which means 'drop writing (drawing)'. The suffix 'tik' can mean 'small drop'. Therefore, 'mbatik' is defined as the repetitive process of using a canthing to draw on a fabric in such a way that it forms lines and finally gives patterns, allowing us to appreciate as a whole. In short, we may consider that 'mbatik' is representation of drawing, painting, or writing, giving aesthetic values, unlike mathematics. Such process generates what is called patterns of generative batik (Sintungkir and Dahlan, 1999b).

Batik motifs in Indonesia nowadays are numerous and vary. Even, the number of batik motifs which spread across Indonesia has not yet been able to be identified due to various types of batik motifs across regions in Indonesia. Indonesia is an archipelago with different cultures, leading to the presence of various batik motifs. The motifs are classified into geometric and nongeometric motifs. Geometric motifs include repeated patterns of batik or similar patterns. They have geometrical arrangement of ornaments. Some geometric motifs known in Javanese batik art include: (a) those forming diagonal lines, such as various motifs of parang, (b) those forming whole series of geometric patterns, such as motifs of ceplok, (c) those forming borders (motifs of pinggiran), and (d) those forming two rows of triangle (tumpal) or bouquet designs, such as batik buketan. Figure 1 shows examples of Solo and Yogyakarta geometric motifs: truntum, bokor kencono, kawung, and sidoluhur. Meanwhile, nongeometric motifs cover irregular arrangement of motifs in term of geometry. Such motifs include such ornaments of plants as meru (mountain), pohon hayat (tree of life), and of animals as garuda (mythical golden eagle), snake (dragon); all of which are drawn in irregular arrangement, as shown by Figure 2.



(a) (b)

(c) (d)

Figure 1. Geometric motifs of batik (a) *truntum*, (b) *bokor kencono* (c) *truntum*, (d) *sidoluhur*

Source : http://batikdan.blogspot.co.id/2011/08/motif-batik.html

(a) (b)

Figure 2. Nongeometric motifs of batik (a) forest animals, and (b) birds, butterflies, and plants

Source : http://parasakti7970.blogspot.co.id/2012/06/ragam-hias-non-geometris.html

Patterns of modern batik and batik from outside of Java are more varied and free. The arrangement of motifs is often done either symmetrically or asymmetrically, or by combining several patterns of traditional batik. The word 'ornament is derived from Latin language 'ornare', which means 'decorating'. Gustami (1980) defines it as a component of art products added or intentionally created for decorating purposes. Ornamentation refers to the process of decorating. Doellah (1997) mentions three stages of batik ornamentation:

a. Klowongan. It is the process of drawing and forming basic elements of batik designs in general.
b. Isen-isen. It is the process of filling parts of ornaments of the determined patterns. Several patterns used traditionally comprise motifs of cecek, sawut, cecek sawut, sisik melik, etc.
c. Ornamentasi Harmoni (harmonization). It is the addition of backgrounds for a whole design to give harmonious combination. The patterns used include ukel, galar, gringsing, or such modifications of isen as sekar sedhah, rembyang, sekar pacar, etc.

Batik involves a process derived from cognitive system, and depiction of nature and surrounding environment. It is created through mapping of objects beyond batik makers and cognitive articulation and psychomotor aspect conveyed in batik works. Although it is impossible to see batik regardless its context and making, motifs and ornaments of batik indeed have level of complexity with interesting geometric shapes (Wells, 1991; Weisstein, 1999; Wolfram, 2003). The inherited geometry involves Aristotelian perspective which regards geometric dimensions as original numbers. Obviously, a line has dimension 1, a plane dimension 2, a cube dimension 3, etc (Situngkir and Dahlan, 1998). It is, however, not that simple. In a journey through history of modern science, classical geometry serves as a basis to see the world.

A fractal is a rough geometric shape at all scales which can be split into parts in radical ways. Several fractals can be broken down into self-similar fractals. Fractals can have potentially unlimited detail and self-similar structures at different scales. In many cases, a fractal can be created by repeating a pattern, particularly through recursive and iterative processes.

The history of science indicates that fractals are considered to be better and more appropriate in seeing the world due to their nature which realizes imperfection of model of universe. One of evidences is the presence of knowledge on noninteger dimensions, called fractal dimensions. Mandelbrot (1982) proposed that certain natural structures can be interpreted lying in the range between traditional integer dimensions. Cauliflowers, crumpled paper balls, ashes, and coastlines are examples of natural objects having fractal dimensions. Coastlines, for example, are neither lines (dimension 1), nor flat surfaces (dimension 2) since smaller segments of coastlines (order of meters) in an aerial photo have geometric self-similarity as long coastlines (order of kilometers). This phenomenon can also be found in batik designs. When turned around, batik tends to have similar geometric patterns termed fractals. Fractals have initiated a change and presented scientific creativity and progressivity in several fields in the form of interdisciplinary. Figure 3 denotes patterns of Javanese fractals resulted from Figure 1.

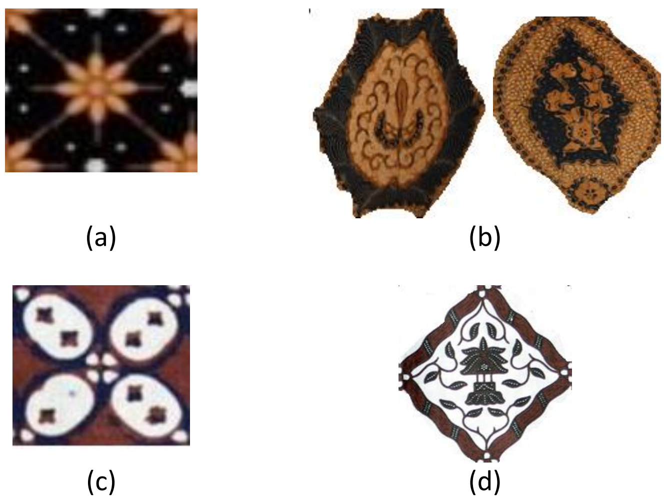


Figure 3. Fractal patterns of motifs of (a) *truntum,* (b) *bokor kencono*,
(c) *kawung* and (d) *sido luhur*

The development in modern science and technology has brought us to generation in which simulation for imitating process (natural, physical and biological processes, price movement and social interaction) can be done computationally. From several scientific approaches, it is realized that natural and social phenomena which look complicated, random and chaotic, principally are originated from simple things. Arithmetically, mathematic patterns and chaotic and indeterministic dynamics can be indicated in simple and deterministic manners (Malkevitch, 2003).

How are the complicated forms and patterns in the nature which look random and complex visually? Computational technology, as what can be implemented to observe simple arithmetic pattern which results in chaos can also be applied to see simple geometric pattern resulting fractal (Barnsley, 1988). Clam pigmentation, tendril patterns of clam shell, complicated snow flower shape, cancer growth, and even some patterns of stock exchange index movement in economy show fractal pattern. By computationally imitating various computational systems, complex patterns in the universe and social environment can be identified. This sort of analysis is also known as analytical form based on generative science. Various aesthetic objects which create this are called computational/ generative objects. In computational and fractal geometric study, like cellular automation, Julia and Mandelbrot (Mandelbrot, 1982) sets, L-system, Peano curve, etc are in general used as the bases of fractal development (Freeman, et.al., 1988).

When batik's fractal patterns can be presented, batik is potentially seen in generative form and pseudo-algorithm is recognized to produce batik as what have been explained previously on ornamentation process: klowongan-isen-harmonization. According to BFI (2017), there are at least three types of fractal patterns which computationally can change into generative fractal batik motifs which can be explained as the followings:

a. Fractal as a batik. Some types of fractals which are customized in such a way that they take certain patterns can be designed to inspire batik design construction. Customization can be made based on iterative rules, modification of the design of color, and so on.
b. Batik fractal Hybrid. Fractal patterns can serve as core model patterns of ornamentation and decorating basis along with original isen of the basic motif of batik, and so on. This can be brought into reality by using traditional batik motif computationally as result of adaptation of nonbatik fractal. Modus of this design aesthetically combines fractal patterns produced computationally and the outputs resulted from widely-known batik cultural tradition.
c. Fractal innovation batik. This is a form of implementation of figures with certain and/or random patterns using the shapes of iterative selection or filling algorithm from original batik ornamentation as and isen (filling) of basic motif of batik ornamentation which has been recognized traditionally. This can be made by extracting basic motif of batik ornamentation which later is reiterated using recognized batik pseudo-algorithm.

Those three patterns are resulted from generative implementation of understanding on how batik has fractal characteristics and support the expansion of appreciation on non-woven textile culture in Indonesia.

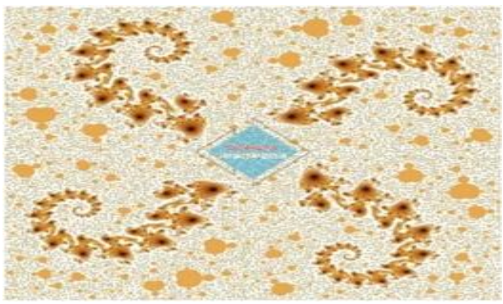
B. METHOD

Algorithmic and mathematic modeling in fractal batik has provided opportunities of computational technology acquisition as a means to help support creativity and innovation of traditional batik. Pseudo-algorithm pattern on batik, design and pattern of iterated function system (IFS) provides opportunities to raise new patterns and motifs which can enrich the horizon of batik innovation. All computational patterns growth to find fractal character in batik can turn into the sources of creativity to create new motifs. Fractal geometric understanding manifested an interaction between mathematics and arts some years ago that is called generative art (Situngkir & Dahlan, 2009b). Numerous new designs can be brought into reality through generative fractal batik. Acquisition of computational fractal batik can be made to redesign basic motifs originated from the batik basic motifs taken from original traditional design or various regenerative imitations of basic motifs from iterated function systems, or even fractal patterns which basically are not the basic motifs of batik but have the same structures with the batik patterns that we have already known. By identifying basic mathematic equation which creates motif, for example, through small-scale modification of function parameter, various new motifs can be presented computationally to enrich batik types.

C. DISCUSSION AND RESULTS

When designing fractal batik, the first thing to do is measuring batik DNA (measuring motif regularity and the characteristics of batik by using means of fractal dimension). The result of measurement is later called batik DNA. The motif is transformed into fractal mathematic formula using L-System language ([BFI], 2017; Hariadi et al. (2013)). The formula is then modified by changing its parameter to produce more complex and complicated formula. Afterwards, the formula is processed using JBatik program, an application which is created on the basis of open-source software (Hariadi et al. (2007), Hariadi et al. (2013)). This formula will produce batik motif that is different from the original one. Fractal is derived from Latin word 'fractus' which means 'fraction'. On material, fractal is characterized with self-similarity (Aouidi, J. & Slimane, 2002). The object of fractal is composed by smaller components with the same and repeated shapes. Scale invariance or self-similarity means observing batik with various scales, but the geometric and dimensional shapes are the same as the basic element of the fractals.

Fractal batik existing in Indonesia is the result of study carried out by research group of design from Institut Teknologi Bandung (ITB), Pixel People Project (Muhammad Lukman, Nancy Margried Panjaitan, and Yun Hariadi). This study reveals that batik is fractal. Fourier transformation test demonstrates that batik motif dimension is fractal character-based fraction. On batik motifs with Solo and Jogjakarta styles, the dimension stays at 1.5. Meanwhile, the dimension of motifs with Cirebon and Pekalongan styles is more varied, closer to integers of 1, 2, or 3.data. The research results and the discovery must be the answers or the research hypothesis stated previously in the introduction part.



(a) (b)

Figure 4. Fractal batik produced computationally with (a) *klowong* that is batik variation from Cirebon coastal area and *isen* from algorithmic variation and (b) zooming (magnification) of phonix fractal pattern (from Julia set) and later the harmonization of *isen* using Mandelbrot sets.

Source: http://netsains.com/2009/10/proses-pembuatan-batik-fractal-vs-batik-tradisional/

D. CONCLUSION

Batik as a patterned aesthetic object has its pseudo-algorithmic description rules which can be treated as generative art form. Batik which can be developed as fractal batik is that with geometric motifs. Fractal batik is scale invariant, meaning that it is observed with various scales, but its geometrical and dimensional shapes are the same as the seed of fractals. Fractals have initiated a change and presented scientific creativity and progressivity in several fields in the form of interdisciplinary. All computational patterns growth to find fractal character in batik can turn into the sources of creativity to create new motifs.

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