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IMPLEMENTATION OF ETLINGERA ELATIOR FOR UNIQUE BRANDING OF CENTRAL SULAWESI BATIK MOTIF

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ABSTRACT

Batik is the art work of the Indonesian people which is a cultural heritage from their ancestors which has become one of the world's recognized cultural heritages. Batik itself has a variety of patterns that are influenced by the customs of the local community and contains deep meaning and philosophy. Endemic flora and fauna are often used as patterns for batik motifs. In the process of forming batik motifs, mathematical knowledge is often required which sometimes appears naturally. Mathematics that is closely related to culture is called ethnomathematics as a branch of mathematics. Ethnomathematics can be used in forming batik patterns, especially fractal forms. A fractal shape is an object that appears to have a symmetric self-resemblance to one another when viewed at a certain scale and is the smallest part of the overall structure of the object. The purpose of this research is to make fractals of local batik motifs from Central Sulawesi using the endemic plant of Bunga Katimong (Etlingera Elatior) with the help of the j-Batik application so that new motifs are obtained to add to the diversity of existing batik motifs. The new batik motifs produced in this research are Katimong, Kantan, Kincung and Honje.

Keywords: *Batik, Ethnomathematics, Etlingera Elatior, Fractal, Motif*

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INTRODUCTION

In everyday life, a society from the past until now will certainly never be separated from mathematics. Likewise with culture, something that cannot be avoided in everyday life because it is a unified whole that applies in people's lives. In its development, mathematics and culture are two things that have a relationship with each other. The branch of mathematics that can be used to explain the relationship between mathematics and culture is called ethnomathematics. (Ascher, 2017). Most people think that mathematics can only be learned through formal education, such as at school. However, in reality mathematics can be learned with the presence of a culture that exists in a place or area. Moreover, if the culture requires its people to use certain patterns and calculations in order to survive. Mathematics that is practiced by the community and related to cultural nuances that exist in a place is referred to as ethnomathematics (Joseph, 1987). One of the community activities in several countries such as Malaysia, Thailand, Japan and especially Indonesia which links the relationship between mathematics and culture is batik. With the existence of complex patterns which often require calculation methods and high precision in the manufacturing process, it requires a person to be able to have both mathematical and cultural knowledge simultaneously and integrated (Rahmidani & Susanti, 2019).

As the nation's cultural heritage, batik is an art work that must be maintained, protected and preserved (Gatut & Aryanto, 2010). Batik continues to develop according to the changes that occur in society, both in style and in use. At this time, batik is not only used for clothing and fabrics but also batik has been used by the public in interior designs such as at home and even in offices. In Indonesia, there are various types of batik with regional characteristics such as Yogyakarta, Solo, Pekalongan, Cirebon, Madura, Tuban and Banyuwangi. Each of these areas has different batik patterns and motifs according to the characteristics of each place. At this time, Pesisiran is one of the batik that is being favored by the public. This batik is produced by industries located in the northern coastal areas of Java Island, such as Pekalongan, Pati, Lasem and Tuban (Hariani et al., 2019).

Batik in every region in Indonesia also has a distinctive pattern and different motifs. For example Jumputan comes from Palembang, Tanah Liek batik is from West Sumatra and other areas. One area that has a distinctive batik pattern is Central Sulawesi. This type of batik is very unique with interesting and attractive patterns. This type of batik is called Bomba and its use is very widespread even in foreign countries (Jaya et al., 2021), (Alam et al. 2022). This paper provides the steps and processes involved in obtaining new batik motifs by exploring the endemic flora of Central Sulawesi, namely the Katimong flower with the Latin name Etlingera Elatior. Furthermore, fractals by performing geometric transformations with the help of Matlab software are applied to obtain these new motifs. These results are then as unique branding of Central Sulawesi batik motifs.

MATERIALS AND METHODS

2.1. Fractal

Fractals are an object of concern which has a similar shape to one another (self-similarity), symmetry when observed at a certain scale and is the smallest part of the overall object structure (Viengkham et al., 2022). According to (Pilgrim & Taylor, 2018) , the properties of fractals include self-similarity and self-affinity. Self-similarity shows that a fractal object is composed of parts that are similar to itself, while self-affinity shows that a fractal object is composed of parts that are connected to one another. The natural fractal object is very rare that truly have similar properties to themselves (self-similar). There are certain objects that naturally have the properties of self-similarity and self-affinity such as Sirpienski triangles, Koch Snowflake, and fern leaves (Rahimi & Anaraki, 2020), (Purnomo et al., 2019). The type of fractal that has exactly self-similarity properties, namely the properties that are similar to the shape of the object as a whole when viewed from various scales, is the regular fractal type. Examples of fractal objects that have exactly self-similarity properties are the structure of fern leaves and the Sierpinski triangle (Zhikharev,2021).

2.2. Ethnomathematics

Ethnomatematics is a branch of science as a result of derivatives due to the interaction between mathematics and culture. In other words, there are cultural nuances in the learning and use of mathematics and vice versa. This shows that there is a framework for discussion and explanation in mathematics which is caused by differences in human culture. On the other side, there are economic

and technological differences in people's lives that are influenced by thinking and behavior that can be explained by mathematics [1].

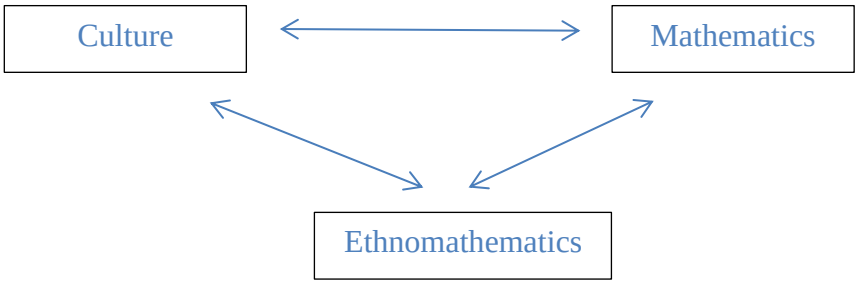

Figure 1 Ethnomathematics: Relationship between culture and mathematics

Figure 1 shows the relationship between culture, mathematics and ethnomathematics. The relationship that appears to be a reciprocity between culture and mathematics. Both of them influence each other (Borba, 1990).

RESULTS AND DISCUSSION

The motif chosen in the transformation process to get a new batik motif is the Katimong Flower motif. The resulting four new batik motifs were obtained by using the j-Batik application as a tool. In the following, the objects used, the steps and processes carried out as well as the results of the new motifs obtained from this research are presented.

3.1 Object

The object used in making batik motifs is an endemic flora from Central Sulawesi, namely the Katimong flower (Etlingera elatior). Figure 2 is the object used to obtain new batik motifs.

Figure 2 Katimong flower

3.2 Batik Motifs from Katimong Flower

The steps and processes involved in obtaining new motifs with Katimong flower objects are making leaf patterns by applying orchids (Calanthe triplicata), making stem patterns are also uses orchids (Calanthe triplicata), the Etlingera Elatior is then used for flower patterns. Finally, the process of merging the existing components and the file storage process is carried out so that the expected motive is obtained.

3.2.1 Leaf patterns

Here are the steps taken to make the leaf patterns

In the axiom Bar inputs Xr In the Bar Detail inputs some commands

X=[A][a]
A=PPPppp+(140)bxdxbxCxBxC
a=PPPppp-(140)dybydyByCyB
B=f+(3)^^}.B
C=f-(3)^^}.C
b=f+(3)&&}.b
d=f-(3)&&}.d
P={f^^^^P
p={f&&&p
x=+++++++
y=-------
In the Bar Property Sheet:

Iteration	: 5
Angle	: 2
Length	: 4
Width	: 1

The screen presented in Figure 3 is the structure of the leaf pattern which will then be applied to obtain new motifs combined with other components.

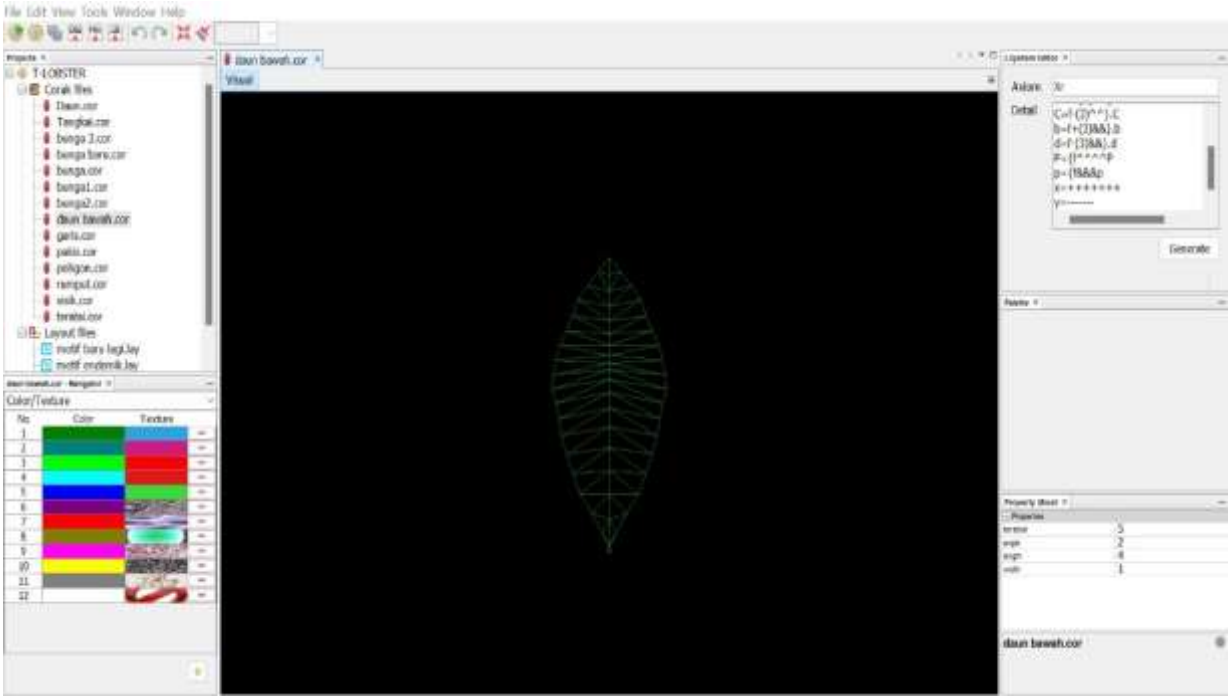

Figure 3 leaf motif will be taken as a batik design

3.2.2 Stem patterns

The steps in making the stem pattern are as follows.

In the axiom Bar inputs A
In the Bar Detail inputs a command: A=F[+F]F[-F]+A
In the Bar Property Sheet:

Iteration: 4	
Angle	: 30
Length	: 100
Width	: 10

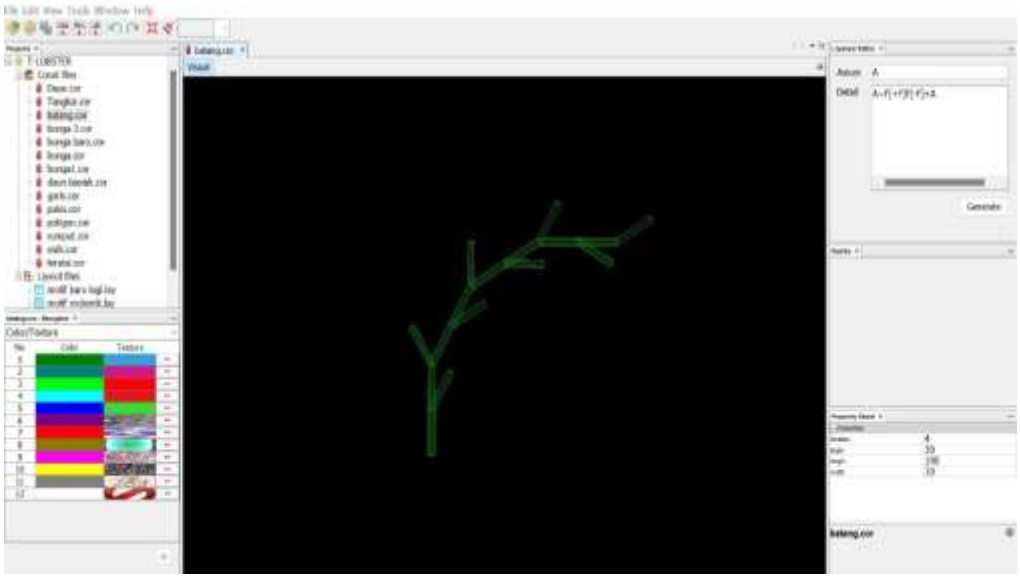

Figure 4 The stem motif that will be taken into a batik design

Figure 4 shows the results on the screen which is the structure of the stem pattern which will then be used in designing new motifs.

3.2.3 Katimong Flower patterns

Here are the steps taken in obtaining the Katimong flower pattern.

In the axiom Bar inputs F[W][Y][Z][H][I][J][X]
In the Bar Detail inputs several commands:
W=ffffA+W
Y=C+Yfff
Z=D+Z
H=Eggg+H
I=F+I
J=G+J
X=B+X
A=[*(poligon.cor)]
C=[&(45)*_____]
E=[&(50)*_____]
F=[&(55)*_____]
G=[&(60)*_____]
B=[*(kelopak 1.cor)]
(kelopak 1.cor):
Axiom : Xr
Detail :
X=[A][a]
A=PPPppp+(140)bxdxbxCxBxC
a=PPPppp-(140)dybydyByCyB
B=f+(3)^^}.B
C=f-(3)^^}.C
b=f+(3)&&}.b
d=f-(3)&&}.d
P={f^^^^P
p={f&&&p
x=+++++++
y=-------
Property Sheet:

Iteration	: 5
Angle	: 2
Length	: 4
Width	: 1
(poligon.cor):	
Axiom	: [A}][B]
Detail	:
A=f&(10)[+f}{]."A	
B=f&(10)[-f}{]."B	
Property Sheet:	
Iteration	: 20
Angle	: 60
Length	: 40
Width	: 40
In the Bar Property Sheet:	
Iteration	: 10
Angle	: 45
Length	: 1
Width	: 1

On the screen presented in Figure 5 is the structure of the Katimong flower pattern which will then be used in designing new batik motifs.

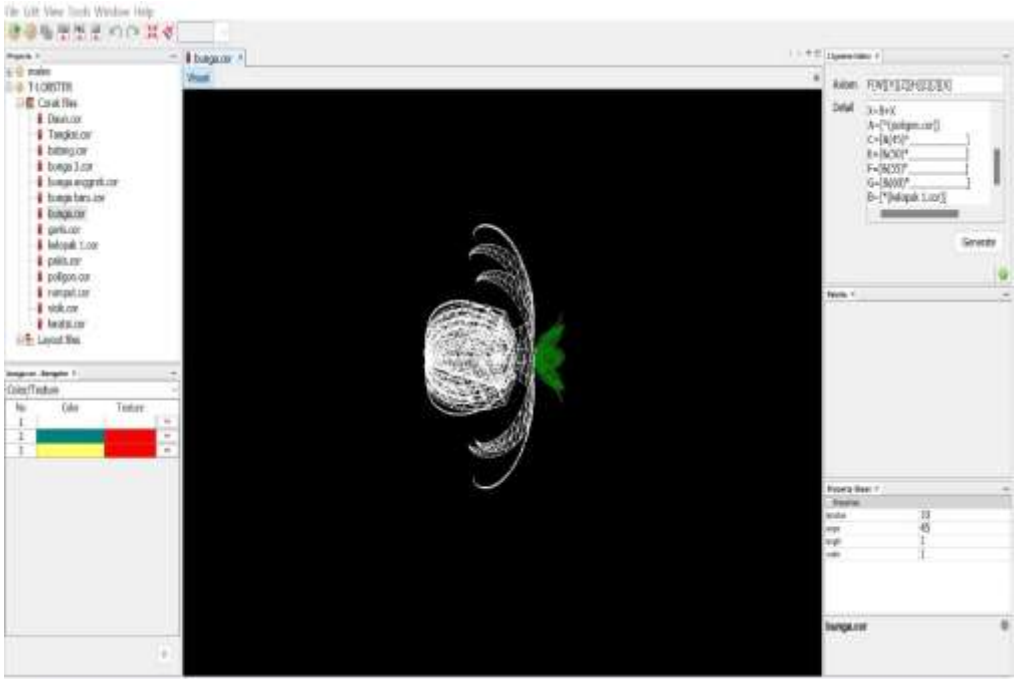

Figure 5 The Katimong flower motif which will be taken as a batik design

3.2.4 Combination of patterns in making motifs

The next step is to combine the leaf, stem and flower patterns that have been made as separate components so as to produce a new motif that is more interesting, attractive, elegant and charismatic. The steps in merging these components are as follows.

Input the formulas:

1. Axiom : +(-89.62)?(7.3241)"(7.3241)B
2. Detail : B=F-B
3. Property Sheet:

- x : 21746
- y : 8957
- Iteration : 18
- Angle : 0
- Square Rotation Angle : 6.835646
- Length : 300
- Width : 300
- Increment Angle : 1
- Increment Length : 1
- Increment Width : 1

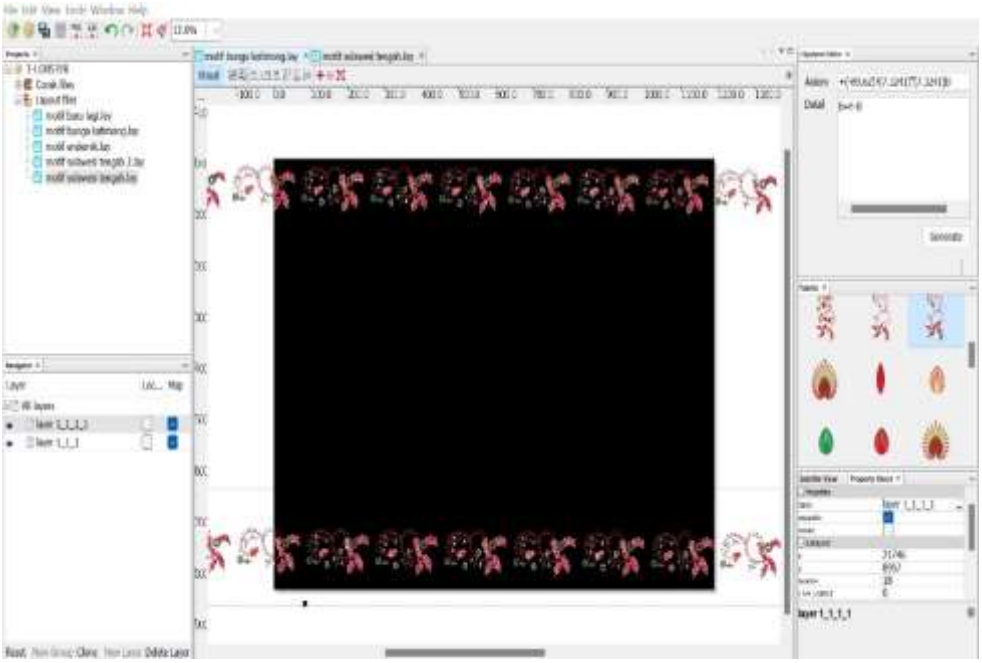

Figure 6 Display of Layers

Figure 6 is a layer display of the combined results of the leaf, stem and flower patterns.

Figure 7 Display of layers that have been arranged and filled with PNG

Entering the PNG that has been saved in the Bar PNG Libraries into layers is the last step that must be done to get a new motif. Figure 7 is the layer display after filling in the PNG.

3.2.5 Saving motifs that have been created

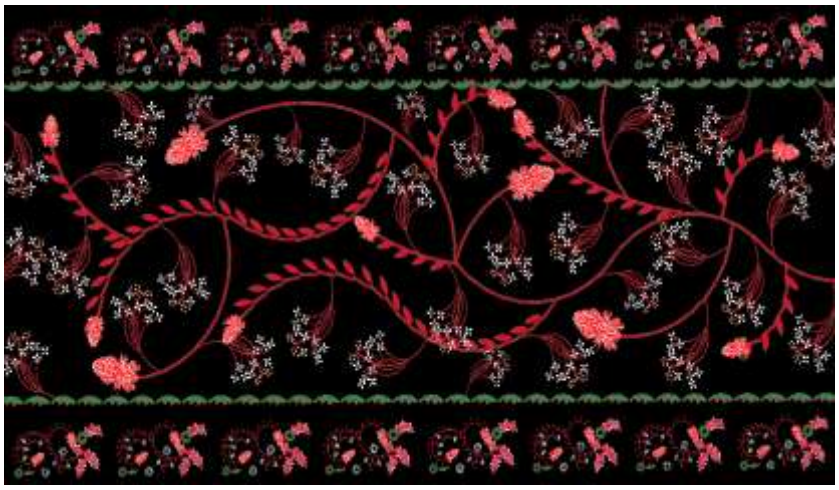

Figure 8 Katimong motifs batik

The motifs that have been made are then saved, this is done in order to see the end result of all the processes that have been carried out. Figure 8 presents one of the new motive results obtained from the steps that have been taken. The new type of motif resulting from the transformation process in Figure 8 is called the Katimong Motif.

3.3 Types of Katimong Flower Motifs

Several other new types of motifs as a result of the transformation process carried out besides the Katimong motifs are the Kantan, Kincung and Honje motifs. Figure 9, Figure 10 and Figure 11 are other new motifs that have been obtained in this study respectively. These new motifs are obtained by carrying out the same process and steps as those carried out for the acquisition of the Katimong motif.

3.3.1 Kantan Motif

Figure 9 shows a new motif called Kantan which is the result of a transformation with the process being carried out using the j-Batik application.

Figure 9 Kantan Motif

3.3.2 Kincung Motif

Figure 10 is the Kincung which is new motif as a result of the transformation process carried out using the j-Batik application.

Figure 10 Kincung Motif

3.3.3 Honje Motif

Figure 11 is a new motif obtained and then this motif is called Honje. This motif is the result of a transformation with the process being carried out using the j-Batik application.

Figure 11 Honje motif

CONCLUSION

The implementation of batik motifs using fractals begins with identifying the selected batik motifs and then selecting the type of fractal to be combined with the selected batik motifs. From the selected batik and fractal motifs, a process of combining components is carried out through the concept of geometric transformation in the form of translation, rotation and scaling processes as well as iteration processes to make the new motifs more interesting, elegant, attractive and charismatic. From the selected object, namely the Katimong flower (Etlingera Elatior), four new batik motifs have been produced, namely the Katimong, Kantan, Kincung and Honje motifs. The j-Batik application as a tool to create new motifs is used in the process. The results of the transformation of batik motifs using fractals will not only be produced into batik cloth or shirts, but it can also be produced into other forms, for example interior design and so on.

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