

Evolutionary Clustering in Indonesian Ethnic Textile Motifs

Hokky Situngkir
[hs@compsoc.bandungfe.net]
Dept. Computational Sociology
Bandung Fe Institute

Abstract

The wide varieties of Indonesian textiles could reflect the diversity that has been living with the diversity of Indonesian ethnic groups. Meme as an evolutionary modeling technique promises some conjectures to capture the innovative process of the cultural objects production in the particular collective patterns acquainted can be regarded as fitness in the large evolutionary landscape of cultural life. We have presented the correlations between memplexes that is transformed into distances has generated the phylomemetic tree, both among some samples from Indonesian textile handicrafts and *batik*, the designs that have been living through generations with Javanese people, the largest ethnic group in Indonesian archipelago. The memplexes is extracted from the geometrical shape, i.e.: fractal dimensions and the histogram analysis of the employed colorization. We draw some interesting findings from the tree and open the future anthropological development that might catch the attention further observation.

Keywords: memetics, ornamentation, *batik*, Indonesian textile patterns, phylomemetic tree.

1. Introduction

When the customs of an ethnic group is considered to be emerged from the complex relations among a lot of factors, e.g.: anthropologically, climatologically, geographically, the way people dress or choose to be appeared is an important thing to be observed. Ethnic and traditional fashion styles are becoming the easily sensed identities of the collective identity. The co-evolution of memes and genes are somehow shaping the way we dress and choose what we think to be the fancy thing to get dressed with [3]. Memes are reflected as we choose, let us say, South Sumatran *songket* motif, to become ornaments attached in our dress, as well as recent general trend of *batik* dress code in Indonesian people wedding celebrations attendance.

The large diversity of Indonesian ethnic cultures and traditions become the source of a great deal of variations of dress or textiles ornamentations and decorations. The varied woven cloth, dyed-resist clothes, and a lot more are another thing as almost unlimited ornamentations and decorations are to be observed. Bataknese are recognized with their *ulos*, Padangnese with their *songket*, Javanese with their *batik*, and so on. These textiles are not plain things but decorated in such unique ways related to the visual aesthetics attached to the respective collective identities. A lot of interesting motifs decorate the textiles and they are important and enrich the landscape of the economic processes laid upon creativity and innovation.

The paper celebrates the richness of Indonesian traditional motifs of textiles by incorporating phylomemetic tree to see the innovative (read: evolutionary, in big picture) emerged upon the products and traditional crafts. This phylomemetic trees let us to visualize the “familial” relations between memes as emanated from the respective cultural artifacts [10]. Discussions about phylomemetic tree reveal the very elementary structures of information constituting the artifacts. While the global pictures express the similarities between products, the local ones challenge the detail information that invigorates the existence of the products as being perceived.

The paper is structured as follows. It begins with discussions about the extraction of information as shown in the textile’s ornamentations. This is delivered by revealing the basic structure of the decoration by employing the fractal geometry shown in the artifacts and the fundamental of colorizations related to them. The latest uses the information in the color histograms of the digital images of the artifacts. This section is followed by the discussions related to the properties of the memplexes and the construction of the phylomemetic tree. The paper ends by outlining the open discussions related to the visualization of the diversity of Indonesian textile decorations.

2. The Memplexes of the Ornaments in Indonesian Textiles

The *first* parameter we propose to see is the one sensitive to the geometrical shape of the motifs. The fractal dimension of the motif delivers this. We know that fractal dimension measures the self-similarity of the object or any quantities: the similar structures at different scales at the object. The measurement we use here is the box-counting (Mikonwski) dimension, *i.e.*: the fractal dimension of a set of S in metric or Euclidean space, R^N . If we place the object into the observational space with evenly-spaced grids and count how many boxes are required to cover the object or set, the fractal dimension is then calculated by counting the changes of the boxes count as finer grid is applied. This is illustrated in figure 1, Javanese Batik Gurdha and the result of the box counting. The set is fractal as the calculation gives a power-law,

$$N = N_0 r^{-a} \tag{1}$$

Here, we have a as the fractal (capacity) dimension (Peitgen & Richter, 1986).

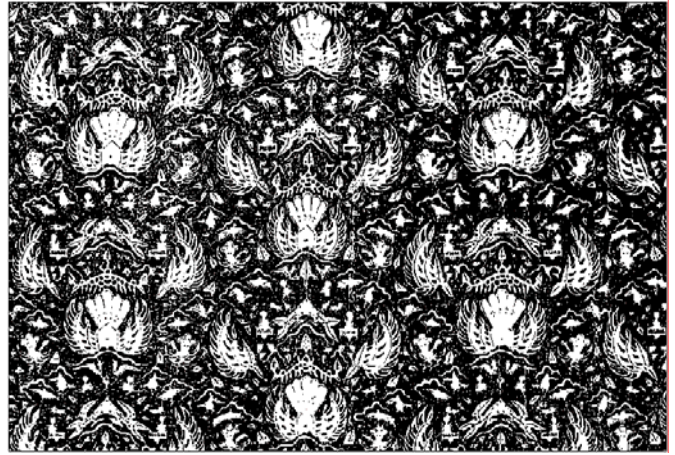
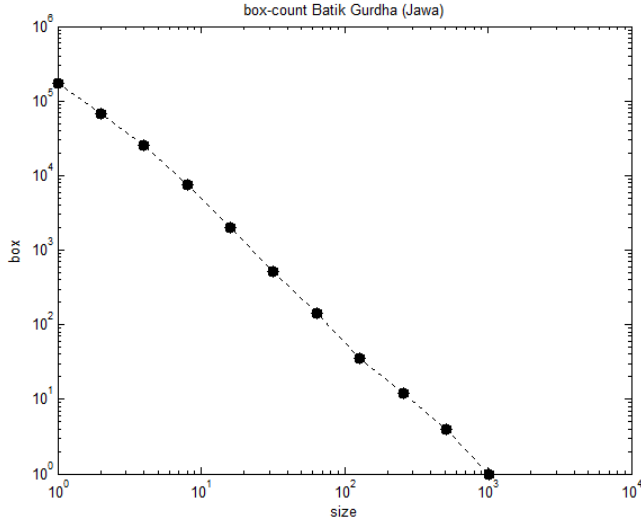


Figure 1

The box-count fractal dimension calculation for *Batik Gurdha*

The *second* parameter is related to the chosen color used to present the motif. The histogram of each color in a digital image contains a lot of information related to the mixture of the colors used in it. An example is shown in figure 2 on the motif of Sasirangan in textiles from South Kalimantan. Here we can see that a color histogram is a vector stores the number of a given color in an image (Pass, *et. al*, 1996). Revealing the color histogram of a digital image is by means of retrieving the computational information in an image from the bottom-up. Thus, in the sense of memplexes, this is an elementary information reflected from an image and a thing that is reflecting the thing that it is in mind as transformed onto the artifact.

It is also worth noting that color histograms are very sensitive to the brightness of the image. Thus before the analysis, we should standardized the vector by using histogram equalization (Acharya & Ray, 2005). If we denote the histogram of the a single color, $H^{R,G,B}(w)$, then we could apply the equalization from its cumulative distribution function,

$$C^{R,G,B}(x) = \sum_{w=0}^x H^{R,G,B}(w) \quad (2)$$

This cumulative distribution function is being normalized to have more gradual cumulative distribution function by applying,

$$w = \frac{C_w^{R,G,B}(x)t}{l \times h} \quad (3)$$

where, $C_w^{R,G,B}(x)$ is the value of cumulative distribution in w - degree of the Red, Green, and Blue gradation, t as the threshold of respective color degree, and $l \times h$ are the dimension of the image. In fact, most of image processing software has included this function in their package. Thus, the point is to make sure that our images of motif are not too dark or too bright before the construction of the memplex.

From the two distinctive categories we can fill the memplexes as we could reveal from a lot of Indonesian traditional motifs,

$$M^{motif} = m^{dim} \cup m^{color} \quad (4)$$

where we could define the red, green, and blue is the dominant elements from each color vectors,

$$m^{color} = \max [H^{R,G,B}(w)] \quad (5)$$

that is also the average or most frequent elements from the respective colorization vectors.

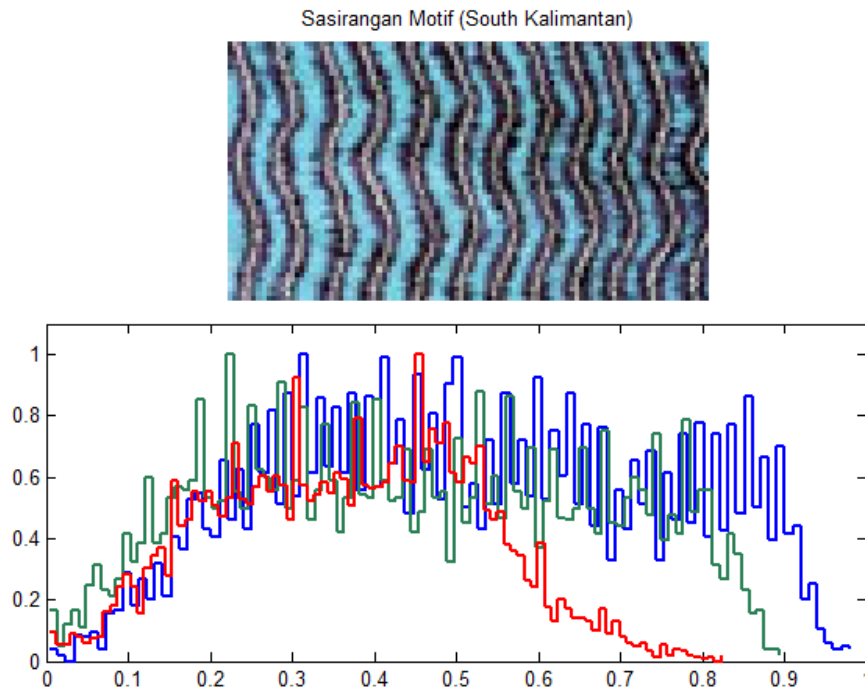


Figure 2
The Red-Green-Blue histogram of Sasirangan (South Kalimantan) motif

The expression (5) reflects the elementary information related to the colorization of the decorations and ornamentals of the artifacts we would like to observe. These two features constitute the memplexes that are reflecting the cultural objects which is in the form of digital images. Our data sets are taken from various resources and references, from the books of textiles [4, 5, 12] to the direct observation to the centers of the craftsman. That is why, when it is related to the analytical models of colorization, the histogram equalization becomes a very relevant issue.

From the variables obtained in the two computational observations and calculations we can fill the memplexes emanating from each artifact. The method of the phylometric tree construction is based upon the correlations transformed into distances in ultrametric spaces among memplexes as it has been discussed in [10]. Here, we can outline two sets of data, one related to the complexity of batik and another several samples of Indonesian general textiles. The first is interesting since *batik* has been widely recognized even in international stages as signature of Indonesian fashion. *Batik* depicts the complexity related to not only the processes of ornamentation and the related usages in (Javanese) specific occasions but also places where the unique *batik* is crafted: the palace-centric (*keraton*) *batik* and those which produced in creative industries of coastal areas in Java [11].

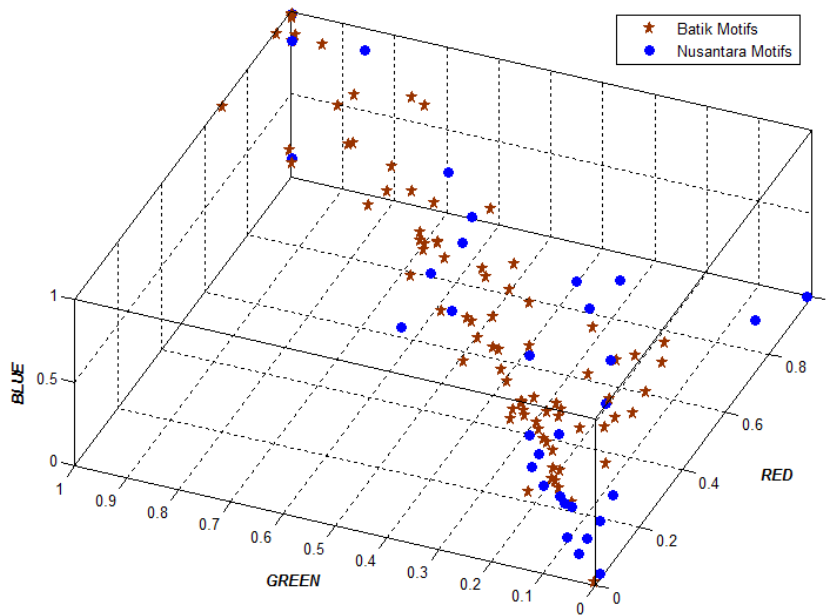


Figure 3
The distribution of dominant averaged colors of Indonesian textiles.

An instant observation to the colorization of Javanese *batik* and some of broader Indonesian textile sample datasets shows interesting features as shown in figure 3. The colorization of *batik* is somewhat obvious in the linear band of the mid-histogram of the three fundamental colors (red-green-blue) with some tendency to the red one. This is probably rooted in the nature of materials used in *batik* dying processes incorporating the natural colors emerging the brownish colors of most *batik* decorations. However, the colors of some of our Indonesian textiles ornamentation are wider, but interestingly some samples are in the extreme dominant red color. Most of our data does not exhibit the relatively the dominance of blue and green colorizations. Roughly speaking, the red colors have more affinity with Indonesian traditional ornamentation despite the materials used in the crafting processes.

3. The Phylomemetic Tree of Nusantara Textiles

For the sake of more apparent visualizations, we construct two phylomemetic trees: the *batik* phylomemetic and the one incorporating general samples of Indonesian textiles. Interestingly, there are some clustering related to the ethnic groups emerging the particular artifact. Figure 4 shows the constructed phylomemetic tree. In the figure, the *tapis* Banjar craft does not clustered with other artifacts, while others are grouped within two clusters. One clusters are dominated by Balinese textiles along with some similar ones from Lampung, Papua, Javanese motif *ayam puger*.

Sumatran woven cloth from North Sumatra is clustered with one from West Sumatra in the other group. The close clusters made by one from West Kalimantan, Jambi, and West Sumatra, for instance, could be seen as the cluster of Malay clusters. It is interesting to see that *batik* from Jambi is not closely related with one from Java. The memetic influence in the production of Sumatran *batik* is apparently distinguishable from the one from Java. The data we included in this phylomemetic construction is collected in the reference of modern and recent documentations. This explains that some handicrafts from geographically very far apart ethnic groups can be clustered for influencing

each other production modus, e.g.: *sarung* from Bima (eastern Indonesia) and *tusuk silang* from Payakumbuh West Sumatra.

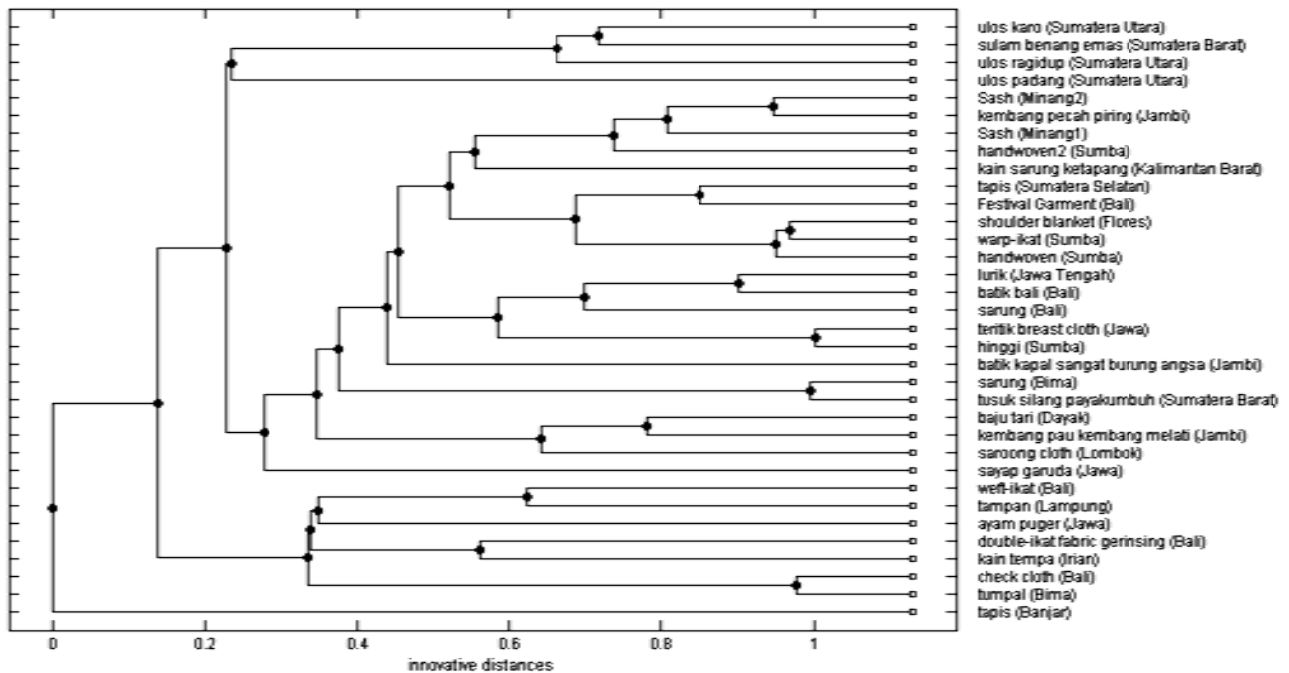


Figure 4
Phylogenetic Tree of Several Indonesian textile ornamentation.

Other interesting facts about the phylogenetic tree on textile handicrafts are also shown in the specific tree of Javanese *batik*. The calculated fractal dimensions and color histogram analysis in their roles as variables filling the memplex vectors has brought the clustering of *batik* products in the sense of their respective locations. The *batik* crafted in *keraton* (Javanese classical palaces) traditions, e.g.: Yogyakarta, Surakarta, grouped in different clusters with those produced by crafters in coastal tradition, e.g.: Lasem, Pekalongan, Semarang. This explains that the different anthropological aspects of the culture between the two traditional crafting processes and techniques as well as the existing and culturally emerged aesthetical tastes. However, some particular things can also be read from the visualization regarding to the similar general processes of *mbatik* between those traditional work of arts, *batik*. *Kelelawar* (bat) motif, for instance, is made in the coastal tradition (Lasem), but yet clustered closely enough with some motifs from Surakarta (*Solo Keraton*). This is interesting and simultaneously showing that from the pictures depicted in *batik* still has some “familial” crafting principles and of course the familial of Javanese whether they live in the palace’s surrounding or in coastal areas.

Evolutionary speaking, the similar cognitive capacity and interactions with foreigner has changed the way of appreciation of (visual) aesthetics which in turn affected the creation of *batik patterns*. The phylogenetic tree of *batik* in some ways could bring us to the conjecture of further explanation of the different characters of the Javanese people living in the coast-side and in the rural. From here, anthropological works on human culture and history could meet and excite the further discussion of the evolution of culture. This is the right track for memetics is meant to be a tool explaining the diversity of culture related to various aspects of human life, acquisition of information, and cognitive capacity in the sense of evolutionary method and principles.

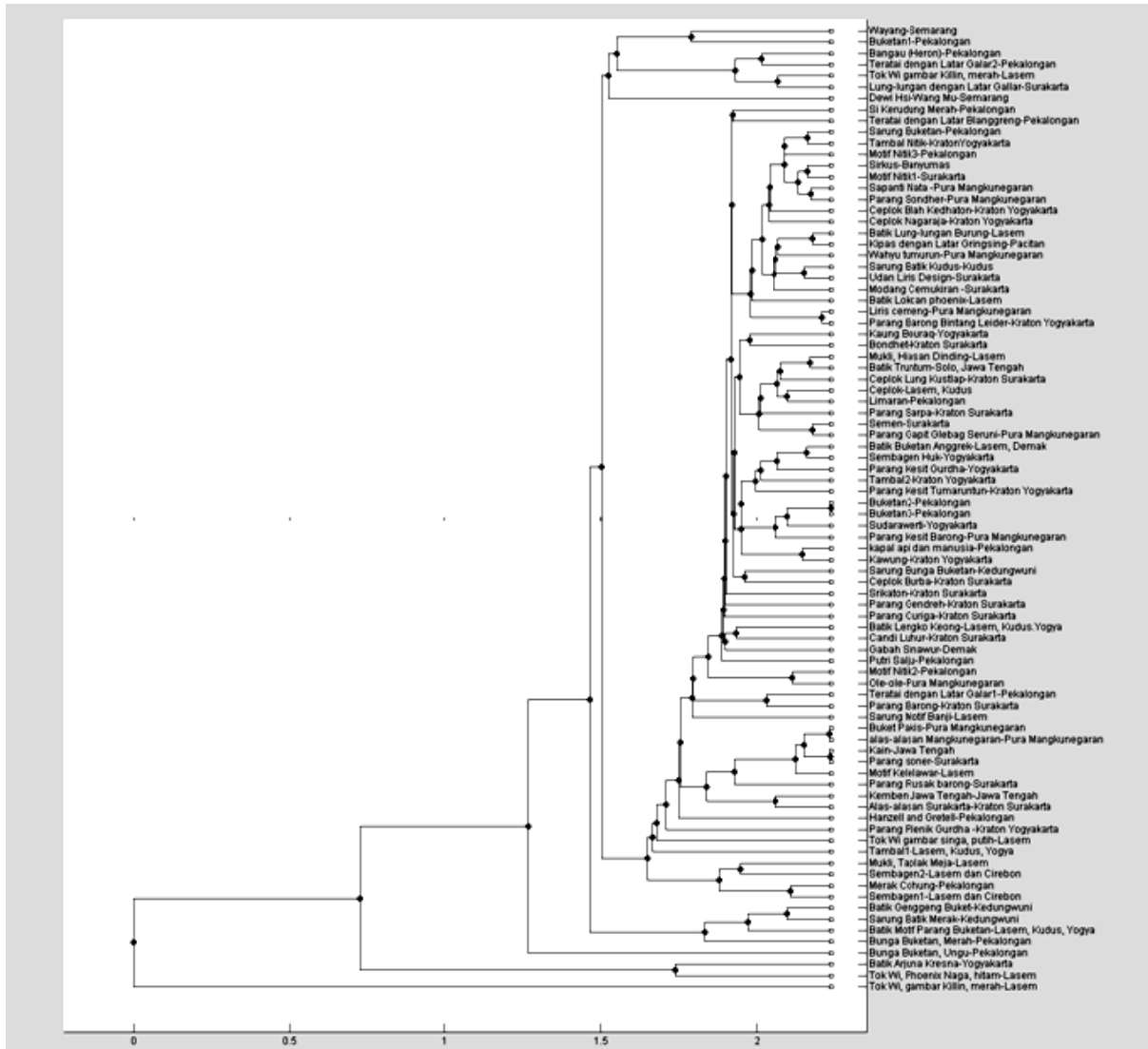


Figure 5
Phylogenetic of Indonesian Batik.

4. Closing Remarks

Traditional textile ornamentation is a complex thing as emerged from various aspects of human living individually (related to aspects of creativity, cognitive capacity, etc.) as well as socially (related to social interaction both among people and between social collectivity and natural aspects). The memetics is thus needed in order to have the comprehensive view of these aspects. The effects of the existence of human culture are reflected in the way of acquisition of things surrounding her and the way she creates artifacts to support her life and existence.

Traditional culture related to the living systems as reflected from visual representation and appearances in aesthetic way is an interesting thing to start with. This visual aesthetics can be seen from the geometrical shapes and colorization employed as reflected in the cultural artifacts. Both can be seen as the smallest unit of information of the cultural aspects. We have presented the correlations between memeplexes that is transformed into distances has generated the phylomemetic tree, both among some samples from Indonesian textile handicrafts and batik, the

designs that have been living through generations with Javanese people, the largest ethnic group in Indonesian archipelago.

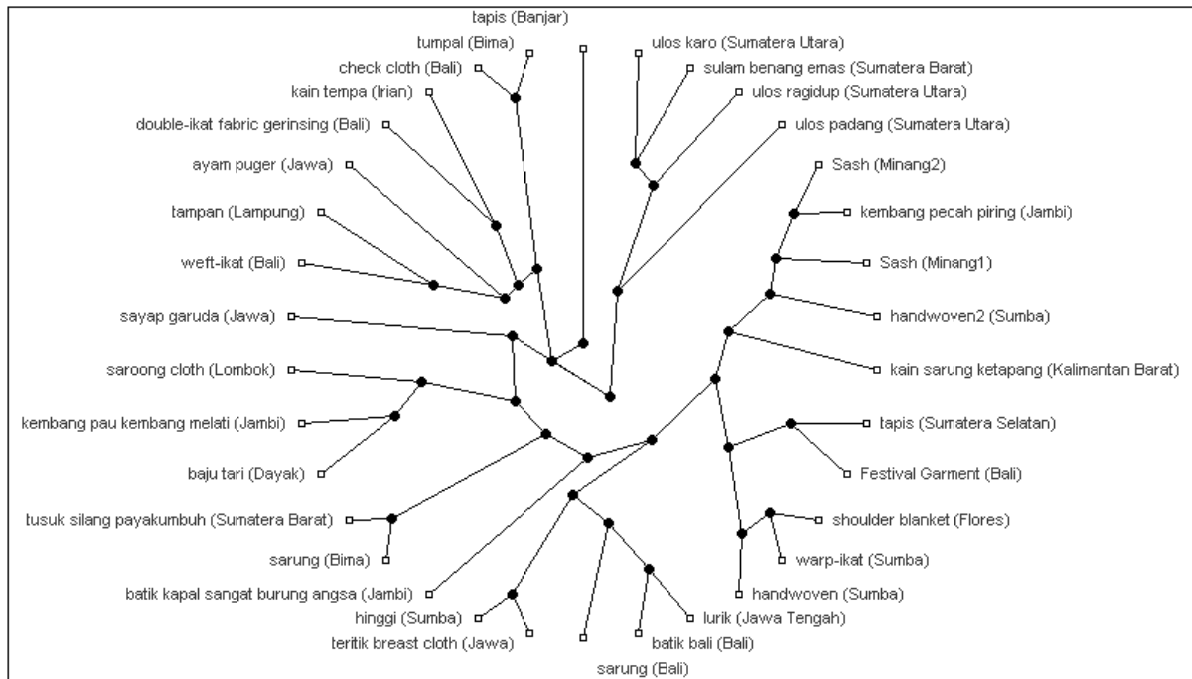


Figure 6
Radial representation of Indonesian ornamentations phylomemetic.

The similarities as well as diverse aspects of ornamentation as reflected in the artifacts has opened an ajar door for further both anthropological (or sociological discussions) and aesthetics of Indonesian people in general by incorporating the evolutionary terms of memetics. Further works on more data including the contemporary work of arts can be conjectured to see how the visual patterns could fit the meme of human social and cultural evolution.

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