

Analysis of Frieze Patterns Concepts in *Pua Kumbu*

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Abstract: A traditional practice of the Iban from Sarawak, *Pua Kumbu* is a form of textile which is famous for its beauty. There is a general appreciation of how it is exquisitely designed and patterned. It has been recognised by analytical studies that *Pua Kumbu* designs use transformational geometrical shapes in the frieze. This paper explores the geometry elements that have been portrayed in the form of different flora and fauna motifs. The examples of mathematical ideas in motifs produced by weavers in Sarawak have been analysed through this study. Although it is still in the form of preliminary observations, it has been revealed that the principles of geometry, such as enlargement, reflection, rotation, and translation are often used in the *Pua Kumbu* patterns. This woven art by the Ibans indirectly applies the principles of geometry in the form of beautiful and high-value motifs. This paper may benefit this field and the professionals related to it to act as a useful guide and also may serve as a point of reference for future studies on the unique patterns and designs of *Pua Kumbu*. The study also suggests that patterns based on geometry and symmetry exist in the ways *Pua Kumbu* is created.

Index Terms: *Pua Kumbu*, weaving, mathematical concepts, frieze patterns

1. Introduction

The objective of this paper is to explore the geometry elements that have been portrayed in the form of different flora and fauna motifs, commonly used in *Pua Kumbu* patterns. Besides that, this paper aims to explore the examples of mathematical ideas which exist in motifs produced by weavers in Sarawak. The way mathematics and culture are related can be expressed through ethnomathematics. A term referring to a particular sociocultural context, where it encompasses linguistic, symbolic, physical, and behavioural characteristics. It also refers to traits of jargon and codes, as well as value and belief systems.

Mathematics is used abundantly in the songket weaving process, but a weaver is not conscious of the principles of mathematics that underlie it [1]. In this study, the mathematical thought patterns of those engaged in the songket weaving process are discussed, while various fundamental concepts of mathematics are identified. These include the processes of transforming, measuring, and estimating, as well as the need for the end product to be accurate and equal. The findings are applied to *Pua Kumbu* as the outcome of an attractive, traditional Iban form of craftsmanship, in which mathematics is used in the *Pua Kumbu* weaving process.

1.1. Mathematics and Art

A common philosophical belief is that mathematics allows us to perceive the balance and attractiveness of our surroundings. It could be argued that there is a close connection between mathematical and artistic principles because symmetry is considered an ideal among mathematicians, although the concept itself is an approximation [2]. Embong expressed a similar view, outlining how a natural object like a human, an animal, a tree, a flower, or a leaf frequently displays symmetry [2]. In the artistic and natural context, it is possible to discover beauty through approximate symmetry, rather than in the clarity of symmetry [1].

1.3. Iban Motifs

The manner in which motifs are obtained for use in this Iban craft shows how intimate the connection is that these indigenous people have with the natural world of the Bornean forest. In the Iban culture, their way of life relies very much on nature to fulfil their needs. Therefore, in Iban motifs, the features and attributes in the design frequently adopt the natural forms on which their beliefs are based. In the Iban social culture, both import and purpose are attributed to certain plants, creatures, and other objects with symbolism. A fundamental subject can be identified in an Iban motif, which may contain a repertoire of items and images that are generally depicted simply as abstracts. Animals that are legendary or real yet anamorphic that are normally represented as dragons, hornbills, dogs, and roosters. The creature may also be an amphibian, a crustacean, or a reptile. The motifs may be floral or plant-based with wild ferns or flowers, celestial or cosmic with stars, moons, suns or clouds, or a supernatural being such as a giant, a ghost or an ancestor's picture. In Iban motifs, other key features by which to identify them are the swirls, spirals, and entities that often interlope or become entangled. Iban cloth-making and basket weaving also