The Ornaments of Shoowa Kuba: A digital re-interpretation of a textile art

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ABSTRACT
This paper will discuss how Shoowa Kuba textiles could be analyzed as an ornament that can be digitally constructed and applied in design. An historical outline of ornament is provided by briefly comparing Classical and Gothic ornaments. This theoretical framework is then compared to the art of Shoowa Kuba focusing on their textile embroideries. Various patterns and techniques will be introduced showing how Kuba people implement rules as well as how they break them. These patterns will be digitally reconstructed to show their applicability to the digital design domain.

KEYWORDS: Digital design research, textile patterns, ornaments, scripting.

1. The World of Ornament

Up until the 20th century, there was a constant desire for the use and transformation of ornament in art and architecture. In many historical architectural styles such as the Gothic and Renaissance, ornament has been central to design while its relation to structure has varied. In Classical architecture, this notion transformed the abstract lines of structure to smooth rounded forms of columns while adding complimentary organic figures to make it appear vital. This organic naturalism, through the usage of natural figures, is placed onto the mechanical and geometrical structure that is defined by the lines of support. In contrast, the Gothic forms of ornamentation there is no such superposition. Instead there is an *"amalgamation"* of both tendencies where the abstract configuration of ribs acquires an *"organic rhythm"* (Worringer, 1911/1957: 41). This effect is achieved through the variation and configuration of ribs that express the lines of structure. While ribs individually bundle and spread through the structure, their groupings create asymmetrical breaks and extension from the symmetrical plan schemes (Spuybroek, 2012:33).

This expressive and abstract character of ornament is exemplified by specific African tribal textile art where intricate and playful patterns emerge out from a woven scheme. The Shoowa Kuba embroideries which will be the main focus of discussion in this paper, will be analyzed in order to reveal their proximity to the behavior of Gothic ribs. In Shoowa Kuba art, the playful usage of simple geometric lines produce dramatic and surprising patterns that gives each cloth an aesthetic quality. Each motif is executed by the application of rules that can be programmed through scripting. The current knowledge and technology in digital design will enhance the understanding of how this process works. This method could take the complexity of ornament to the medium of design, so that the qualities and characteristics of these patterns would bring expression to the structure. The utility of a programmable machine for this procedure will be tested in this paper.

2. The Classic and Gothic Ornament

The classical notion of ornament is formed by two main components: organic natural elements and structural members that are in a juxtaposed configuration. While the composition and connection of the lines of

construction constitute to the body of the structure, organic ornament is later added on the mechanical form of the building, in order to embellish its structural frame (Spuybroek, 2012:44). The superposition of these systems brings all the aspects of natural beauty; along with symmetry, harmony and balance, to the overall composition of the structure.

The naturalism of classical ornament is dependent on the quality of imitation of figures taken directly from nature. For instance, acanthus leaves are extensively used on capitals to instill a notion of growth and blossom that makes them as natural and beautiful as possible. In the absence of these organic forms, the classical ornament results in the total inanimate matter called *"crystalline beauty"* (Worringer, 1908/1967:19). This lifeless organization of the structure requires general rules of geometry, proportions and symmetry that will constitute a regular and absolute beauty. Similar usage of ornaments could be found in the primitive art as well, where the figures produced by ancient tribes require geometrical usage of lines that constitute a similar static effect.

In Gothic ornament, it's hard to make a distinction between ornament and structure because of the structural behavior of the ribs that posit an in-between state. This amalgamation gives the Gothic an expression of vital behavior, as the ornament itself produces the structure that pleases the onlooker. Worringer defines this as *"vitalized geometry"* where the abstract lines of geometry acquire organic behavior and produce ornaments throughout the structure (Worringer, 1911/1957:41). In this case, the structure follows a generative nature; like a living organism, starting from the bottom of its foundation it grows all the way vertically. This living formation doesn't require the placement of these secondary elements as seen in classical ornament, instead the primary structure becomes the ornament itself.

In order to achieve an expressive notion of ornament, the Gothic system requires an agent that allows it to vary. This *"perpetual variety"* in the system is achieved by the thinnest elements of construction through the configuration of ribs (Ruskin, 1853: 32). The ribs that are being mentioned here are not forms borrowed from nature for their aesthetic pleasure. They are mechanical servants of the Gothic ornament that are in the form of spline curves. In addition, they do not provide imitations of figures from nature, they themselves exert abstracted forces of nature to produce various configurations in three dimensional space. This activity gives them vital behavior that conjugates the aspects of both empathic naturalism and abstract geometry as *"ornament acts like structure and structure acts like ornament"* (Spuybroek, 2012:44). In a Gothic cathedral the ribs sprout from the foundations of a column and start moving vertically, connecting with other parts of the structure through

splitting and intertwining. Their grouping constitutes to the vaults, whereas their splitting forms up the tracery. The ornament and variation is everywhere in Gothic architecture as every component is united and everything is in continuum.

Both classical and Gothic ornaments show different utility of labor. In classical construction the hand labor is used to produce exact copies of columns, capitals and details to achieve a perfect end product. In contrast the construction of a Gothic cathedral requires innovation due to the differences of each and every part of the ribbed structure. In some cases these unique pieces are not done properly or the stone carvers create further details which are not planned beforehand in the design process. Under these circumstances mistakes occur that are evidence of this adaptive labor. According to Ruskin this is one of the fundamental aspects of Gothic ornament, called *"savageness"* where the craftsmen learn through the progression of construction (Ruskin, 1853). In this case, this machine of human labor is bound to make improvisations that will cause mistakes during the process.

Fig. 1. The Kuba men preparing the raffia panel (left), The Kuba women weaving the appliqué (right).

3. The Art of Shoowa Kuba

There are many other abstract ornaments that exhibit similar behavior to Gothic. One of them can be found in the art *Shoowa Kuba* textiles that are created by the Kuba people of Congo since 17th century. The Kuba are involved in the creation of decorative patterns of which up to 200 different types can be found. These patterns can be found in architecture, basketry, carved objects, female body scarification and textiles. The art of Kuba is characterized by irregularity through patterns which show abundant variations that are improvised by embroiderers. This is a reflection of their pluralistic view of society that embrace individual identity, offbeat music, tribal dances and cultural heritage (Adams, 1989). Most of these embroideries are used for funeral events as well as special ceremonies that bring different clans together.

The Kuba cloths, woven from the fiber of the *Raphia Vinifera Palm* follow a multi stage process involving the participation of children, men and women of the same

clan. The basic woven cloth units measure approximately 26" x 28", which is defined by the natural length of the raffia fibers, are done by the Kuba men. The Shoowa women subsequently embroider the patterns onto the blank cloth by inserting short treads through the fabric (Fig.1). The process of making these textiles involves weaving, dyeing, embellishing, appliqué and patchwork (Svenson, 1986). When different pieces of embroidery with both irregular and ordered motifs are joined together they produce visually pleasing effects.

The Kuba patterns can be classified in three different categories: crossing, loop and woot patterns; each of which follows certain geometrical rules (Meurant, 1986). Most of the motifs are organized through outlines that are drawn on the raffia cloths before the appliqué. The motifs are created using offsets and overlaps that follow these outlines. In crossing patterns the figures emerge out of a dual diagonal grid running along the cloth. These patterns have mostly diamond or rectangular shapes that are offset from the diagonal axis. The loop and woot patterns follow zigzagging outlines that run along one direction on the cloth. In this case, the patterns emerge by extensions and offsets of the guidelines that dissolve in the pattern (Fig.2).

In many examples the deformation of these patterns is evident, as the system propagates by a change in the motif or the guideline. This transformation is also present within the patchworks done by joining different cloths together by cuts (Fig. 2). Since these raffia cloths are small in size, they are joined together in patchworks in order to achieve larger pieces to be wrapped around the body. In this case, the unification of different patterns involve sudden shifts. This technique not only provides the creation of patchwork patterns but also enables the embroiderer to make improvisations during the process of appliqué. Some unfinished samples reveal that the women work out the patterns not through samples or sketches but within their minds (Adams, 1978). In both cases these shifts appear as "mistakes" that give a vibrant effect to the overall pattern.

Although these patterns feature abstract usage of line

geometry, their overall implementation is somehow different than primitive tribal ornaments. The irregularity within the lines of construction generate pleasing effects in the outcome despite the lack of natural abstraction. Patterns of different motifs emerge out of these lines as their overall effect produces depth within the system. As a result, it is not possible to define Shoowa Kuba as an anti-vital primitive art. In direct contradiction it needs to be understood through Worringer's analysis of Gothic ornament where we see the perfect amalgamation of the structure and the ornament being the source of life through the concept of "*vitalized geometry*" (Spuybroek, 2012:195). In the case of Shoowa Kuba, the usage of such geometrical rules gives the ornament such quality, rendering it structurally intact as well as expressive and visually pleasing.

4.Digital Machines:

Kuba patterns follow geometrical rules and constraints that produce variations and breaks in the overall system. By breaking down these rule-sets it is possible to program an abstract tool to generate these patterns digitally. A similar approach could be found in cellular automaton studies done by Stephen Wolfram. By implementing certain rules on cellular level interactions, these programmable machines provide generative patterns on a larger scale (Wolfram, 2002:171). In Shoowa Kuba patterns a similar rule based system is evident that produce asymmetrical and harmonious deformation of motifs out of zigzag outlines. By applying certain procedures, it is possible to program an abstract machine that will take the complexity of ornament to the medium of design, so that the qualities and characteristics of these patterns would bring expression to the structure of patterns.

The analysis and research on the patterns of Shoowa-Kuba cloths define the characteristics of different motifs and techniques that create amazing variations within patterns. Unfinished embroideries show proof of the underlining outlines of the patterns that make it possible to decode the system of different motifs (Fig. 2). This idea is carried forward through the analysis of
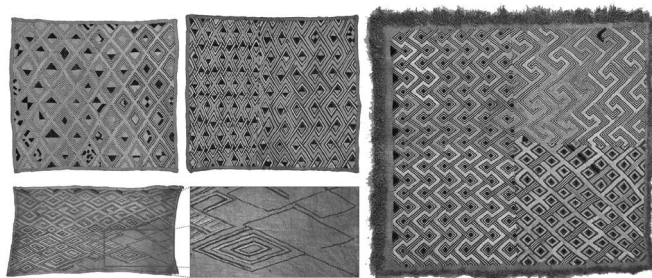
Fig.2 Various Kuba patterns, crossing pattern (top-left), loop pattern (top-middle), patchwork pattern showing cuts (right), unfinished cloth showing the details of the outlines (bottom-left).
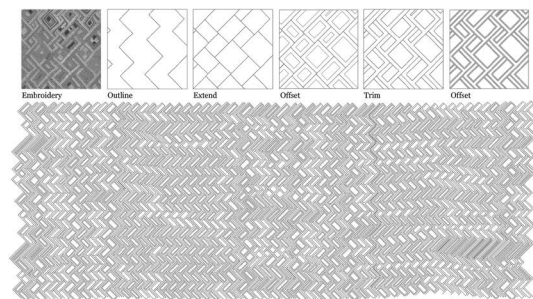

Fig. 3. The breakdown of Ekwakwa Ingala motif (top), The carpet matrix of the motif (below).

three different motifs to define the certain rule-sets behind the making of them. The decoding of these motifs involves a multi-stage process that starts from finding the outlines of each pattern and defining different set of rules that create the final pattern (Fig. 3). The images of the patterns are taken to the medium of Rhinoceros (CAD) where the lines of the motifs are traced over. By disregarding the deformation of the textile, the regularity of zigzag outlines is set to a perpendicular angle. Depending on the motif and its configuration between the outlines, the corners of the zigzag have been used to define the motifs. In many stages various operations like offsets, extension and trims are used to construct the geometry of the motifs. These rules are implemented to the medium of scripting to define the necessary rule-sets to generate these patterns digitally.

The formation of the outlines in Shoowa Kuba patterns is central to control the amount of variation and pattern generation. In Grasshopper, a script is written with parameters to control the behavior of the zigzagging outlines. By using randomized values, different offsets and zigzags could be generated to provide a gradual transformation of outlines for further pattern construction. For each motif a separate code is used to operate on these zigzagging outlines. For instance, to generate the Ekwakwa Ingala motif the script uses the corner points of the zigzags that are grouped under two rows for the alternative placement of motifs (Fig.3 & 5). Diagonal vectors operate on these point groups according to the offset value for the extensions. These vectors create the extensions and the loops of the motif starting from the corners of the zigzags. Each enclosed motif defines an area that can be filled with a required number of offsets. The average motif size is used as the segregator to define four different size groups on which different numbers of offsets are applied. The application of the script to the array of zigzags enables the creation of infinite number of carpet matrixes that show the gradual variation and vibrant effects of these patterns (Fig.3).

The generated digital carpets are later combined by cuts to create a patchwork study (Fig. 4). In Shoowa Kuba pattern cuts follow horizontal or vertical lines that combine rectangular patches together. The resulting patchworks show the mistakes that create discontinuity of motifs. However this operation doesn't disturb the overall quality and progression of the system as certain figures have corresponding geometries. Compared to the Gothic ornament, the Kuba patterns display a similar utility of hand labor that is highly improvisational and embracing the mistakes. These imperfections have no delimiting effect on either the visual outcome or the abstract beauty of the system. On the contrary, this technique provides an ultimate technique where the programmer can create intentional operations on the cloths that produce unexpected results.

5.Conclusion:

In this paper, I presented Shoowa Kuba patterns that provide an interesting case study for digital design research. In the historical debate of ornament, the Kuba textiles show qualities akin to Gothic ornament that involve figure variation and improvisational hand labor. These aspects are shown through the analysis of main pattern types and their reconstruction using scripting tools. This process is carried forward first by extracting the necessary geometrical rules of the patterns from embroideries and then implementing them in Grasshopper to construct digital carpets. These pattern matrices are combined by cuts to produce a patchwork carpet to show the applicability of the system in design. In order to apply this body of research to architecture, these patterns could be generated three dimensionally (Fig. 5). In this case digital tools can be used to transform these ornamental patterns into wrinkled façades. By applying color and thicknesses these ornaments can produce interesting effects that could be further investigated in architectural design.

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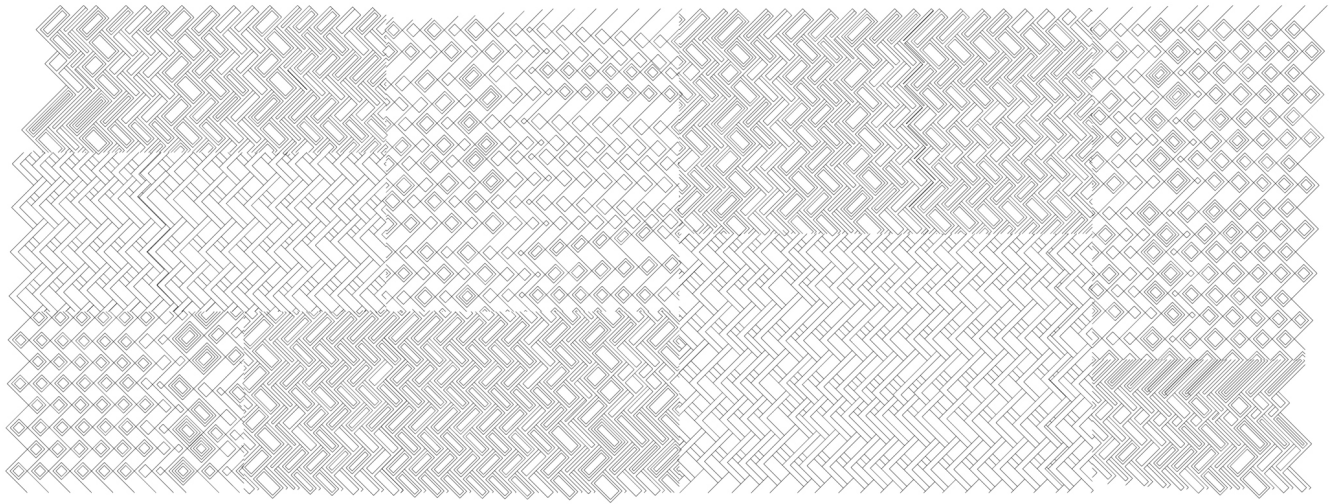Worringer, W. 1911/1957. *Form In Gothic*. London,United Kingdom:Alec Tiranti.

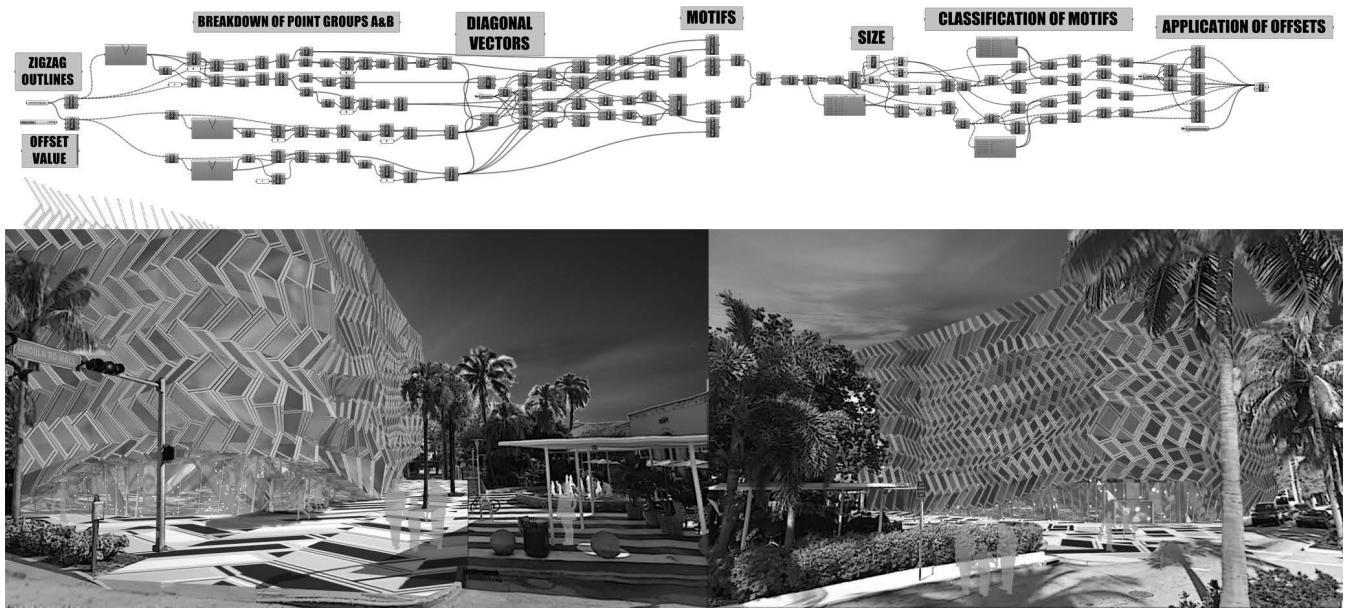Fig. 4. The patchwork pattern made up of three different patterns.

Fig. 5. The Grasshopper definition for "Ekwakwa Ingala" motif (top), Renderings of a façades with Kuba patterns (below).