

**THE ORNAMENTS OF SHOOWA KUBA:
A DIGITAL RE-INTERPRETATION OF A TEXTILE ART**



A Dissertation
Presented to
The Academic Faculty

by

Sabri Gokmen

In Partial Fulfillment
of the Requirements for the Degree
Master of Science in the
School of Architecture / College of Design

Georgia Institute of Technology
December 2010

COPYRIGHT © 2010 BY SABRI GOKMEN

**THE ORNAMENTS OF SHOOWA KUBA:
A DIGITAL RE-INTERPRETATION OF A TEXTILE ART**



Approved by:

Prof. Lars Spuybroek, Advisor
School of Architecture
Georgia Institute of Technology

Date Approved: December, 10, 2010

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

Sabri Gokmen

Abstract:

This paper will discuss how the African tribal art of *Shoowa Kuba* could be analyzed as a textile ornament in order to be digitally re-constructed and applied in architecture. The topic is going to be constructed among the arguments of ornament, craft and digital tools.

The introduction of the paper will feature the ideas of Wilhelm Worringer on ornament and how it relates to the current problems in aesthetics in architecture. Although his theories were based on “Gothic”, the main focus will be on the art of *Shoowa Kuba* - an African tribal textile ornament - in order to define where it stands within his notion of aesthetics. The text will proceed with how these intricate patterns could be digitally re-interpreted through the ideas of John Ruskin (1853).

The historical analysis will be extended from Worringer’s *Abstraction and Empathy* (1908), through the comparison of his ideas on ornament. Greek and Gothic ornaments are discussed featuring the ideas of Theodor Lipps and Alois Riegl in order to establish a strong basis for the argument. The comparison of the organic and crystalline ornaments will be developed along with Ruskin’s concept of “variation”.

As a result of this comparison, the paper will introduce the African textile ornament - *Shoowa Kuba Embroideries* - through classifications and characteristic techniques. This part will not only introduce the art of *Kuba* extensively, but also discuss where their notion of pattern fits in the argument of “ornament”. Ruskin’s ideas on “imperfection” are going to be discussed including examples to clarify their role in the patterns and their contribution to the overall composition of the ornament.

The final chapter will be a practical study into the possible use of *Shoowa Kuba* ornaments in architecture. The technical attributions of these ornaments will be re-interpreted in the digital medium over the concepts of scripting and programming. Here, the paper will discuss whether a machine that can create or produce imperfection, and how these can be scripted in a way they might be used for ornamental patterning in architecture.

Introduction

The will for artistic creation in art has been present since the first primitive man started decorating his surroundings to fulfill his urge to live. He believed that his imitation of a greater divine power in the search of his enjoyment, would give him the ultimate satisfaction through his life. This “urge” led him to the emergence of many different ways to show this appreciation of art; that appeared on the walls of pyramids, on textile arts of savage tribes, on the pillars of the Greek Temples, and last but not least on the Gothic columns. What started with the first primitive man’s impulse to draw those first lines of his expression, had eventually given birth to the ultimate creation of art: ornament.

Until the 20th century there has been a constant transformation of the ornament in its use in art and architecture. In many historical architectural styles such as the Gothic and Renaissance, ornament has been the origin of development on which these tendencies proceeded. This fundamental element not only organized the structural elements of a building but also made them appear “beautiful” to the eyes of the onlookers as well as the artist that created them. These people were first and foremost occupied with showing their appreciation of life in their work. This came to be realized through their interpretation of ornament in many cases such as on the structural columns of an ancient Greek temple or in the vault configurations of Gothic architecture. In many different movements we see different utilizations of structure and the ornament. In Classical architecture, this notion not only transforms the abstract lines of structure with smooth rounded forms of columns, but also adds organic figures to the structure to make them appear as “vital” as the nature where they have been copied from. This superposition of two systems defines the main characteristics of the Classical ornament. In this case the organic naturalism, through the usage of organic figures in the ornaments, is placed onto the mechanical and geometrical structure; which is defined by the lines of support that carry the structure.

In Gothic Ornament we don’t observe such a superposition of structure and ornament. On the contrary, there is an amalgamation of both where the structure acquires the organic aspects of nature and tends to have a ‘vital’ notion of its own. The expressive character of Gothic marks the ultimate utilization of ornament in the historical development of art and architecture. Worringer, who is considered an important art historian of the past century by colleagues such as Herbert Read or Rudolph Arnheim defines this unification as “vitalized geometry”. From his perspective he explains the phenomena in the following way:

Our organically tempered sense of vitality recoils before this senseless rage of expression as from a debauch. When, however, finally yielding to compulsion, its energies flood these lifeless lines, it feels itself carried away in a strange and wonderful manner and raised to an ecstasy of movement, far outstripping any possibilities of organic movement. The pathos of movement which lies in this vitalized geometry- a prelude to the vitalized mathematics of Gothic architecture- forces our sensibility to an effort unnatural to it. (Worringer, 1911/1957: 42)

In Gothic, we see the abstract lines of structure become animated in order to fulfill our urge for a, what Worringer calls, empathic form of aesthetics. Nevertheless, Worringer uses his analysis of Classical ornament to understand the formation of the Gothic, which denotes the emergent nature of this ornament. In this case, ornament becomes the structure of the system, in constant motion, as the building rises from its foundation to the vaults that are carried by the pointed arches. This notion is configured by ribs that express the lines of structure as they articulate the columns. However, this configuration is different from the Classical ornament as there is no imitation of a natural figure like leaves or flowers but an extraction of abstract structural relationships that constitute the ribs. This makes the primary element of Gothic ornament 'vital' in its behavior as it not only follows the lines of support through geometry, but also its wide variety of deformations that make it spread continuously over the structure expressing the nature of growth. The analysis of Gothic, brings the amalgamation of different systems as ornament becomes both the origin of the expression and the structure of the system.

At this point we can start thinking whether there are any other ornaments that we can find, with such qualities within the same argument. This brings our attention, among many other ornaments, to specific African tribal textile art. Here we see intricate and playful patterns emerging out from a woven scheme. The Shoowa Kuba embroideries which will be the main focus of our discussion in this paper, will be analyzed in order to reveal its proximity to Worringer's description of Gothic ornament.

In Shoowa Kuba art, we are confronted with the playful usage of simple geometric lines, out of which dramatic and surprising patterns emerge that gives each cloth their artistic quality, thus defining them as another yet valuable form of decoration that requires our attention. The aesthetic quality of these patterns follows the same aspects of "vitalized geometry" which are based on the abstract usage of geometric interplay of lines. These lines proliferate from zigzagging or diagonal outlines that lay out the structure of the pattern. By application of different rule-sets such as offsetting and extending, the motifs emerge out of these initial guidelines to compose the overall pattern. This continuous system of lines produces effects that appear visually pleasing and give the patterns an expressive behavior in the final product.

Kuba people use the art of weaving in order to imply these set of rules to the raffia cloth where we see the motifs gradually changing as they follow the outlines. Since such behavior is controlled by the geometry of the lines, the motifs attain an emergent nature through the application of their own rule-sets. This causes a "variation" in the system which is one of the fundamental notions of ornament, as each motif is deformed to constitute to this overall behavior. The art of Shoowa Kuba consists of not only the variation of the motifs but also the assembly of them in patchwork patterns. In patchwork embroideries, different patterns are joined together through joints or cuts where motifs and lines are abruptly separated in order to create a sudden shift in the pattern. This shift causes irregularities in the overall patchwork pattern as the discontinuity of the lines becomes evident at the lines of the cuts. What is interesting in these embroideries is that these imperfections or quasi "mistakes" do not destroy the unison of the patterns in the final product. Instead, they appear both as planned and improvised operations that keep the system continuous.

The rules in Shoowa Kuba patterns control the generative nature of the motifs using geometry of lines which reveal the techniques that are being used in order to understand the “machine” behind the creation. The art of Kuba not only consists of following these set of rules, but as well as making “mistakes”- intentionally - in order to enable certain shifts within the system to achieve its complexity. The rules that are used on the pure geometry of lines make it possible to breakdown the logic behind the making of this textile art. This requires a reverse engineering procedure where these rule sets are extracted from each pattern until the initial outlines are defined. By determining these rules and procedures such motifs could be computed by setting up an abstract ‘machine’ which can generate these patterns on a different medium. The construction of such a device involves the notion of programming and scripting which requires the application of the extracted rule-sets to the initial geometries of outlines that are derived. Such a study will contribute immensely to validate our argument as the expressive behavior of this ornament could be tested in order to reveal its association to the “vitalized geometry” of the Gothic ornament.

There is an astonishing connection between the fundamental principles of Shoowa Kuba and the Gothic ornament as we see both systems contain ‘variation’ and ‘mistakes’ in their configuration. In Kuba cloths, these effects are achieved by the articulated zigzag or diagonal lines and the harmonious overlay of motifs in between them. However, in Gothic such notion is achieved by rib-configuration that makes the columns into ‘compound piers’ and weaves into the netted vaults in continuous motion. This configuration has been explicitly defined by John Ruskin in *The Nature of Gothic* in the first two sections on savageness and changefulness. In the section on savageness, he discusses the idea of making mistakes where craftsmen are encouraged to make improvisations for each local formation of ornament. As these adaptations follow the emergent nature of the ribs, their ‘mistakes’ dissolve in the overall appearance of the ornament. In changefulness, he introduces the idea of “perpetual variety”; where the rigidity of the figure or motif is broken to achieve infinite number of deformations that enables the rib formations to adapt to every possible form. (Ruskin, 1853: 32) Both aspects are inseparable elements of the Gothic architecture as well as Shoowa Kuba embroideries as their implication make the ornament ‘vital’ in behavior.

Through the analysis of these techniques in Shoowa Kuba embroideries, we will understand how an abstract “machine” can operate on such set of rules as well as break them. As the rules of the system start to unravel, we will be able to reconstruct these patterns in our medium; that will give us in our turn the potential of creating Shoowa Kuba ornament. Although our digital machines can provide us with the potential to create variations on these playful patterns, is it possible to simulate the handmade craft of Shoowa Kuba digitally? Our main focus in this case will be the “mistakes” that play a sophisticated role in the patchwork patterns where the embroiderer makes local decisions to make sudden shifts in the system. These shifts appear when two different patterns are joined together using a “cut” that creates an instant change of motif while keeping certain lines of the system flowing. This technique makes the “mistakes” eminent; however, they do not appear as random interventions of the embroiderer. On the contrary, these are moments when a system shifts to another set of motifs to provide

continuity in the ornament. As digital machines are able to generate these motifs through scripting; these shifts could be produced within patchwork patterns. Thus, a programmed abstract machine can create ‘mistakes’ as it follows the rule sets that generates these patterns with such notion.

The Organic and the Crystalline

Throughout the history, men sought for a divine connection between his creations and the things that surrounded him. His volition became his pursuit, as he started to search for a meaning in his own invention; a reason for his enjoyment akin to the nature of the world that he lived in. He tried to express these forces surrounding him into his artistic will; as he implemented these ideas to the emergence of a “vitalist” behavior which has been dominant in art and architecture till the early 20th century. As a result of this tendency, we find the art historians studying ancient styles in order to understand this progression of expressionism in art and architecture. One of those historians was Wilhelm Worringer in the early 20th century. In his book *Abstraction and Empathy*, he compares the different types of ornaments in ancient cultures in order to clarify this expressive behavior that evolved through time which constituted to the Gothic ornament. His research begins with the analysis of the Classical ornament via two predecessor art historians – Alois Riegl and Theodor Lipps – to establish a profound basis for his arguments to understand the Gothic. Through the analysis of aesthetics in Classical ornament, we find an abstraction of nature in an expressionist way, to empathize to the organic beauty of life, which is supported by the ideas of Theodor Lipps. On the other side, we find Riegl, believing in the absolute beauty through the abstraction of geometric rules that creates a “will to form” (Worringer, 1908). Although both these historians are “vitalists” in accordance to their ideas in aesthetics, we encounter a polar definition of aesthetics in Worringer’s analysis which we will be investigating.

Before we start comparing the duality of these aesthetic systems, it is necessary to state that Classical notion of ornament is heavily based on the fundamental aspects of Leon Battista Alberti. In his book *De Re Aedificatoria*, he suggests that the artists should look for beauty in their artistic creations through the study of nature, thus, imitating it to achieve the aesthetic quality through the harmony and balance of the parts within the whole. He defines the ornament as:

Ornament may be defined as a form of auxiliary light and complement to beauty. From this it follow, I believe, that beauty is some inherent property, to be found suffused all through the body of that which may be called beautiful; whereas ornament, rather than being inherent, has the character of something attached or additional. (Alberti, 1435/1988: 156)

Alberti’s definitions of body and ornament follow his principles of *concinnitas* and *varietas* which correspond to the organization and construction of his structures of beauty. In Classical ornament, the principle *concinnitas* depends on three aspects: Number, Outline and Position. These terms control the composition and connection of

the lines of construction that constitute to the body of the structure. This fundamental rule of nature defines the form of sympathy that appears “beautiful” through the harmony of the parts within a whole. On the other hand, in *varietas* we find a differentiation of parts that are used in the whole. This catalogue of figures that are influenced by the forms of nature, are applied or quite literally “stuck on” the mechanical form of the building, in order to embellish its structural frame. Through Alberti, we find the fundamental aspects of the Classical ornament. The structure and ornament controlled by *concinnitas* and *varietas* define the addition of figures originating in nature to the schematics of construction. The superposition of these terms brings all the aspects of natural beauty; along with harmony and balance, to the overall composition of the structure.

This influence is also eminent in Worringer’s analysis of the Classical ornament, as he introduces the ideas of Lipps. He defines that the organic structure of an ornament is also the source for our inner self-activation, our urge to “empathy”, in which we use the forms of nature to create this “vital” feeling to find aesthetic quality within a work of art (Worringer, 1908). This “vital” behavior is the key to understand why we choose our ornaments from nature, as we extract certain rules and implement these to imitate the natural forces in a mechanical way. Worringer explains this in the following way:

All the elements of organic structure there are: regularity arrangement round a centre, balance between centrifugal and centripetal forces (i.e. circular curvature), equilibrium between carrying and burdening factors, proportionality of relationships, and all the rest of the wonders that strike us when we examine closely the organism of a plant - they it is which now make up the content and the living value of the ornamental work of art; and only a later epoch approximates this ornamental style, which has almost as little to do with natural model in principle as the geometric style, to naturalism. The process therefore consists in the subsequent naturalization of a pure ornament, i.e. an abstract form, and not in the subsequent stylization of a natural object. (Worringer, 1908/1967: 60)

In the case of organic behavior in aesthetics, the main objective is not to abstract a natural ornament; on the contrary the aim is to utilize the laws of nature which bring harmony and balance to the design for the sake of making the ornament appear as



Figure 1 - The Corinthian Capitals of Pantheon

natural as possible. This “naturalism” is a fundamental notion in Classical ornament; as we see the forms of nature along with their rules of organization and construction being applied to the bare structure of columns and lintels for aesthetic purpose. These forms follow the natural forces which are the sources behind the aesthetic quality of the natural object. Their implementation to the artistic medium brings the same “vital” notion to the ornament. If we take the capitals for instance, we observe the natural figures of acanthus and leaves being organized all around the circular form. The implementation of growth and blossom are present as we see the leaves flourishing away from the column as lines of growth organize the natural ornament of pleasure. (Fig. 1)

In absence of such elements, the Classical structure would appear solely dependent on its mechanical purpose of creating enclosure, which follows the simple rules of geometry and materiality, yielding to the opposing pole of aesthetic abstraction. In this case, the rules of organization are not extracted from the forms of nature but from simple rules of geometry that enable the composition of the work of art. This “will to form” requires the total abstraction of the natural forces. This abstraction tries to create a balance between purpose and the aesthetic quality of the outcome. Every structural element is a part of this network where they constitute to a pure, balanced and geometrically perfect entity where basic rules of geometry and symmetry were used for the organization of the structure. When we take a Greek temple into consideration, this structural notion rests on its components, which are columns, architrave, pediment and capitals. Although these primary elements can be in any given shape to satisfy the requirements of the structure, their abstract geometries are articulated in order to make them appear as ‘beautiful’ as possible. On the other hand, such articulation still enables these elements to be functional, making them the lines of support as they carry the loads of the structure. The lack of presence of natural forms within the system makes it primarily dependent on its abstract formation, namely “pure” geometry which defines the second pole of the aesthetic argument. Worringer explains this phenomenon as follows:

The simple line and its development in purely geometrical regularity was bound to offer the greatest possibility of happiness to the man disquieted by the obscurity and entanglement of phenomena. For here the last trace of connection with, and dependence on, life has been effaced, here the absolute form, the purest necessity, while everywhere else the caprice of the organic prevails. (Worringer, 1908/1967: 20)

The absence of the organic form in Classical ornament results in the total inanimate matter; which Riegl calls as “crystalline beauty” (Worringer, 1908/1967: 19). In Classical ornament, the notion of construction is distinguished from all laws of nature (organic), as the structure follows the abstract rules of geometry and materiality. This ‘lifeless’ organization of the structure requires general rules of geometry and symmetry that will constitute to a regular and absolute “beauty”. Worringer finds a similar notion in the ‘primitive art’ as well; where the ornaments produced by ancient tribes require geometrical usage of lines that constitute to these pure flat entities that are considered not to have any vitality. As these ornaments are not formed by the forms or forces of nature, their formation depends solely on their geometric structure. Such usage of lines, figures and motifs with rules of geometry is similar to the structural genesis of the

Classical ornament; making its configuration as 'crystalline' as the pure columns of the Classic.

So far we have described the counter poles that form up the Classical ornament; on the one side structural abstraction, and on the other organic naturalism. This duality of understanding brings a division within the same "urge" to define the works of art. Although these tendencies could be found in other forms of art, in Classical ornament there is a superposition of them; as the organic ornaments are placed on to the inanimate configuration of the structure. This collaboration enables two different systems to work together as forms of nature, embellishing the pure form of the structure to make it visually pleasing. The reason why Worringer analyses these ideas is to understand the problem in Gothic through the analogy of such notions. However, in Gothic, it's hard to make a distinction between ornament and structure. Instead, we see a hybridization of these two tendencies where the abstract lines of construction start to gain an expression of its own. As Worringer defines this unison:

This is not a case of the harmonious interpenetration of two opposite tendencies, but of an impure, and to a certain extent uncanny, amalgamation of them, a requisition of our capacity for empathy(which is bound up with organic rhythm) for an abstract world which is alien to it. (Worringer, 1911/1957: 41)

This amalgamation makes the Gothic the ultimate expression of vital behavior, as the ornament itself gains this "will to form" that gives itself this expressive character. Worringer defines this as "vitalized geometry" where Gothic ornament takes the abstract lines of the pure geometry and gives them the vital and organic character of the Classical



Figure 2 - The Interior of Amiens Cathedral

ornament. In Classical, we don't see such behavior in neither structure nor the ornament as they are completely two different notions of two totally different scale levels. The consolidation of both systems however, gives Gothic ornament not only a mechanical structure through the usage of lines that support the building, but also an organic behavior that makes it "vital". In this case, the structure follows a generative nature; like a living organism, starting from the bottom of its foundation grows all the way vertically. This living formation doesn't require the placement of these secondary elements as we see in Classical ornament, instead the primary structure becomes the ornament itself, by actions as various as bending, bundling, interlacing and weaving. These primary elements are the 'ribs' in this case. Rising along the walls of a Gothic Cathedral, they not only organize the structural entity of the system but also obtain a notion of life and growth. (Fig. 2)

The ribs that are being mentioned here are not forms borrowed from nature for their aesthetic pleasure. On the contrary, they are fundamental mechanical servants of the Gothic ornament that are abstract in nature. This mechanical tendency is similar to what we have found in the first notion of Classical ornament we discussed earlier. Although we don't see actual imitations of figures from nature, the movement of these ribs; which act like actual living organisms that constitute the structural form in Gothic ornament. Since these tendrils are the lines of support, their behavior is somehow related to geometrical aspects as well. This complex, versatile and 'living' element of design is the origin of this amalgamation that we are addressing to, namely the Gothic tendency towards both abstraction and empathy. The ribs are abstracted forces of nature rising along with the building; bundling, intertwining, splitting and twisting. Their whole configuration is in three-dimensional space, exploiting their use of geometrical line completely different than what we have experienced through Riegl's notion of abstraction. In addition, despite the lack of natural imitation, their formation appears 'vital' in behavior. Within these ribs we won't find roses, leaves or any other natural forms. It's the emergent use of these structural ribs and ribs only - that conjugates the aspects of both empathic naturalism and abstract geometry. The system of ribs happens to join both tendencies of expression within itself in the Gothic; thus taking its expression to a higher level. As Worringer defines this expression;

In short, the Northern line does not get its life from any impress which we willingly give it, but appears to have an expression of its own, which is stronger than our life. (Worringer, 1911/1957: 41)

So how does a simple element like a rib happen to behave in such manner, maintaining both aspects of structuralism and vitalism? In order to understand such behavior we have to take a close look at the basic component of Gothic - the rib - figure from a different perspective. What enables the ribs to act like flexible stalks that adapt itself to any formation, is their potential articulation through deformation of their initial motifs. The movement and flexibility of a rib starts along a column and propagates through the web vault could only be achieved by forcing the figure to bend or deform. The genesis of such pliability involves the rib to acquire an adaptive notion where they can follow the forces in the structure. Although the ornament itself is deformed in this case, its original notion doesn't vanish, as it maintains the continuity and regularity of the system.

In Gothic ornament, in order to achieve the expressive notion of the structure, the system requires an agent that allows itself to vary. Such figures have to be articulated without losing their ornamental characteristics. This “variation” in the system leads us to the fundamental notion of the Gothic ornament where we see the elements of construction attaining such behavior through the configuration of ribs. This notion had been explicitly defined by John Ruskin, as he explains this “perpetual variety” in Gothic architecture.

[...] they were capable of perpetual novelty. The pointed arch was not merely a bold variation from the round, but it admitted of millions of variations in itself, for the proportions of a pointed arch are changeable to infinity, while a circular arch is always the same. The grouped shaft was not merely a bold variation from the single one, but it admitted of millions of variations in its grouping and in the proportions resultant from its grouping. The introduction of tracery was not only a startling change in the treatment of window lights, but admitted endless changes in the interlacement of the tracery bars themselves. (Ruskin, 1853: 32)

In Ruskin’s analysis the example of the *arch* in Gothic and Classic architecture marks the differentiation of ornaments. In Classic structure the vaults follow the line of a perfect circle limiting its variation to only scaling. In Gothic, on the other hand, this circle is split by a simple point that could be stretched to unlimited dimensions allowing the pointed arch to not only acquire an adaptive form locally, but also demonstrate the potential of the geometry as it can generate unlimited solutions within the structure. The perfect circular arch becomes a curve in this case, allowing the ornament to bend and follow the forces of structure through its geometry. These curves configure the ribs of the structure that allow Gothic to develop such wide variety of spatial structures.

Since the Classical ornament is not continuous in behavior, its components appear in a repetitive gesture, and their variation only tends to happen through proportional scaling as they are superposed to carry the loads of the structure. Such configuration doesn’t fit Ruskin’s definition of “variation” as Alberti defines this as multiplication without providing much differentiation of the same parts within the whole. In the Gothic however, the continuity creates a smart agent that can adapt itself to any circumstance by deforming itself. The ribs follow the abstract lines of force and the structure relies on their configuration as other elements emerge from certain operations applied to them. In a Gothic cathedral we see 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. In the medium of design we are not obliged to pick different structural elements with various sizes from a catalogue, on the contrary, we use ribs to solve the structure at any given interval. Since this element requires continuity for load distribution the system gains such variability. The ornament and variation is everywhere in Gothic architecture as every component is united and everything is in continua.

This expressive structural notion is the fundamental for Gothic ornament. It not only makes the whole structure resonate together with continuity of such elements, but also

the nature of 'growth' through the rib configuration makes it a 'vital' system. This hybridization of systems that is provided by Worringer's analysis, marks the end of the development of the ornament in the timeline. The art of Gothic happens at the point where we see the abstract lines becoming animated in order to fulfill our urge for aesthetics. The origin of this expression lies in the notion of "variation" defined by Ruskin, as we find the rib figures being deformed throughout the structure. Such pliability articulates other elements of the design as well, such as tracery and the webbed vaults in order to create continuity and unity. In our research through this paper we will be investigating a similar notion in another form of ornament akin to what we experience in the Gothic. Thus, it is essential to use these profound acknowledgements for the foundation of our argument, in order to understand the art of Shoowa Kuba.

The Case of the Shoowa-Kuba

What we have stated so far is a summarized notion of ornament in art and architecture which gives way to the emergence of the Gothic, where we see the ornament becoming the origin of the expression and the structure of a system. At this point we can start thinking whether there are any other ornaments that we can find, with comparable qualities. This brings our attention, among many other pattern types, to a specific African tribal textile art; where we see intricate and playful patterns emerging out from a woven configuration. The Shoowa Kuba embroideries will be the main focus of our discussion in this paper and will be analyzed in accordance with Worringer's 'vitalized geometry'.

The *Shoowa Kuba* textiles are created by the Kuba people of Congo, who have formed up a multi-ethnic kingdom since the 17th century in Zaire in central Africa. The Kuba are involved in the creation of decorative patterns of which up to 200 different types can be found, having been passed through generations that can be found in architecture, basketry, carved objects, female body scarification and textiles. Since they were one of the last to become subject to the western influence they were able to keep their art and craft sacred and unique for a long period of time. Our focus in this paper is the embroidered and appliqué raffia textiles that are produced by the Kuba. These sophisticated 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 on to the blank cloth by inserting short treads through the fabric (Fig.3-4). The whole family is involved in the process as different pieces are later combined together to be used in ceremonial events as well as trading. The process of making these textiles involves weaving, dyeing, embellishing, appliqué and patchwork. Different pieces of embroidery are joined together to form unique pieces that demonstrate these dramatic patterns while both irregular and ordered motifs come together to render them as visually pleasing and full of surprises. (Svenson, 1986)



Figure 3 - The Kuba men preparing a raffia panel

Figure 4 - The Kuba women weaving raffia panels

Although there are not many resources on how the innovative people of Kuba can derive certain complex patterns using simple geometric rules, one artist provides valuable information. George Meurant's book called *African Textiles from the Kingdom of Kuba* provides a rich source of information about the origin of these textiles along with explanations and drawings by the author that help us reveal the secrets of this tribal art. In his book, Meurant classifies the Kuba art in three different categories, each of which follows geometrical usage of lines: Crossing, Loop and Woot patterns (Meurant, 1986). Most of the motifs that are shown in the book are organized through the lines that are drawn on the raffia cloths, in order to help the embroiderer to control the outline of the ornament. Through the usage of these lines we see certain operations that create motifs using offsets and overlaps. Certain rules are kept effective whereas others are broken during the making of these raffia cloths. These rules constitute to various effects where the order is broken by irregularity; as the geometry is asymmetrically balanced and the motifs become fluid in the overall layout of the cloths. In Shoowa Kuba art, we are confronted with the playful usage of simple geometric lines, out of which dramatic and surprising patterns emerge that gives each textile their artistic quality; thus defining them as another yet valuable ornament that needs our attention.



Figure 3 - Some examples of the "Crossing" patterns

The three groups of patterns in Shoowa Kuba are derived from different configurations of the motif. In crossing, the pattern emerges out of a dual diagonal grid running along the cloth. Being the simplest of the three the patterns that occur, the crossing patterns have mostly diamond or rectangular shapes that are offset from the diagonal axis (Fig. 5). On the other hand, loops and woots follow zigzagging guide lines that run along one direction on the cloth. In this case, the patterns are the extensions of the zigzag where the line overlaps on itself to the lines that are used to define the motifs are commonly offset in order to highlight the geometries and create certain depths within



Figure 4 - Some examples of “Loop” patterns

the embroidery. In woot and loop configurations the guidelines dissolve in the pattern as the figures evolve directly out of these zigzagging geometries whereas crossing patterns behave like tessellations; where a regular motif is spread with variations of its size using different sets of offsets and infill (Fig. 6&7). Since these raffia cloths are small in size, in order to achieve larger pieces to be wrapped around the body, patchworks are created where we see different pieces being joined together through ‘cuts’. In this case, we can see unification of different patterns as well. The technique of using ‘cuts’ not only provides the creation of patchwork patterns but also enables the embroiderer to make improvisations to a single cloth at certain points during the process of appliqué.

In the previous part of this paper, we have discussed the concepts of variation through Ruskin and stated their crucial role in configuring the ornaments. In Shoowa Kuba we can find a similar notion; as these three types of patterns provide such generosity through the articulation within their line geometry. In most of the cases we find the outlines of the motifs – diagonals or zigzags – providing such variation by different offsets or intervals between the kinks of the outline. In an irregular zigzag pattern we find the outlines undulating in harmony. Since the motifs emerge out of these guidelines through a set of rules their geometries are differentiated as well, to create variation



Figure 5 - Some examples of "Woot" patterns

throughout the pattern. In many examples the deformation of these patterns is evident, as the line configuration of the motifs tends to break down gradually. In such cases the geometrical system reveals its limits as the initial motifs could not be propagated anymore. Consequently, we find adjustments within the lines as the system tends to adapt itself by a change in the motif or the guideline. This alteration is also present within the patchworks done by joining different cloths together by 'cuts' (Fig.8).



Figure 8 - Some examples of patchwork patterns

Using this method, larger pieces could be achieved while the patterns are permanent through the continuity of the outlines. In both patchwork and deformation of patterns we see a shift within the system. In deformation this shift is gradual, causing the system to quasi malfunction; as the motifs could not be placed onto the outlines anymore. On the other hand, within patchworks through the abstract usage of cuts, this shift tends to be sudden as two different systems are combined. In both cases the shift emerges from the variation that the motifs provide causing the embroiderer to make intentional "mistakes" in order to be able to finish what he started.

The Kuba women start their intrinsic design by overlaying the outlines that are going to be replaced by the motifs and lines. As they draw these primary geometries their plans are unclear about the exact end result. Their worthy craft takes place as they start filling in these lines, motif by motif, adding new geometries, thicknesses and colors to it. At some points they apply a gradual deformation to the initial motif that they pick. However there comes a moment where these generative lines won't embrace the initial motif. This is where the embroiderer is forced to make a change or "mistake" as her design is asking for a shift in the system. This transformation could be achieved gradually if the motifs are on the same raffia cloth. In such a case an alteration of the motif is made; thus the motif adapts itself to the new geometry through the improvisations done by the women. Although these imperfections are evident in design their overall implication is fundamental in the art of Shoowa Kuba; as the raffia pieces never lose their coherence and quality. Another notion of these 'mistakes' is also present in patchworks done by joining the cloths through 'cuts'. In this method different pieces are brought together to create a sudden transformation of the motif. The intention of 'cuts' is to provide the continuity of the system, whereas this instant break causes unexpected results as certain lines don't match while some motifs are cut abruptly. Although the lines mismatch and reveal the lines of break in the system, the overall composition of the lines remains intact as it solely depends on its abstract usage of line geometry. In Shoowa Kuba the notion of making 'mistakes' becomes a part of the design like an internal technique or tool that could be used to adjust and control the ornament. Such a definition is profoundly defined by Ruskin on Gothic ornament, where he explains this phenomenon of how 'savageness' becomes a fundamental aspect in ornament:

You can teach a man to draw a straight line, and to cut one; to strike a curved line, and to carve it; and to copy and carve any number of given lines or forms, with admirable speed and perfect precision; and you find his work perfect of its kind: but if you ask him to think about any of those forms, to consider if he cannot find any better in his own head, he stops; his execution becomes hesitating; he thinks, and ten to one he thinks wrong; ten to one he makes a mistake in the first touch he gives to his work as a thinking being. But you have made a man of him for all that. He was only a machine before, an animated tool. (Ruskin, 1853: 14)

In Gothic ornament, the notion of making a 'mistake' is a local aspect; whereas the whole structure of ornament remains global. During the making process, the role of the craft - stone carving - is expected to follow the lines of the structure. As we have discussed through Ruskin's idea on variation, certain forms are deformed in order to achieve continuity within the system. These deformations are applied by hand labor where the craftsmen have to analyze each state or connection to adapt the shape of the stone correctly. Each and every part of the rib structure in a Gothic Cathedral is unique and its creation requires innovation and craft. As Ruskin addresses to this issue, in some cases these unique pieces are not done properly as the stone carvers are striving to achieve the exact forms. Under these circumstances 'mistakes' occur that are evidences of this restrictive labor; where it becomes a progression of learning through construction. This is another fundamental notion of Gothic ornament among the main

six aspects that Ruskin defines in the chapter from *The Stones of Venice*, “The Nature of Gothic”. For the construction of a Gothic cathedral hand labor is required. In this case this ‘machine’ of human labor is bound to make improvisations which involve ‘mistakes’ during the process.

In Shoowa Kuba embroideries, we see a similar notion of hand labor. The geometry of lines implements the same structure on which the motifs emerge. As the embroiderer is progressing along the line, motif by motif the system starts to deform; thus it arrives to a point where the motif cannot be deformed anymore. This is where Ruskin’s Savageness comes in. The Shoowa Kuba provides two options in such a case: either switching to a different motif which is the transformation of the system into a different set of rules, or cutting the cloth to join the motifs and lines with another set of geometries. This is not a breaking of rules that forces the motif to be transformed but is an introduction of another set of rules that takes the notion of the line geometry and modifies it for continuity. In both cases this shift takes place locally within the variation of the motif. By using ‘cuts’ the shift is implemented suddenly as these operations are sometimes read as scars on the cloth. On the other hand, the transformation of the motif that causes it to deform to its limit is more gradual. Nevertheless, both techniques constitute to the global continuity of the system without destroying its consistency of the ornament.

So far we have experienced the true nature of Shoowa Kuba through the variation and configuration of its line geometry. Such notion shows parallelism to Gothic ornament through Ruskin’s aspects, as we can see the importance of changefulness and savageness being vigorous in the lines of Shoowa Kuba. These lines not only vary to create rhythmic deformations of the motif but also involve certain operations like ‘cuts’ that reveal the ‘mistakes’ within the patterns. Without these fundamental aspects Shoowa Kuba would be obliged to depend solely on its structural abstract geometry; making it another example of ‘primitive art’ that we analyzed through Worringer. Although Shoowa Kuba embroideries contain this abstraction of line geometry, their overall implementation is somehow different than what we have discussed earlier. In Shoowa Kuba, the lines provide certain effects in the outcome of the pattern as the diagonal or zigzag lines vary not only by their thicknesses but also through their movement and intervals. This irregularity within the lines constitutes to pleasing effects in the outcome despite the lack of natural abstraction. Patterns of different motifs emerge out of these lines as their overall effect produce depth within the system. This effect is not present in the regular, structural notion of the ‘primitive art’ that we is defined by Riegl. In abstract “crystalline beauty”, the structural lines are inanimate and they don’t involve such impact. However in Shoowa Kuba, these lines become animated - like Worringer’s “vitalized geometry” - where the structure and the ornament merge together within the planar organization of a textile art. As a result, it is not possible to define Shoowa Kuba as an anti-vital primitive art; in direct contradistinction 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”. In the case of Shoowa Kuba, the usage of such geometrical rules gives the ornament such quality, rendering it structurally intact as well as visually pleasing. Through the analysis that we have made in the previous chapter the concepts of abstraction introduced by

Worringer through Riegl becomes wrong; as ‘primitive’ yet vigorous lines of Kuba are the direct sources of vitality where the pattern itself becomes expressive and emergent.

So how can we define the origin behind this vitality in Shoowa Kuba? What is the force behind planar geometrical ornament that gives it such behavior? In order to answer these questions we have to raise our argument among the system of geometries that are happening within the patterns. Textile configurations are formed up by the relationships of the motifs and the pattern. There is an interactive behavior between the local parts (motifs) and the whole (pattern). Such behavior can only be discussed through the ‘systems thinking’ that has been introduced by organismic biologists in the first half of the century. As Capra explains this theory:

According to the systems view, the essential properties of an organism, or living system, are properties of the whole, which none of the parts have. They arise from the interactions and relationships among the parts. These properties are destroyed when the system is dissected, either physically or theoretically, into isolated elements. Although we can discern individual parts in any system, these parts are not isolated, and the nature of the whole is always different from the mere sum of its parts. (Capra, 1997: 29)

As we mentioned earlier the whole aspects of variation and craft are implemented to the motifs of the pattern. These components are essential in order to achieve the aesthetic results that emerge out of the ‘vitalized geometries’. The transformation and deformation of such agents are locally implemented actions whereas their contribution is perceived globally as the whole pattern gains vital behavior. If we remove any of these permutations in the system, we will only have repetitive parts without any variation that will make the whole a mere addition of elements, a “sum of the parts”. In the case of Shoowa Kuba, the quality of this textile ornament relies on this notion of the ‘systems thinking’ where the parts and the whole are interactive while the vitality of the system depends on the configuration of the motifs. Here the whole is larger than the sum of its parts. It is “emergent”. It shouldn’t be just implemented as randomized variation; instead there is a rhythmic configuration that organizes the motifs like musical notes. Since there is harmony within the parts their contribution to the whole becomes instrumental.

This “system” that is constructed by the abstract machine of hand labor, reveals the rules that are caused by the pure geometry of lines. This makes it possible to breakdown the logic behind the making of this textile art through the definition of the rules that take place within the parts. By doing so, it will be possible to experiment the vital effects happening in the whole structure of the ornament. The historical and analog study that we have made so far, gives way to analyze this ornament on a different medium; which firstly involves the breakdown of its components in order to be able to reconstruct them to achieve such results. The potentiality of this system will emerge from the making of a “machine” that can generate such behavior in a digital environment which will be the medium for our research in this paper.

Introduction to Scripting

The technological advancements in the last decades have given rise to men's ultimate creation: 'The Digital Machines'. This abstract device overtook the capability of the craft that had been done by human hands since the beginning of history, to the new medium of computer based technologies. The possibilities of this 'machine' provided not only mass production and fabrication capabilities, but also programming complex procedures through the language of coding and scripting. This language follows basic principles and rules set by the programmer. The role of the programmer in this case is to set up a machine which will give him the control over any procedure. By using this technology such processes could be simulated in order to test the results of a given complex system with high efficiency.

An example for such a machine could be found in Conway's *Game of Life*. In this program he uses two dimensional orthogonal grid cells that follow certain rules to create an evolutionary system. (Conway, 1970) The system's name is driven by the abstract notion of full or empty cells on the grid – live and dead cells – that interact with each other by following rules set by the programmer to create propagation in the system. This programs a rule based system where for the emergence of subsequent generations of lives relies on the neighbor interaction of cells. Such a line of development creates emergent patterns in the system where it could be observed by changing the initial parameters of the game. In Shoowa Kuba patterns a similar notion occurs within the geometry of lines. Through non-linear variation of basic figures like zigzags, the pattern obtains a life of its own. These visual effects emerge out of the asymmetrical, harmonious and undulating deformation of motifs where they emerge out of these zigzag outlines by following certain rule sets. Their final appeal is surprising as they constitute to unpredicted yet visually striking effects.

The reason why we are interested in the digital medium for our research is because the art of Shoowa-Kuba provides geometrical rules that can be parametrically simulated. Although most of the analysis depends on the information extracted from original embroideries, the limited number of examples demonstrates a small portion of the configurations and combinations that the system could offer. As parametric systems could be programmed by scripting, the aspects of the ornament could be tested to understand the behavior and limits of these patterns. Since the configuration of the patterns follow certain rule sets, the script could be programmed to combine different abstract notions of craft and geometry. As a result of this study where we program an abstract 'machine' that will be able to generate visually pleasing motifs by following simple rules, without investing the same amount of time and labor into the actual hand making of these patterns. This makes digital notion of scripting a powerful tool for our research as not only the variations of the motifs could be generated through the codes of programming geometrical relations, but also mutations of patterns through 'cuts' could

be achieved. The analog studies of Shoowa-Kuba patterns will be elaborated through our digital research to write scripts that can generate infinite number of configurations of these motifs. While creating these pattern matrixes our focus will be to investigate whether an abstract digital machine that can make mistakes could be programmed.

Scripting the Shoowa-Kuba

In the introduction part we stated that scripting tools involve the application of rule sets to program 'abstract machines'. Before we get involved with the programming of this system it is necessary to define the rule set that will be applied to the geometries that we want to operate on. Through our analysis and research on the patterns of Shoowa-Kuba cloths we defined the characteristics of different motifs and techniques that created amazing variations within patterns. Nevertheless, this theoretical analysis is not satisfactory to define the rule sets that are used in the making of these cloths. Some unfinished examples that are found revealed the methods and certain rules, which would make it possible to decode the system of different motifs. These cloths had parts without appliqué (application of motifs), which showed proof of the underlining outlines of the patterns (Fig.9).

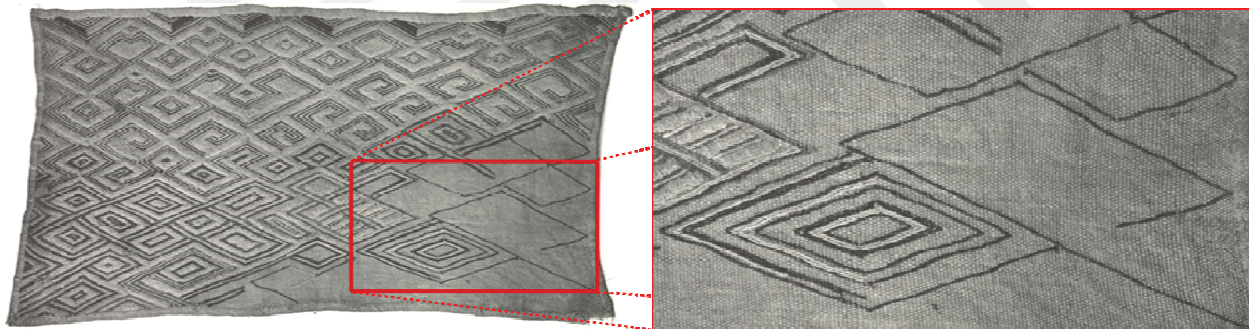


Figure 9 - An unfinished embroidery showing the outlines

The unfinished embroideries show that the outlines on the cloths are the base structures of the whole pattern on where different motifs emerge from. Thus by looking at finished embroideries it becomes possible to define the proceeding motifs. Different motifs call for different types of outlines and layouts. A crossing pattern has two diagonal arrays of lines, whereas loop and woot patterns use zigzag lines with different intervals. In each case these outlines are the continuous structures of the pattern running along the whole cloth without breaking or splitting. This idea was carried forward through the analysis of three different motifs, to define the certain rule-sets behind the making of them. The decoding of these motifs involves a multi-stage process where it starts from the finding the outlines of the pattern and defining different set of rules that create the final pattern (Fig.10-12). The images of the patterns are taken to the medium of Rhinoceros (CAD)

where the lines of the motifs are traced over. During this process the deformation of the pattern due to raffia tension had been disregarded to derive and simplify the geometric rule sets.

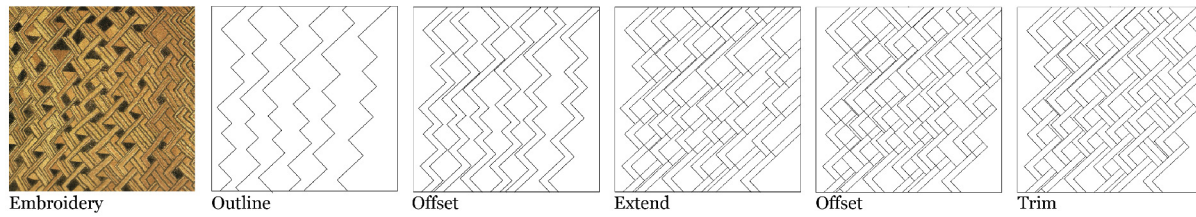


Figure 10 - The breakdown of a Crossing Pattern - 'Bisha Kota'

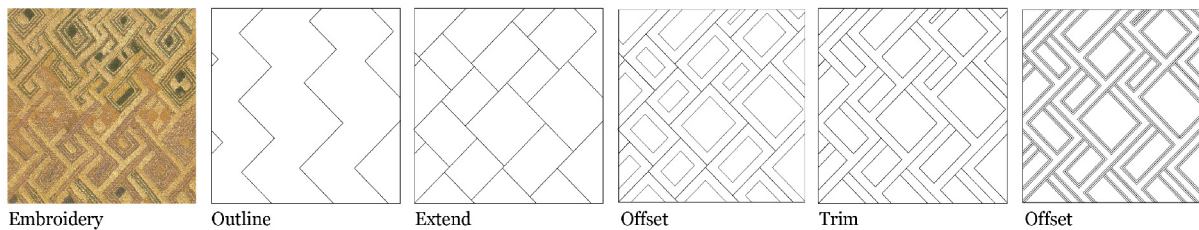


Figure 11 - The breakdown of a Loop Pattern - 'Ekwakwa Ingala'

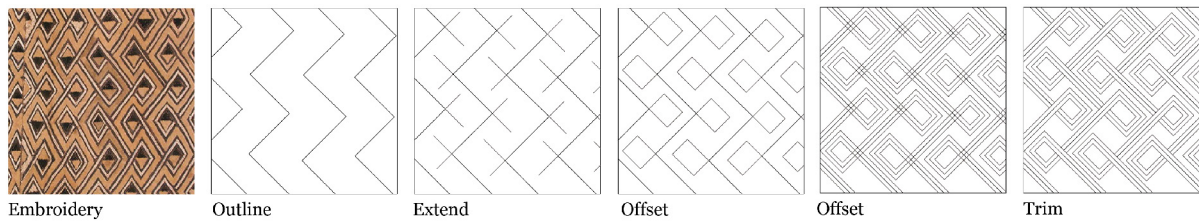


Figure 12- The breakdown of 'Loop' Pattern

The first sequence of decoding, involves drawing the outlines of the motifs. In this case three motifs with a zigzag outline have been chosen to investigate their rules of production. By disregarding the deformation of the textile, the regularity of zigzag outlines is set to a perpendicular angle. Depending on the motif and its emergence between the outlines, the corners of the zigzag have been utilized to create the motifs. To provide variation, the distance between the outlines has been differentiated enabling dissimilar extensions. In many stages offsetting and trimming have been used to generate the motifs out of these extensions. The final phase of the sequence substantiates the rules of the geometry that have been applied during the process, as the extracted lines in Rhino correspond to the underlying patterns. These rules behind the formation and configuration of the motifs that are gathered from this analysis are implemented to the medium of scripting to define the necessary rule-sets to generate these patterns digitally. As the scripting language follows a linear scheme, the structure of breaking down each motif is reversed to create them from any given zigzag lines. The

formation of the outlines in Shoowa Kuba is patterns fundamental, as it not only triggers the evolution of the motif, but also controls the variation.

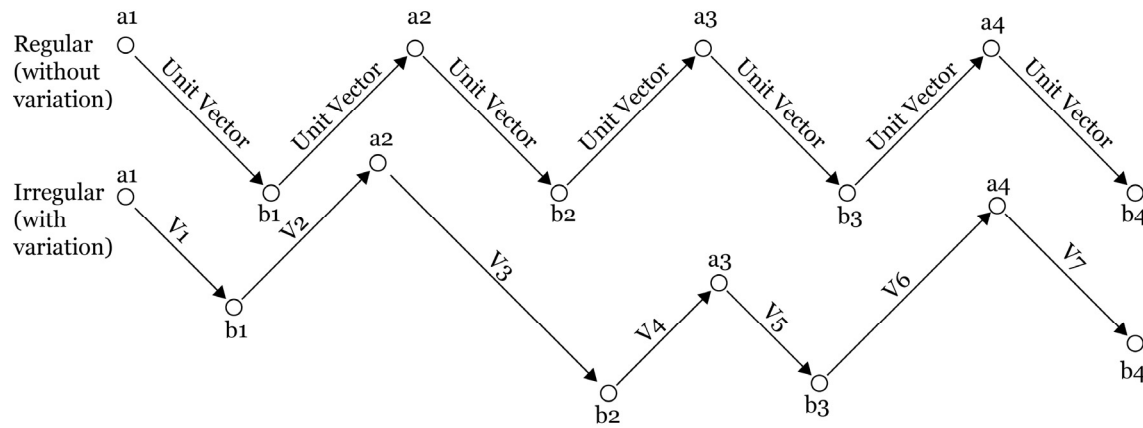


Figure 13 – Variation of zigzag

At this stage we have enough knowledge to start constructing our ‘digital machines’. This machine will be composed of the interaction of several scripts that will give us the lines of the patterns that we want to create. The initial input of the system will be the outlines that we have obtained through our breakdown of the motifs. As we have selected motifs that follow zigzag lines, in order to create variation through the motifs it is necessary to create variation within the outline. In geometry the zigzag lines are defined by a set of points that are propagated using diagonal vectors. If these vectors are the same the zigzag becomes regular. If the vectors are differentiated then the zigzagging becomes differentiated. (Fig.13) For scripting such a variable notion we need a set of points that are shifted from each other by another set of different vectors. Thus the point groups of A and B could be created by applying randomized vector values successively.

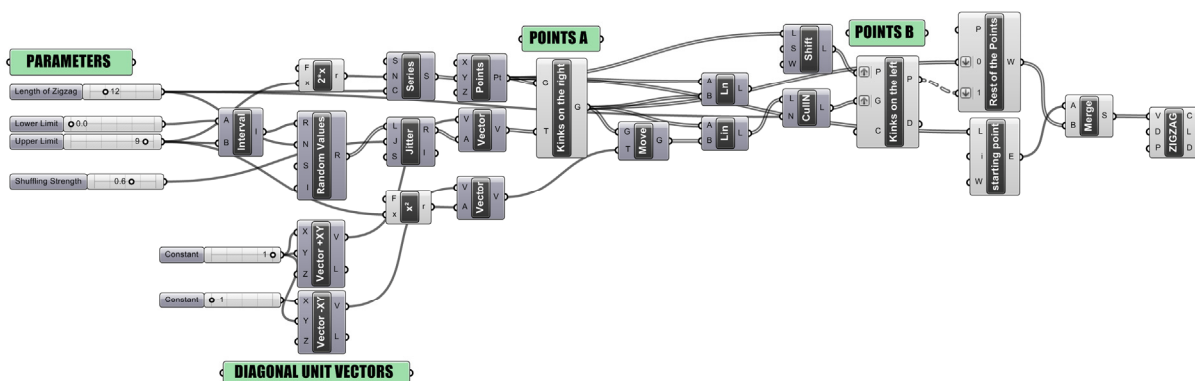


Figure 14 – The script used to generate various zigzag lines

In Grasshopper, a scripting plug-in for Rhino, we can create parameters to control the behavior of the zigzagging by controlling the length of the zigzag, interval of random

values and the shuffle strength for the random distribution (Fig.14). Thus we would be able to generate infinite number of zigzags to control the variation of the patterns that we want to create.

The first set of zigzags is used for controlling the deformation of the pattern. These outlines are distributed along a flat surface to generate the intermediate zigzags on which the patterns will emerge (Fig.15). Another script is used to create the array of these zigzags that follow the deformation by certain parameters. In this script, the distance parameter between the zigzags is used to create different intervals that will produce various motifs. By removing this parameter the zigzags will occur in a regular repetitive notion, allowing the distance variation to be neglected for gradual changes within the pattern.

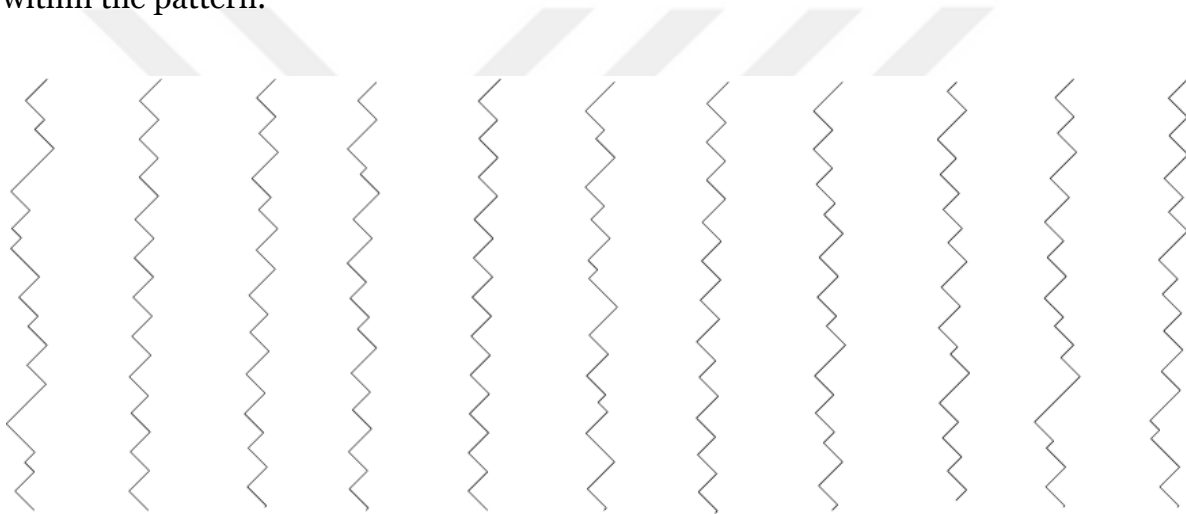


Figure 15 – Generated zigzags

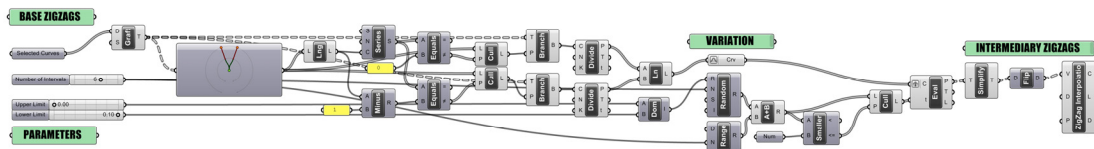


Figure 16 – The script used to generate intermediary zigzags

The script uses the corners of each zigzag to create a connection line for deformation paths. The idea behind using these lines to generate the intermediate lines is to prevent the zigzags from overlapping. In addition, such construction method enables the undulation of the system to be controlled. However by using random values in scripting, unpredictable outlines could be generated (Fig.16). The example provided in Figure 17 is a proof of the many occasions that demonstrates the emergent character of scripting and the usage of random values to create heterogeneity within the system.

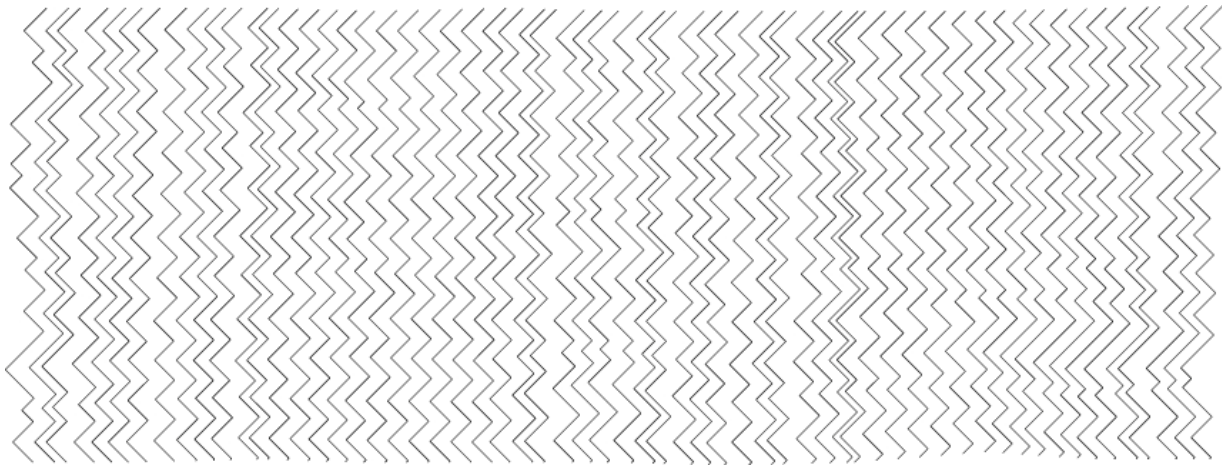


Figure 17 – The array of zigzags

Until so far, we have explained how the outlines of a pattern could be created by scripting. At this point we can use different patterns that emerge out of zigzag lines for our research. Since we have done analysis on three motifs and defined the rule sets used for their creation, the same procedure could be used to code another script that will operate on these zigzags that will produce these motifs. In both cases our code will be operating on the corners (Point Groups A&B in figure 13) of the zigzags to obtain the information and use this to apply the preceding rule-sets. The selected patterns emerge from geometrical operations like offsets and extensions. In scripting, the extensions will be automatically controlled by the intervals of the zigzags. The distances between these lines will configure the variation on the emergence of these initial lines. On the other hand, offsetting requires a value input which could be defined by the programmer; that will be used during the operations. In Shoowa Kuba the offsets are used for filling the surface area. Different numbers of offsets occur according to the size of the motifs. Thus, the same notion could be used to create an additional variation to motifs through offsetting.

At this stage we are going to examine how one of the motifs that we have decoded in figures 10-12 could be scripted. For this analysis the ‘Ekwakwa Ingala” motif has been chosen as it is one of the most efficient surface filling motifs. The script requires the zigzags that we have created in figure 10 and an offset value for calculation. In the first phase the corners of the zigzags have been broken down for further operations (Fig. 18). These points are grouped under two rows (A&B) for the alternative placement of motifs. 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. The enclosed motif defines an area that can be calculated and filtered to define the number of offsets required to infill the rectangular shape. The average motif size is used as the segregator to define four different size groups on which different numbers of offsets are applied to (Fig.19).

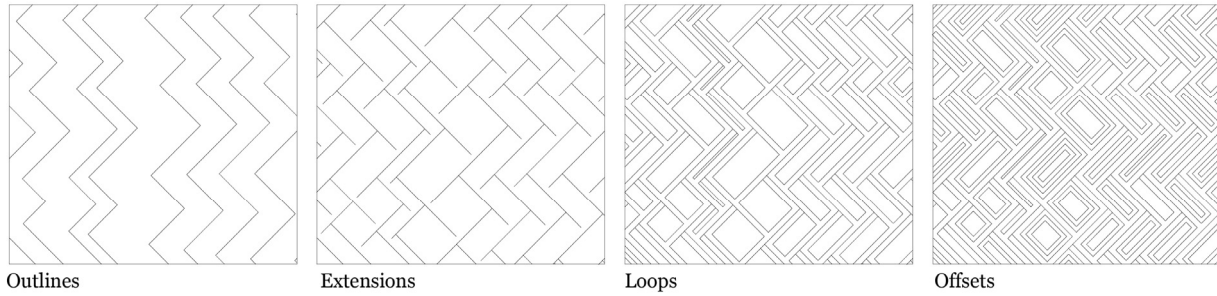


Figure 18 – Diagrams for “Ekwakwa Ingala” motif sequence

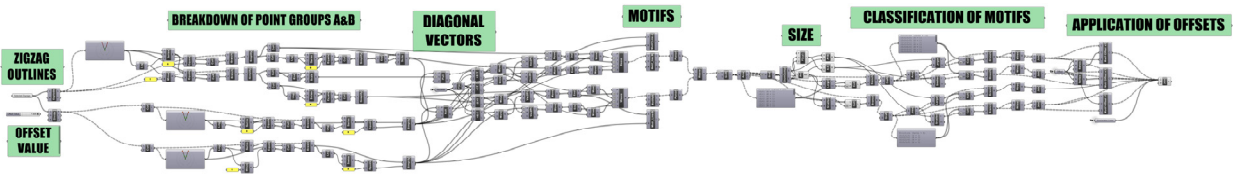


Figure 19 – Script for “Ekwakwa Ingala” motif

The application of the script to the array of zigzags enables the creation of infinite number of carpet matrixes (Fig.20). In this case the restrictive size of the raffia fibers is eliminated as this digital tool can be applied to any size and any configuration. The carpets exploit the fundamental notion of the Shoowa Kuba textiles through the display of gradual variation by using different zigzags. The digital patterns created show the potential of the motifs as unexpected effects are created in the pattern. The same concept for pattern carpets is applied to the remaining motifs to test their coherence within the notion of scripting. In both studies the zigzags and offset values are used again as inputs for the script to program its emergent character.

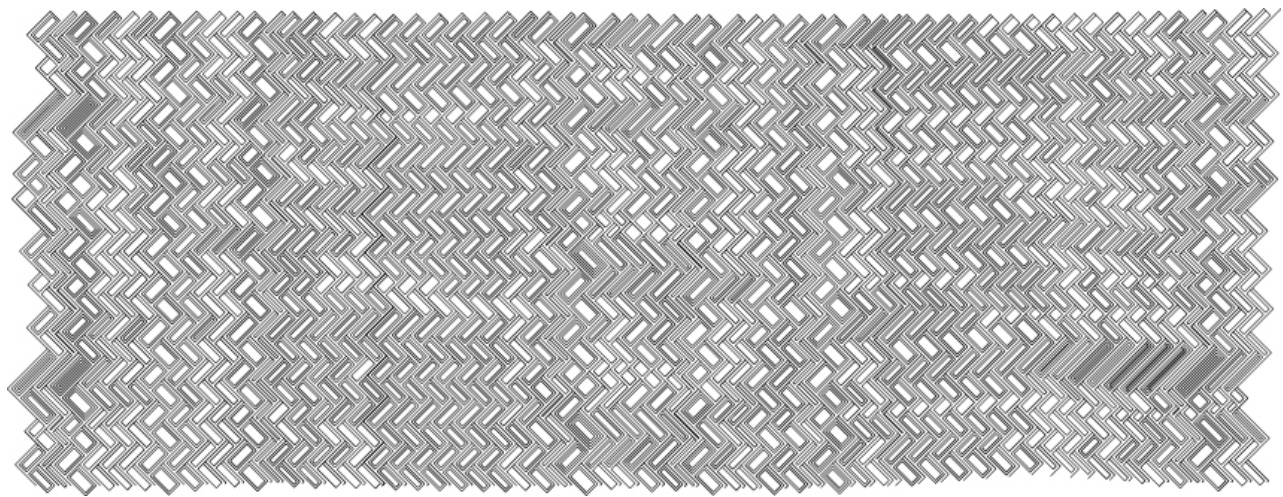


Figure 20 – “Ekwakwa Ingala” carpet

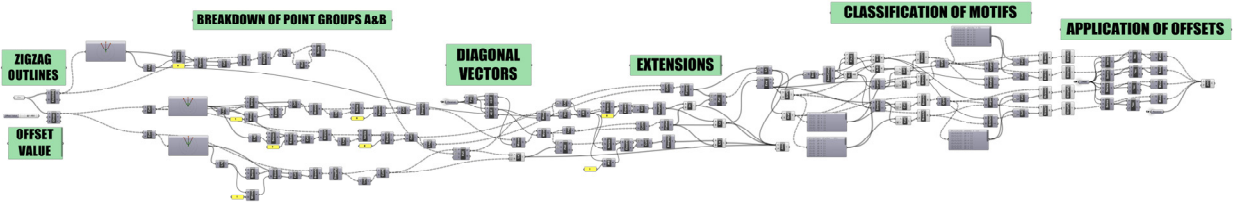


Figure 21 – Script for “Bisha Kota” motif

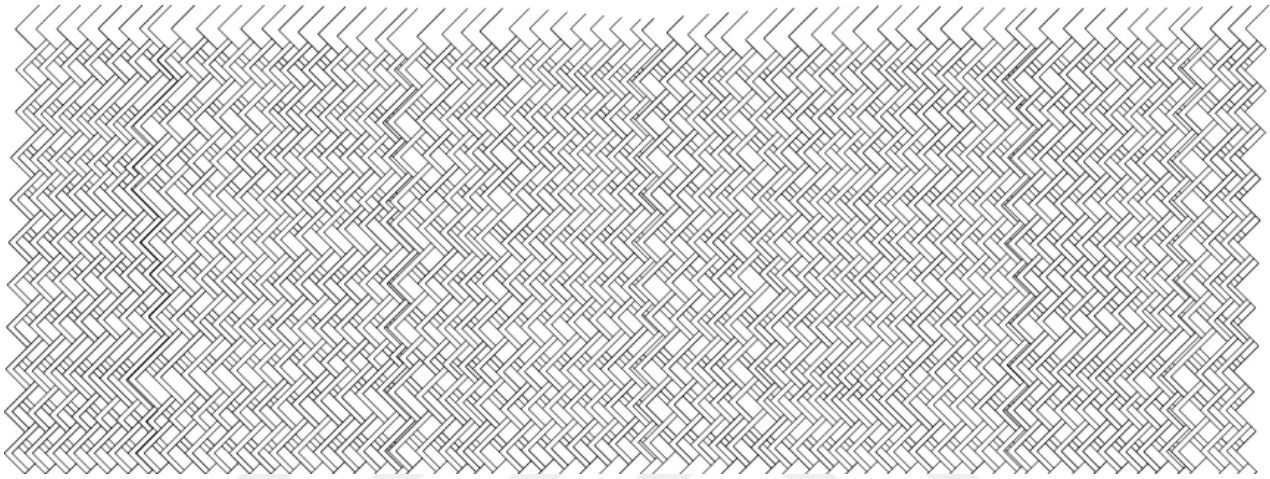


Figure 22 – “Bisha Kota” carpet

For “Bisha Kota” motif, the length of the extensions is used as the defining segregator for offsetting; whereas in “Loop” pattern the size of the enclosed motif sets the number of offsets to be applied to the looping figure (Figures 21&23). Apart from these differentiations their sequential development is similar to the “Ekwakwa Ingala” motif that we described in Figure 20. Extensions and offsets are used to create motifs with different sizes that are subjected to different number of offsets. Such heterogeneity within the programming of these patterns is evident in the emergent outcome as each carpet displays various visual effects. (Figures 22&24) These effects rely on the gradual variations of the motif within the carpet. Since the carpet studies provide an extensive articulation of each motif, the deformations become easier to notice. By looking at the carpets that we have generated so far we can examine the behavior of different motifs as they gradually deform and adjust to the variation of zigzag outlines. As a result, the deformation of each pattern would tell us where the pattern formation is causing ‘mistakes’ because of overlapping motifs.

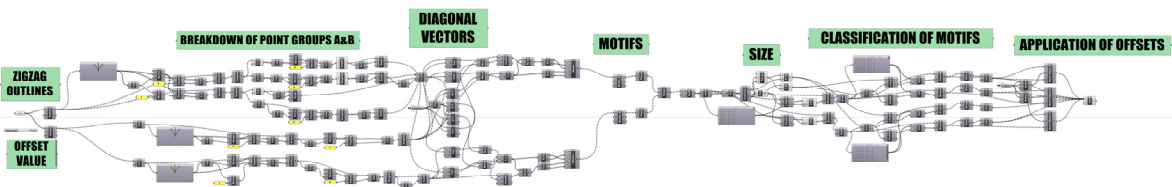


Figure 23 – Script for “Loop” motif

In our analysis we have defined two main types of variation that the Shoowa Kuba patterns provide. These are either gradual, depending on the deformation of the motif, or the sudden, happening through ‘cuts’. The carpet studies provide an extensive evaluation of the former gradual effects occurring on each different pattern matrix. In order to study the sudden shifts it is crucial to understand how patchwork patterns are

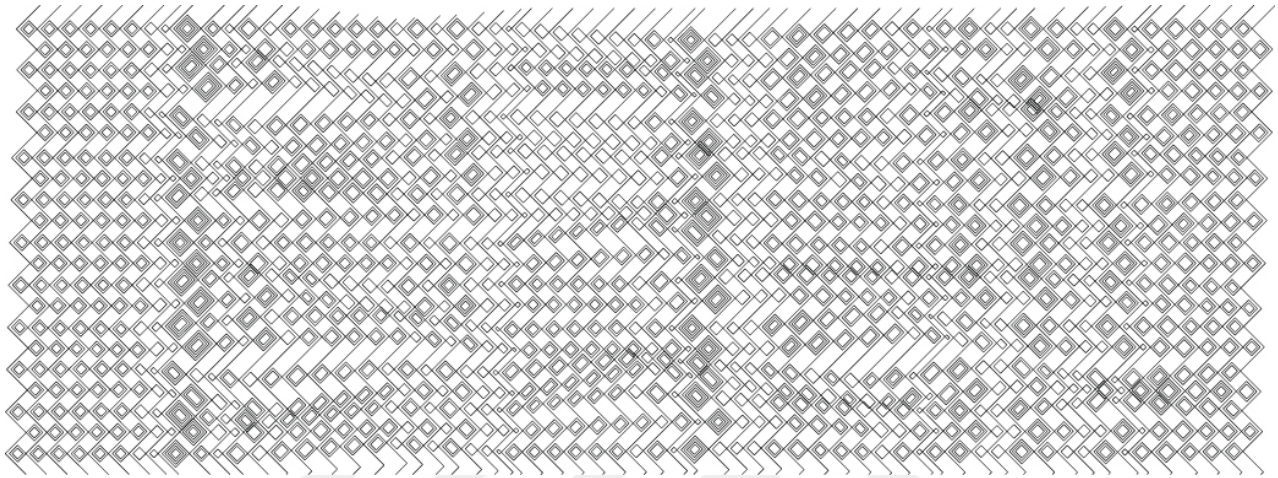


Figure 24 – “Loop” carpet

formed. The patchwork technique involves the unification of different types of patterns by using ‘cuts’ on the raffia cloth. In this case the deformation of a pattern is ‘cut’ abruptly creating a sudden shift in the system. Although this splitting effect is evident in the cloth, the coincidental connection of lines of separate motifs provides unity within the overall pattern. In some examples the placement of these cuts is crucial as the motifs are cut abruptly; whereas the intention of perpetuating the cut lines is possible (Fig.25).

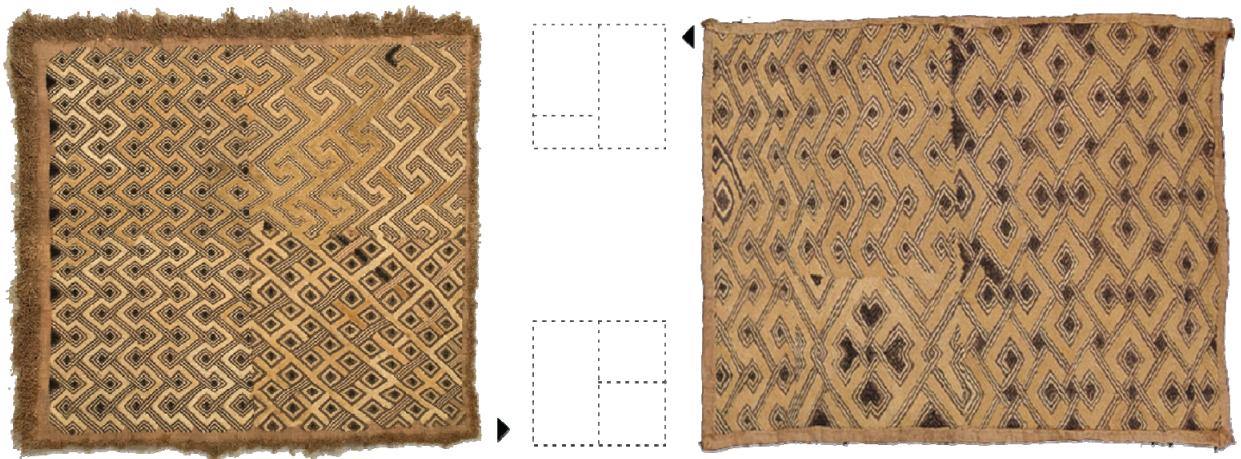


Figure 25 – ‘Cuts’ on patchwork embroideries

Patchwork patterns are a result of external actions outside of weaving. The abstract machines that we have constructed so far are able to accomplish the digital ‘weaving’ for us. The idea of cutting different patterns and joining them lies in the process of decision making as the embroiderer picks the parts to join together. Cutting these patterns at certain lines makes an abrupt and sudden shift within the system. However, it doesn’t destroy the overall effect of the patchwork as individual patterns keep acting together. Thus, this technique provides a manual input that we can exploit through our digital carpets by implementing such notion. In this case we can look back to the motifs that we created and pick the best parts of the carpets to join. As ‘cuts’ of Shoowa Kuba follow horizontal or vertical lines, we will be able to pick any rectangular pieces to test the coherence of patchwork within our digital machine. Although this action requires an outside decision, it provides lots of possibilities as sudden shifts could be placed anywhere within the patchwork. By using the same zigzag outlines the different motifs that we have generated will be following the same lines of formation. As a result, the ‘cuts’ that we place will be separating the lines of the motifs but coincidental connections will provide the overall behavior of Shoowa Kuba patchworks (Fig. 26). The lines that continue on the patchwork embroideries reveal the intentions of the embroiderer that is striving to connect the lines of different motifs together. In such a case each pattern is woven separately on different raffia cloths. Their unification requires a smart way of choosing the right patterns that could be connected together through their structural lines. For Shoowa Kuba this becomes a visual problem as such an operation creates ‘mistakes’ that show breaking of lines and abruptly cut motifs. As a result, the transformation of the pattern is instant; causing imperfect solutions.

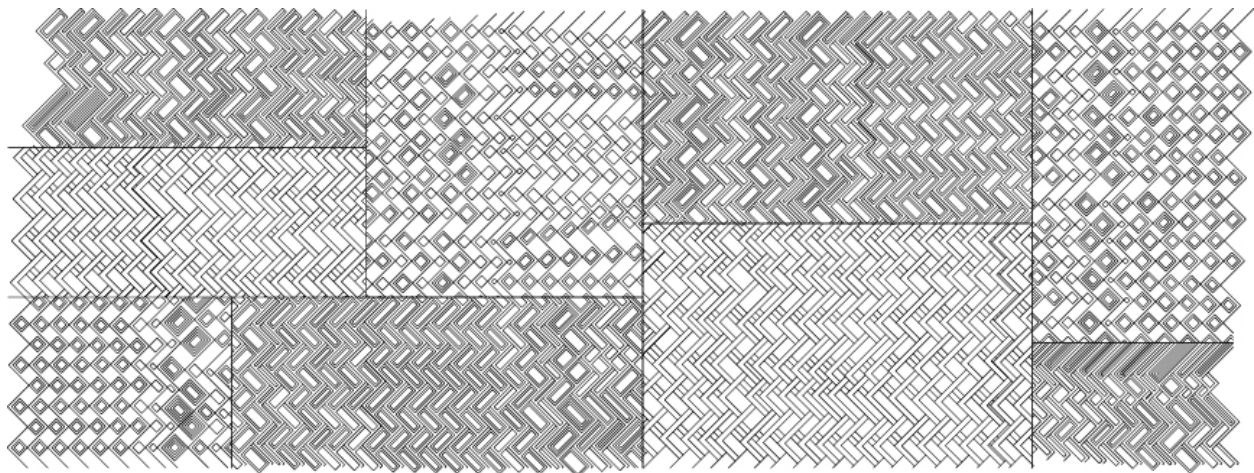


Figure 26 – Patchwork Carpet

The imperfections or ‘mistakes’ are inseparable elements of Shoowa Kuba craft. Their presence within the patterns, has 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 embroiderer can create intentional operations on the cloths that

produce unexpected results. Nevertheless, all these operations form up the emergent nature of the system where it tends to gain visual effects that make the patterns look 'vital'. In scripting the same notion has taken into consideration as these 'cuts' are placed to create a similar effect in the outcome of our digital machine. As this machine is programmed with the abstract rules of geometry that we have extracted from Shoowa Kuba cloths, its execution will follow the zigzag outlines that we input into the system. Consequently, such an abstract digital machine can produce certain 'mistakes' that produces breaking of lines through 'cuts' or overlapping motifs in gradual variations within the system. Through our digital analysis and studies we have tried to exploit the potential aspects of the Shoowa Kuba to prove how visually pleasing and vital these patterns can be. Using tools like scripting and joining patterns together by 'cuts'; such experiments have been made possible as they provide the tools to program an abstract machine. A machine that can make 'mistakes' for the sake of the ornament.

Conclusion

Architecture has always been one of the influential professions that helped creating the world we live in. While architects strived for creating enclosure and space for our daily activities, artists on the other hand were occupied with creating expressions in different mediums that we empathize to. Although their roles have been separated in the past century, their contribution to the creation of many ornaments throughout the history is evident. From the early civilizations men were not only obliged to create structures that protected them from the harsh conditions of the nature, but also were occupied with making them appear 'beautiful' to their eyes to fulfill their urge for aesthetics. This affinity involved reproducing forms of nature by implementing either their structural behavior or aesthetic quality in the works of art and architecture. This tendency constituted to the creation of ornaments, which decorated the structures and objects to embellish their visual impact.

In our historical analysis we have seen that until 20th century the urge for aesthetics in architecture gave way to the emergence of many ornaments like Classical and Gothic. Within both styles ornament is the source of the 'beauty' as it uses natural figures to create 'vital' effects in design. In Gothic, ornament becomes the ribs of the structure as its extensive use is spread throughout the design. Its continuous motion and variation is achieved by the deformation of this agent that the system utilizes at every occasion. In Shoowa Kuba, such notion is achieved by abstract geometries of lines and motifs as the patterns gain a vitality of their own in the final product. On the other hand 'cuts' provide an unorthodox technique where different patterns are joined together in patchworks, creating sudden shifts in the overall layout. Nevertheless, this technique becomes a

fundamental element of design as it doesn't destroy the continuity of the patterns but offers the possibility of using different groups of motifs with coherence.

Shoowa Kuba motifs are executed by rules that could be programmed through scripting. By applying these rules to certain procedures an abstract digital machine can be programmed which can create 'mistakes'. The notion of scripting provides us an extensive knowledge to prosecute the purpose of this machine. As we have experienced through the Gothic architecture, the extensive usage of the ornament is the source of the expression of the structure. Imagine if Kuba people had the same potential to waive a wall or even a house with these delicate motifs of their art. This would take their complex notion of ornament to the medium of design where the qualities and characteristics of their patterns would bring expression to the structure. Although Kuba people are restricted by their natural techniques in weaving, our knowledge and current technology in buildign construction could provide an enhanced abstracted notion of it. In such a case, it would be up to our machines to configure the patterns that we would like to see on our walls, floors or even furnitures. As a result our abstract machine would be turned into a tool; where we can use their abilities to bring the qualities of this valuable ornament and its expressive art to our designs.

In order to use Shoowa Kuba patterns in architecture our pattern system has to be transformed into a morphology. In design, scripting proves to be a powerful tool, as it not only enables us to generate various patterns that create such effects but also extract information from these. In this case, the Shoowa patterns could be generated three

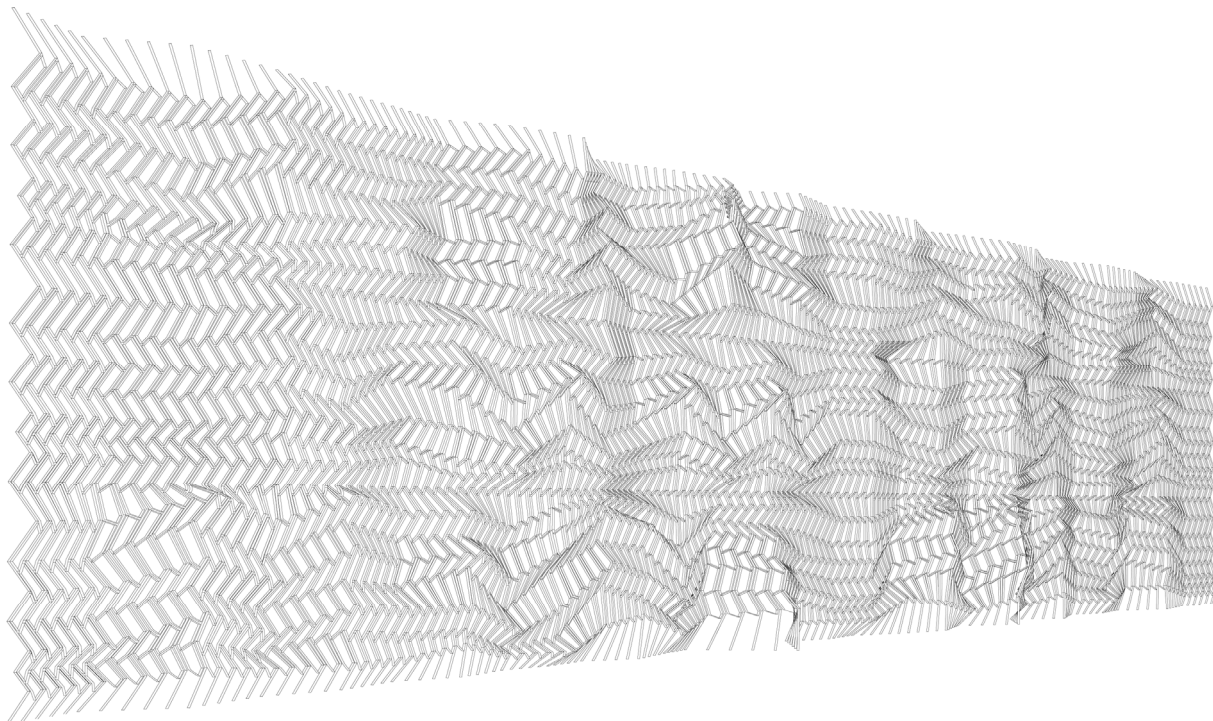


Figure 27 – Wrinkled wall with Shoowa Kuba “Ekwakwa Ingala” motif

dimensionally that express the effects within the pattern (Fig.27). Adapting the motifs into a wrinkled wall enables us to articulate this ornament in design as façades of a building could be generated. The gradual variation in the patterns is the source of such a configuration as the initial zigzag outlines could be used to provide such wrinkling on the façade. Since ‘cuts’ join different patterns together, the same rule could be used to stack different program units in a building. As the art of Shoowa Kuba involves the notion of design, these rules and techniques could be implemented in architecture to provide the use of such ornamental patterns.

In order to prove the architectural coherence of Shoowa Kuba patterns, a project proposal has been developed which embodies a commercial program that requires a visually appealing skin. A highly active commercial district in Miami on Lincoln Avenue has been chosen where such a project could be designed in an appropriate milieu to test the architectural implication of our system. Through our research we have programmed a ‘machine’ that could be utilized to implement the Shoowa Kuba notion in architectural design. By using this tool we can adapt the structural and aesthetic qualities of the patterns to the physical enclosure of a department store. Although this machine can make ‘mistakes’, it would be able to generate the components of our design which we need to imply the rules of Shoowa Kuba to. As a result such a building skin with a commercial program could be designed using Shoowa Kuba patterns that will not only generate an expressive ornamental façade, but also make the shopping experience visually pleasing.(Fig.28)

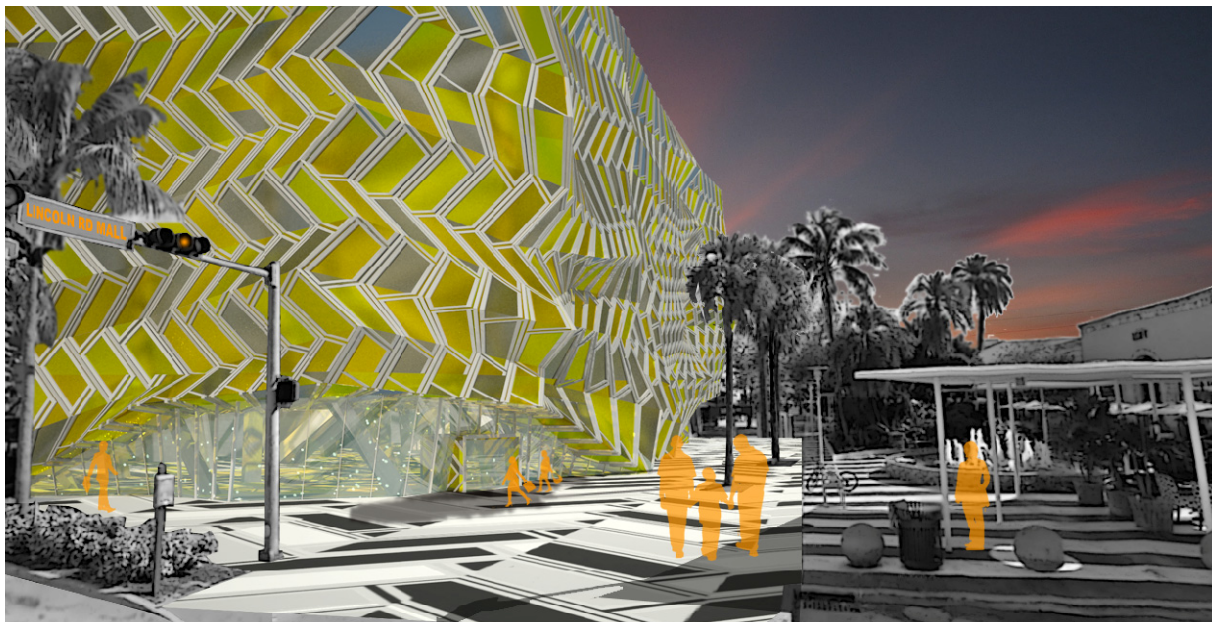


Figure 28 – Department Store Project on Lincoln Road Mall

References

Alberti, L. B. (1485/1988) *De re aedificatoria On the Art of Building in Ten Books*(translated by Joseph Rykwert, Neil Leach , and Robert Tavernor) : Cambridge, Mass.: MIT Press

Capra, F. (1996) *The Web of Life*. New York:Anchor Books

Conway, J. H. (1970) *Game of Life* at: http://en.wikipedia.org/wiki/Conway's_Game_of_Life

Meurant, G. (1986) *Shoowa Design:African Textiles from the Kingdom of Kuba*. London:Thames and Hudson

Ruskin, J. & Morris, W. (1854) *The Nature of Gothic*. London:Smith,Elder &Co.

Spuybroek, L. (2008) *The Architecture of Continuity*. Netherlands:V2_Publishing

Spuybroek, L. (forthcoming)

Svenson, A. (1986) *Kuba textiles: an introduction*. In *WAAC Newsletter*. Vol. 8, no. 1: 2-5.

Worringer, W. (1908/1967) *Abstraction and Empathy*. Cleveland,Ohio: The World Publishing Company

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