SYMMETRY CLASSIFICATION OF THE DECORATING PATTERNS OF FABRICS IN GREECE

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Abstract: The systematic science is based on the categorization of determined repeated units. These units give us the possibility of systematic observation of phenomena and description of their regularity. Many tried they interpret the particularities of these units, as code information or indicators of national identity. The categorization of symmetry, regarding to the placement of patterns more generally, leads in repeated description. It is realized that the patterns, are placed in not accidental forms, from the artists of concrete cultural unit. It is an important tool, with regard to in the organization and in the objective presentation of these cultural particularities. In the present statement become study and classification of textile patterns of various geographic regions of Greece, via their symmetric provisions. The comparison of results provides precious material that concerns the cultural influences that accept the various patterns per region. As well as from the historical and geographic data that practice influence in each region. The contact of the local population with populations outside the borders of Greece, resulted in the increase of the imagination and this is reflected directly in the symmetries used, as the decorative elements are met represent a considerable complication. The colors, the designs, the motifs are used at Epirus could be characterized as Doric, contrary to the stitches of the islands that someone would think that they were reflect their daily life, as they are simpler and more playful.

Key words: categorization of symmetry, placement of patterns, design, fundamental unit, arrangement

1. INTRODUCTION

"Pattern is born when one reproduces the intuitively perceived essence" (Soetsu Yanaki). Human psychology leads us to create repeating patterns of geometrical shapes. Through history there have been numerous applications of patterns to woven fabrics, furniture and buildings as well as many other items of everyday use. Subdivision of two-dimensioned space has generally one major purpose: to be pleasing to the eye.
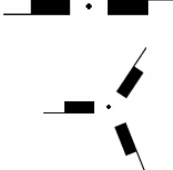
2. SYMMETRY

Symmetry is everywhere in our lives and demands our attention. It overwhelms human activity, from decorative design and textiles, to architecture and advertising logos. Field and Golubitsky considered symmetry to be "the accurate correspondence of the form and the element arrangement on the opposite sides of a dividing line or plane or around a centre or an axis." [1] Symmetry can be thought as one of the most basic geometrical concepts. [2] Mathematicians may consider it simply as a motion in the two-dimensional plane. A symmetric figure is any figure which is comprised of more than one identical part. Symmetry may provide a connecting link among the different scientific fields. Hence, harmony and proportion may help in the connection of seemingly different scientific fields. Symmetry provides a different perspective from which the whole world can be unified.[3]

3. THE BASIC SYMMETRY OPERATIONS

Regular repeating patterns are characterized by the repetition of a motif (fundamental unit) at regular intervals. The process of symmetry analysis begins by identifying the fundamental part of the design, which is the part from which the whole pattern is generated. In other words, the smallest element required to explain the repetition forming the pattern. The area enclosing this smaller element is known as the "fundamental region".

In symmetry analysis the first requirement is to identify the fundamental unit, while the next step includes the determination of the motion by which, when that part is repeated in one or two directions, it forms the whole design. If a design is composed of only one non repeated fundamental part, it is called "**asymmetrical".** Put simply, asymmetry may be either the absence of symmetry in a design or is the characteristic of a fundamental unit. [4] A motif or a design may be asymmetrical or symmetrical. A symmetrical motif is a figure which includes two or more parts of identical size, shape and content. A simple design commonly consists of arrangements of one or more elements. In more complex designs the conspicuous or seemingly significant parts are groups of elements. Usually there is expected symmetry, but sometimes that expectation is not met. This is called symmetry breaking. In nature and art, symmetry is imperfect. However we treat it as ideal. It seems that this approximation deceives the mind while it pleases the eye. [5] However, it is a common fact that symmetry in a design gives a pleasing effect of balance and order, with an aspect of intrigue and enchantment. Through these, their geometric characteristics and properties may be examined. [6]

Table 1: Symmetry classes and kinds of motion involved in producing different design patterns from the fundamental part illustrated [3]

Pattern	Fundamental part	
	Fundamental part	
Pattern	**Motion**	
	Translation	Rigid motion with repetition along a line
	Bilateral symmetry (or mirror reflection) -vertical -horizontal	Rigid motion with repetition across a line
	Rotation (point) -b-fold -multiple (3-fold)	Rigid motion with repetition around a point
	Glide reflection (translation & mirror reflection)	Rigid motion with reflected repetition along a line

Classification and design analysis according to symmetry group entails a thorough examination of underlying structure. The repetition of the motif of a design has limitless possibilities, and can be either asymmetrical or symmetrical. In point of fact, symmetry describes how the fundamental units of a design are combined and placed in the plane in order to form a pattern. This affects only one basic parameter of the design and that is its structure. Basically there are four kinds of movement, and consequently four classes of symmetry may be defined:

- translation
- bilateral or reflection
- rotation
- and glide reflection [7]

(a)	(b)	(c)	(d)
Z	Z		3
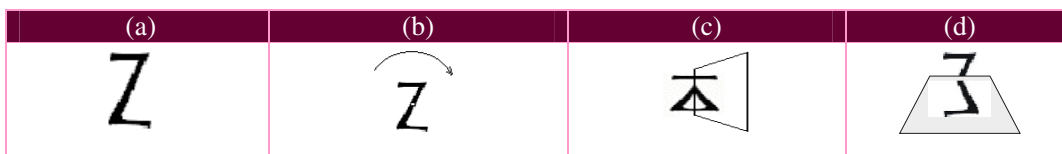
Fig. 1. *The letter z is a typical example of 2-fold rotational symmetry in letters. It can be rotated around its roto-cetre at an angle of 180^0. However, it doesn't present any reflectional symmetry, either vertical or horizontal ((c), (d)).[8]*

3.1. Symmetry Classification of Motifs in Greek Region

The motif arrangements which are found in Greek traditional art can be in woodcarvings, mosaics, ceramics, woven fabrics, stamped fabrics and embroideries. The design forms of each locality are based entirely on tradition. They are formed during eras or at places influenced by certain human or geographic particularities. Thus, the arrangements can be classified as: lowland, mountainous and insular.

The decoration of the embroideries, relatively to the arrangement, is controlled by human intelligence. It can be circular, dimensional, vertical or to both directions. As for the color and theme, in combination with the stitch type, the variety is so great that the researcher can determine at a glance the place of origin. It is expectable that at each region are select symmetrical arrangements which express the certain place of origin. In the present research, the symmetrical arrangements of certain geographical areas of Greece - the Ionian Islands, the Dodecanese, the Cyclades, and Mainland of Greece and Epirus – are analyzed and compared. The results are listed below.
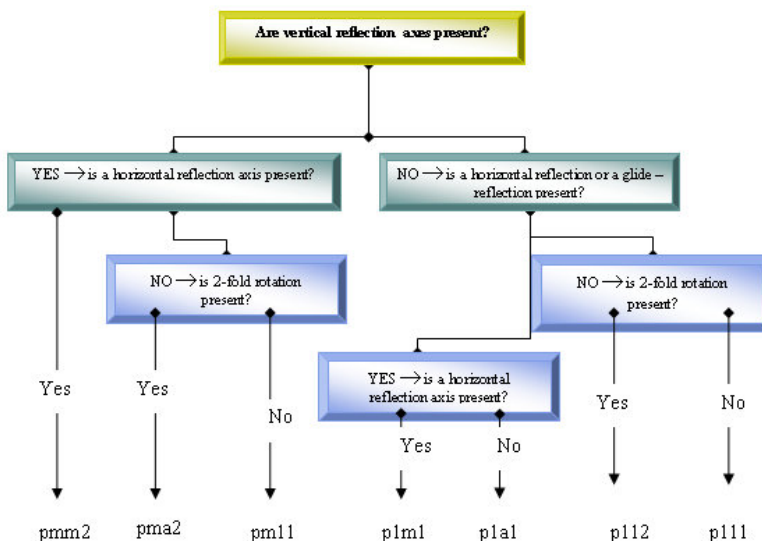

Diagram 1- *Classification methodology*

The method used for the classification of the decorative motif, is applied according to the universal bibliographic sources, using the above mentioned questionnaire. [4] The logic is based on the detection of the axes of symmetry that may exist in the arrangement of motifs and the potential centers of rotation. [3]

Regarding the area of the Ionian Islands, a total of 74 designs from the local weaving and embroidery art were analyzed. The results are presented in the table and the histogram that follows:

Table 2. *Area of the Ionian Islands- design arrangements*

| Symmetry classification	Number of patterns	Percentage %
pmm2	20	27.03
p1a1	3	4.05
p111	12	16.22
pm11	29	39.19
pma1	7	9.46
p112	1	1.35
p1m1	2	2.7
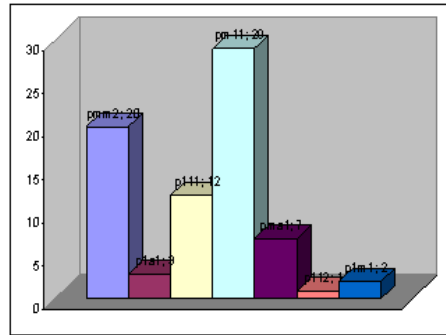
Fig. 2. *Area of the Ionian Islands- design arrangements*

Due to the number of islands and their specificities, there is a great variety and many variations of designs. A feature of the Dodecanese islands is the Byzantium residents, which continued to be used in daily life for several years, until today. A typical example is the costume of Simi, which resembles fairly to the Byzantine one. The lifestyle of the inhabitants of these islands is reflected in the folk art objects. A part of folk art is embroideries and costumes. Imports from other areas due to trade, affect a variety of designs. From the area of the Dodecanese 158 projects were analyzed, which can be categorized as follows:

Table 3. *Area of the Dodecanese- design arrangements*

Symmetry classification	Number of patterns	Percentage %
pmm2	30	18.99
p1a1	5	3.16
p111	28	17.72
pm11	80	50.63
pma1	13	8.23
p112	1	0.63
p1m1	1	0.63
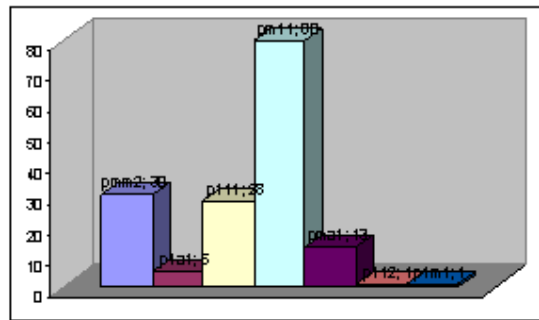
Fig. 3. *Area of the Dodecanese-design arrangements*

It is observed that the arrangements of the designs do not follow a wide variety of movements. The basic movements are the vertical shifting and reflection and double reflection.

The West side of the Mainland of Greece, as a folklore section, is not limited to the conventional administrative boundaries of Aitoloakarnania and Evrytania, but it is spread over a wider area to the northwest and east. The northern and eastern part is par excellence, highland and inaccessible areas with mountains, full of firs, and in any case cold climate. Hills and high peaks in dense order, create deep canyons that leave very little space for small valleys. Because, of the above mentioned geographic particularity, the everyday life is very difficult.

The remaining space presents a completely opposite scene, as it has the great privilege of being by the sea. The economy of this place has always been sustained by the two primitive professions, namely agriculture and animal stockbreeding, as they were the determinants of advancement. The slow pace at which evolution took place had as counterbalance, the spread of immutable traditional elements of folklore.

Regarding the region of Epirus, and the Western mainland, a total of 122 projects from local weaving art were analyzed. From the results given in the table and the histogram below, the following conclusions may be extracted:

Table 4. Area of west side of the Mainland-design arrangements

Symmetry classification	Number of patterns	Percentage %
pmm2	9	5,69
p1a1	17	10,76
p111	35	22,15
pm11	1	0,63
pma1	0	0
p112	2	1,26
p1m1	58	36,71
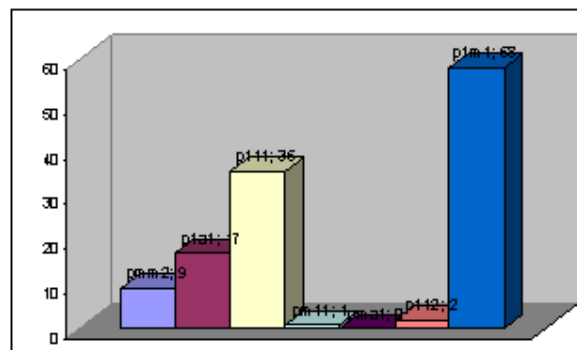
Fig. 4. *Area of west side of the Mainland-design arrangements*

In these locations there is no rotation of the basic pattern. The simple horizontal reflection or shifting and the shifting reflection, are the main categories which most of the pattern arrangements of the samples taken off this geographical region were classified. The designs follow in such a way the psychism and the robustness, which characterize the identity of their creators.

Observing the table and the histogram, there is a great variety of ways the motifs "move" in the arrangement. The main bulk lies in arrangements by shifting, reflection, reflection and double reflection combined with rotation. The rotational motion and the great variety are due to Western influences and the geographical and cultural characteristics of the region.

Comparing the representations of the embroideries, with those of Central Greece and Epirus it is noticed that they use different colors. It could be said, accurately, that they are more light, more positive, while the subjects used outside the plant and animal kingdom are directly related to the sea.

Regarding Epirus, 124 design arrangements were examined. The results are given in the following table:

Table 5. Area of the Epirus- design arrangements

Symmetry classification	Number of patterns	Percentage %
pmm2	26	16,45
p1a1	11	6,96
p111	35	22,15
pm11	1	0,63
pma1	5	3,16
p112	11	6,96
p1m1	34	21,52
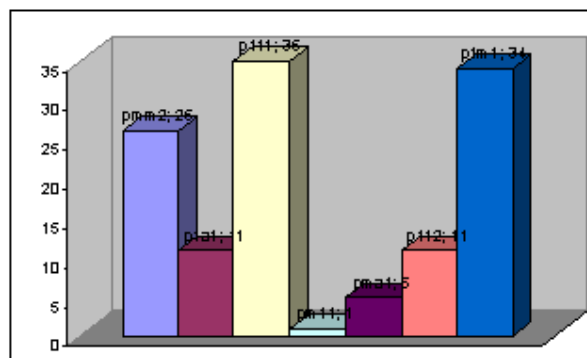
Fig. 5. *Area of the Epirus-design arrangements*

Observing the above mentioned data, it is obvious that the classification of patterns which come from Cyclades, exhibit the greatest dispersion. Shifting, horizontal and double reflection and rotation is of the most widespread movements. Typical examples of this style are given below, together with the codes.

4. CONCLUSIONS

The geographical and geological characteristics affect the psychism of the habitants and thus the tradition and costume style. It wouldn't be unreasonable to say that all these differences are influenced by the local environment, both geographically and culturally. The final form of every pattern layout consist the reflection of the conditions governing the historical memories of each place.

Socio-economic, geographic, climatic, etc. conditions, interactions, and positive production, the purchase of materials for construction, modulates the so called form.

Therefore, the following conclusions can be extracted: The decorative patterns used in the regions of Western Mainland and Central Epirus, show little variety of symmetries. About 50% of the patterns are classified to the pmm2 category, while the distribution of decorative motifs in the other categories, is quite limited. Essentially, the symmetries used are quite strict. The arrangement of the patterns is done under specific rules and repetitions. This coincides with what is known about the region of Central Mainland and Epirus. The decorative motifs originating from these areas are stricter both in their themes and colors, as well as the symmetry that is followed.

Observing the corresponding diagrams that are reflecting the symmetries of motifs used in the Cyclades and Dodecanese islands, a broad distribution of symmetries of the used decorative motifs is noticed. The rotation of the basic structural unit of the pattern is used to a large extent, giving a lighthearted style to the final design. The reflection symmetries pmm2, although occupying a wide range of preference at the insular part of Greece, they do not have the almost exclusive use, observed at the regions of Mainland and Epirus. This fact supports that the sea life and the geographical distribution of ground, contributed to the creation of more lighthearted decorative structures and favored the existence of a big variety of designs. The contact of the local population with populations outside the borders of Greece, resulted in the increase of the imagination and this is reflected directly in the symmetries used, as the decorative elements that are met represent a considerable elaboration.

The colors, the designs and the motifs that are used at Epirus could be characterized as Doric, contrary to the stitches of the islands that someone would think that they reflect daily life, as they are simpler and more playful.

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