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# Motifs and Symmetry Characteristics of the Ornamentation on Traditional Greek Woven Textiles from the Area of the Aegean

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## Abstract

*This paper presents an analysis of woven ornamentation of traditional Greek textiles from the area of the Aegean. The aim of this research is to explore the relationship between woven ornamentation and the technology used for its construction. Ornament forming on woven structures is specific because of the influence and restrictions that weave technology imposes on the aesthetic result of the artifacts produced. In this study, a group of traditional hand-woven fabrics from the Aegean area was digitally recorded. The decoration and motifs of these textiles /were analysed using the international classification and notation system created by H. J. Woods and M. A. Hann, taking into account the limitations that exist in the case of woven ornaments. This methodology enables the classification of woven ornaments into categories, making possible the comparison of ornament 'types' with the weave techniques used. Results of the symmetry analysis of these textiles are presented in this paper and lead to some conclusions that show that technology plays a determinant role in the appearance of woven ornaments.*

**Key words:** woven ornament, weave technology, hand-weaving, symmetry group, motif, traditional Aegean weaving.

## Introduction

Ornamented textiles are an important part of a culture's heritage, on which various characteristics, influences, traditions and ideas are imprinted. Woven textiles constitute a special area of applied arts, since the influence of the technology is probably stronger than in any other area of folk art [7]. The weave technology used determines what kind of ornamentation is possible to produce. This technology does not only influence the stylisation of isolated motifs, but also the way these are arranged in the plane to form a woven pattern. The arrangement of woven patterns of Aegean textiles analysed here is based on geometric symmetries. Symmetry analysis of the woven patterns aimed to provide some insight into the decorative rules of the area's weaving ornamentation, and their relation to the weave technology used.

The term "Greek" textiles is used here to denote textiles that are produced in the area, regardless of the specific patronage of their motifs, since there has been a constant and independent movement and exchange of motifs with other cultures over time [8]. The tracing of the origins of the motifs is beyond the scope of this paper, as the main focus is the influence of weave technology on motifs and symmetry.

Hand-weaving techniques have been used in the Aegean area for a very long period. Studies of prehistoric images of patterned Aegean textiles suggest that

they were produced on very basic looms, and the patterns were inserted by hand during the weaving process, with techniques similar to embroidery and tapestry [9]. The samples of hand-woven textiles that survive today, which are studied in this paper, are of the period from the end of the 18<sup>th</sup> to the beginning of the 20<sup>th</sup> century. This is a period from which a satisfactory amount of hand-woven textiles survive in museum collections. Textile samples of earlier periods are very rare, and thus it is not feasible to record a group of them. The samples that are studied are usually produced on basic looms, often with only two or four loom shafts, and the techniques used are mainly tapestry and the hand-brocading of extra wefts (a technique also known as 'embroidery weave' [10]). Weaving constitutes a very strong tradition in the area, since common technology and techniques seem to have been in use until the beginning of the 20<sup>th</sup> century when hand weaving was gradually replaced by machine weaving. For this research a number of hand-woven samples were recorded. The purpose of this recording was not only analysis, but also digital preservation in the form of a database devoted to this type of cultural heritage, which can be of use to designers and researchers. The woven patterns were analysed using the Woods – Hann system of notation and classification [1 - 6]. Although a lot of research has been done on Greek textiles in the past, this type of systematic analysis has not been applied until now, and can give way to more conclusions, and also the opportunity to conduct comparative studies.

## The sample

For this research 597 woven textiles from the area of the Aegean were digitally recorded. These textiles are currently stored in the collections of various Museums in Greece and also at the Victoria & Albert Museum collection in London. The textiles that were recorded and studied come from various islands of the Aegean area i.e. Crete, Lesvos, Chios, Syros, Nisyros, Skyros, Karpathos, Kastelorizo, Astypalaea, Kalymnos, Kos, Mylos, Samos, Skopelos, and Rhodes, amongst others, and also from the Aegean part of Asia Minor. The techniques used mainly involved hand-weaving, with the exception of some areas i.e. Asia Minor, Lesvos, Chios, Syros, where weaving was a developed trade, and where hand-operated dobby and draw looms were in use. All this production gradually vanished with the emergence of industrialisation.

The materials mostly used were cotton, silk, linen and wool in various combinations e.g. silk motifs on a cotton-silk ground.

The patterns were formed during the weaving process using the techniques of extra weft brocading (157 items), which is used in two variations: with continuous or discontinuous supplementary weft, creating floats on a plain weave ground, tapestry (134 items), also divided in two subcategories: slit, dovetailed or interlocked tapestry<sup>1)</sup>, twill weaves (120 items) - in the variations possible on the usually 4 shaft looms used, card

weaving (8 items), and drawloom weaving (104 items), although this technology is used in very few areas. Almost all the hand ornamented textiles were weft faced, making the weft that is inserted by hand visible. Most of them have stripes of plain weave between their patterns, which are thus arranged in horizontal bands, which will be subsequently analysed.

## Research question and methodology

The aim of this research is to examine and analyse the ornamentation of these woven textiles, as well as the motifs and symmetries that form the patterns, in order to establish the predominant ones. This will allow the examination of the interrelation of symmetry preferences with the weave techniques used, exploring the particular relationship of woven patterns with technology.

The analysis of patterns was made possible – apart from the descriptive approach that has been applied to the analysis of Greek textiles until now – with the use of the method of geometric analysis by Woods and Hann. This method, based on the principles of crystallography, classifies patterns, including woven ones, based on their geometric symmetries on the plane. It constitutes an extremely valuable tool for this research because it enables the characterisation of patterns into different classes or ‘types’, and therefore allows the establishment of the main or prevailing ‘types’ of a given sample of textiles, something not possible with descriptive analysis. This is important when the research incentive is the unveiling of the common structure of these “types” of patterns rather than just the verification of the use of specific motifs.

The type of pattern repeat on woven textiles is dependent on the type of loom used. When patterns are formed using loom shaft movements, then certain types of symmetries are obligatory, depending on the threading of the loom and the weave (lifting) plan. However, when a pattern is inserted by hand, as in the techniques mainly used in the Aegean, then the repeat of the motif is a design decision, because there are no such restrictions in this type of weaving. Nevertheless, in traditional weaving a preference for repeated patterns is observed. All the samples that are examined here have re-

peated patterns, and therefore conform to symmetries that can be analysed.

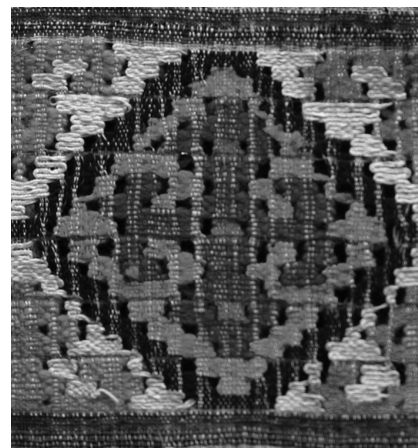
The international classification and notation system of ornamentations divides all regularly repeating weaving ornaments into three classes: finite ornaments, mono-translational and di-translational ornaments. These three classes, depending on the combinations of the four basic symmetry operations, are subdivided into two, seven and seventeen (only twelve for weaves [7]) groups, respectively. More explanation of the classification of ornaments is given by D. K. Washburn and D. W. Crowe [11]. The textile patterns will be analysed and classified into these groups according to their symmetry.

## Analysis

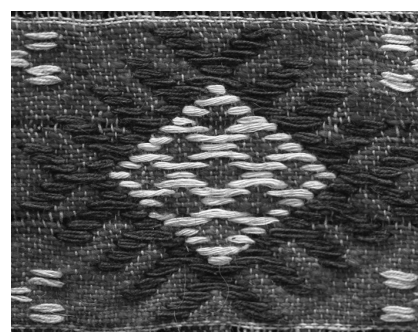
### Motifs

Most of the motifs found in hand-weaving techniques (tapestry and extra-weft brocading) are geometric, mainly abstract and some represent recognizable things like plants and figures, but are extremely stylised. The main ones from the 291 textiles produced with these two techniques are: diamonds, simple geometric shapes, geometric plants, eight-pointed stars and geometric figures. Diamonds were found in 64% of the samples, they usually have d2 symmetry and, more rarely, d4. There are two different types of diamonds used in the two different hand-weaving techniques (*Figure 1 & 2*). Simple geometric shapes, such as half diamonds, parallelograms and triangles were found in 79% of the samples, with various symmetries, usually complementing other motifs. Geometric plants were found in 17% of the samples, which have a d1 symmetry. They are found exclusively in extra-weft brocading techniques. Eight-pointed stars were found in 10% of the samples, with those from tapestry having a d2 symmetry, while those produced by the extra-weft brocading technique have a d1; they are composed of 8 diamond shapes. The weft brocading type of eight-pointed star sometimes looks more like a flower than a star. Stylised human figures were found in 5% of the samples of d1 symmetry. They are only found in extra-weft brocading techniques.

These motifs have a particular appearance and their symmetries repeat in various samples, and are specific to the techniques used for their construction, even to variations of techniques. Comparing



*Figure 1. Diamond motif: detail of a wall-hanging woven with the slit-tapestry technique, from the island of Karpathos.*



*Figure 2. Diamond motif: detail of a blanket woven with the discontinuous extra-weft brocading technique, from the island of Karpathos, circa 1900.*

these motifs with ones from the same period created with different techniques, we observe that the ones woven on a dobby loom always have abstract and geometric motifs, but are a lot simpler due to the restrictions of loom technology in the area, which seems to be the basic 4-shaft loom, producing structures such as herringbone, diamonds, squares etc. In drawloom examples from the same period, the motifs are usually non-geometric flowers with no symmetries, (often influenced by European fashions of the time) (59% of the drawloom samples), but there is also a small amount of diamonds (5%) and symmetric flowers (8%). The motifs of this technique do not seem to be of a specific range, since there is great diversification within this group.

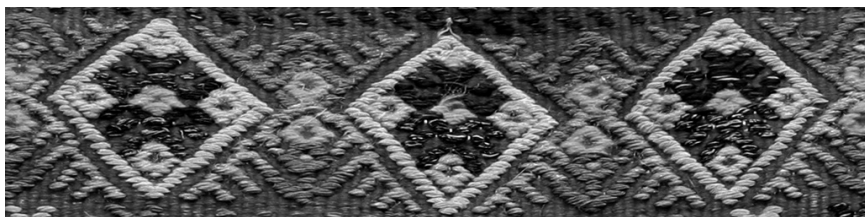
## The symmetry of patterns

In hand-weaving techniques most of the ornamentation is made up of mono-translational patterns (89% of the samples). This is due to the technique, since these decorative bands are in the hand-inserted weft direction. These bands are usually

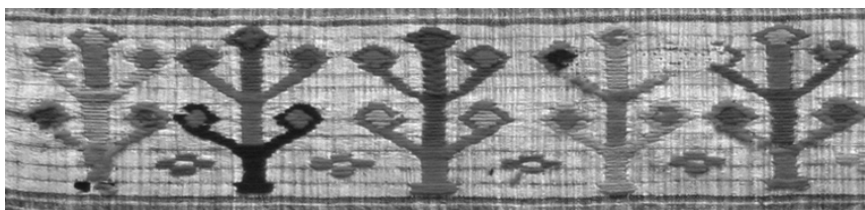
found on the narrow ends of the fabric (72%), repeating symmetrically on the two ends of the weave. These bands are sometimes found in all the length of the fabric (16%). Di-translational patterns are less used in hand-weaving techniques (11%). Contrary to this, in dobby and draw loom techniques, di-translational patterns are a rule – imposed by the nature of these techniques. Also, some mono-translational patterns are usually found in them at the edge of a di-translational pattern or as a border around it.

The main symmetries of mono-translational patterns of the textiles that were analysed are pmm2, found in 65% of the samples produced by hand-weaving techniques, usually with diamonds, eight-pointed stars and simple geometric shapes. They are used in tapestry and extra-weft brocading (*Figure 3*). A symmetry pm11 was found in 27% of the samples produced by hand weaving techniques, usually with d1 plants and d1 human figures, which are used almost exclusively in the extra-weft brocading technique (*Figure 4*). Symmetry pma2 was found in 19% of the samples made using hand weaving techniques, with various geometric shapes, which are used in all hand-weaving techniques (*Figure 5*). A p112 symmetry was found in 9% of the samples manufactured using hand-weaving techniques, with simple geometric motifs, which are used in all hand-weaving techniques (*Figure 6*). Symmetry p1m1 is/was found in 9% of the samples made using hand-weaving techniques, with simple geometric motifs, which are used in all hand-weaving techniques (*Figure 7*). A p111 symmetry was found in 4% of the samples were produced by hand-weaving techniques and 10% by draw loom techniques, with motifs of no symmetry. In hand-weaving techniques this symmetry is only used in extra-weft brocading (*Figure 8*). A p1a1 symmetry was found in 3% of the draw loom samples, and in only one sample of those produced using the extra-weft brocading technique (*Figure 9*).

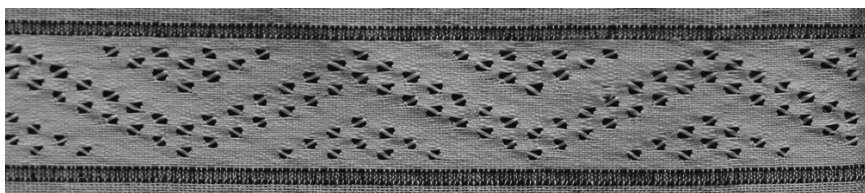
In hand-weaving techniques di-translational patterns are rare (11%). Most of the di-translational patterns of hand-weaving techniques are of a cmm symmetry (91% of di-translational patterns are made by these techniques), always with geometric abstract motifs – usually diamonds (*Figure 10*). The main di-translational symmetry of Dobby weaves is also cmm, with very simple motifs, and the same



*Figure 3. Example of a pmm2 pattern: border detail of a pillow woven with the discontinuous extra-weft brocading technique, with diamond motifs, from Crete.*



*Figure 4. Example of a pm11 pattern: border detail of a wall-hanging woven with the discontinuous extra-weft brocading technique, with stylised plant motifs, from the island of Karpathos.*



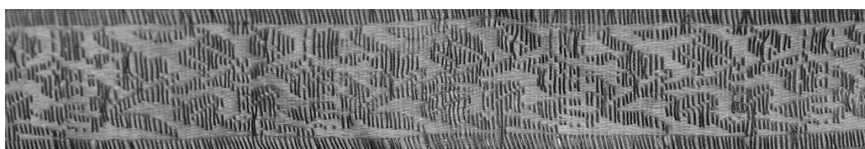
*Figure 5. Example of a pma2 pattern: border detail of a towel woven with the plain-weave open work technique - a variation of the tapestry technique, from the island of Skyros.*



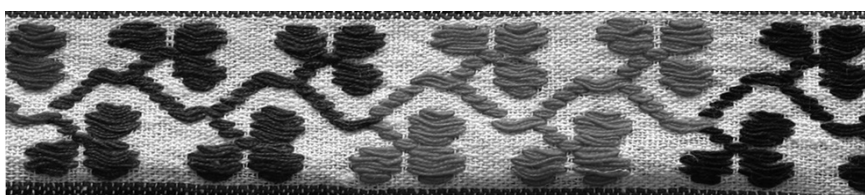
*Figure 6. Example of a p112 pattern: border detail of a blanket woven with the continuous extra weft brocading technique, from the island of Karpathos, circa 1900.*



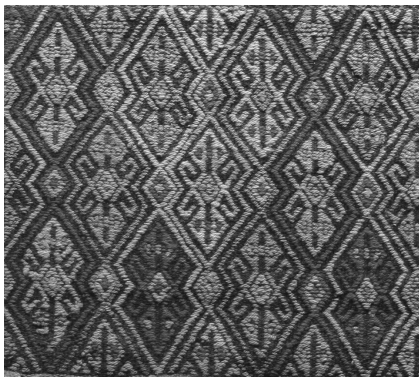
*Figure 7. Example of a p1m1 pattern: border detail of a kerchief woven with the dovetailed tapestry technique, with simple geometric motifs, from the island of Chios.*



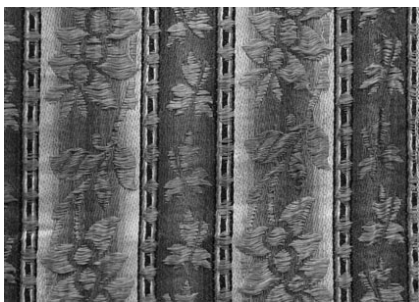
*Figure 8. Example of a p111 pattern: detail of fabric woven on a draw loom, with flower motifs, from Asia Minor.*



*Figure 9. Example of a p1a1 pattern: border detail of a kerchief, woven with the discontinuous extra-weft brocading technique with leaf motifs, from the island of Karpathos.*



**Figure 10.** Example of a *cmm* pattern: detail of a blanket woven with the discontinuous extra-weft brocading technique, with diamond motifs, from Crete, from the beginning of 20<sup>th</sup> century.



**Figure 11.** Example of a *pg* pattern, detail of fabric from women's pants/underpants/trousers, woven on a draw loom, with flower motif, from Chios, from the beginning of 19<sup>th</sup> century.

symmetry was found on very few card weaving samples, although more complicated patterns are possible with this technique. Di-translational patterns are widely used in samples made on a draw loom, in a variety of symmetries: *pg* (27%, **Figure 11**), *cm* (13%), *p1* (10%), *pgg* (10%), *p4m1* (5%).

The *cmm* symmetry preference on/of di-translational patterns created with hand-weaving techniques is related to the *pmm2* symmetry preference of mono-translational patterns created with the same techniques. If a *pmm2* symmetry pattern is extended to form an all-over pattern, then a *cmm* pattern is created, and this fact verifies the preference for a *pmm2* symmetry in hand-weaving techniques, as well as the predominance of the diamond motif, which is related to this type of symmetry.

#### Additional observations

From the analysis of this group of Aegean textiles, we conclude that certain woven patterns and their symmetries are strictly related to the techniques used for their

construction. Different techniques use different groups of motifs as well as symmetries, and hence techniques decisively influence the aesthetic result.

This relation can be further proved when the patterns produced with these widely used techniques are compared. In **Figures 12 - 14**, some samples of tapestry from different areas and periods of time are presented. It is clear from the similarity of patterns that, when the same level of weave technology is used, similar patterns are produced, which is related to these techniques. It is suggested that geometric and stylised shapes placed in certain symmetries are the vocabulary of hand-weaving, influenced more by technology and weave techniques than by cultural context.

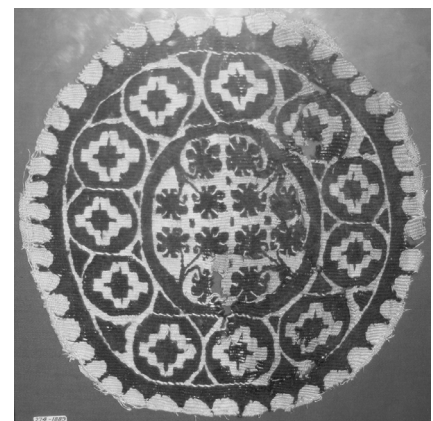
Another explanation of symmetry preferences could be given by the theory of visual perception. According to this theory people share some innate characteristics, in relation to the cognitive mechanisms (such as chunking, binding and exaggeration, amongst others) typically exercised in recognising objects. These mechanisms work without us being conscious of their existence [12, 13], and due to them, people tend to put shapes together in specific ways [14]. Gestalt psychology, which examines the role of symmetry in perception, suggests that during object recognition, symmetry contributes to the "goodness of a pattern", and tests have shown that symmetrical shapes are preferentially produced and reproduced over/using asymmetrical shapes, regardless of whether the shapes are simple or complex [15].

These results from Gestalt psychology tests offer an explanation not only of the preferences for symmetrically repeated patterns, but also for common symmetry preferences among different cultural contexts. They also provide a good defence of A. Riegl's position, that symmetry in decoration derives from an internal human need for harmony - beauty, the same as the one found in nature, as man in his decoration employs the same laws as nature: the laws of crystallinity [16, 17]

Apart from the similarity in the decoration of woven textiles observed in the neighbouring areas of Greece – the wider area of the Balkans and Near East, the same relation of weave technology with motifs is also observed geographically further, where the same techniques are



**Figure 12.** Tapestry weave: detail of a rug from Peru, 200-600 A.D., with diamond and cross motifs.



**Figure 13.** Tapestry weave: a piece of a Coptic tapestry, Egypt 4<sup>th</sup> - 5<sup>th</sup> century, with diamond and flower motifs.



**Figure 14.** Tapestry weave: detail of an apron from Dalmatia, from 19<sup>th</sup> century, with diamond motifs with *pma2* and *pmm2* symmetries.

used. For example, the *pmm2* symmetry, which is found to be a strong preference among Aegean textile patterns, was also found to be a predominant symmetry in the studies of other cultures' textiles, as

in the study of V. Milasius et al. in their analysis of traditional Lithuanian woven textiles [18], and in Kukle & Zommere's analysis of Latvian card-woven bands [19]. In these studies patterns were also analysed using geometric analysis methodology, making quantitative comparison possible.

Some of the motifs and symmetries that were found to be preferred can also be seen in the ornamentation of textiles from Aegean prehistory. These textiles survive only through representations, usually painting. Analysis of the techniques of these prehistoric textiles has troubled researchers in the past. The correlation of symmetries to specific techniques that was proved here for more recent Aegean textiles through the analysis of their symmetries, could form a tool through which the techniques used on these prehistoric textiles will be determined. Since there have been no revolutionary changes in weave technology for a long time, it might be possible that the same relation of pattern and technique remains unchanged.

## Conclusions

This paper presented an analysis of woven patterns from the area of the Aegean using the method of geometric pattern analysis. This method allows the classification of patterns into symmetry groups. The main conclusions drawn are that the main arrangement for hand-woven techniques is that of mono-translational patterns, in the direction of the hand inserted weft. Di-translational patterns, common in weave patterns produced with other techniques, are less used in hand-weaving patterns, and the ones found mainly have a cmm symmetry. The most preferred symmetries of mono-translational patterns are pmm2, pm11 and pma2. The main motifs used are geometric and symmetrical diamonds, eight pointed stars, stylised plants and figures with a bilateral symmetry, and simple geometric shapes.

From the analysis of the weave techniques used for their construction, and the analysis of their symmetries, it is clear that certain symmetries are correlated to certain weave techniques.

This relationship is further proved when the patterns of dobby and draw loom techniques produced in the same area and

period are compared – it was found that they use different motifs and symmetries. This leads to the conclusion that hand-weaving follows some strict decorative rules in which technique plays a major part. When similar textiles are compared from different cultures, a common decorative vocabulary of woven ornamentation is apparent. The nature of weave technique seems to be dominated by the aesthetic result and appears to overcome cultural influences.

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## Editorial note

In the two techniques of extra weft brocading and tapestry (and their variations), the woven motif is created by hand, without any programming of the loom other than that of the plain weave movement of the warp. The difference is that in extra weft brocading, extra wefts are inserted to form the motif during and in between the weaving of a plain-weave base cloth, whereas in tapestry it is the different wefts that form the cloth as well as the motifs by being inserted as a plain weave structure and by being stopped and changed by hand at any point during their insertion in the warp according to the design.

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