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METHODS FOR ARRANGING VARIOUS COMPOSITE ORNAMENTAL PATTERNS WHEN CREATING TECHNICAL DRAWINGS

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Abstract:

This study examines methods for arranging composite ornamental patterns in technical drawings for carpet design. It focuses on the relationship between geometric structure, proportion, symmetry, rhythm, repetition, motif hierarchy, and color harmony. A qualitative, practice-based visual analysis was conducted using four illustrated pattern arrangements, including medallion, grid, serrated, striped, and circular compositions. Each example was evaluated according to its underlying framework, balance, repeat system, scale relationships, focal organization, and suitability for carpet production. The findings show that coherent compositions emerge when the geometric scaffold is established before detailed motifs and colors are introduced. Medallion structures concentrate visual emphasis, whereas modular grids distribute motifs consistently across the surface. Symmetry and repetition strengthen continuity, while controlled variation prevents monotony and clarifies the hierarchy of primary and supporting elements. The study proposes a staged geometric-modular method that can support manual and computer-aided design, improve technical drawing consistency, and contribute to Uzbek ornamental traditions.

Keywords: Pattern, carpet, composition, craft, technical drawing.

Introduction

The placement of patterns and ornaments in a technical drawing lies at the intersection of fine art, decorative and applied art, design, and engineering graphics. Composition forms a unified image by organizing visual elements through structure, repetition, symmetry, proportion, positive-negative space, and emphasis [1].

A resolution adopted by the President of the Republic of Uzbekistan on June 26, 2020, established measures for developing the national hand-made carpet-weaving sector [2].

The policy emphasizes the preservation of the national carpet-making tradition, the expansion of competitive products for domestic and international markets, and the creation of employment

opportunities. These priorities increase the need for design methods that connect inherited ornamental knowledge with reproducible technical-drawing procedures [3].

Uzbek carpet making has developed over a long historical period and has become an integral part of the country's material culture. Its artistic identity is expressed through luminous color relationships, stylized motifs, structured borders, medallions, and repeat systems. Studies of ornament and textile history show that such visual systems function simultaneously as decoration, cultural memory, and organized design knowledge [4].

Modern carpet enterprises increasingly use computer-aided technologies to prepare and apply designs [5]. Digital production, however, does not remove the need for compositional control: the designer must still define the geometric framework, motif hierarchy, repeat unit, symmetry, scale, and color relationships before the pattern can be transferred accurately to the carpet surface [6].

Uzbek decorative and applied art has accumulated visual conventions over many generations. Ornamented architecture, textiles, and household objects demonstrate how form, material, color, and symbolic associations can be combined within a coherent composition [7]. These artifacts are therefore useful not only as aesthetic objects but also as sources for studying cultural identity, design logic, and the transmission of craft knowledge [8].

The Uzbek term "naqsh" denotes a pattern, image, or decoration. Traditional compositions commonly combine islimi plant-like motifs, girih geometric constructions, and mixed floral-geometric arrangements. Comparable studies of Islamic ornament explain how polygons, stars, interlacing structures, and stylized vegetal forms can be generated through grids, transformations, and repeated modules. In applied objects, these systems are adapted to the shape, scale, material, and function of the decorated surface [9].

Individual motifs and their combinations may preserve information about artisans' worldviews, local traditions, and interpretations of nature. Although the original meanings of some symbols have changed or become uncertain, their structural role within borders, fields, and medallions remains observable. For this reason, the present study focuses on verifiable compositional properties rather than assigning fixed symbolic meanings to every motif.

Methodology

The study employed a qualitative, practice-based visual analysis of the four technical-drawing examples presented in Figures 1-4. The unit of analysis was the composite ornamental arrangement rather than an individual historical carpet. Each example was examined according to six criteria derived from established design literature: geometric framework, proportional division, symmetry, rhythm and repetition, motif hierarchy, and color harmony [10].

The analysis followed five stages. First, the outer field, border, central axis, and medallion or repeat area were identified. Second, the underlying square, rectangular, circular, diagonal, or grid construction was traced. Third, motifs were classified by configuration and scale. Fourth, reflection, rotation, translation, repetition, and balance were assessed. Finally, the suitability of the color distribution and the adaptability of the composition to carpet production were evaluated.

The procedure was descriptive and design-oriented. It did not include experimental participants, statistical hypothesis testing, or measurements of learning outcomes. Consequently, the findings report structural observations from the illustrated arrangements and formulate a reproducible design sequence that can be tested in future educational or production settings [11].

Results and Discussion

The analysis showed that proportion provides the initial framework for organizing a composite ornament. Among the proportional systems available to designers, the golden ratio is a well-known model for relating a larger segment to a smaller one [12]. It should be treated as one design option rather than a universal rule because effective ornament may also be constructed from square grids, modular ratios, and radial divisions.

In a golden rectangle, the ratio of the longer side to the shorter side is approximately 1.618:1. Removing a square from the rectangle leaves a smaller rectangle with the same proportion, allowing the division to

continue recursively [13]. This construction can guide the placement of dominant and subordinate zones in a technical drawing.

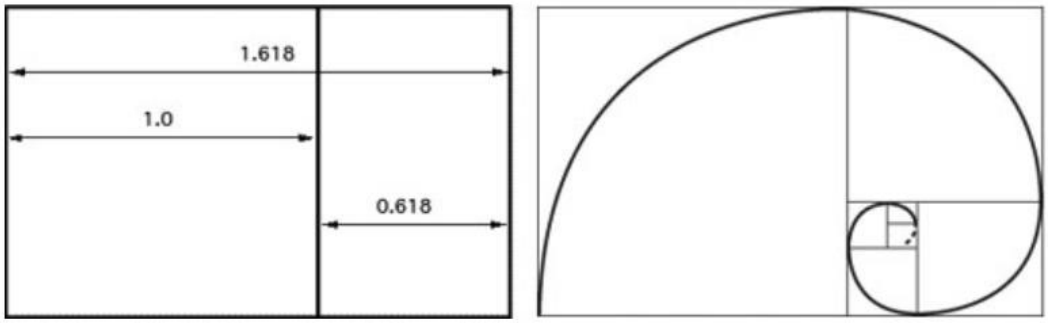

Figure 1. Golden-ratio construction dividing a rectangle into smaller and larger parts in a ratio of approximately 1:1.618

A sequence of proportionally related rectangles may be used to construct a spiral-like visual path and to position focal motifs. In Figure 1, the working rectangle is subdivided while maintaining the approximate 1:1.618 relationship. Repeated subdivision creates progressively smaller compositional zones and helps the designer control scale transitions [14].

The ornaments are arranged along the medallion section.

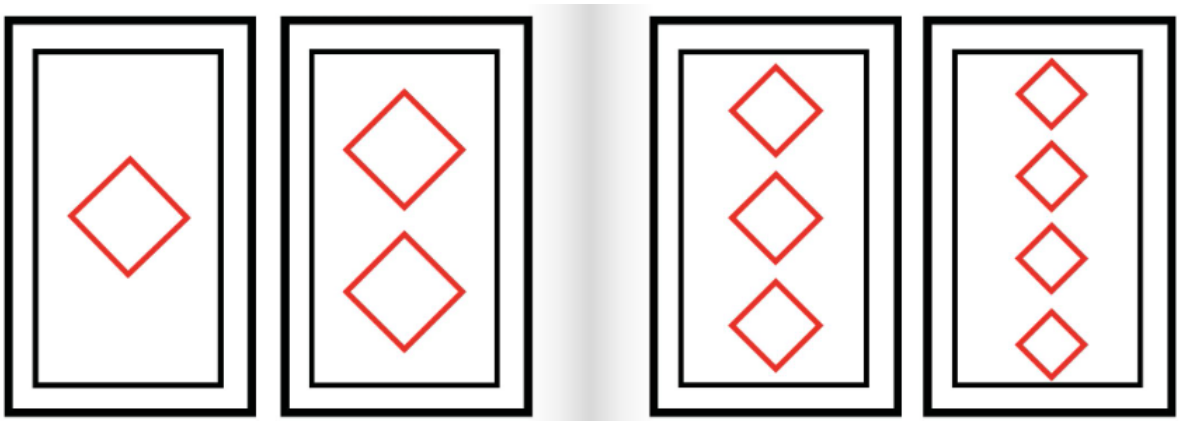

Figure 2. Arrangement of ornamental patterns featuring objects 1, 2, 3, and 4

Color was found to operate as a structural component rather than a final decorative addition. Hue, value, saturation, contrast, and the distribution of dominant and supporting colors affect motif visibility and the unity of the overall composition. A controlled palette can clarify hierarchy, whereas excessive contrast may fragment the pattern [15].

The illustrated complex compositions organize motifs through repeat units. Geometric carpet fields can be generated by translating a module across a grid and varying the scale or orientation of lattice, serrated, hook-like, diamond-shaped, circular, or striped elements. This result is consistent with symmetry-based accounts of ornamental organization, in which repetition produces continuity while controlled variation prevents monotony [16].

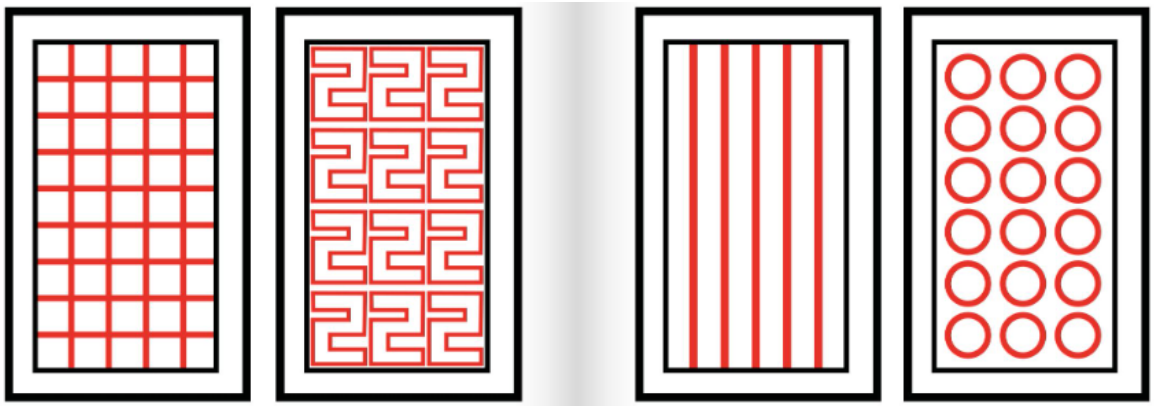

Figure 3. Arrangement of net-like, serrated, vertical-line, and circular-object ornamental patterns

The comparison of the drawings indicates that rearranging or adding elements can enrich a design only when unity is preserved. Repetition, symmetry, rhythm, emphasis, stylization, balance, and proportional consistency jointly determine whether the added motifs strengthen or weaken the composition. The focal point should remain identifiable, and secondary details should support rather than compete with it [17].

Figure 4. Color image of net-like, serrated, vertical-line, and circular-object ornamental patterns

The arrangements further demonstrate that motifs placed inside repeated shapes must remain symmetrical where symmetry is intended, fit the containing geometry, and maintain consistent growth and connection. Border systems with varied connecting lines increase compositional diversity and allow the same motif family to be adapted to rectangular fields, medallions, and peripheral bands.

The practical sequence begins by selecting motifs appropriate to the surface and preparing a composition sketch. Alternative color schemes are then tested before the final technical drawing is transferred to production. This workflow connects traditional craft knowledge with systematic design development: material texture, production constraints, visual balance, and cultural character must be considered together [18].

Across Figures 1-4, the most stable arrangements were those in which the geometric scaffold was established before detailed motifs were introduced. The medallion arrangement concentrated visual emphasis, while grid-based examples distributed attention across the field. In both cases, symmetry and repetition improved continuity, and scale variation distinguished primary motifs from fillers. These observations support a geometric-modular model in which the frame, axes, repeat unit, motif hierarchy, and palette are specified sequentially.

Conclusion

The study concludes that composite carpet ornaments can be arranged more consistently when the technical drawing is developed through a staged geometric-modular method. The designer should first define the surface and its proportional divisions, then establish axes or a repeat grid, select motifs suited to each zone, verify symmetry and rhythm, and finally determine the color hierarchy. This sequence

reduces arbitrary placement and makes the composition easier to adapt for manual or computer-aided production.

The analysis also confirms that proportion, repetition, balance, and color are interdependent. A technically precise grid does not guarantee artistic coherence if motif scale or color contrast is uncontrolled. Conversely, culturally meaningful motifs require an appropriate geometric structure to function effectively within a carpet field, border, or medallion.

Because the study is based on visual analysis rather than experimental testing, future research should evaluate the proposed sequence with design students and carpet-production specialists. Comparative assessment of drawing accuracy, completion time, motif consistency, and expert ratings would provide evidence of its educational and industrial effectiveness.

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