



Visual Grammar Extraction of Russian Traditional Patterns for Digital Poster Design

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Abstract. This study proposes a systematic framework for extracting the visual grammar of Russian traditional artistic patterns and applying it to digital poster design. Based on a four-dimensional model including morphology, color, composition, and semantics, traditional patterns are transformed into structured design rules. These rules are further implemented through a digital workflow using vector-based tools and integrated into a teaching process for undergraduate design students. A pre-test and post-test experiment is conducted to evaluate the effectiveness of the proposed method. The results show significant improvements in visual grammar application, cultural integration, and overall poster design quality. The study demonstrates that visual grammar-based approaches can effectively bridge traditional cultural resources and contemporary digital design practice, providing a replicable model for cross-cultural design education.

Keywords: Russian Traditional Patterns; Visual Grammar; Digital Poster Design; Teaching Method; Cross-cultural Design.

1 Introduction

Russian traditional artistic patterns, such as Khokhloma, Gzhel, and Pavlovo Posad shawl motifs, are characterized by highly stylized forms, rhythmic repetition, and symbolic color systems. These patterns embody rich cultural meanings and visual order, making them an important component of global decorative art. In contemporary design education, digital poster design emphasizes visual hierarchy, impact, and digital expression. However, the application of Russian traditional patterns in digital posters often remains at a superficial decorative level, lacking systematic extraction and transformation of their underlying visual grammar.

To address this issue, this study proposes a visual grammar-based analytical framework for Russian traditional patterns and explores its application in digital poster design teaching. By integrating visual grammar extraction with design practice, a structured teaching model is developed to guide students from pattern analysis to digital transformation and poster composition. The study aims to enhance students' cross-cultural design ability and provide a replicable approach for incorporating traditional visual resources into modern design education.

2 Literature Review

2.1 Russian Traditional Artistic Patterns

Russian traditional artistic patterns, such as Khokhloma and Gzhel, have been widely studied from the perspectives of cultural symbolism and decorative form [1]. These patterns are characterized by stylized natural motifs, including flowers, leaves, and animals, as well as distinctive color systems such as red–gold and blue–white combinations. Their visual features often exhibit strong regularity, including symmetry, repetition, and rhythmic composition, reflecting both aesthetic principles and cultural narratives embedded in Russian folk art traditions [2].

Existing studies mainly focus on the historical development, cultural meaning, and formal characteristics of these patterns. In terms of application, research has explored their use in crafts, textiles, and product design [3]. However, most studies remain at the level of descriptive analysis or direct visual borrowing, lacking a systematic framework to extract and reconstruct their underlying visual structures for contemporary design contexts, particularly in digital media.

In recent years, visual grammar has been increasingly applied to the analysis and transformation of traditional visual elements in design practice. Some studies have explored the use of visual grammar in folk pattern reconstruction, digital media design, and poster composition, focusing on visual hierarchy, layout organization, and symbolic meaning transformation. In addition, research on traditional pattern applications in digital posters has mainly emphasized decorative adaptation and stylistic borrowing, often through direct visual translation rather than systematic rule-based reconstruction. However, these studies rarely integrate visual grammar theory with a structured extraction process and teaching-oriented design framework.

2.2 Visual Grammar and Design Education

The concept of visual grammar, proposed by Kress and van Leeuwen, provides a systematic framework for understanding how visual elements convey meaning through composition, salience, and information value [4]. This approach has been widely adopted in visual communication, media studies, and design analysis, enabling a more structured interpretation of images beyond purely aesthetic perspectives [5].

In the context of design education, particularly in digital poster design, teaching practices are largely influenced by modernist paradigms such as Bauhaus and Swiss design. While these approaches emphasize clarity, order, and functional hierarchy, they often overlook the integration of traditional cultural visual resources [6]. As a result, current research on cross-cultural design education remains limited, especially in terms of transforming traditional patterns into structured and teachable visual grammar systems [7].

Therefore, a clear research gap exists: there is a lack of systematic approaches for extracting the visual grammar of Russian traditional patterns and applying it to digital poster design through structured teaching models and empirical validation [8].

3 Methodology

3.1 Overall Framework Design

As illustrated in Fig. 1, this study proposes an integrated framework combining visual grammar extraction, digital transformation, and teaching application. The methodology consists of four layers: data acquisition, visual grammar extraction, digital processing, and poster design with instructional implementation, supported by an evaluation and feedback loop.

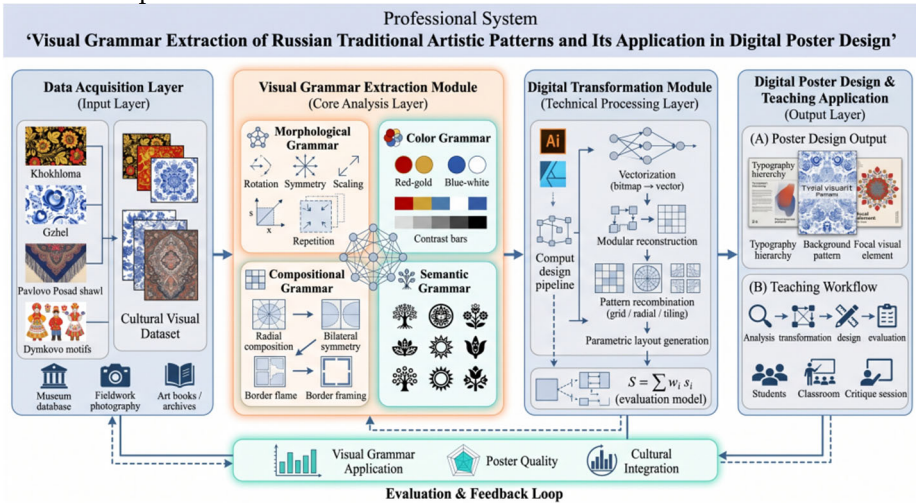


Fig. 1. Framework of Visual Grammar Extraction and Digital Poster Design Process.

The workflow starts with collecting Russian traditional patterns, followed by grammar extraction and digital transformation using graphic tools. The processed elements are then applied in digital poster design teaching, and their effectiveness is validated through quantitative and qualitative evaluation. This framework enables a systematic transition from traditional visual resources to contemporary design practice.

3.2 Visual Grammar Extraction

In the second stage, pattern samples are analyzed using a four-dimensional visual grammar framework (Fig. 1) to transform implicit visual features into explicit design rules. Morphological analysis decomposes patterns into basic units such as floral motifs, geometric elements, and contours, from which transformation rules—such as symmetry, rotation, scaling, and repetition—are identified and abstracted into modular forms for digital reconstruction.

Meanwhile, color organization is examined based on functional roles within the visual system. For instance, Khokhloma patterns typically feature red and gold as dominant colors with black as a stabilizing background, while Gzhel emphasizes blue

variations on a white base. These color schemes are further structured into primary, secondary, and accent roles to support systematic application in digital poster design..

3.3 Digital Transformation Process

After visual grammar extraction, patterns are converted into digital design elements using tools such as Adobe Illustrator and Affinity Designer (Fig. 1). Instead of direct replication, selected motifs are redrawn as simplified vector graphics while preserving key structural features.

These elements are then organized into modular units and recombined based on grammar rules, such as radial duplication, grid tiling, and symmetrical composition, with parameters like spacing and scale adjusted to ensure visual consistency.

Finally, the modules are applied to poster layouts as backgrounds, borders, and focal elements, with typography and information hierarchy coordinated to maintain overall coherence. To evaluate the effectiveness of this transformation, a weighted scoring model is adopted::

$$S = \sum_{i=1}^n w_i s_i \quad (1)$$

where S denotes the overall score, s_i represents the score of each dimension, and w_i is the corresponding weight. This model provides a structured way to assess how effectively the extracted visual grammar is applied in digital poster design.

3.4 Teaching Implementation and Evaluation

The proposed framework is implemented in a digital poster design course for undergraduate students, following a four-stage workflow: analysis, transformation, design, and evaluation (Fig. 1). Students first analyze Russian patterns to identify visual grammar, then reconstruct them into vector modules, and finally integrate these elements into poster designs with clear visual hierarchy and thematic expression. The outcomes are assessed through instructor evaluation, peer review, and self-reflection.

A pre-test and post-test design is adopted to measure learning effectiveness. Students complete an initial poster without guidance and a second one using the proposed method. The improvement rate is calculated as:

$$Improvement = \frac{Post-Pre}{Pre} \times 100\% \quad (2)$$

where Post and Pre represent the average scores of post-test and pre-test, respectively.

An evaluation and feedback loop (Fig. 1) further refines teaching and design outcomes. Key metrics include visual grammar application, poster quality, and cultural integration, ensuring continuous optimization of the framework.

4 Experiments and Evaluation

4.1 Experimental Setup

The experiment was conducted in a digital poster design course with 60 undergraduate students majoring in visual communication design. To ensure reliability, a pre-test and post-test design was adopted. In the pre-test stage, students completed a poster design task without specific guidance on Russian visual grammar. In the post-test stage, the same group of students produced a new poster after receiving instruction based on the proposed framework.

All works were evaluated using a standardized scoring rubric covering four dimensions: visual grammar application, poster design quality, cultural integration, and thematic expression. Each dimension was rated on a 5-point scale by three experienced design instructors, and the final score was calculated as the average. The pattern dataset used in teaching was derived from museum archives, published art collections, and curated visual materials, ensuring both authenticity and academic credibility.

4.2 Main Experimental Results

The experimental results demonstrate that the proposed visual grammar-based method significantly improves students' performance in digital poster design. As shown in Table 1, all evaluation dimensions exhibit notable increases from pre-test to post-test. Among them, Visual Grammar Application shows the highest improvement, indicating that students effectively internalized and applied the extracted grammar rules in their design process.

Table 1. Comparison of pre-test and post-test results

Dimension	Pre-test	Post-test	Improvement Rate (%)
Visual Grammar Application	2.31	3.87	67.5
Poster Design Quality	2.76	3.94	42.8
Cultural Integration Ability	2.18	3.71	70.2
Thematic Narrative Expression	2.64	3.69	39.8

Culture Integration Ability also shows a substantial increase, suggesting that students were able to better incorporate traditional Russian visual elements into modern poster compositions. Improvements in Poster Design Quality and Thematic Narrative Expression further confirm that the method enhances not only decorative application but also overall design coherence and communication effectiveness.

Overall, the results validate the effectiveness of the proposed framework in bridging traditional visual resources and contemporary digital design practice.

4.3 Discussion

The results indicate that the proposed framework effectively enhances students' ability to apply visual grammar in digital poster design. The most significant improvement in Visual Grammar Application suggests that the structured extraction method enables

students to move beyond superficial imitation toward rule-based design thinking. This confirms the value of translating traditional patterns into explicit and teachable grammar systems.

The notable increase in Cultural Integration Ability further demonstrates that students are able to reinterpret traditional Russian visual elements within contemporary design contexts. Rather than directly copying motifs, they successfully integrate them into layout, hierarchy, and thematic expression.

However, the relatively moderate improvement in Thematic Narrative Expression indicates that cultural interpretation still requires deeper understanding and longer-term training. Overall, the findings suggest that the proposed method is effective but could be further strengthened by extending the teaching duration and incorporating more cross-cultural comparative cases.

5 Conclusion

This study proposes a systematic framework for extracting the visual grammar of Russian traditional artistic patterns and applying it to digital poster design. By integrating morphological, color, compositional, and semantic dimensions, the research transforms traditional visual elements into a structured and reusable design system. Based on this framework, a four-stage approach—visual grammar extraction, digital transformation, and poster integration—was developed and implemented in a digital poster design course.

The experimental results demonstrate that the proposed method significantly improves students' performance in visual grammar application, cultural integration, and overall design quality. The findings confirm that structured grammar-based analysis can effectively bridge traditional artistic resources and contemporary digital design practice. In addition, the study highlights the value of incorporating cross-cultural visual resources into design education.

Future work may extend this approach to other cultural pattern systems and explore long-term teaching effects, as well as the development of digital visual grammar databases for broader educational applications.

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