SEMIOTIC AND PSYCHOLOGICAL ANALYSIS OF NATIONAL PATTERNS AND FORMS IN THE DESIGN OF CHILDREN’S PLAYGROUNDS

Jurat Tajibaev
Associate Professor, Tashkent University of Architecture and Civil Engineering (TUACE)
Akramova Gulnoza
Tashkent University of Architecture and Civil Engineering (TUACE)

Abstract: *This article examines the scientific and theoretical foundations of designing children’s playgrounds in the modern urban environment of Uzbekistan. The main objective of the research is to reveal, from a semiotic perspective, the influence of national patterns (girih and islimi) and geometric forms on children’s cognitive development, their psychophysiological state, and national identity. The article integrates the semiotics of applied art by academician S. Bulatov and the theory of geometric harmonization by M. Bulatov with Jean Piaget’s stages of cognitive development. Additionally, a methodology for optimizing national forms in design based on international safety standards (EN 1176, ISO 8124) is proposed.*

Keywords: *children's playground, semiotics, girih, islimi, cognitive psychology, geometric harmonization, design, safety standards, 3D modeling, urban planning.*

INTRODUCTION

The early stages of human life, especially the preschool period (ages 3 to 7), are crucial for forming the intellectual and emotional foundation of an individual. During this stage, a child perceives the world not only through words but also through visual images, shapes, and colors.

In Uzbekistan, children’s playgrounds should serve not merely as spaces for physical activity, but as “open-air classrooms.” In today’s urbanization processes, many playgrounds are designed based on standardized international models. However, in the context of globalization, preserving national identity and instilling cultural codes into the younger generation remains a pressing issue.

As academician S. Bulatov emphasized, traditional decorative art is a silent language that speaks across centuries. Therefore, the semiotic (meaning-based) and psychological (perceptual) analysis of national forms in playground design holds significant scientific importance for designers and educators.

1. PSYCHOLOGICAL AND HISTORICAL ROOTS OF PLAY ACTIVITY

Play is a product of social development and is closely linked to the evolution of human labor culture. According to D.B. Elkonin’s theory, children imitate adult activities through play and internalize social roles.

In Uzbekistan, children’s games have historically served as a means of fostering collectivism, courage, and agility. From a psychological perspective, a playground forms a

child’s “zone of proximal development” (L.S. Vygotsky). Here, children develop willpower by overcoming obstacles and social intelligence through interaction with peers.

National elements (such as small “ayvon” or “supa”-like structures) provide children with a sense of cultural familiarity, safety, and stability.

Figure 1. Cognitive-Geometric Construction Based on Girih Patterns.

2. ARCHITECTURAL SEMIOTICS AND “READING” NATIONAL CODES

Semiotics is a system of signs and symbols that interprets each form in design as a carrier of meaning. In playground design, three levels of semiotic analysis can be identified:

1. **Syntactics-(Structure):**

The rhythmic relationship between form elements. For example, fences designed in traditional patterns evoke a sense of order and harmony.

2. **Semantics-(Meaning):**

The symbolic meaning of patterns. In Uzbek ornamentation, stars symbolize light and higher order, while islimi represents the infinite growth of nature.

3. **Pragmatics-(Impact):**

The influence of design on children’s behavior. Soft, curved forms (based on islimi) calm children, while sharp geometric forms (based on girih) stimulate activity and logical thinking.

Figure 2. Islimi: Biomorphic Forms and Emotional Stability and Color Psychology.

3. COGNITIVE-PSYCHOLOGICAL ANALYSIS OF NATIONAL PATTERNS

3.1. Girih: Geometric Logic and Spatial Thinking

Girih (meaning “knot” in Persian) is a geometric system based on complex mathematical calculations and hidden symmetry. M.S. Bulatov explored geometric harmonization in Central Asian architecture.

Using girih patterns in playgrounds provides:

- Logical thinking development: Repetitive and progressively complex patterns enhance understanding of sequences.

- Spatial orientation: Climbing walls or labyrinths based on girih improve spatial imagination and mental rotation skills.

3.2. Islimi: Biomorphic Forms and Emotional Stability

Islimi consists of plant-like motifs symbolizing softness, growth, and infinity. According to Jean Piaget, children aged 2–7 (preoperational stage) are more attracted to organic, curved forms.

- Stress reduction: Islimi-based elements create harmony with nature and soften the harshness of urban environments.

- Creative imagination: Biomorphic shapes encourage imaginative and pretend play.

4. COLOR PSYCHOLOGY AND NATIONAL COLOR HARMONY

Color is a powerful visual factor influencing a child’s emotional state. Traditional Uzbek palettes include blue, turquoise, and gold tones:

- Blue/Turquoise: Symbolizes sky and water; calms and improves concentration (used in relaxation zones).

- Terracotta/Red: Represents energy and vitality; stimulates activity (used in sports areas).

- **Yellow/Gold:** Symbolizes the sun and joy; enhances memory and mood (used in learning zones).

Design recommendation: overly saturated colors may create “visual noise.” Balance should be achieved with natural materials like wood, stone, or neutral tones.

5. LANDSCAPE DESIGN AND “GREEN FRAMEWORK” INTEGRATION

Playgrounds are integral parts of urban landscapes. According to K.D. Rakhimov, natural conditions and terrain must be considered.

- **Microclimate:** In Uzbekistan’s hot climate, shaded playgrounds are essential. Traditional “ayvon” structures provide both symbolic and functional shading.
- **Ecological safety:** Avoid thorny, toxic, or allergenic plants.
- **Geoplastics:** Small hills and terrain variations develop children’s balance and coordination.

Figure 3. International Safety Standards" and "7. Innovative Technologies.

6. INTERNATIONAL SAFETY STANDARDS AND ERGONOMICS

Safety is the primary criterion in design. Standards such as EN 1176 and ISO 8124 define requirements:

- **Fall safety:** Surfaces should use EPDM rubber, sand, or mulch. These can incorporate national patterns.
- **Entrapment prevention:** Openings must be designed to prevent head or finger entrapment.
- **Materials:** Surfaces must be smooth, non-toxic, and UV-resistant.

7. INNOVATIVE TECHNOLOGIES: FROM 2D PATTERN TO 3D FORM

Modern CAD technologies and 3D printing enable transformation of traditional patterns into spatial forms:

1. **Digitization:** Scanning historical patterns into digital models.
2. **Parametric design:** Using AI to adapt patterns into playground structures.

3. **Smart elements:** LED panels projecting national motifs at night, creating a “magic city” effect.

CONCLUSION

The study shows that using national patterns in playground design is not merely decorative but a scientifically grounded pedagogical and psychological method.

Key conclusions:

- Girih patterns enhance logical and mathematical thinking.
- Islimi elements promote emotional stability.
- National color schemes should be harmonized with safety standards.
- All designs must comply with EN 1176 and ISO 8124.

This research serves as a theoretical guide for creating safe, educational, and culturally meaningful playground environments in Uzbekistan through the integration of national heritage and modern technology.

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