

INTEGRATION OF NATIONAL MOTIFS INTO CONTEMPORARY  
FASHION DESIGN: FROM CRAFT TO DIGITAL AESTHETICSB.D. AITKULOVA\* , Y. TOLEPBAY 

(Almaty Technological University, Kazakhstan, 050012, Almaty, Tole bi str., 100)

Corresponding author's email: balnur.doszhankyzy@mail.ru\*

*This study is dedicated to the critical analysis of the transformation of Kazakh national motifs (ornamentation, chapman and saukele cut) within the fashion industry, driven by the global demand for authenticity and the need to preserve intangible heritage amid digitalization [3, 5]. The research aims to develop and substantiate the "From Craft to Digital" Conceptual Model, ensuring the efficient and ethical integration of traditional art into digital aesthetics. The key research areas include the semiotic analysis of motifs (Qoshqar muyiz), investigation into the influence of 3D technologies and generative design on their interpretation, and evaluation of the heritage's potential for sustainable design [9]. The methodology is based on historical-cultural and comparative analysis of collections over the last decade, supplemented by empirical modeling (translating a motif into a parametric 3D grid using Rhino/Grasshopper). The main results show that successful integration requires conceptual reinterpretation (deconstruction) and algorithmic decoding of traditional principles. The conclusions confirm that digital tools act as a bridge for the revitalization and scaling of local cultural codes. The value of the study lies in the proposed algorithm for adapting Kazakh craft techniques to the needs of Industry 4.0, addressing the lack of methodological resources in regional design.*

**Keywords:** National Motifs, Kazakh Design, Digital Aesthetics, Qoshqar Muyiz, Craft, 3D Modeling, Sustainable Fashion.

ИНТЕГРАЦИЯ НАЦИОНАЛЬНЫХ МОТИВОВ В СОВРЕМЕННЫЙ  
FASHION-ДИЗАЙН: ОТ РЕМЕСЛА К ЦИФРОВОЙ ЭСТЕТИКЕ

Б.Д. АЙТКУЛОВА\*, Е.Т. ТОЛЕПБАЙ

(Алматинский технологический университет, Республика Казахстан,  
050012, г. Алматы, ул. Толе би, 100)

Электронная почта автора-корреспондента: balnur.doszhankyzy@mail.ru\*

*Исследование посвящено критическому анализу трансформации казахских национальных мотивов (орнаментика, крой шапана и сэукеле) в контексте индустрии моды, что вызвано глобальным запросом на аутентичность и необходимостью сохранения нематериального наследия в условиях цифровизации [3, 5]. Целью работы является разработка и обоснование Концептуальной модели "От Ремесла к Цифре", которая обеспечит эффективную и этичную интеграцию традиционного искусства в цифровую эстетику. Основные направления: семиотический анализ мотивов (қошқар мүйіз), исследование влияния 3D-технологий и генеративного дизайна на их интерпретацию, а также оценка потенциала наследия для устойчивого дизайна [9]. Методология основана на историко-культурном и сравнительном анализе коллекций за последнее десятилетие, дополненном эмпирическим моделированием (перевод мотива в параметрическую 3D-сетку с использованием Rhino/Grasshopper). Основные результаты показывают, что успешная интеграция требует концептуального переосмысления (деконструкции) и алгоритмического декодирования традиционных принципов. Выводы подтверждают, что цифровые инструменты служат мостом для ревитализации локальных культурных кодов и их масштабирования. Ценность исследования заключается в предложенном алгоритме адаптации казахских ремесленных приемов для нужд Индустрии 4.0, восполняя дефицит методических материалов в региональном дизайне.*

**Ключевые слова:** Национальные мотивы, Казахский дизайн, Цифровая эстетика, Қошқар мүйіз, Ремесло, 3D-моделирование, Устойчивая мода.

## ҰЛТТЫҚ МОТИВТЕРДІ ЗАМАНАУИ FASHION-ДИЗАЙНҒА ИНТЕГРАЦИЯЛАУ: ҚОЛӨНЕРДЕН ЦИФРЛЫҚ ЭСТЕТИКАҒА

Б.Д. АЙТҚҰЛОВА\*, Е.Т. ТӨЛЕПБАЙ

Алматы технологиялық университеті, Қазақстан Республикасы, 050012, Алматы қ., Төле би көшесі, 100  
Автор-корреспонденттің электронды поштасы: balnur.doszhankyzy@mail.ru\*

*Зерттеу қазақ ұлттық мотивтерінің (өрнектері, шапан мен сәукеленің пішімі) сән индустриясы контекстіндегі трансформациясына арналған, бұл жаһандық аутентиктік сұранысымен және цифрландыру жағдайында материалдық емес мұраны сақтау қажеттілігімен шартталған [3, 5]. Жұмыстың мақсаты — дәстүрлі өнерді цифрлық эстетикаға тиімді және этикалық интеграциялауды қамтамасыз ететін "Қолөнерден Цифрға" Концептуалды Модельін әзірлеу және ғылыми негіздеу. Негізгі бағыттар: мотивтердің (қошқар мүйіз) семиотикалық талдауы, 3D-технологиялар мен генеративті дизайнның оларды түсіндіруге әсерін зерттеу, сондай-ақ мұраның тұрақты дизайн үшін әлеуетін бағалау [9]. Әдіснама соңғы онжылдықтағы коллекциялардың тарихи-мәдени және салыстырмалы талдауына негізделген, оны эмпирикалық модельдеу (Rhino/Grasshopper қолдана отырып мотивті параметрлік 3D-торға аудару) толықтырады. Негізгі нәтижелер табысты интеграция дәстүрлі принциптерді тұжырымдамалық қайта түсінуді (деконструкция) және алгоритмдік декодтауды талап ететінін көрсетеді. Қорытындылар цифрлық құралдар жергілікті мәдени кодтарды жандандыру мен масштабтау үшін көпір қызметін атқаратынын растайды. Зерттеудің құндылығы аймақтық дизайндағы әдістемелік ресурстардың тапшылығын толтыра отырып, қазақ қолөнер әдістерін Индустрия 4.0 қажеттіліктеріне бейімдеудің ұсынылған алгоритмінде.*

**Негізгі сөздер:** Ұлттық мотивтер, Қазақ дизайны, Цифрлық эстетика, Қошқар мүйіз, Қолөнер, 3D-модельдеу, Тұрақты сән.

### **Introduction**

#### **Rationale and Relevance of the Topic**

The paper addresses the vital necessity of transforming Kazakh national iconography (ornamentation, cut of the chapan and saukele) within the contemporary fashion landscape. This necessity arises from two converging trends: the global market's increasing appetite for cultural specificity and the urgent need to safeguard intangible heritage in the rapidly advancing digital age [1, 2].

A retrospective analysis of design scholarship (spanning the last decade) reveals a significant methodological gap. While existing works on ethno-design (Shaigozova [3], Palaguta [4]) have established the semiotic grounding, and Fashion Tech literature (Chen [5], Wang & Li [6]) have described digital instruments, there is a clear critical omission: a structured framework for translating the inherent complexity and variability found in Kazakh artisanal practices (e.g., hand-felting, biz keste embroidery) into industrial-scale digital fabrication. Previous research offers incomplete solutions regarding how the integrity of the craft can be preserved when adopting parametric and automated design workflows. The practical weight of this study is confirmed by the imperative to elevate the international market standing of national Kazakh fashion brands through distinct and authentic cultural positioning.

#### **Defining Research Elements**

- Object of Study: The process of embedding traditional Kazakh cultural codes (qoshqar muyiz

motif, structural geometry of the chapan and kamzol) into the development of modern apparel.

- Subject of Study: The set of conceptual and technological strategies for the algorithmic decomposition and translation of Kazakh craft legacy into a functional digital fashion aesthetic.

- Research Goal: To establish and academically validate the "From Craft to Digital" Conceptual Model, aiming to demonstrate that the revitalization of traditional Kazakh design is possible via digital technologies without compromising its deep cultural meaning and authentic character.

- Hypothesis (Thesis): Successful and responsible integration of national motifs into contemporary fashion is achieved by moving beyond simple reproduction. It requires the algorithmic breakdown of the underlying semiotic and structural rules inherent in Kazakh craftsmanship. Digital tools must therefore be employed to generate novel patterns that are culturally consistent, maintaining the foundational structure and symbolic meaning of the original motif (qoshqar muyiz).

### **Materials and research methods**

#### **Characterization of the Material**

The research material is a complex cultural and design heritage, including:

1. National Motifs (Ornamentation): Patterns like qoshqar muyiz (ram's horn) and bota көз (camel's eye), used in syрмаq (felt carpet), embroidery, and inlay [7].

2. Structural Elements: The traditional cut of the chapan (robe), saukele (wedding headpiece), and kamzol (vest) [4].

3. Designer Collections: Works by contemporary Kazakhstani designers and international brands over the last 10 years that have referenced Central Asian ethnic motifs.

**Research Problem, Hypothesis, and Stages**  
**Research Problem**

The main problem lies in the fact that highly automated digital technologies (3D printing, parametric modeling) are unable to fully reproduce the tactile complexity and organic variability of traditional Kazakh craft techniques (hand-felting, quraq appliqué), which leads to a loss of authenticity when scaling the design.

**The Proposed Hypothesis (Thesis)**

Hypothesis: Effective and ethical integration of traditional Kazakh motifs into contemporary Fashion Design is achieved not through direct scanning or

copying, but through the algorithmic decoding of the basic semiotic and constructive principles of the craft. Digital tools must be used to create new patterns that preserve the structure and meaning of the original motif, but adapted to modern materials and production capacities.

**Research Stages**

1. Stage 1: Semiotic Analysis and Archiving. Collection and classification of basic Kazakh motifs. Studying their symbolic meaning and historical context [2, 8].

2. Stage 2: Comparative Design Analysis. Studying collections based on ethnic motifs. Identifying successful and unsuccessful examples of tradition interpretation [9].

3. Stage 3: Empirical Modeling and Verification. Testing methods of digitalization and parametric modeling using the qoshqar muyiz motif (translation into a 3D texture for printing or laser cutting) [6, 10] (Table 1).

Table 1. Design Research Methods and Procedure

| Method                                  | Description and Procedure                                                                                                                                                                  | Novelty in the Context of the Study                                                                                                                              |
|-----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Historical and Cultural Analysis</b> | Study of museum samples of Kazakh costume. Analysis of sources to identify the original function of the ornament and cut (the utilitarian nature of the chapan).                           | Focus on the utilitarian function of the motifs, which is transferred into modern functional design [4, 11].                                                     |
| <b>Semiotic Analysis</b>                | Decoding of cultural signs, analysis of the transformation of qoshqar muyiz depending on the material.                                                                                     | Establishing a "digital vocabulary" of Kazakh ornamentation: translating the symbol into a basic vector code for further generative design [7].                  |
| <b>Comparative Analysis</b>             | Comparison of three groups: 1) Authentic artifacts; 2) Literal quotation (Folkloric Style); 3) Conceptual deconstruction (Ethno-futurism).                                                 | Comparison of metrics for cultural authenticity and commercial success across different integration approaches [1,9].                                            |
| <b>Empirical Modeling</b>               | Use of Rhino and Grasshopper [10]. Creation of a parametric grid based on qoshqar muyiz. Adaptation of the grid for 3D printing or laser perforation on modern technical textiles [5, 12]. | Novelty: Creation of perforation on neoprene in the shape of qoshqar muyiz as a transfer of the traditional decorative principle (appliqué) into digital product |

**Results and discussion**

**Analysis of Semiotic Decoding of Kazakh Motifs**

The outcomes from the initial (Semiotic Analysis) phase confirmed that Kazakh ornament functions as a highly organized system of cultural signs [3]. Specifically, the pivotal motif, qoshqar muyiz (ram's horn), was meticulously deconstructed into its fundamental curves and angular geometry. This deconstruction allowed for its conversion into a functional parametric code, which subsequently served as the core foundation for all empirical modeling efforts. In contrast to earlier studies that predominantly focused on historical classifications [7], our

investigation introduces a "digital lexicon" of Kazakh ornamentation, specifically engineered for computational and generative design.

**Discussion of Comparative Analysis of Design Practices**

The analysis of fashion collections spanning the previous decade highlighted two primary modes of integrating national themes: literal quotation (resulting in rapid obsolescence) and Conceptual Deconstruction (Ethno-futurism). It was observed that the most commercially and critically acclaimed designers achieve distinction by prioritizing the reinterpretation of structure and silhouette (leveraging the expansive geometry of the chapan) over the mere application of

surface ornament. This approach is intrinsically more justifiable from an ethical standpoint, as it respects the cultural integrity by focusing on systemic principles rather than direct replication [9]. This strongly validates the core principle that the underlying rule holds greater significance than the external form in the context of digital adaptation [4].

### **Empirical Modeling: From Felt to 3D Texture**

The primary accomplishment of the third stage was the successful empirical simulation carried out using the modeling environment Rhino and the auxiliary Grasshopper plugin. The algorithmic grid of qoshqar muyiz was employed to affect a parametric surface distortion. The tangible result was the creation of a perforated texture on an advanced technical textile (neoprene), where the resulting pattern directly corresponds to the geometry of the qoshqar muyiz. This inventive technique successfully achieved three goals: maintaining the motif's symbolism, incorporating functional attributes (such as ventilation), and ensuring high industrial scalability (potential for industrial cutting) [10].

**Analysis of Results:** These practical outcomes provide direct and robust evidence supporting the initial hypothesis. Generative digital tools serve effectively to preserve the structural integrity and cultural resonance of the craft: our work involved creating a novel generation algorithm that produces a distinctly Kazakh motif, fully optimized for the conditions of a digital aesthetic.

### **Conclusion**

#### **What were the Goals and Methods of the Study?**

The central goal of the study was to formulate and provide academic substantiation for the "From Craft to Digital" Conceptual Model, intended for the responsible and practical assimilation of traditional Kazakh craft into modern fashion design. This was executed through a comprehensive multi-disciplinary methodology, encompassing Semiotic Analysis [3], Comparative Analysis [13], and Empirical Modeling [10].

#### **What Results were Achieved?**

- **Algorithmic Decoding of the Motif:** The capacity to translate complex traditional motifs (qoshqar muyiz) into a repeatable and scalable parametric algorithm was definitively demonstrated [5].

- **"From Craft to Digital" Conceptual Model:** The developed model advocates for a shift towards conceptual deconstruction (e.g., extracting the form logic of the chapan) for implementation via digital fabrication methods (3D printing, laser etching) [12].

- **Confirmation of Sustainability:** Findings confirmed that employing digital design tools actively supports the principles of sustainable development

[14], by allowing unique designs to be efficiently scaled, thereby enhancing the economic value of local cultural production [11].

### **What are the Conclusions?**

1. **Validation of the Proposed Thesis (Hypothesis):** The core assertion that effective integration hinges on the algorithmic decoding of fundamental craft principles is unequivocally validated. Digital instruments function as an essential technological linkage, ensuring that the structure and symbolic weight of traditional design endure during its adaptation for modern manufacturing.

2. **Contribution to Academic Knowledge:** This research contributes to the discipline of design theory by transitioning the focus from mere historical replication to generative design using cultural codes. This establishes a contemporary, ethical framework for engaging with national heritage [9].

### **What are the Prospects and Opportunities for Application?**

- **Practical Implementation:** The study's results are immediately applicable within the design curriculum of Kazakh higher education institutions. The Conceptual Model can serve as a detailed strategic guideline for national Fashion brands targeting international markets with technologically advanced and culturally distinct products.

- **Opportunities for Future Research:** The immediate next step involves investigating the role of Metaverse environments on national design. This research would explore the creation of virtual Kazakh apparel (Virtual Saukele), where cultural symbolism and intricate forms can be realized free from the constraints of physical materials [14, 15].

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