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From Clay to Code: Artificial Intelligence and the Reinvention of İznik Tile Motifs

Kilden Koda: İznik Çini Motiflerinin Yapay Zekâ ile Yeniden Yorumlanması

Arş. Gör. Sinem Ünal GERDAN

ORCID: 0000-0002-8599-6753 ◆ Yıldız Teknik Üniversitesi, Grafik Tasarımı, Araştırma Görevlisi ◆ sinem.unal@yildiz.edu.tr

Abstract

This study comprehensively explores how artificial intelligence (AI) technologies can be used to reinterpret and digitally reconstruct traditional Turkish art, with a particular focus on 16th-century Iznik tiles. By bringing together various disciplines such as design, computational creativity, and cultural heritage preservation, the research evaluates the capacity of generative AI tools (e.g., DALL-E, Firefly, Prome AI) to reproduce, reinterpret, and visualize historical tile motifs. The study not only conducts technical experiments but also critically addresses ethical issues such as originality, authorship, and cultural appropriation arising from the use of these tools.

The conceptual background examines how AI-generated visuals transform the symbolic meaning of traditional art forms and how this transformation opens the door to new aesthetic and cultural debates. In this context, the digital reproduction of traditional art is evaluated not merely as a visual transfer, but as a redefinition of meaning, context, and cultural continuity. Methodologically, the study combines descriptive visual analysis on multiple digital platforms with prompt-based image generation processes, thereby establishing a research model that is both qualitative and experimental.

The research findings show that AI tools can offer a high level of visual fluency and aesthetic diversity, but in most cases lack cultural depth, historical contextual knowledge, and an understanding of local aesthetic values. While this highlights the instrumental value of AI in cultural heritage projects, it also underscores the continued indispensability of human expertise. By building a bridge between contemporary computational tools and traditional visual culture, the study makes a meaningful contribution to the evolving literature on the relationship between AI and art.

In addition, it proposes applicable models for how AI-assisted heritage reinterpretation can be integrated into public engagement strategies for museums, educators, and cultural institutions. These models encompass a wide range of applications, from exhibition design to digital archiving, from educational materials to interactive cultural experiences. Thus, the study offers an innovative perspective on the preservation and reinterpretation of cultural heritage in the digital age, both in theoretical and practical dimensions.

***Keywords**:* Artificial Intelligence, İznik Tiles, Cultural Heritage, Generative AI

Extended Turkish Abstract

Bu çalışma, yapay zekâ (YZ) teknolojilerinin geleneksel Türk sanatını, özellikle 16. yüzyıla ait İznik çinilerini yeniden yorumlamak ve dijital olarak yeniden inşa etmek amacıyla nasıl kullanılabileceğini incelemektedir. Tasarım, hesaplamalı

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yaratıcılık ve kültürel mirasın korunması alanlarından yöntemleri bir araya getiren çalışma, üretken YZ araçlarının (örneğin DALL-E, Firefly, Prome AI) tarihsel çini motiflerini yeniden üretme, yorumlama ve görselleştirme kapasitelerini değerlendirmektedir. Teknik denemelerin yanı sıra, araştırma özgünlük, müelliflik ve kültürel temellük gibi etik meseleleri de eleştirel bir bakış açısıyla ele almaktadır.

Kavramsal çerçeve, YZ ile üretilen görsellerin geleneksel sanat biçimlerinin simgesel anlamını nasıl dönüştürdüğünü ve bu dönüşümün yeni estetik ve kültürel tartışmalara nasıl zemin hazırladığını tartışmaktadır. Yöntemsel olarak çalışma, çoklu dijital platformlarda betimleyici görsel analiz ile komut tabanlı görsel üretim süreçlerini bir araya getirerek niteliksel ve deneysel bir araştırma yaklaşımı ortaya koymaktadır.

Bulgular, YZ araçlarının yüksek düzeyde görsel akıcılık sunabildiğini, ancak çoğu zaman kültürel derinlikten ve bağlamsal anlayıştan yoksun kaldığını göstermektedir. Bu makale, çağdaş hesaplamalı araçlar ile geleneksel görsel kültür arasında bir köprü kurarak YZ ve sanat ilişkisine dair gelişen literatüre katkı sağlamaktadır. Ayrıca, müzeler, eğitimciler ve kültürel kurumlar için YZ destekli miras yeniden yorumlamasının kamusal etkileşim stratejilerine nasıl entegre edilebileceğine dair uygulanabilir modeller önermektedir

Kültürel miras, insan kimliğinin temel bileşenlerinden biridir; ancak geleneksel koruma yöntemleri, mirasın çevresel tahribat, çatışma ve zaman karşısında korunmasında çoğu zaman yetersiz kalmaktadır. Buna karşılık, dijital teknolojiler—özellikle yapay zekâ (YZ)—mirası korumak, yeniden yorumlamak ve yeni, dinamik yollarla paylaşmak için güçlü araçlar olarak öne çıkmaktadır.

YZ, sanatçılara ve araştırmacılara kültürel nesneleri daha önce mümkün olmayan bir derinlikte keşfetme imkânı sunar. Büyük veri kümelerini analiz edebilir, gizli desenleri ortaya çıkarabilir ve kültürel materyallere kamusal erişimi artırabilir. Korumanın ötesinde, YZ mirası gelişen bir yaratıcı sürece dönüştürerek hem sanatın tanımını hem de deneyim biçimini genişletmektedir.

Bu çalışma, canlı renkleri, karmaşık motifleri ve kültürel sembolizmiyle tanınan İznik çinilerini Türk kültürel mirasının temel örneklerinden biri olarak ele almaktadır. Yapay zekânın bu eserlerin dijital yeniden yapımı ve yeniden yorumu süreçlerine nasıl katkı sağlayabileceğini incelemektedir. YZ ile oluşturulan İznik çini görsellerinin görsel ve kavramsal çıktıları değerlendirilerek, bu teknolojilerin yaratıcı potansiyeli ile karşı karşıya olduğu etik ve teknik zorluklar birlikte ele alınmaktadır.

Bu çalışmanın amacı, yapay zekâ teknolojilerinin geleneksel Türk sanatını, özellikle 16. yüzyıl İznik çinilerini yeniden yorumlama ve dijital olarak yeniden inşa etme süreçlerine nasıl katkı sunabileceğini araştırmaktır. Araştırma, üretken YZ araçlarının yalnızca renk, form ve desen gibi görsel özellikleri yeniden üretebilme kapasitesini değil, aynı zamanda bu eserlerde yer alan derin sembolik ve kültürel anlamları yansıtıp yansıtamayacağını da incelemektedir

Çalışma, kültürel mirasa yönelik çevresel zararlar, çatışmalar ve geleneksel koruma yöntemlerinin dijital izleyiciye erişimdeki yetersizlikleri gibi artan tehditlerden hareketle şekillenmiştir.

Araştırmanın kapsamı teknik, kuramsal ve etik boyutları içermektedir. Teknik olarak, DALL-E, Firefly ve Prome AI gibi araçların İznik çinilerinin görsel dilini yeniden üretme performansları değerlendirilmiştir. Kuramsal düzlemde, dijital sanat ve kültürel mirasın yeniden yorumlanması süreçleri incelenmiştir. Etik boyutta ise müelliflik, özgünlük ve kültürel temsil sorunları ele alınmıştır. Ayrıca, YZ'nin geleneksel biçimler üzerindeki algıyı nasıl dönüştürdüğü incelenmiş ve müzeler, eğitimciler ve kültürel kurumlar için uygulanabilir öneriler geliştirilmiştir. Böylece çalışma, sanat, teknoloji ve miras kesişimindeki güncel tartışmalara katkı sunmaktadır.

Bu çalışma, Christopher Frayling'in (1993) "tasarım yoluyla araştırma" (research through design) kavramına dayanan uygulamalı bir araştırma çerçevesi benimsemektedir. Bu modelde, görsel çıktılar yalnızca betimleyici değil, aynı zamanda bilgi üretiminin temel yöntemi olarak kabul edilmektedir—yani üretim, deneme ve düşünsel yansıma yoluyla bilgi üretilmektedir.

Çalışma, dijital görsel kültür kuramlarından, özellikle Lev Manovich'in yaklaşımlarından esinlenmiş ve komut mühendisliği yalnızca teknik bir işlem değil, yaratıcı ve yorumlayıcı bir süreç olarak ele alınmıştır. Araştırmacı, kültürel çevirmen ve eleştirel değerlendirici rollerini üstlenmiş, bu da özellikle İznik çinileri gibi kültürel açıdan özgül motiflerle çalışırken kritik bir önem taşımıştır.

Çalışma, tarihsel ve görsel analizle başlayan uygulamalı bir görsel deneme tasarımı kullanmaktadır. Literatür taraması ve görsel belgeler aracılığıyla İznik seramiğine özgü boyut (25,4 x 25,4 cm), simetri, renk paleti (kobalt mavisi, turkuaz, zümrüt yeşili, parlak kırmızı) ve floral-geometrik motifler gibi temel nitelikler tanımlanmıştır. Bu analiz, tarihsel açıdan doğru ve standartlaştırılmış bir komutun oluşturulmasına temel teşkil etmiştir.

Oluşturulan komut, Prome AI, DALL·E 2, DALL·E 3, Adobe Firefly, Adobe Express ve ChatGPT Sora olmak üzere altı önde gelen YZ görüntü üretim aracında test edilmiştir. Üretilen çıktılar şu niteliklere göre niteliksel olarak değerlendirilmiştir:

İznik tarzına estetik sadakat

Motiflerin doğru şekilde yeniden üretimi

Kültürel bütünlük ve simgesel derinlik

Yaratıcı yeniden yorumlama

Sayısal puanlama yerine karşılaştırmalı görsel analiz yöntemi tercih edilerek, her aracın kültürel özgüllük ve görsel gelenekle kurduğu ilişki değerlendirilmiştir.

Araştırma, insan merkezli bir model benimsemiş, araştırmacı üretim sürecine aktif şekilde katılarak komutları şekillendirmiş ve çıktıları tarihsel ve kültürel bütünlük açısından yorumlamıştır. Bu yaklaşım, YZ destekli yorumlamaların insan uzmanlığına ve eleştirel yargıya dayalı kalmasını güvence altına almıştır.

Bu çalışma, 16. yüzyıla ait İznik çini motiflerinin YZ araçlarıyla nasıl yeniden üretildiğini incelemek için uygulamalı bir görsel test yöntemi kullanmıştır. Bulgular, Prome AI, DALL·E ve Adobe Firefly gibi platformların, kültürel açıdan zengin komutlar kullanıldığında görsel açıdan etkileyici sonuçlar üretebildiğini göstermektedir. Bazı araçlar, yüzeysel özellikler olan renk uyumu ve geometrik tekrar gibi unsurları başarıyla yansıtabilse de tarihsel doğruluk, motif kesinliği ve mimari kompozisyon açısından zayıf kalmıştır.

Bu sonuçlar, mevcut YZ teknolojilerinin kültürel miras bağlamlarındaki hem potansiyelini hem de sınırlılıklarını ortaya koymaktadır. Elde edilen çıktılar, özellikle komut oluşturma, estetik değerlendirme ve kültürel uyum açısından insan rehberliğinin önemine dikkat çekmektedir. Uzman bilgiyi ikame etmekten ziyade, YZ'nin eleştirel ve etik bir çerçevede kullanıldığında yaratıcı yeniden yorumlama süreçlerini destekleyen tamamlayıcı bir araç olarak işlev gördüğü görülmektedir.

Bu araştırma aynı zamanda 2025 yılı itibarıyla üretken YZ'nin görsel performansına dair tarihsel bir anlık görüntü sunmakta; dijital beşeri bilimler alanında gelecekteki arşivleme ve karşılaştırmalı çalışmalar için kaynak niteliği taşımaktadır. Tarihsel ve simgesel açıdan zengin biçimlerle çalışan güncel YZ araçlarının kültürel mirasa yaklaşımını uygulamalı olarak inceleyerek, YZ, kültürel miras ve görsel sanatlar kesişimindeki disiplinlerarası tartışmalara katkı sunmaktadır.

Çalışmanın temel katkıları arasında, YZ'nin kültürel miras bağlamındaki görsel performansına dair daha net bir kavrayış, müelliflik ve önyargılar üzerine etik bir değerlendirme ve teknoloji ile beşerî bilimler arasında daha derin bir iş birliği çağrısı yer almaktadır. Araştırma, YZ'nin kültürel temelli tasarım ve miras koruma çalışmalarında bir "ikame" değil, destekleyici bir sistem olarak ele alınmasını önermektedir.

***Anahtar Kelimeler**:* Yapay Zekâ, İznik Çinileri, Kültürel Miras, Üretken Yapay Zekâ

Introduction

Cultural heritage forms the foundation of human identity, embodying values transmitted across generations. Yet, it remains vulnerable to environmental degradation, conflict, and time (Beridse, Kumar, 2025, p. 637). Traditional preservation methods are often constrained by limited resources and scope. In response, digital technologies—particularly artificial intelligence (AI)—are playing a transformative role in preserving and reinterpreting cultural heritage.

AI offers artists and cultural practitioners new ways to create and engage with heritage, expanding both the definition and boundaries of art (Gülpınar and Boyraz, 2024, p. 5). With its capacity to process vast historical datasets, uncover patterns, and optimize resource management, AI enhances accessibility and preservation while enabling new forms of creative production (Tiribelli, 2024, p. 293). It shifts preservation from a static process to one of interactive reinterpretation, suggesting a future where safeguarding heritage becomes a creative act in itself.

This study focuses on İznik tiles—a prominent element of Turkish cultural heritage known for their vibrant colors, geometric precision, and symbolic depth (Türel Art, 2021). It explores how AI-driven reinterpretation can contribute to the digital reconstruction of such heritage, assessing both the transformative potential and the challenges at the intersection of traditional aesthetics and emerging technologies. Building on AI's dual role in preservation and transformation, the next section grounds the study in the historical and aesthetic specificities of İznik tiles. This background provides the evaluative criteria—palette, motif grammar, and compositional logic—against which AI-generated outputs will later be read.

Historical and Artistic Legacy of İznik Tiles

İznik tiles are a unique tiles art form rooted in the rich history of Turkish art, reaching their zenith during the Ottoman Empire. This section provides the fundamental context for their digital reinterpretation by discussing the rich history, distinctive artistic characteristics, and profound cultural significance of İznik tiles. Having outlined İznik tiles' material, formal, and symbolic features, we now turn to how contemporary AI methods intersect with these features—from digitization and virtual reconstruction to generative reinterpretation.

Origins, Development Processes, and Characteristic Features

Tile art in Anatolia has deep roots, beginning with the Uyghur Turks and continuing with the Karakhanids and Great Seljuks, with İznik emerging as the historical capital of this art (Doğan, 2025). İznik's tile production dates back to the 4th century BCE, influenced by Mesopotamian, Egyptian, and Asian ceramic traditions (Gökçe, 2018, p. 225). The true development and global recognition of İznik tiles occurred particularly between the 15th and 17th centuries during the Ottoman Empire. These tiles were widely used in Ottoman palaces, mosques, and other important buildings, making significant contributions to Ottoman architecture by adding colorful and vibrant designs (UNESCO, 2014).

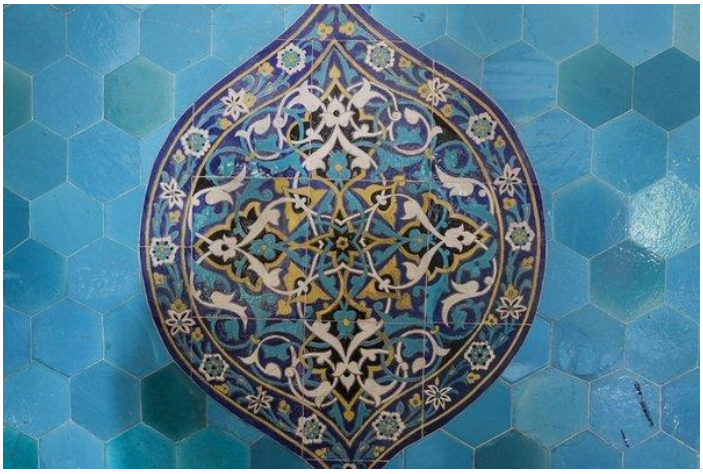

Figure 3. *The Green Complex (1413–1419) in Bursa, commissioned by Sultan Mehmed I, named after its turquoise, green, and blue İznik tiles. Source: Fikriyat, 2018.*

The earliest examples can be found in the Green Mosque and Mausoleum in Bursa (1421) and the Muradiye Mosque in Bursa (1426). The “Green Complex” (Figure 1) (1413–1419), built by Sultan Mehmed I, is named after its İznik tiles in turquoise, green, and blue, considered unique in ceramic art. The richly decorated complex symbolizes the Ottoman revival after the Interregnum and remains a landmark attracting visitors (Fikriyat, 2018).

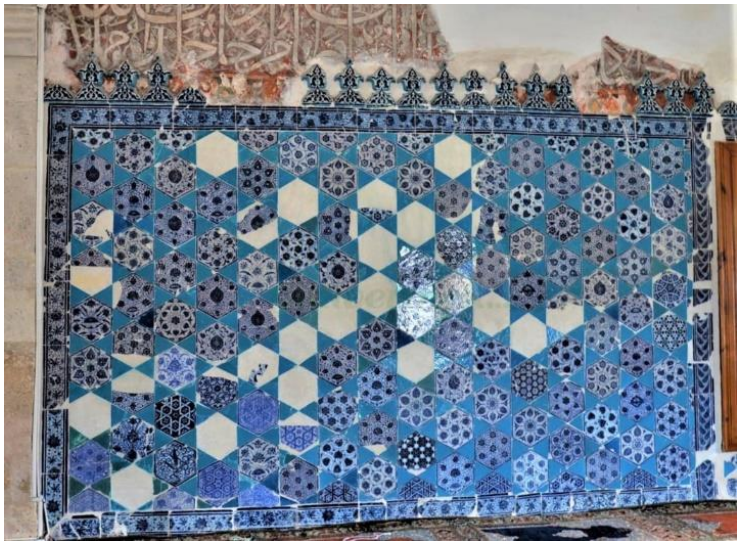

Figure 2. *Muradiye Mosque Tiles. Hexagonal blue-and-white tiles with turquoise fillers forming stars, early underglaze technique. Source: Elbeyli, 2017.*

The Muradiye Mosque (1426, Bursa) represents one of the earliest applications of the underglaze technique in Ottoman tile art. As noted by Rezan Elbeyli, “the side walls are covered with hexagonal blue-and-white tiles (Figure 2) on a white ground, produced in 37 variations using the underglaze technique—the first examples of this method in the Ottoman Empire. Turquoise triangular tiles fill the gaps, forming star-shaped compositions” (Elbeyli, 2017).

İznik tiles represent a significant technical innovation in Turkish ceramic art. Their bodies are composed of granulated quartz, frit and a small amount of white clay, which gives them durability and brilliance. (Frit is a granulated ceramic compound commonly used as a key component in enamel and ceramic glazes). The "Nakkaşhane" institution in Istanbul, established in the late 15th century and reaching its peak in the 16th century, played a vital role in the design process. Ottoman painters prepared paper drawings that İznik artisans used as stencils, ensuring the production of precise and identical patterns. İznik tile was influenced by Chinese blue-and-white tile and metalwork, with their motifs evolving from initial curvy branches, Rumi, lotus, and palmette motifs to a more naturalistic tendency later incorporating specific flowers and animal figures (Gökçe, 2018, p. 226). This indicates that İznik tile art was not a static tradition but a dynamic art form that assimilated external influences and adapted over time. This historical artistic evolution and intercultural synthesis provide a fundamental argument supporting the legitimacy of AI-based reinterpretation as a continuation of this dynamic process.

In İznik tiles, motifs often appear as symmetrical forms rising from a strong root, dominating the center of the composition. While preserving their natural shapes, these motifs are enriched with intricate inner details. Floral patterns such as tulips, carnations, hyacinths, roses, poppies, pomegranates, and spring branches are combined with nature-inspired elements like rocks and waves, as well as geometric borders such as zencerek, creating a harmonious and ornamental whole (Kurt Kırtay, 2023, p. 142). Building on these compositional principles, the visual language of İznik tiles is further distinguished by its vibrant color palette and refined decorative techniques.

İznik tiles are characterized by their rich colors and intricate patterns. Blue (obtained using cobalt oxide), red, green were predominantly used. The red color, achieved through a special technique, is a particularly distinctive feature (Türel Art, 2021). Motifs typically include botanical designs (tulips, carnations, roses, hyacinths, pomegranates, grapes), animal figures (birds, dragons, phoenixes), and geometric patterns (stars, crosses, circles, squares) (UNESCO, 2014).

Place in Turkish and World Art and Cultural Value

İznik tiles are considered one of the most important and recognized representatives of Turkish art. They are valued for their vibrant aesthetics, historical significance, and symbolic depth.These tiles reflect the rich culture and history of the Ottoman Empire, serving not only as artworks but also as historical documents. Beyond their aesthetic value, İznik tiles hold a significant place in the spiritual fabric of society, reflecting cultural history and meaning (Doğan, 2025). Each motif and color has its own deep symbolic meanings, making them storytellers rather than mere decorative objects.

The art form experienced a period of decline in the 17th century but was revived three centuries later by dedicated individuals, demonstrating the resilience and enduring value of the heritage (Türel Art, 2021). Today, the finest examples of İznik tiles are exhibited in leading museums worldwide. Qualities such as the "spiritual fabric" (Doğan, 2025) and "symbolic depth" (UNESCO, 2014) of İznik tiles suggest that they possess an intrinsic "aura" that transcends their physical form. However, it is noted that AI-supported virtual experiences might weaken this "aura" and the physical experience of the artwork, leading to "communicative and relational impoverishment." (Doğan, 2025). This highlights a significant tension: while AI offers unparalleled accessibility and new forms of interaction, there is a risk of losing the intangible, spiritual connection that defines much of cultural heritage. The challenge for AI reinterpretation is not merely to replicate visuals but to attempt to convey or evoke this deeper cultural resonance, or at least acknowledge what is lost in translation.

Table 1. *Feature categories and their symbolic meanings in İznik tiles*

Feature Category	Details and Meanings
Colors	Blue: Represents the sky and sea (obtained with cobalt oxide).

	Red: Symbolizes love and passion (produced with a special technique). Green: Expresses nature and fertility.
	Rarely Yellow / Turquoise / Purple: Add aesthetic variety and symbolic depth.
Materials	Quartz, frit, white clay, glass enamel, metal oxide paints.
Production Process	Shaping, initial firing, outlining (pattern drawing), painting, glazing, and a second high-temperature firing.
Important Floral Motifs	Tulip: Love and affection.
	Carnation: Loyalty.
	Rose: Beauty.
	Hyacinth: Longing.
	Pomegranate: Abundance and wealth.
	Grape: Paradise and eternal life.
Important Animal Motifs	Bird: Freedom and ascension (in pairs: love and loyalty).
	Dragon: Power and might.
	Phoenix: Rebirth and immortality.
Geometric Motifs & Meanings	Star: Light and guidance.
	Cross: The four cardinal directions and the universe.
	Circle: Eternity and perfection.
	Square: The four elements (fire, air, water, earth) and the four seasons.

The table below summarizes the key features of İznik tiles and the meanings of their motifs:

Artificial Intelligence in the Digital Reconstruction of Cultural Heritage

Artificial intelligence is creating revolutionary changes in the fields of cultural heritage preservation, restoration, and virtual reconstruction. This section discusses the broad applications of AI for cultural heritage, providing a basis for its use specifically with İznik tiles. Literature points to both opportunities and risks; to test them in practice, the following section reviews AI models relevant to stylistic transfer and synthesis as a prelude to our practice-based protocol.

Applications of Artificial Intelligence Technologies

Artificial intelligence is transforming cultural preservation practices through deep learning, machine learning, and virtual reconstruction techniques (Beridse and Kumar, 2025, p. 637). These technologies enhance artifact restoration, heritage digitization, language preservation, and the creation of immersive experiences through virtual reality.

Virtual reconstruction using AI enables the restoration of damaged or lost cultural artifacts and sites, offering interactive insights into the past. Generative AI further supports heritage preservation through 3D modeling, photogrammetry, oral-history archiving, and digital documentation tools (Ajuzieogu, 2021, p. 4-18).

The approach to cultural heritage preservation has evolved from focusing on "mitigation" of harmful effects in the past to an "adaptation approach" today. This new approach emphasizes "ensuring cultural continuity and giving heritage new values and meanings depending on changes in society." (Tiribelli et al. 2024, p.293). AI's ability to create "dynamic, interactive experiences" and "new

art forms through generative AI" (Beridse and Kumar, 2025, p. 637-638). aligns perfectly with this adaptation approach. This makes it possible for AI not only to freeze heritage in time but also to actively re-engage with it, allowing it to evolve and remain relevant in contemporary society, thereby ensuring its continuity.

Existing Digital Reconstruction Projects and Examples

Digital reconstruction projects have gained prominence in recent years, utilizing Augmented Reality (AR), Virtual Reality (VR), and AI-supported modeling methods to revive lost cultural heritage. A significant case study in this field is the digital reconstruction of Saray-ı Amire, a lost Ottoman architectural structure in Manisa (Özkuyumcu and Kalaycı, 2025, p. 13).

The Manisa Saray-ı Amire case study clearly demonstrates that while AI tools offer "rapid modeling workflows" and "significant advantages in terms of time efficiency", "fast modeling processes often lead to a loss of detail" and have "limitations in preserving historical accuracy." This reveals a fundamental dilemma in the field of digital heritage: the efficiency and speed offered by AI often come at the cost of detailed historical accuracy and complex nuances. This underscores that a purely AI-driven approach is insufficient for truly authentic and valuable digital reconstruction work, emphasizing the indispensable role of human expertise and a "hybrid methodology" (Özkuyumcu, 2025, p. 14).

For instance, Hutson et al. emphasize how digital twins can safeguard both physical structures and intangible cultural narratives (Hutson et al., 2023, p. 4). While digital reconstruction projects focus primarily on the recovery and preservation of tangible heritage, a parallel field has emerged where artificial intelligence is applied to reinterpreting artistic and cultural expressions. This creative dimension shifts the emphasis from restoration to reimagination—examining how AI can act not only as a technical tool but also as a co-creator in the visual arts.

AI Models and Artistic Creativity

Artificial intelligence offers unprecedented opportunities to reinterpret historical paintings and artworks, bringing classical masterpieces into modern art. Generative models such as Generative Adversarial Networks (GANs) and Neural Style Transfer (NST) are key to this process (Leong, 2025, p. 3). GANs, consisting of a generator and a discriminator, learn to produce new data resembling training examples and excel in image synthesis, creating realistic, complex images (İnanç, 2025). They are particularly capable in high-resolution synthesis, able to emulate intricate style details such as brushstrokes, lighting, and the texture of classical paintings (Neural Frames, 2025).

Neural Style Transfer (NST) combines the content of one image with the style of another, separating content and style features using deep learning algorithms (İnanç, 2025). This makes it possible to transform photographs into the style of famous paintings or artistic movements. (Neural Frames, 2025). Stable Diffusion models offer creative freedom and can generate new compositions inspired by historical movements (Leong, 2025, p. 2). AI is described as a "digital artist" emulating human creativity (Wood, 2022). This indicates that AI is fundamentally changing the traditional paradigm of artistic creation, transforming it from the exclusive domain of skilled human artists to a more inclusive, technologically supported practice. This raises questions about the future role of human artists and the definition of artistic skill.

Based Reinterpretation of İznik Tile Motifs and Aesthetics

The reinterpretation of İznik tile motifs through artificial intelligence represents a compelling convergence of cultural heritage and technological advancement. Generative models such as GANs (Generative Adversarial Networks), as well as tools like DALL·E and Midjourney, have demonstrated notable success in mimicking the intricate floral and geometric patterns characteristic of Ottoman-era İznik tiles. These models are able to learn and replicate traditional aesthetics through visual features and color schemes embedded in historic tilework (Xiong and Wu, 2023, p.5). Similarly, machine learning algorithms can approximate high-fidelity tile designs by minimizing visual error across large

datasets, reproducing traditional forms with impressive accuracy (Matsumura et al., 2019, p. 3). However, the authenticity of such outputs is largely dependent on the training data and input specificity, which may influence the level of cultural and visual fidelity achieved (Xiong and Wu, 2023, p. 6).

Case Studies and Artist-AI Collaboration

Collaborations between artists and artificial intelligence (AI) have increasingly gained prominence in today's art world, particularly in projects grounded in traditional cultural heritage motifs such as Turkish tile art. These partnerships position AI not merely as a tool, but as a creative partner that influences both artistic decisions and aesthetic outcomes (Rozental et al., 2024, p. 4). Artists employ generative design methods to reinterpret heritage-inspired motifs—transforming existing patterns or generating entirely new compositions (Ibrahim, 2023, p.7).

Moreover, AI-generated reinterpretations are not limited to static replications of historical motifs; they act as bridges between traditional and contemporary art practices. Interactive installations powered by machine learning and GANs can evolve in real time based on environmental data or viewer interaction, transforming artworks into dynamic, participatory experiences that blur the line between creator and algorithm. This development shows that AI not only reinterprets existing styles but also introduces new artistic forms and mediums, supporting the unpredictable and organic evolution of creative expression (Yuhan, 2024, pp. 9090–9101).

Technologies like style transfer even extend into video and interior design contexts, suggesting future possibilities where AI pushes the boundaries of artistic imagination beyond what traditional media allowed (Neural Frames, 2025).

In this context, various studies have examined the potential of AI in reproducing İznik tile motifs and aesthetic features in contemporary architectural and interior design (Gür et al., 2024, p. 2). Tools such as DALL-E and Midjourney are capable of generating "vibrant Turkish floral tile patterns" and "historically referenced contemporary designs" (www.freepik.com, 2025, Gür et al., 2024, p. 1).

Figure 1. *Vibrant Turkish Floral Tile Pattern With Blue Red and Yellow Flowers Generative AI | Premium AI-generated image. (2024, September 23). Freepik.*

One such example—referred to as Image X—was freely created and published by a user on the stock image platform Freepik, where AI-generated content is openly shared (Freepik, 2024). However, research indicates that such tools are "hardly equipped with the necessary conceptual background for the interpretation of traditional İznik tiles in contemporary architectural design" (Leong, 2025, p. 2). This underscores a significant limitation: although AI may successfully replicate visual patterns and surface aesthetics, it often fails to capture the deeper cultural, symbolic, and emotional "spirit" embedded in traditional art forms.

Nonetheless, this creative expansion brings forth critical concerns. The integration of AI into artistic production processes raises ethical debates regarding the conceptual depth of artworks and the role of the artist's creative agency. It is argued that although AI enhances technical capabilities, it risks leading to a superficialization of artistic essence (Urquiza and Monroy-Mondragón, 2024, p. 3). Similarly, Artists have argued for clearer regulations that address these challenges, emphasizing the importance of transparency in AI training processes, especially when derived from traditional cultural expressions (Lovato et al., 2024, p. 910). Furthermore, the inability of AI systems to fully grasp the contextual and symbolic depth of traditional art forms poses a cultural risk: although innovative reinterpretations may emerge, there is a danger that cultural authenticity may be lost in translation (Gjorgjieski, 2024, p. 52).

These critical reflections underscore the necessity of positioning AI as a tool that enriches cultural and symbolic heritage rather than replacing the human creative role it is meant to complement. Also, these observations motivate a focused inquiry: we therefore articulate the study's aim and operationalize it through a standardized prompt and a comparative, practice-based method.

Aim

The aim of this study is to explore how artificial intelligence technologies can contribute to the reinterpretation and digital reconstruction of traditional Turkish art, with a particular focus on 16th-century İznik tiles. The research examines not only the capacity of generative AI tools to reproduce visual characteristics such as color, form, and pattern, but also their potential to reflect the deep symbolic and cultural meanings embedded within these works.

Method

This study adopts a practice-based research framework, grounded in Christopher Frayling's (1993) concept of "research through design." In this model, the creation of visual outputs is not merely illustrative but constitutes a core method of inquiry—generating knowledge through making, testing, and reflection.

Informed by digital visual culture theory, especially the work of Lev Manovich, prompt engineering is treated not as a purely technical process, but as a creative and interpretive act. The researcher functions as both cultural translator and critical evaluator—particularly crucial when working with culturally specific motifs like those of 16th-century İznik tiles.

The study uses an applied visual experimentation design, beginning with a historical and visual analysis of İznik tile. Drawing on scholarly literature and visual documentation, key attributes such as size (25.4 x 25.4 cm), symmetry, color palette (blue, turquoise, emerald green, brilliant red), and floral-geometric motifs were identified. This analysis informed the construction of a standardized, historically accurate prompt.

This prompt was tested across six leading AI image generation tools—Prome AI, DALL·E 2, DALL·E 3, Adobe Firefly, Adobe Express, and ChatGPT Sora. Outputs were evaluated qualitatively based on:

- Aesthetic fidelity to İznik style
- Accuracy of motif reproduction
- Cultural coherence and symbolic depth
- Creative reinterpretation

Instead of numerical scoring, comparative visual analysis was used to assess each tool's engagement with cultural specificity and visual tradition.

The research follows a human-in-the-loop model, with the researcher actively shaping prompts and interpreting outputs to maintain historical and cultural integrity. This ensures that AI-assisted reinterpretation remains grounded in human expertise and critical judgment. With the prompt, tools, and criteria fixed, we report comparative results across six generators, attending to aesthetic fidelity, motif accuracy, cultural coherence, and creative reinterpretation.

Findings

Using one historically grounded prompt across six generators, we observed a consistent pattern: tools reliably reproduced surface regularities (symmetry, tiling rhythm, cobalt–turquoise harmony) yet underperformed on culturally determinant specifics—most notably bole-red relief, border grammar, and tulip/pomegranate morphology. Expert checkpoints measurably improved cultural coherence.

This study employed a practice-based visual testing methodology to investigate how contemporary AI tools reinterpret 16th-century İznik tile motifs. The findings reveal that generative platforms such as Prome AI, DALL·E, and Adobe Firefly are capable of producing visually compelling outcomes when provided with culturally specific and detailed prompts. While these tools successfully emulate certain surface-level characteristics—such as color schemes, symmetry, and geometric repetition—they frequently fall short in capturing historical accuracy, precise motif structures, and the architectural coherence intrinsic to the original designs.

The results underscore both the promise and the limitations of current AI technologies in the context of cultural heritage. Notably, the outputs emphasize the indispensable role of human input, particularly in prompt formulation, aesthetic evaluation, and ensuring cultural alignment. Rather than serving as replacements for domain-specific expertise, AI systems are best positioned as supplementary instruments that support creative reinterpretation when used with critical awareness and ethical responsibility.

Furthermore, this research serves as a temporal benchmark for assessing the visual capabilities of generative AI tools as of 2025, contributing to archival and comparative efforts in the digital humanities. By offering a practice-based examination of how AI interacts with symbolically and historically rich forms such as İznik tiles, the study advances the interdisciplinary discourse at the intersection of artificial intelligence, cultural heritage, and visual arts.

The research affirms that while AI can replicate stylistic and formal attributes, it often lacks the contextual understanding and cultural sensitivity required for meaningful reinterpretation. This deficiency highlights the continued necessity of human oversight in domains where nuance, historical depth, and symbolic resonance are essential.

This study introduces:

1. a standardized, historically grounded İznik prompt (dimensions, palette, border grammar, motif taxonomy) usable for future benchmarking;
2. a four-criterion rubric—aesthetic fidelity, motif accuracy, cultural coherence/symbolic depth, creative reinterpretation—applied comparatively across six tools;
3. a 2025 temporal snapshot of generator capabilities in a culturally dense domain; and
4. a human-in-the-loop workflow identifying where expert checks (palette locks, border grammar, tulip/pomegranate morphology) materially improve cultural validity.

Prompt Engineering and Digital Literacy in AI-Based Cultural Heritage Visualization

Building upon the previous discussions on artistic collaboration, this section explores the role of digital literacy—particularly prompt engineering—in AI-assisted cultural heritage visualization. The ability to formulate effective prompts is crucial for obtaining accurate and culturally respectful visual outputs from generative AI tools.

Digital literacy in this context includes the skill to write precise and historically informed prompts that enable AI-based visualization platforms to generate meaningful representations of traditional artworks. Below is an illustrative example, in which a historical description of an İznik tile from the Harem section of Topkapı Palace is translated into a detailed prompt suitable for AI tools such as Sora, Adobe Firefly, and Express.

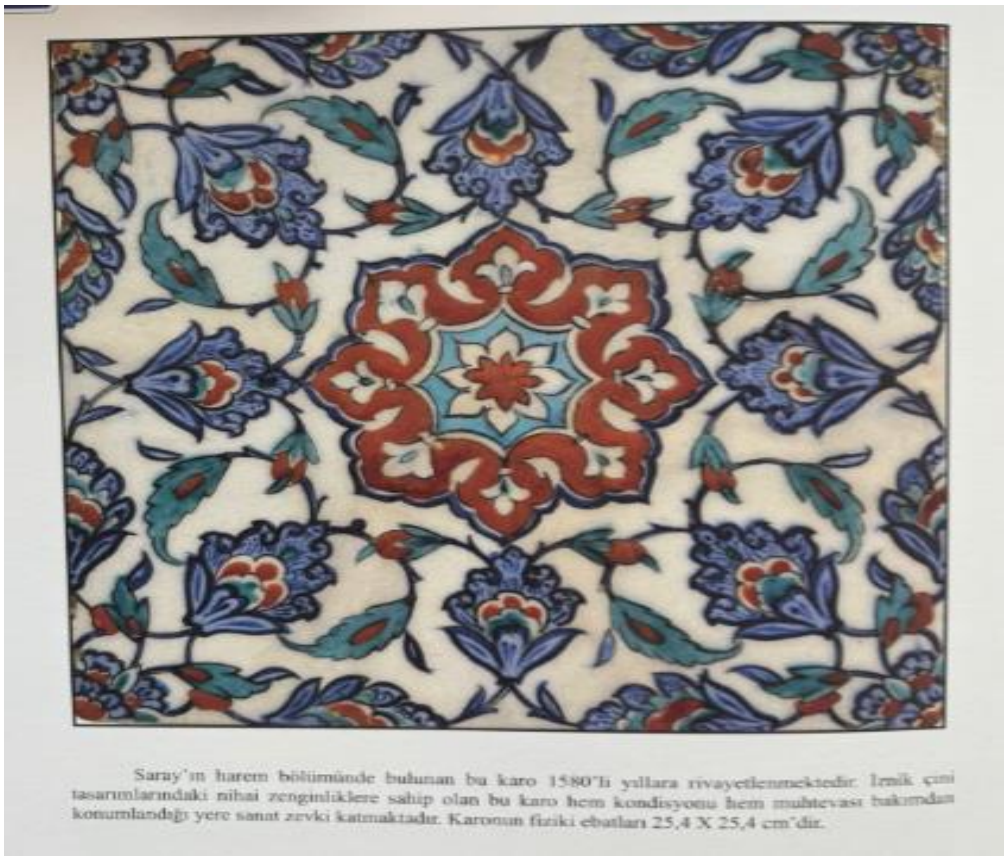

Figure 2. *Iznik Tile*

Translated Description (p. 120)

"This tile, located in the Harem section of Topkapı Palace, is believed to date back to the 1580s. Possessing the ultimate richness found in İznik tile designs, this tile contributes artistic elegance to its location through both its well-preserved condition and its intricate content. The physical dimensions of the tile are 25.4 x 25.4 cm."

AI Visualization Prompt Example

"Generate a highly detailed and realistic image of an İznik tile located in the Harem section of Topkapı Palace, dating back to the 1580s. The tile should exhibit the ultimate richness of İznik tile designs, adding artistic flair to its location in terms of both condition and content. The physical dimensions of the tile are 25.4 x 25.4 cm. Emphasize vibrant İznik colors such as blue, red, green, and turquoise. It should include intricate floral motifs like tulips, carnations, roses, hyacinths, pomegranates, and grapes, as well as elegant geometric patterns. The tile should appear perfectly preserved in a historical setting, subtly referencing the opulent atmosphere of the Harem. High-resolution, artistic photograph."

This prompt provides the AI model with specific, historically grounded instructions—ranging from contextual and aesthetic information to dimensions and symbolic motifs—thus enabling a more accurate and culturally informed visual interpretation.

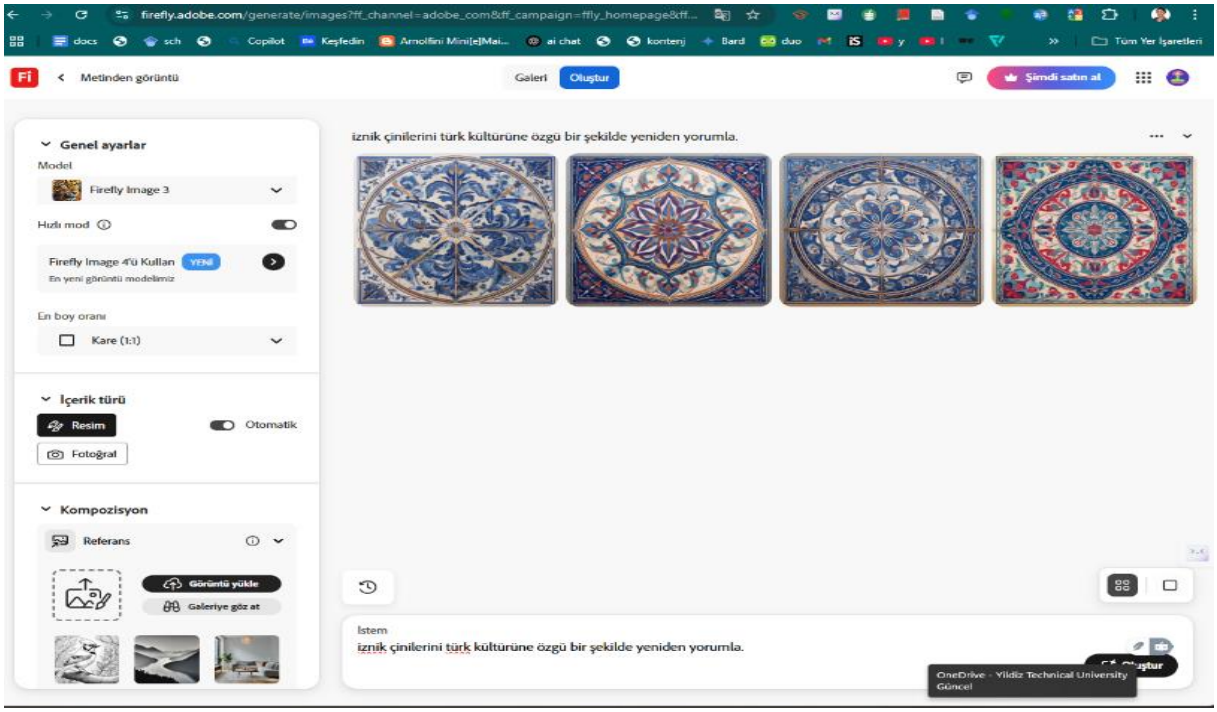

Figure 3. *First Visual Trial Using Adobe Firefly Interface (2025, September 15).*

Before developing the detailed prompt presented below, an initial experiment was conducted using Adobe Firefly (Image Model 3) via its web-based text-to-image interface (https://firefly.adobe.com). The first trial prompt, written in Turkish — "Reinterpret İznik tiles in a manner unique to Turkish culture." — was intentionally kept simple to observe how the AI tool would interpret cultural and stylistic nuances without explicit historical or compositional guidance.

As shown in Figure 3, the generated visuals reflect a preliminary attempt to capture İznik tile aesthetics, yet they primarily emphasize surface-level floral and geometric ornamentation. Following this initial experiment, the prompt was systematically refined to include historical context, dimensions, color palette, and symbolic motifs, as exemplified in the English version presented below. This process illustrates how iterative prompt engineering contributes to a more accurate and culturally informed AI visualization workflow.

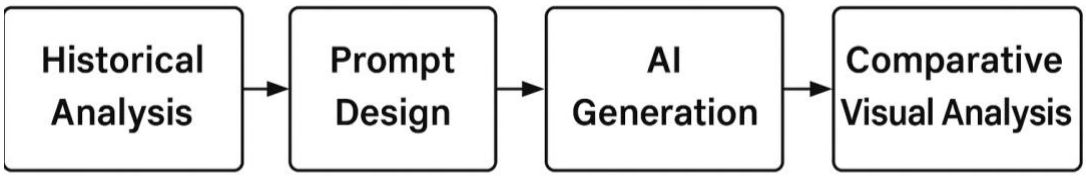

Figure 4. *AI-Driven Image Generation Workflow.*

Following the initial exploratory test illustrated in Figure 3, the workflow was subsequently formalized into a structured methodological process summarized in Figure 4. This flow diagram visualizes the sequential stages of the study—beginning with historical analysis, progressing through prompt design and AI generation, and concluding with comparative visual analysis and evaluation. By transforming the experimental prompt trials into a repeatable and transparent workflow, the research establishes a systematic framework that bridges artistic experimentation and academic rigor. This structured approach ensures that each phase of AI-assisted reinterpretation remains grounded in cultural authenticity while allowing iterative creative exploration within a controlled methodological context.

Ethical and Technical Challenges of AI-Assisted Reinterpretation

The increasing use of AI in cultural heritage reinterpretation brings with it ethical and technical challenges. Core concerns include authorship, authenticity, cultural bias, model transparency, and the essential role of human involvement.

Authorship and Authenticity

AI-generated artworks raise unresolved legal and ethical questions around authorship. As Cunningham notes, "The legal definitions struggle to keep pace with technological advancement, leading to unresolved questions about the rights of artists over AI-generated works" (Cunningham, 2025, p. 141). Legal cases such as Thaler v. US Copyright Office reflect the urgency for clearer frameworks. Visually convincing outputs often lack deeper meaning; "AI-generated artworks may demonstrate cosmetic proficiency, [but] they can risk becoming mere imitations devoid of authentic intent" (Qureshi et al., 2025, p. 106).

Cultural Bias in Training Data

Bias in training datasets—especially those dominated by Western imagery—can distort or erase non-Western cultural meaning. "AI systems trained predominantly on Western-centric datasets often misinterpret or entirely overlook the symbolic meanings embedded in non-Western artistic traditions" (Jerrin and Bhuvaneswari, 2024, p. 89). This leads to superficial replication and narrows interpretive depth.

Opacity and Algorithmic Limitations

Artificial intelligence often distorts cultural symbols because it interprets them based on surface-level visual similarities (Li et al., 2024, p. 46). In the case of İznik tiles, motifs like the tulip or the phoenix carry deep historical and cultural meanings that AI systems are typically unable to grasp. Furthermore, the decision-making process of AI models is not always transparent, making it difficult to identify or correct such misinterpretations. While the visual output may appear compelling, human oversight remains essential to ensure cultural sensitivity and contextual accuracy.

Human-in-the-Loop and Cultural Sensitivity

To overcome these issues, human involvement is key. "Collaboration between human creativity and AI can yield more nuanced cultural interpretations" (Vivaldi and Sutedja, 2024, p. 1320). Similarly, "Human artists are essential in the AI design process to ensure the work is grounded in cultural intent…" (Tang, 2025, p. 1). These findings stress the need for human-AI collaboration in culturally sensitive contexts.

In sum, responsible integration of AI into heritage practices requires confronting issues of authorship, cultural bias, and transparency, while reinforcing the importance of human expertise in every step of the generative process.

Transition to Experimentation Section

Building on these challenges, the next section presents a comparative test using a standardized İznik tile prompt to evaluate the performance of six leading AI image generators—Prome AI, DALL·E 2, DALL·E 3, Adobe Firefly, Adobe Express, and ChatGPT Sora. Each tool is assessed for its ability to visualize the following historical description:

A richly detailed 25.4 x 25.4 cm İznik tile tile from the 1580s, originally located in the harem section of Topkapı Palace. The tile features traditional Ottoman floral and geometric patterns in blue and turquoise on a white glazed background. It is in well-preserved condition, showcasing the artistic elegance and visual intricacy typical of 16th-century İznik tilework. The composition should reflect historical authenticity and architectural refinement suitable for a royal Ottoman setting.

Table 2. *Performance and Limitations of AI Tools in İznik Tile Reinterpretation Projects (Evaluation Rubric Overview)*

AI Tool Example	Generated Image	Performance Observations	Identified Limitations	Source
Prome AI		Enabled rapid generation of tile textures with visually compelling outputs in seconds.	Struggled to preserve historical accuracy and failed to capture architectural nuance characteristic of 16th-century Ottoman design.	'Featured AI Image Generator : Turn Text to Images | PromeAI', accessed 4 June 2025, https://www.promeai.pro/ai-image-generation.
DALL·E 2		Produced detailed visuals with complex patterns.	Included excessive ornamentation; lacked conceptual grounding in traditional Ottoman art.	OPEN-AI, 'DALL·E 2', 3 November 2022, https://openai.com/index/dall-e-2/.
Adobe Firefly		Generated vibrant, stylistically consistent designs with rich motifs.	Modernized visual elements; lacked architectural depth and omitted key colors, such as red.	'Adobe Firefly', accessed 4 June 2025, https://firefly.adobe.com/generate/images?ff_channel=adobe_com&ff_campaign=ffly_homepage&ff_source=firefly_seo&id=bdd34933-16e6-408e-88cc-e6eaa5ae2264.
Adobe Express		Fast and user-friendly; achieved basic tile repetition and color harmony.	Used inaccurate colors; divided the image into quadrants, disrupting historical layout accuracy.	Adobe Express, 'Adobe Express', 2025, https://new.express.adobe.com/id/urn:aaid:sc:AP:6a3629c2-0bca-40c8-8dd1-4b0cbdc20055

				?category=media&referrer=https%3A%2F%2Fwww.adobe.com%2Fexpress%2F&tab=all.
ChatGPT Sora		Interpreted prompts for basic visualization and ideation.	Ignored specified dimensions; output diverged in motif and color from the original reference.	'Sora', Sora, accessed 4 June 2025, https://sora.com/library.

Conducted in 2025, this analysis not only assesses the visual performance of current AI tools such as DALL·E, Firefly, and Prome AI, but also serves as a historical record that documents the technological state and aesthetic tendencies of AI-assisted image generation at that moment.

Results

This study has examined the potential and limitations of AI-assisted generative tools in the digital reinterpretation of traditional Turkish cultural heritage elements, with a particular focus on İznik tiles. The experimental visual production analysis conducted using various AI-based image generation platforms revealed that while these tools can produce aesthetically compelling results, they often fall short in capturing the cultural and contextual depth embedded in historical art forms. Deviations observed in aspects such as color palette, compositional structure, and motif detail underscore the critical role of human intervention in maintaining historical authenticity.

Looking ahead, this research demonstrates that AI can serve as a technically effective tool in the visual reproduction of traditional art forms, yet it requires human expertise to meaningfully interpret cultural narratives. Rather than functioning solely as an automatic image generator, AI—when guided by well-crafted prompts and enriched with cultural insight—has the potential to contribute more meaningfully to creative and educational projects. In this sense, AI should be viewed as a complementary tool that can support, but not replace, human creativity and cultural sensitivity. Realizing this potential, however, depends not only on technological capacity but also on a critical, interdisciplinary approach grounded in cultural knowledge, ethical awareness, and reflective practice. Beyond its immediate analytical scope, this study—conducted in 2025—serves as a temporal archive, capturing the capacities, biases, and stylistic tendencies of AI-based generative tools during a key phase of technological experimentation in cultural heritage reinterpretation.

In educational contexts, the findings of this study can guide interdisciplinary learning models that integrate art, technology, and cultural heritage. The AI-assisted reinterpretation of İznik tiles can be incorporated into museum workshops, design studios, and art education curricula to promote both creative experimentation and cultural awareness. Teachers and cultural heritage educators can use prompt-based design exercises to help students understand the relationship between traditional

aesthetics and computational creativity. Similarly, project-based learning models can introduce students to ethical issues in AI art—such as authorship and cultural representation—through practical experimentation. For policymakers and institutions, integrating digital literacy and cultural heritage modules into national or international curricula would strengthen critical engagement with emerging creative technologies.

For future perspectives, the role of artificial intelligence in the field of cultural heritage is not limited to its visual production capabilities; rather, it holds the potential to evolve into more interactive, participatory, and educational applications in the future. Advances such as personalized content generation, augmented reality (AR) integration, and multilingual cultural narration may position AI as a tool that democratizes access to cultural experiences. This transformation will require closer and more sustainable interdisciplinary collaboration among art historians, designers, software developers, and cultural institutions. Through such collaboration, it will be possible to produce digital outcomes that are not only technically accurate but also rich in cultural context and meaning.

Findings are bounded by a single canonical prompt, tool versions as of 2025, and the absence of a licensed, expert-annotated İznik dataset. Results should be read as a period snapshot and a methodological proposal rather than a definitive ranking.

Future studies should focus on curated, licensed İznik datasets with motif-level metadata; measurable metrics combining expert evaluation with color and motif accuracy; explainability analyses identifying failure points in generative diffusion steps; and user-in-the-loop design editors that lock color palettes and border grammars while allowing generative flexibility in interior motifs.

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Conflict Declaration

No material or immaterial benefits were obtained at any stage of the preparation of the article.

Statement of Publication Ethics

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