Metaverse 2025, 6(1), 3560.
https://doi.org/10.54517/m3560

Editorial

Metaverse & parametric design: Shaping the future of culture and industry

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CITATION

Liu D. Metaverse & parametric design: Shaping the future of culture and industry. Metaverse. 2025; 6(1): 3560.
https://doi.org/10.54517/m3560

ARTICLE INFO

Received: 15 March 2025
Accepted: 27 March 2025
Available online: 31 March 2025

The fusion of digital technology with culture and industry is redefining our connection to the past and future. This collection of research explores two key areas: the metaverse's impact on cultural preservation and education, and parametric design's role in mechanical engineering innovation.

1. Metaverse: Revolutionizing cultural heritage and education

The metaverse offers new ways to preserve culture and enhance education. For example, the 18th-century Rigas Velestinlis' Charta is transformed via 3D scanning and blockchain, allowing users to interact with digital versions [1]. Brazilian schools use Roblox for financial literacy education, boosting knowledge retention by 40% [2]. However, IP (intellectual property) issues like NFT (Non-fungible token) disputes need solutions combining blockchain and legal frameworks [3].

2. Parametric design: Transforming mechanical engineering

In mechanical engineering, parametric design and cloud technologies are replacing traditional methods. AI-driven systems automate parameter optimization, reducing modeling time and material waste [4]. These innovations align with Society 5.0, enabling small manufacturers to access advanced tools [5]. Yet, ethical concerns like the decline of traditional craftsmanship and workforce reskilling are emerging. The integration of quantum computing and eco-friendly materials promises more sustainable engineering.

3. Synergy between virtual and physical worlds

The metaverse and parametric design intersect in fields like healthcare and psychology. AI diagnostics paired with metaverse surgical training enhance medical skills [6]. Similarly, iterative processes in gaming narratives and parametric design show how digital spaces can refine outcomes, whether in trauma resolution or engineering testing [7]. Technology should augment human potential, not replace it.

4. Future outlook: Dynamic coexistence of history and innovation

Looking ahead, the metaverse could simulate historical scenarios, while parametric design may develop self-healing materials. Policymakers and educators must balance open access with IP protection and ethical standards. Industries should prioritize ethical AI and cross-sector partnerships. As climate change and cultural loss threaten, these technologies are crucial for preservation and resilience.

In this digital renaissance, we must harmonize technology with human values. The metaverse should enable collaborative storytelling while preserving cultural

heritage, and parametric design should pursue sustainability without losing traditional craftsmanship. By balancing these aspects, we can create a future where technology honors the past, empowers the present, and inspires future generations.

Conflict of interest: The author declares no conflict of interest.

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