

Generative AI for the Interpretation of Non-Alphabetic Visual Systems: A Cross-Cultural Study of East Asian Scripts and Iconography

Celia López Castillo¹ and David Díez Galindo²

¹Universidad de Sevilla

²Universidad de Zaragoza

The study of non-alphabetic visual systems in East Asia—including logographic writing, symbolic calligraphy, and complex iconographic structures—is undergoing a profound transformation due to the rapid development of generative artificial intelligence. This technology introduces innovations previously unattainable, such as generating visual hypotheses from minimal fragments, probabilistically reconstructing missing strokes, and automatically comparing stylistic patterns in contexts where data is scarce or materials are severely degraded. Yet these same capabilities also entail significant risks, particularly in low-resource settings where the fragility of the support, limited corpora, or historical deterioration challenge the reliability of AI-based interpretations. This paper offers a critical analysis focused on East Asian printmaking and painting, examining how generative models interact with their visual languages and material characteristics. This tension between innovation and illusion is especially relevant today and aligns directly with the promises and limitations of AI-driven visual analysis in low-resource data contexts.

Combining expertise in East Asian art with the study of emerging digital technologies, the research evaluates how generative models reinterpret logographic characters, calligraphic motifs, pictorial narratives, and symbolic structures. Through concrete case studies, the paper assesses the ability of AI to reconstruct missing strokes, propose stylistic variations based on historical patterns, and generate visual hypotheses in low-quality data environments. Accessible platforms such as Krea AI, alongside lesser-known tools like Qwen Chat and Pixella, are employed for restoration, generative recomposition, and structural analysis directly from original images. These tools enable experimentation with hypothetical reconstructions of damaged works, particularly valuable for fragile or hard-to-access materials such as Kunichika Toyohara's prints or woodblock compositions depicting figures like Takechi Mitsuhide or Ichikawa Danjūrō, where pigment loss and surface erosion hinder iconographic interpretation.

The study also examines the mural painting of the Takamatsuzuka tomb, where degradation has obscured volumes, pigments, and brushwork essential for interpretation. Generative models allow the exploration of alternative reconstructions and facilitate comparisons between different systems' reinterpretations of deteriorated elements. However, the research highlights critical risks, including “stylistic hallucinations,” the

introduction of contemporary influences foreign to the original tradition, the oversimplification of complex semiotic structures, and the tendency of models to fill gaps with learned patterns that may not correspond to the historical context. These limitations are particularly acute in low-resource contexts, where data scarcity increases the likelihood of illusory or misleading interpretations.

The paper concludes by proposing a methodological framework for the responsible adoption of generative AI in ancient world studies, including guidelines for critical evaluation, transparent documentation, and interdisciplinary collaboration. Overall, the proposal underscores the need to balance technological innovation with academic rigor, especially in visual traditions whose semiotic richness and material fragility demand a contextualized and critically informed approach.