

Creative Processes of the Visual Arts and Generative AI. Correspondences between Michelangelo and Sebastiano Del Piombo in the *Flagellation of Christ* Ideation

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The Great Masters Workflow

Preparatory Drawings

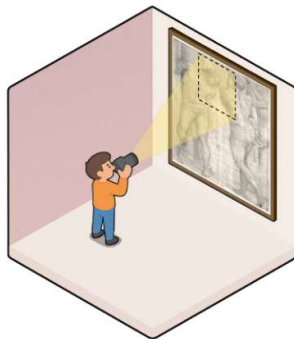


Final Works

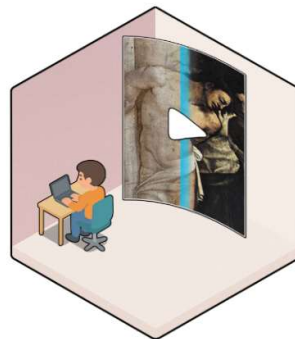


The Digital Tools Workflow

Gigapixel



AI animation Tools



XR application

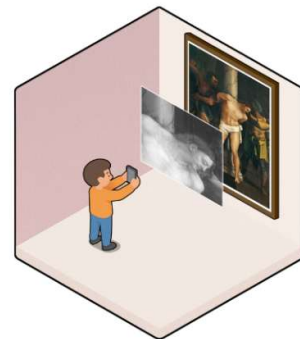


Figure 1: The proposed workflow

Abstract

Is it possible to visualize the creative process of the art in the making? How can we display an intangible phenomenon such as artistic research to make it perceivable and understandable?

The Enacting Artistic Research project, EAR WP2, promoted by the Accademia di Belle Arti di Roma, in partnership with Accademia di Belle Arti di Firenze, Accademia di Belle Arti Milano-Brera, Conservatorio di Roma “Santa Cecilia”, Conservatorio di L’Aquila “Alfredo Casella”, Istituto Nazionale di Fisica Nucleare—Università di Roma Tre and Università Politecnica delle Marche, is intended to reveal the steps of the imaginative dimension of the ideas through the connection of the successive phases of the preparatory drawings for a painting, or any other work of art, through artificial intelligence.

In the Enacting Artistic Research (EAR) project, a series of examples were identified for the choice of a case study that could lend itself to the continuous representation of the creative process from the first idea to the chosen pictorial solution. In order to enhance the creative process, the paper will present a workflow for the analysis, knowledge creation and storytelling of the artistic process, based on Gigapixel images, Artificial Intelligence generative tools and Large Language Models. The pilot case introduces innovative investigative and visual restitution techniques, such as virtual reality (VR), extended reality (XR), advanced imaging, and 3D modeling, unveiling artistic research within creative processes, opening new avenues of aesthetic understanding.

1.Introduction

Art has always been the result of a process: a movement from idea to form, from mental image to material realization. Historical artworks, particularly in the Renaissance, rarely emerged fully formed. Instead, they passed through layers of preparation (studies, sketches, underdrawings, compositional trials) that capture the unfolding of imagination in real time. These intermediate materials are fundamental steps for understanding the aesthetic, technical and cognitive dimension of artistic creation.

Today, we are equipped with tools that allow us to re-examine and reconstruct these processes. Infrared reflectography, gigapixel digital imaging [CAD*22] and artificial intelligence enable us to access hidden stages beneath the surface of paintings, compare compositional changes and visualize the evolution of forms across time. In the case of Michelangelo and Sebastiano del Piombo's *Flagellation of Christ*, such technologies made it possible to track how the initial concept was transformed across drawings, underdrawings and multiple painted versions, revealing not just artistic decisions but entire systems of collaboration, influence and revision.

Yet access to material and tools is not enough. The core challenge remains: how do we communicate this layered, often non-linear process of artistic research in a way that is both rigorous and accessible? How can we narrate what is essentially invisible (the path not taken, the thought behind the gesture, the erased lines) and make it visible, tangible and shareable?

This project responds to this challenge by proposing an integrated workflow that merges historical analysis, digital reconstruction and storytelling.



Figure 2: *Flagellation*, Sebastiano del Piombo, Viterbo

Thanks to this historically and visually rich case study – the preparatory drawings for the *Flagellation of Christ* designed by Michelangelo and executed by Sebastiano del Piombo – the project proposes to reconstruct the continuous transformation of artistic ideas from sketches to underdrawings and final painting.

The *Flagellation* for the Borgherini Chapel in San Pietro in Montorio (Rome) was executed between 1516 and 1524. Starting from Michelangelo's compositional sketches, the project follows a lineage of studies: drawings attributed to both Michelangelo and Sebastiano, intermediate *cartoni*, underdrawings revealed through infrared reflectography, and multiple painted versions, including those in Viterbo (fig. 2) and Cingoli. This case encapsulates a rare continuity of visual traces in Renaissance artmaking, allowing for an unprecedented digital reenactment of the artistic process.

2.Contribution to the research

This work contributes to multiple fields: art history, digital humanities, visual storytelling, and the epistemology of artistic

research. It proposes a new model to reconstruct and communicate the cognitive and aesthetic dimensions of artistic creation using AI and high-resolution imaging.

From an art history perspective, the study advances knowledge on the collaborative dynamic between Michelangelo and Sebastiano del Piombo. The selection and comparative analysis of preparatory drawings (including lesser-studied sheets like the *cartonetto* in a private collection) unveil the mechanisms of visual invention and its adaptation across time and contexts. This path was already analysed and investigated [Bar24] and it's further validated here. The evolution of Christ's pose (elongation of the body, rotation of the head) and the repositioning of flagellators are visual devices employed to increase emotional engagement with the viewer, as noted in Vasari and substantiated by underdrawings and infrared scans.

Moreover, the research addresses the role of spiritual and political symbolism embedded in iconography. The pairing of *Flagellation* and *Transfiguration* in the Borgherini Chapel, their associations, and the eschatological message of renewal through suffering, are all crucial elements contextualized through visual and textual analysis. The integration of historical letters, such as those between Sebastiano, Michelangelo, and Leonardo Sellaio, strengthens the chronology of artistic decisions and execution.

These aspects have been analyzed, discovered and narrated through the manipulation of 3D data (photogrammetry and AI tools) contributing to develop new cross-cutting methodologies for experts in digital technologies and art history [CQM*24]. Boosting the potential of generative AI adversarial networks (GANs) made it possible to fill the gap between different frames (including aspects of time and shape) and visualize the artistic process. According to a recent survey [SGH*24] on image inversion and generative editing, GAN inversion techniques offer precise control over latent trajectories, making them particularly suitable for semantically coherent morphing between visual states. This underpins our speculative reconstruction pipeline, which relies on latent space continuity rather than arbitrary frame interpolation. Moreover our approach, though not structured as a classical Retrieval-Augmented Generator (RAG) pipeline but as a multi modal RAG (MRAG) adopts a retrieval-conditioned generation model that shares these grounding objectives, situating our work within this emerging research direction [ZHZ*25].

3.Innovation / extension of the state of the art

This project exploits AI as a tool not only for classification or stylistic prediction [SLB*25], but for visual storytelling, constructing speculative but historically grounded visual narratives of an artwork's development. While digital art history has long utilized imaging technologies for conservation and attribution [KAK*24], this research combines:

- Gigapixel imaging to access minute pictorial details.
- Generative AI tools to interpolate between known sketches and generate plausible intermediate phases.
- XR to visualize the process spatially.

This multi-layered approach allows viewers and scholars to experience the genesis of an image as a temporally unfolding process, not merely a static sequence. AI models are trained with specific visual vocabularies from Michelangelo and Sebastiano's

drawings, allowing for controlled and historically accurate image generation. Infrared reflectography (IRR) data is aligned with visible light photography to reconstruct underdrawing sequences, which can be animated or projected in augmented reality environments.

Notably, the pilot study [Bar24] repositions the private *cartonetto* (fig. 3) not as a copy, but as a preparatory study for the versions in Viterbo and Cingoli. Overlaying its proportions onto the IRR of the Viterbo painting confirms close alignment, especially in the earlier positioning of Christ's torso and head, which were later altered to increase pathos. This discovery suggests a recursive process of experimentation and modification, further visualized through AI-simulated morphing.

An early example of multimodal alignment in the domain of art history is the SemArt dataset [MSC*18], which paired fine art images with textual commentary to support cross-modal retrieval tasks. While not a generative system, SemArt established a structured benchmark for semantic matching between visual and textual content. Its influence extends to more recent RAG models such as ArtRAG, which inherit the goal of grounding visual outputs in culturally relevant textual knowledge [WTZ*25].

4.Methods

The methodological framework consists in three main phases, combining traditional art historical research with advanced computational tools and immersive technologies [LZW*24].

4.1.Historical and visual corpus building

The project began by compiling a comprehensive visual and documentary corpus centered on Michelangelo's and Sebastiano del Piombo's *Flagellation of Christ*. This included:

- Preparatory drawings attributed to both artists: Michelangelo's compositional study of the *Flagellation* in red chalk, and again by the same author *The Cristo alla Colonna* in black chalk, both in the British Museum (London); The *cartonetto*, newly reconsidered as an original study by Sebastiano, rather than a mere copy; other attributed sketches such as the Giulio Clovio copy (Windsor).

- Underdrawings captured through IRR, especially the underdrawing of the Viterbo version as revealed by the Opificio delle Pietre Dure during the 2005 analysis.

- Final painted versions, including: *The Flagellation* in the Borgherini Chapel (San Pietro in Montorio); The Altarpiece of *The Flagellation* in Viterbo; The lesser-known *Cristo alla Colonna* in Cingoli, linked to the Farnese patronage circle.

- Selection of a cohesive set of preparatory drawings, IRR images, painted versions, and archival documents. (explain in an extensive way the references of the work, the images used and analysis instruments).

To consolidate this dataset, high resolution digitization of all visual materials was carried out using gigapixel imaging systems. This allowed a precise and optimal inspection of surface treatments, material transitions and tool marks, critical for identifying all the information needed to delve deeper into the artistic process. Together, this structured corpus functioned both as a basis for AI training and as a curated visual archive for documentation and analysis.

4.2.AI-assisted visual reconstruction

In the second phase, the project deployed a series of AI tools to simulate the visual transformation between sketches, studies, and final works [LZW*25]. This included: generative AI adversarial Networks and text-to-image diffusion models with the Retrieval-Augmented Generation, trained with the curated visual dataset, were used to generate interpolated images that suggest how one version of a drawing might have evolved into another. These "simulated sketches" are not presenting as historical facts but as research prompts for discussion and comparison; morphing algorithms were used to visualize the transitional states between known versions from Michelangelo's sketch to the *cartonetto*, from the *cartonetto* to the Viterbo's underdrawing and finally to the painted execution.

The focus was especially on anatomical modifications (e.g. elongation of Christ's limbs, facial rotation), expressive emphasis (pathos, gesture) and compositional shifts (spatial rearrangement of figures). For example, Sebastiano's decision to rotate Christ's head to engage the viewer was tracked across visual stages, enabling a visual narrative of iconographic evolution.

In this project, we employed a range of tools at different stages to achieve the final result. To construct a coherent narrative aligned with the group's conceptual framework, a curated selection of paintings and underdrawings was processed with Midjourney to enrich the visual material, which was then further refined using Stable Diffusion systems. The latter offers greater control over the generation process thanks to its implementation of a visual programming language (VPL). In some cases, cloud-based tools such as Kling AI were also used as exceptions to this workflow. Finally, through precise cropping and framing, initial and final images restrictions were used to ensure the coherence of visual transitions. Then, prompting has been adapted on the specific image and its position within the sequence.

4.3.Immersive visualization

The third and most publicly engaging phase focused on the translation of visual data into interactive environments. The output of this study resulted in the use of the following technologies:



Figure 3: *Flagellation*, Sebastiano del Piombo, Reflectography curated by OPD, Florence. Viterbo.

- XR experiences will allow users to enter a 3D reconstruction of the final paintings with the rest of the data (images and texts). Using VR headsets or AR-enabled tablets and mobile phones, users could toggle between drawing phases (fig. 4), view animations of the composition's transformation and explore

annotated hotspots linked to historical documents and hypotheses. These AR layers were designed for museum fruition, integrating educational content with interactive media.

5.Results

The project yielded several significant outcomes across various aspects: a dynamic visual reconstruction of the creative process behind Michelangelo and Sebastiano's Flagellation, showing the continuous reshaping of Christ's figure and compositional choices over nearly a decade of collaboration and revision; the reassessment of the cartonetto in private collection as a working design tool rather than a derivative copy. Its proportion, anatomy and expressive intensity align more closely with the underdrawing in the Viterbo painting than with the final composition, suggesting its use as a transitional artifact in the workshop; the validation of interpretative hypotheses such as the strategic elongation of Christ's body or the expressive turn of the head, using cross-modal AI analysis (image generation, morphing) and technical imaging (IRR comparison); the establishment of a transferable workflow, a methodological pipeline (historical curation, AI simulation, immersive output) which provides a model for interdisciplinary research and public engagement.

One of the most significant aspects of the project is that the research workflow mirrors the artistic process itself, evolving from initial corpus building to AI-assisted simulation and immersive visualization, much like Renaissance artists refined their ideas from sketches to preparatory drawings and more. Both workflows rely on iterative experimentation, on exploring intermediate states before reaching a final composition. This research doesn't just document the creative process, it re-enacts it with new tools, affirming that digital tools (AI and XR) can serve as contemporary laboratory for history.

However, in its current version it can be seen as lacking of validation criteria for the outputs. Usually, validation is conducted either on the technical side, through model comparisons (e.g., RAG) and objective evaluation of generated images or videos, or perhaps more in line with the goals of this research, through subjective methods, such as user testing aimed at measuring engagement and validating the experience. Both forms of validation are planned for future development.

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