Utrecht University ArtLab

Developing Digital and Material-Technical Tools for Paleography and Technical Art History

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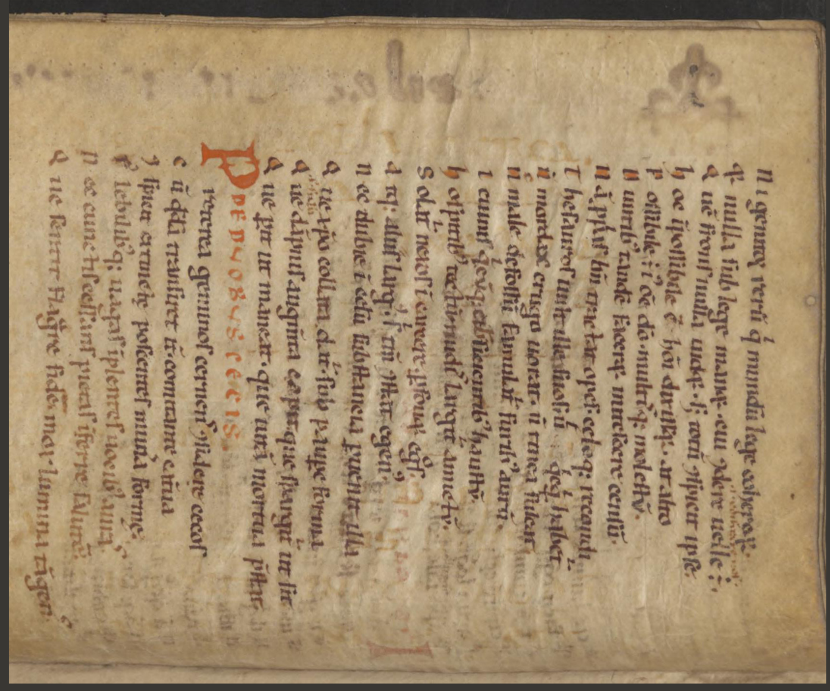
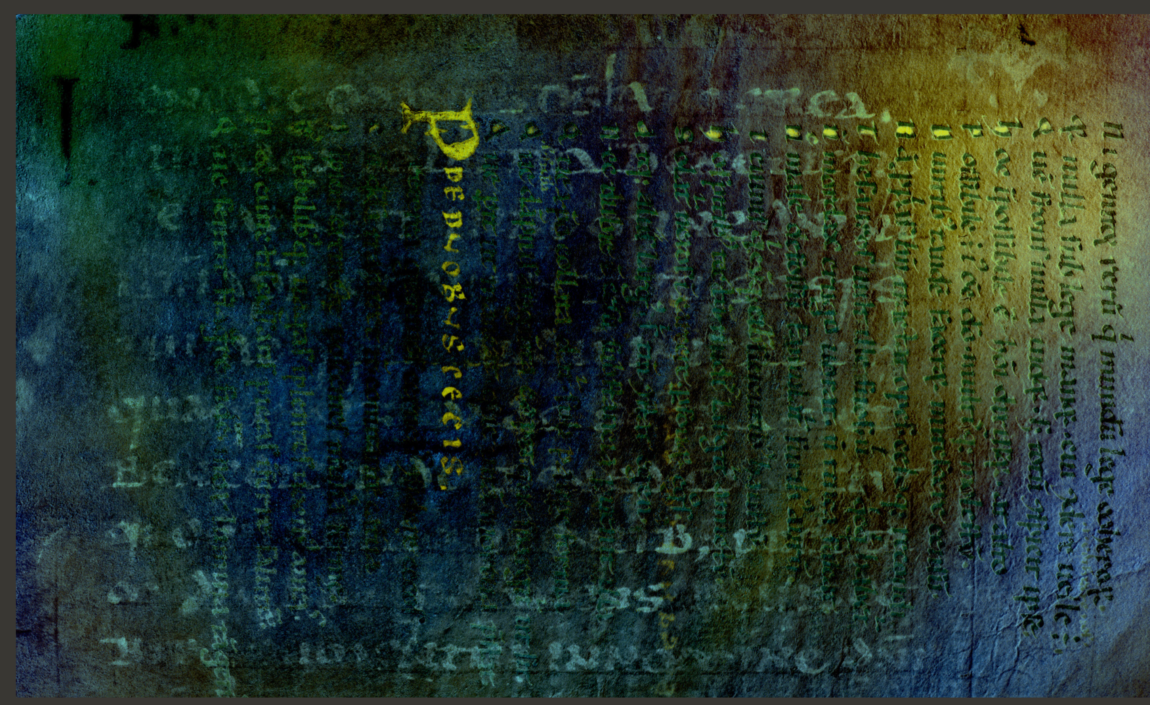


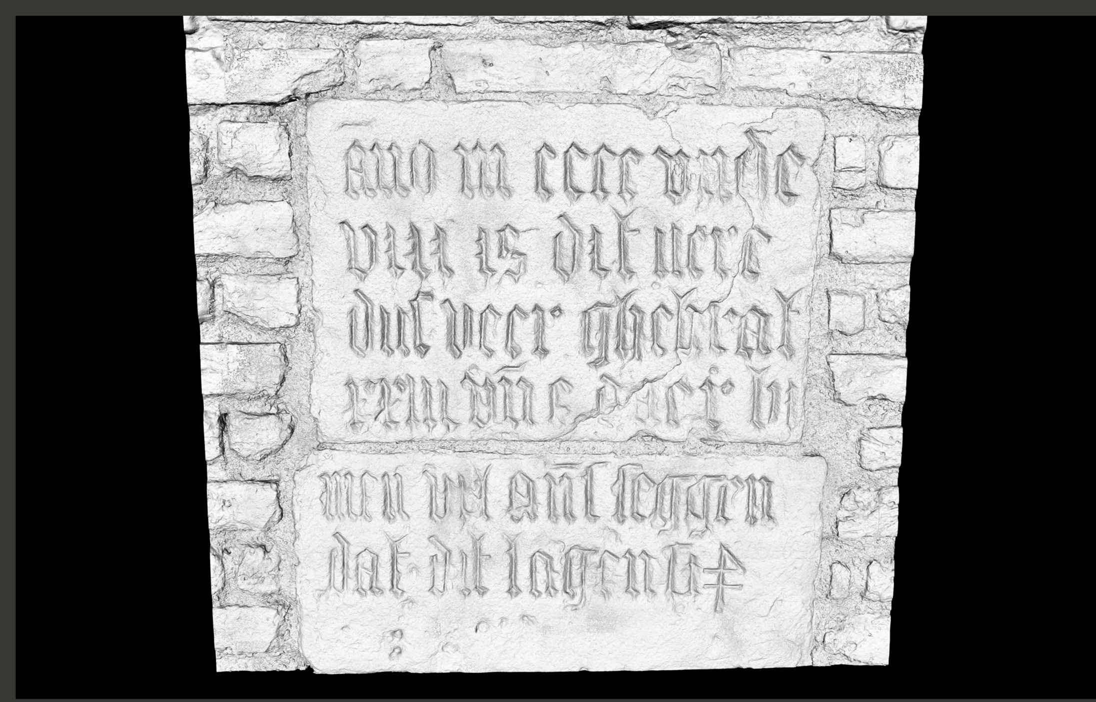



Recovering the Erased Text of a 7th-Century Sacramentary

A remarkable manuscript in UU's Special Collections (Hs. 1661) offers a rare glimpse into the early medieval liturgical tradition. Hidden beneath a 12th-century copy of the *Carmen Paschale* lies a much older text: a 7th-century sacramentary. This manuscript is a so-called palimpsest. While the 12th-century scribe had little interest in preserving the older text, for modern scholars, this sacramentary is a valuable witness to early medieval religious practices. Recovering such erased texts presents two core challenges:1) **Visualizing the faded ink** in order to read the scraped-off 7th-century letters. 2) **Separating the underlying 7th-century text** from the overlying 12th-century writing.

Multispectral Imaging (MSI)) offers a powerful approach to tackle both issues. A modified DSLR camera—one from which the standard infrared and UV cut filters are removed - can capture light across a broad spectral range (ca. 350-1000 nm), spanning from near-UV (UV-A) through the visible spectrum into the near-infrared. By photographing the palimpsest under carefully controlled lighting conditions - using narrow-band LEDs managed by an **Arduino** in a darkroom - subtle spectral differences between the two layers of ink become visible. These differences arise because the residual traces of the older ink and the newer ink absorb and reflect light differently at various wavelengths. To enhance the legibility of the erased text, **statistical techniques such as Principal Component Analysis (PCA)** are employed. PCA isolates and amplifies the spectral signatures of the underlying writing, enabling clear differentiation between the two script layers. The result is a set of enhanced images where the 7th-century text is revealed in ways that are legible and interpretable by paleographers.





Visualizing a 16th-Century Inscription of the Mastenbroek Church

Mastenbroek is a medieval polder in Overijssel that became part of the Diocese of Utrecht in 1363, when Bishop Jan van Arkel founded a parish there. The church he established - dedicated to Onze Lieve Vrouwe ter Zon - still stands at the heart of the hamlet. Little is known about its original construction, but a key clue remains: a weathered 16th-century inscription set into the church wall. This inscription may reveal whether the church was expanded or rebuilt after a fire in 1408, but its poor condition has made it largely illegible.

To address this challenge, we employed **photogrammetry** to create a high-resolution 3D digital model of the inscription. Photogrammetry is a photography-based 3D reconstruction technique that uses overlapping images taken from multiple angles to generate a spatially accurate model. To control lighting conditions and minimize surface glare, we used a **Godox AR500 flash, polarization filters**, and an **ND filter** to reduce the influence of natural light. Around 600 photographs were captured in total. These were processed to generate a **dense point cloud** - a dataset of spatial points derived from the image overlaps - which was then used to construct a precise 3D mesh of the inscription. The resulting model preserves both the geometric details and surface texture of the stone at a high resolution. By applying **shaded renders to the 3D mesh**, subtle variations in surface depth become much more visible than under natural lighting conditions, significantly improving the legibility of the worn inscription. This digital approach not only enhances our ability to read the stone but also ensures long-term preservation and accessibility of the inscription for further study.



Revealing Fine Detail: Digitizing Low-Relief Surfaces with RTI

Dark, oily, and low-relief surfaces - like tombstones, graffiti, and wooden printing blocks - are notoriously hard to photograph. Traditional methods such as photogrammetry or Structured Light Scanning often lack the precision to capture fine incisions. To study the delicate carvings of 17th-century woodblocks by Christoffel II van Sichem (1581-1658), we used **Reflectance Transformation Imaging (RTI)**. This technique involves photographing the object under directional lighting from multiple angles. The images are then processed into a **relightable digital model**, revealing surface details through interactive light adjustment.

RTI is especially effective for reflective or worn surfaces, and also generates **normal and height maps,** enabling a 2.5D relief reconstruction. It offers both detailed analysis and public accessibility, bringing subtle craftsmanship into clear view.

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