Anchoring the archive

physical space as a digital access point to research documentation

This poster investigates the process and gains of using Augmented Reality and Virtual Reality to digitally dress a space in material obtained through both normal, Ultra Violet, and Infrared Radiation photography.

Technical photography has long been a means to document the materials and condition of cultural heritage. Through filter and illuminant selection, not only visible but also UV and IR light, as well as stimulated emission (fluorescence and phosphorescence), can be used in image documentation. In the heritage documentation context multi- and hyper-spectral imaging can be thought of as extensions to technical photography, but with respectively increasing degrees of resolution. Multispectral imaging typically uses several band pass filters or specific illumination to generate a stack of images, which if properly processed can yield a low resolution spectrum per unit region of the image. Hyperspectral imaging on the other hand typically employs an imaging spectrograph and camera such that high spectral and spatial resolution images where there can be hundreds of layers in the image cube and where each pixel contains a full spectrum. With recent advances in imaging as well as computing technology, technical photography is seeing a renaissance. New visualisation technologies such as Augmented- and Virtual Reality can help multi- and/or hyper-spectral documentation find new applications in both management and conservation practices of cultural heritage objects and sites.

Documentation

As a case study, the project has worked with a multispectral documentation of the chancel of Hammarö Church, as well as a normal light structure-from-motion documentation of a temporarily uncovered portal in the South facing outer wall of the same church. Hammarö is a medieval corner-timber church built in the early 14th century. The church was enlarged and transformed to a cross-in-square plan in 1748. Originally the church consisted of a rectangular nave and a smaller chancel. The characteristic feature is the trefoil vaults in both nave and chancel. The church was extensively painted, attributed to the famous Swedish painter and school of Master Amund in the late 15th century.

In the chancel of Hammarö, the FujiFilm X-T1 IR, which is a 'full spectrum' camera sensitive in the UV-Vis-NIR regions, was used. Its sensor is fitted with a non-Bayer array RGB filter, thus not monochrome, but it does ship with a fully calibrated autofocus and a customised white balance. A one by one meter section on the north wall of the chancel was carefully documented both without filter, thus capturing the IR light, and with a UV filter.

In addition to this, using the same camera and following the standard procedures of capturing images for processing in a structure-from-motion (SfM) workflow, the entire interior of the chancel was documented both with and without IR filter. The two series of 16 megapixel photographs, 350 captured in IR light and 250 in visible light, were then brought into Agisoft Photoscan Pro and processed into two textured meshes.

Finally, after having the wooden shingles temporarily removed from a section of the outer South wall, the portal beneath was documentedfollowingthesameprocedures.

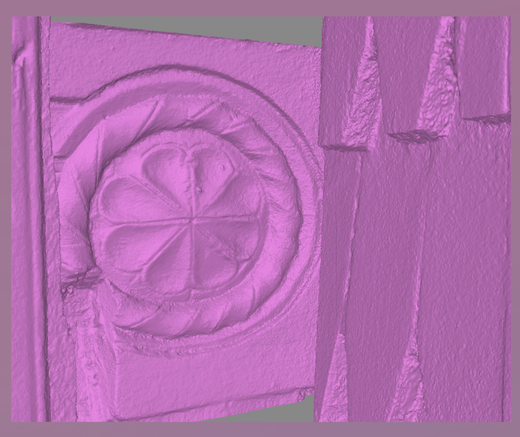
Prototypes of spatial archives

Augmented Reality (AR) is front most associated with layering place specific visual information on top of a live video feed obtained through a smartphone or tablet computer to augment the vision of reality. Using AR as a visualisation tool within the historical disciplines, reconstructed virtual artefacts or monuments can visually be placed in the physical world in real time. This has several advantages as it does allow for the contextualisation of scale, shape and colour. However, AR does not only have the potential of steering our gaze to artefacts lost, but also of marking up our surroundings with data obtained through advanced documentation.

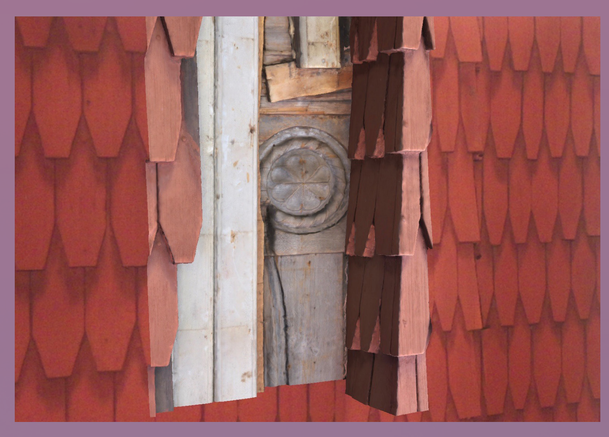
Using the documentation obtained at Hammarö Church, one AR and one VR prototype were created to test the possibilities of organising the documentation in a spatial manner. The AR prototype uses image recognition to match up the digital documentation to the physical space. In the chancel, the prototype application is trained to natural markings, part of the decorative paintings, on a section of the North interior wall of the chancel.

When the handheld device recognises the paintings it overlays the live video feed with the two-dimensional IR and UV imagery of the section obtained through the FujiFilm X-T1 IR camera, thus colouring the section with multispectral information.

On the exterior south wall of the church, due to the repetitive pattern of the shingles discrete markings had to be put on the wall for image recognition to be possible. When the markings are recognised, the prototype application places a detailed three-dimensional model of the old portal in the correct position. This model was obtained through the SfM scanning of the structure inside the wall when the shingles were removed.



High resolution 3d-model of the portal behind the layer of wall shingles. The model was created from eighty high resolution photos using SfM.



By displaying a three-dimensional documentation of the portal, visitors and caretakers can see through the shingles and explore the portal and its relation to the rest of the structure without having to dismantle the wall.

The VR scene combined with the lens-setup allows the user to move around the virtual space and then at will bring up perfectly matched multispectral imagery of all parts of the chancel.

The second prototype combines two full-room SfM-models of the chancel in a single Virtual Reality (VR) scene. The first of these models was photographed using normal light and constitutes the default view, while the second was photographed capturing IR light. After matching them to each other, an interface was created that lets the user bring up a virtual lens through which to view the IR-information from the second model.

Conclusions

By mapping visual data gathered through historical archive research and multi-spectral photography back onto the physical space of origin, or onto virtual copies, AR and VR are framed as contextualised windows through which both to archive and to access documentation. In this physical-digital hybrid space, the digital data of the documentation is given a physical context and the physical space is given a depth beyond normal light and current conditions. Rather than organising the material according to topic, archival and research data is mapped in relation to place in a three-dimensional space.

AR and VR have the potential of being useful tools both for conservators and care takers. By organising archived data in a spatial manner, every detail of an object or environment could provide access to relevant archival records. When the physical space is dressed in digital material obtained through multispectral documentation, both the physical space and the documentation is contextualised. The material is thus resituated as a place-centric analytical layer accessible to care takers, conservation scientists, and the public alike, all while leaving the current state of the physical space free from obtrusive markings.

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Jonathan Westin (jonathan.westin@conservation.gu.se)
Gunnar Almevik (gunnar.almevik@conservation.gu.se)
Jacob Thomas (jacob.thomas@conservation.gu.se)
Kim Bergen (bergen.kim.11@gmail.com)

Department of conservation
University of Gothenburg

UNIVERSITY OF GOTHENBURG