The Murten Panorama, from 2D to 4D

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Abstract

The Murten Panorama (10x100m) was realised by the renowned German panorama painter Louis Braun (1836-1916) in 1893, commissioned by a Swiss consortium. It commemorates the Swiss victory against the army of the Duchy of Burgundy in 1476 and exists as a symbol of independence as well as martial prowess. Originally displayed between 1894 and 1909, it later disappeared from public consciousness. Only in 2002, the panorama was restored and put on display at the Swiss National Expo.02. Since then, it has remained rolled up in storage. The physical display of an original painting spanning 1000m2 represents just as much of a serious challenge today as it did in the nineteenth century. Public attention regarding this national treasure is has recently increased, whilst solutions for a new display are being explored. Moreover, a new campaign for its digitalisation using the latest imaging technologies is being pursued. This article explores how the artwork might be transformed from the second to the fourth dimension. It does so by outlining the work's late medieval and early modern pictorial sources, and by presenting the challenges and output of this new imaging effort, that will result in an image resolution four times higher than any single image in the world.

Keywords

Switzerland, Morat, Murten Panorama, Martial Culture, Interactive Display, Burgundian Wars, Photomosaic Imaging, Data Science, Experimental Museology.

Introduction

The Murten (Morat for the French spelling) Panorama was realised by the renowned German panorama painter Louis Braun (1836-1916) in 1893, having been commissioned by a Swiss consortium [1]. It is the last – and the only remaining – of the eight panoramas by the artist. Along with the Bourbaki Panorama, it is the largest of four surviving panoramas in Switzerland that were created between 1804 and 1893 [2]. Being a massive artwork (10x1000m) the Panorama presented a major challenge for its public display in the nineteenth century, just as it does today.

Following the article of Maillard and Garey, presenting the general context of the artwork, as well as its significance and the ongoing project to valorise the work [3], this article approaches the panorama from an art historical perspective, as well as considering the campaign to digitally image the object using state-of-the-art technologies, in addition to the potential impact this work could make on the field of experimental museology.

2D - The sources of the panorama

Only four years after the victory of the Old Swiss Confederacy and its allied towns against the army of the Duke of Burgundy, the first painting representing the battle of Murten was created. In 1480, the town council of Fribourg commissioned a large painting for the council room of its city hall. Artist Heinrich Bichler was then commissioned to create two further monumental paintings for the Jaquemart and Bern town gates. The Carthusians of Thorberg remunerated him in 1478 for a painting representing Saint-Sulpice [4]. Sadly, this painting of the battle of Murten did not survive and had disappeared by the mid-sixteenth century.

Such early commemoration outlines the significance of the Murten victory, the outcomes of which resonated across Europe. The prowess of Swiss infantry men defeating the great Burgundian army, with the finest knights on horseback and equipped with the latest advancement in artillery cemented the martial reputation of Swiss fighters. Following this event, the princes of Europe, including popes and several kings of France, favoured Swiss mercenaries and even employed them as their personal guards.

The lost painting, however, inspired the 1513 illustrated chronicle by Diebold Schilling (Fig. 1). In this latter work, the artist notably represented several events in the same image that were in fact chronologically distinct from one

Fig. 1: Schlacht bei Murten. Illustrated Chronicle of Lucerne by Diebold Schilling, 1513. Ink on parchement, 39x28.5cm. Luzern, Korporation Luzern, S 23 fol. Credits:10.5076/e-codices-kol-S0023-2.

another. The preparation of the town defences by Adrian the First of Babenberg is situated in the foreground, next to the camps of Jacques of Savoy, count of Romont (lower left panel), and the one of the Burgundians (right panel), later installed. Other events, such as the shock of the Burgundian cavalry and the confederate pikemen near the Villars-les-Moines convent can be recognised. The phenomenon of the conflation and distortion of time in the late medieval image is also a common feature of nineteenth century panoramas, as discussed below.

Fig. 2: Martin Martini, *Battle of Murten*, 1609. Etching on copper, 101x39.5cm Murten Museum. Photo Alain Kilar.

The landscape of Murten was also represented in 1606 by the famous etcher and goldsmith Martin Martini, commissioned by Laurent Wehrli. Martini notably etched two town plans, of Fribourg and Lucerne. The copper etching of Murten (Fig. 2) was later used by Braun as source for the Murten Panorama, while he was working in Munich with the historian Viktor Tobler [5].

Augmented 2D - The panorama and its displays

When creating his panorama, Louis Braun conceptualised an immersive experience of the representation of the battle, represented on the landscape of Murten for a display in a rotunda. As in late medieval images, the viewer was invited to grasp, from a 2D image, the impression of being at the heart of the action due to being surrounded by the panoramic landscape. Braun intended to illustrate multiple events in different locations, thus creating an illusion of a live scene with an unfolding narration of key events. The concept of this realisation relies on a text written in 1894 by the historian Viktor Tobler, sequencing the different actions with twenty-nine commented labels in the form of a panorama guide [6]. The result is arguably an augmented 2D experience in a 3D space. As such, it functions as a pioneering viewing experience for the later movie theatres, but from a still image.

The panorama was on display on the rotunda on the Utoquai in Zürich designed by Rudolf Oechsli (Fig. 3) in 1894-7, and then in Geneva at la Jonction in 1897-1904, and possibly until 1909, but the date of the return of the artwork to Zürich remains unclear [7]. The Swiss consortium for the panoramas was in financial difficulties and was dissolved in 1897, to be rebranded in 1908 in Geneva, but time of the great panoramas had passed. The Zürich rotunda was sold in 1918 and the panorama itself in the end even donated to the town of Morat in 1924. It too fell into oblivion for more than seventy years.

In the planning of a new temporary display in the context of the Swiss national exhibition "Expo01", which took place in 2002 (renamed "Expo02"), the three rolls of the Murten Panorama were restored (Fig. 4) and exhibited in Jean Nouvel's Pavilion on Lake Murten, which featured a monolithic metallic structure on its outside (Fig. 5). Great care was taken in displaying the painting to recreate the original atmosphere of the great nineteenth century panoramas. The Pavilion structure, however, was never designed to be permanent and was dismantled four months after the end of the exhibition, after which time the panorama was again placed back in storage.
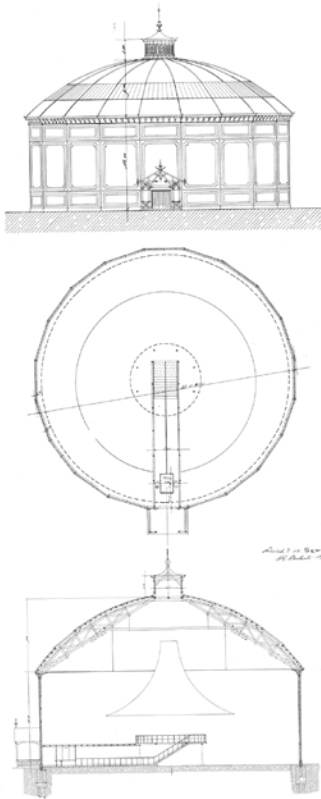
Fig. 3: View and cross-section of the rotunda at the Utoquai in Zürich from the architect Rudolf Oechsli, 1893. Zürich, Stadtbauamt, reproduced from Heinz Schwarz, 1996.

Fig. 4: Restoration of the panorama, 2001. Stiftung für das Panorama der Schlacht bei Murten (1476). Photo by Cuno Vollenweider.

Fig. 5: View of the Monolith of Jean Nouvel, Expo02, 2002. Photo by Cuno Vollenweider.

2D-4D – New imaging campaign

Several projects for a new display of the Panorama have been explored by the owner foundation, joined in 2015 by the Association of the Friends of the Panorama (AAPM) [8]. An ongoing travelling exhibition is raising public interest for the need for a new display in relevant locations all over Switzerland (March-December 2019). Alongside these continuing projects, the digital imaging of the artwork is now being planned.

During the preparation of Expo02, in 1999-2001, an image taken for restoration purposes was used to valorise the panorama in the form of a website, allowing a scalable online encounter with the panorama [9]. Twenty years later, the resolution of these images does not meet current archival and conservation standards, nor does it allow the potential for exploitation of the latest digital technologies to display the work on screen, or on larger installations.

The Laboratory for Experimental Museology (EPFL, Lausanne) has conceived a project to capture the 1000m^2 painting at 1000 dpi, using photomosaic imaging. It is estimated the image will be four times larger than any other single "terapixel" image in the world at 1.6TB [10].

The documentation workflow involves a camera that will be mounted on a fixed truss with a moveable section that is remotely triggered, allowing the camera to take images in a series of vertical strips on the unrolled panorama. Stitching tiles into one large image will require specialist large-image handling, as well as alignment precision for the appropriate high-quality result. Terapixel stitching software for bioscience and microscopy images will thus be used for the precise alignment and fusion of multiple image tiles per channel into one 2D, 3D, and even 4D volumes.

Using the latest camera sensor technology, allowing a 1000dpi acquisition, and by imaging in separate columns of 500mm diameter with a 30 per cent overlap on its horizontal edges, the final image will result in a 1.6 terapixel image, captured as follows:

Estimates in resolution and size for a 150 megapixel camera (in 16 bit)
Target DPI: 1000dpi
Image width x height: 350mm x 250mm
Columns: 402
Rows: 58 images vertically per column
Number of images: 23,722
Photo storage: 20TB
Pixels per mm: 40
Vertical pixels (rounded): 400,000
Horizontal pixels (rounded): 4,000,000
Total gigapixels: 1600
Storage for image in terabytes: 9.6 TB

This project represents an important challenge not only for historian but also for data scientists, as it will not be possible to view the complete image at its full resolution in one screen viewing due to its proportions and enormous scale. The question faced here is how to create a data structure that allows a viewer to extract a portion of the image within a reasonable time, hopefully close to real time. The traditional approach would be a pyramidal format, but it is currently unknown how well this would function at scale. What is therefore required is a custom format and specialist software solution. There are also opportunities for automatic image analysis using computer vision and machine learning algorithms, augmenting a grid-based (x, y coordinates) metadata schema to describe in detail all the elements of the painting.

Panoramic projection

One of the potential outcomes for such a high resolution rendering of the Murten panorama would be to re-project the image into a panoramic (360-degree) cinema cylinder. For one, this format would emulates the original panorama's mode of seeing via multi-dimensional, layered chronologies, while also endowing it with new qualities by augmenting the image with various narrative potentialities. Through sonic, interactive and algorithmic processes of virtual reality, new media techniques could transform such traditional, object-centred panoramic immersion into a heightened sense of presence. As media art theorist Oliver Grau notes, "In virtual reality, the panoramic view is joined by sensorimotor exploration of an image space that gives the impression of a 'living' environment" [11]. The historic panorama as a form of public screen entertainment has been the subject of a number of extensive analytical histories over decades, which led Stephen Oettermann to claim the panorama as "the first true mass medium" [12]. In current media practices, the re-emergence of the panoramic scheme as "the new image vogue" [13] is based on the desire to design virtual spaces and places that can be inhabited by the viewer, maximising a sense of immersion and ultimately "presence" or "being there" [14].

Interestingly, the concerns raised about panoramic immersion in the eighteenth and nineteenth centuries are precisely the problems addressed in contemporary research in virtual reality environments research today. Nineteenth century panorama visitors were treated to increasingly sophisticated scenes and elaborate rotundas and structures in which to observe them. The impact of such realism was a growing demand for a totalising experience that mixed all the genres of sensation (acoustic, atmospheric, olfactory) as part of the viewer's experience. This multisensory demand was often not fulfilled. Johann Eberhard in 1805, for example, spoke of the unease he felt when confronted with a painted panoramic view of London: "I feel entangled in the webs of a contradictory dream-world and not the sure instruction of the feeling in the distance of the location, not the full daylight, not the comparison with surrounding bodies can wake me from the anxious dream, which I must dream away against my will." [15]. Lack of movement in the scene often met with disapproval: where were the scudding clouds and the atmospheric variations? To complete this list of faults, these static landscapes failed to provide temporal or narrative flow [16].

Fig 6: *Pure Land: Inside the Mogao Grottoes at Dunhuang,* virtual representation of the panoramic visualisation system, © Sarah Kenderdine and Jeffrey Shaw, 2012.

In recent years, 3D digital visualisation installations have highlighted the potential of novel panoramic projection environments. Examples include *Pure Land: Inside the Mogao Grottoes at Dunhuang* (*Pure Land*) which exploits an immersive 3D, 360-degree visualisation system. Inside this 10-metre diameter and 4-metre high theatre, up to 30 visitors are able to freely perambulate in a true-to-life scale virtual version of Cave 220 at the renowned world heritage site of Dunhuang (Figure 6). In this interactive environment, a single user interface, operated by one of the visitors or a docent, allows for active interaction with the digitally rendered cave, enabling the revelation and activation of hidden or embedded features in the mural paintings on its walls (Figure 7 and Figure 8). As well as offering a powerful space of embodied representation, *Pure Land* exploits

various digital image processing techniques, such as 2D and 3D animation, as well as 3D cinematography, to further develop its experiential and interpretative capabilities. The installation was first shown to the public in 2012, to critical acclaim and subsequent worldwide attention. *Pure Land* is "exhibition experience of the future," according to Julian Raby, director of the Arthur M. Sackler Gallery and Freer Gallery of Art, Smithsonian Institution [17].

Fig 7: *Pure Land: Inside the Mogao Grottoes at Dunhuang,* augmented layer based on pigment studies by Dunhuang Academy, © Sarah Kenderdine and Jeffrey Shaw, 2012.

Fig 8: *Pure Land: Inside the Mogao Grottoes at Dunhuang,* magnifying glass for mural detail, © Sarah Kenderdine and Jeffrey Shaw, 2012.

Another example is the digital 360-degree projection of the *Pacifying the South China Sea* scroll, painted by an anonymous Qing painter almost two hundred years ago in the early eighteenth century, is considered one of the jewels of the Hong Kong Maritime Museum. The scroll chronicles the story of how piracy was suppressed in the early nineteenth century by the forces of the Jiaqing Emperor. The events of the period are illustrated in twenty different scenes, each abundant with detail depicting the annihilation and eventual appeasement of the pirates by government forces, allowing free trade to flourish again throughout the region. The redevelopment of exhibitions for the new location of the Museum in 2013 was an opportunity to reconsider the display and interpretation of this seminal tangible heritage object of Hong Kong's maritime heritage. In this instance, the South China Sea scroll was scanned at a resolution of 1200 dots per inch (DPI) opening up the possibility of using the image for display at 50 to 100 times the original size of the object (Figure 9).
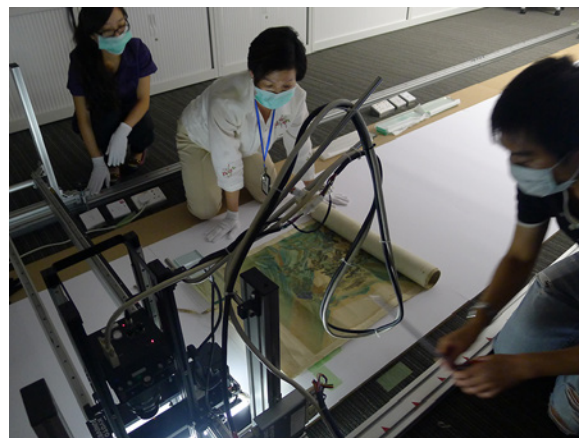

Fig. 9: Linear line scanning at 1200DPI, *Pacifying the South China Sea* scroll, Hong Kong Maritime Museum, 2013. Image: Sarah Kenderdine

Understanding how the scroll was originally expected to be viewed helps to explain its structure. The intention was that it should be studied by only one or two people at a time and slowly unrolled from right to left in sections of two or three feet. In this way the people viewing it could "voyage" through the coastal scenery, watching as Bailing tackles his massive task of subduing pirates and bandits. The scroll is divided into twenty narrative "scenes" containing numerous battles at sea, interspersed with pirates prostrating themselves before Bailing. The successful resolution of the problem is represented through the portrayal of village harmony and government pageantry. The final scene includes two western vessels at anchor, implying that trade with China and through these coastal waters was now safe. The scenes are not all exactly the same length and shape, they do not always seem to follow strict chronological order and the transitions between scenes are handled in a number of different ways.

A digital re-presentation of the scroll, *We Are Like Vapours,* was also staged at the new Hong Kong Maritime Museum in a 360-degree display system (10 metres in diameter and 4 metres high). Inside this cylindrical enclosure the high-resolution scroll slowly rotates, although the painting itself is largely obscured from viewers by digitally generated sea mists that drift over its surface.

Inspired by the "vapours" described in the pirate Zhang Bao's records, these mists slowly thin and part to reveal the key situations, characters and events in the painting, which are then brought to life as animated vignettes.

These fifty-five animations are revealed in a sequence around the screen so that the viewer makes a complete 360-degree turn inside the display system during the 15-minute experience. When the mists open, each animation zooms out from the scroll background and is strongly magnified within a circular window. The level of magnification was only possible because of the ultra-high resolution scan (Figure 10).
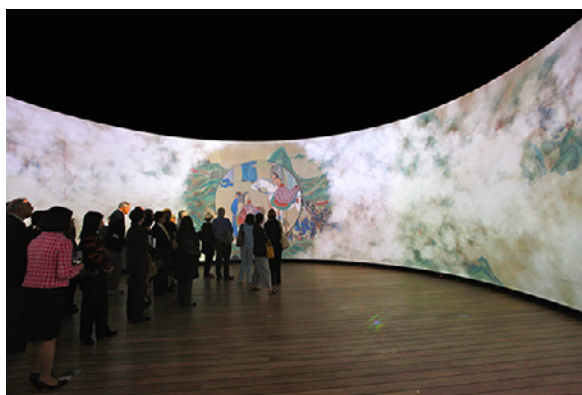

Fig. 10: *We Are Like Vapours*, Hong Kong Maritime Museum © Sarah Kenderdine & Jeffrey Shaw 2013. Image: Sarah Kenderdine

The temporal dramaturgy of mists parting to reveal magnified animated details of the painting is an effective way to communicate to the public the scroll's twenty narrative sequences. The visual experience also has an evocative surround sound audio design, and the animated events are synchronised with vivid sound effects. The overall scenography is punctuated by narrated scene titles (derived from the painting itself) that further helps to elucidate the meaning of each phase of the scroll's unfolding drama [18].

The use of the panorama in virtual, immersive environments provides a lexicon for navigable space that is "not only a topology, geometry and logic of static space" but is also transformed by "new ways in which space can function in computer culture" [19]. It exemplifies sensations of the 'electronic baroque' [20] in a merger between the aesthetics of a Baroque painted ceiling and the all-absorbing 360-degree panorama.

Output and concluding remarks

Firstly, the Murten panorama imaging campaign, with its associated challenges, represents a step forward for research in imaging technologies and data curation in their own right. Secondly, the ultra-high resolution of the image will provide data for digital archiving purposes (conservation), which will potentially last longer than any currently available imaging technology could provide. Lastly, and probably the most interesting for public outreach, the utilisation of this image in immersive interactive displays in the context of a museum – or as projected animation on large surfaces (town walls, buildings, etc.) – represent advances for the valorisation of the artwork.

The focus on the panorama and its virtual derivatives in this article has demonstrated how closely the augmented, hybrid-reality strategies engage with the historical scheme that precedes it. If the purpose of digital cultural heritage research is to develop ways in which cultural heritage assets can be accessed and engaged with, then panoramic virtual worlds are a persuasive interface paradigm for these purposes. Key issues in the current renegotiations and transformations of virtual spaces are concerned with the metaphors for navigation and embodiment. The provocative tension that exists for museums investing in digital cultural heritage is the same tension that exists between the use of new media as a tool for scientific and cultural visualisations, with the inherent scientific requirement to reproduce a rational, and authentic material reality. The transformation of the Murten panorama from 2D to 4D is however work a critical opportunity to enliven the authenticity of the inherent immersive and embodied experience, that so intrigues visitors within these spaces.

The first presentation of this image is already planned in the context of an exhibition on martial culture in towns due to occur in 2021, where the panorama, in a digital form, will be used as a central object [21]. It will be displayed in an immersive interactive installation, allowing the visitors to navigate into the image projected on a circular screen.

Notes

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Acknowledgments

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Professor Sarah Kenderdine researches at the forefront of interactive and immersive experiences for galleries, libraries, archives and museums. In widely exhibited installation works, she has amalgamated cultural heritage with new media art practice, especially in the realms of interactive cinema, augmented reality and embodied narrative. In addition to her exhibition work she conceives and designs large-scale immersive visualisation systems for public audiences, industry and researchers. Since 1991, Sarah had authored numerous scholarly articles and six books. She has produced 80 exhibitions and installations for museums worldwide including a museum complex in India and has received a number of major international awards for this work. In 2017, Sarah was appointed Professor of Digital Museology at the École polytechnique fédérale de Lausanne (EPFL), Switzerland where she has built a new Laboratory for Experimental Museology (eM+), exploring the convergence of aesthetic practice, visual analytics and cultural data. She is also Director and lead curator of EPFL's new art/science initiative, ArtLab.