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From Collection Management to Content Management in Art Documentation: The Conservator as an Editor

Dušan Barok ¹, Julia Noordegraaf ¹ and Arjen P. de Vries ²

¹Media Studies Department, University of Amsterdam, Amsterdam, Netherlands; ²Institute for Computing and Information Science, Radboud University, Nijmegen, Netherlands

ABSTRACT

It has been widely acknowledged that reinstallations and re-executions of contemporary artworks substantially rely on available documentation. Especially for installations and performances it is crucial to record the artist's intent, past iterations, and tacit knowledge involved in staging the artwork. The growing presence of contemporary artworks in museum collections increases the importance of documentation as a central focus of collection care. However, collections management systems have limitations in adequately presenting these often rich forms of documentation. Consequently, documentation required for presenting a specific complex artwork is often dispersed across multiple systems, drives, and dossiers inside various departments. In recent years, several initiatives responded to these challenges by implementing a digital platform supporting the conservation of contemporary art. Collaborative networked software such as wiki came into focus as a prominent choice for managing the related documentation. The wiki promises to integrate diverse material in one place and accommodate much-needed requirements such as multiple iterations of an artwork, relations between its elements, and multimedia content. This paper takes the case of San Francisco Museum of Modern Art (SFMOMA)'s experimental use of MediaWiki to determine whether and under what conditions a wiki is capable of supporting collection care sufficiently in terms of documenting time-based media art. The case further illustrates the consequence of adopting a content management system as knowledge base for conservation. While collections management systems are designed primarily to handle objects using forms, wikis are publishing platforms in the first place and provide a different kind of framework for artwork records. They are designed to employ text and media to compose articles. We propose to conceptualise this consequential role of conservator as a manager of content, an editor.

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Introduction

During the West German federal elections of the autumn of 1969, Hans Haacke took his 'systems' practice into a new territory to make an explicitly political work. Staged at the annual exhibition *Prospect* at Kunsthalle Düsseldorf, his installation entitled *Nachrichten* was intended as a vehicle to open up gallery walls to the surrounding world and its politics. Throughout the show, a Teletype machine kept printing out messages transmitted by Germany's wire service DPA. On the day after the transmission, the paper printouts were displayed on the walls for further reading and, eventually, on the third day, these rolls were labelled, dated, and stored in transparent tubular containers.

Haacke showed the same piece later that year in the United States, as part of his solo show at Howard Wise Gallery. There, the machine was not connected to DPA but to the United Press International news service. In this installation, as in the previous one, the printed paper rolls were displayed after the day of transmission

and then stored. In 1970, *News* was shown at the famous *Software* exhibition at the Jewish Museum in New York. Here, Haacke decided to use *five* teletype machines simultaneously printing news reports from DPA, UPI, but also from the New York Times, the Italian service ANSA, and Reuters. Rather than collected every day, the printouts accumulated on the floor where they were morphing into sculptural forms. They were not posted or preserved beyond the time of the exhibition.

Within one year, the work was shown on three occasions in varying forms depending on the decisions of the artist and staff involved, as if the conceptual framework was primary. In fact, almost four decades later, in 2008, when it was acquired by SFMOMA, it entered the collection only as a set of instructions (Martina Haidvogel, personal communication, 2018). At its premiere staging in the museum, teletype is replaced by a dot-matrix printer connected to the Internet and churling out news stories from RSS feeds of various news agencies from around the world. The museum

CONTACT Dušan Barok  d.barok@uva.nl  Capaciteitsgroep Media & Culture, Faculty of Humanities, Turfdragerpad 15, 1012 XT Amsterdam, Netherlands

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kept a sample of the printout for its artist material archive. The work was shown again at SFMOMA in 2018 (Figure 1). On this occasion, the museum recreated the software to make it possible for various adjustments including news sources for which the artist now selected eighteen varied agencies.

With respect to the media involved, the type of printer has changed across iterations, as well as the type of paper and the way agency news was received. This tells us that these components are replaceable, vehicular media (Laurenson 2014), however their parameters are still significant to the final form of the work. They are not necessarily state-of-the-art technologies: in its latest iteration, the printer is a rather old model; and agency news is sourced through RSS feeds, rather than tweets for example. Rather than a unique, precious, and self-contained object per se, Haacke's *News* is a changeable artwork.

Besides installation and technical setup, the context of the work has also changed. A year before making *News*, in 1968, Haacke gave a lecture about his artistic development. He talked about his gradual realisation of the importance of recognising movement as a defining attribute of the world surrounding us, and taking it into consequences in his artistic practise, first through gestural abstraction, optical plays with perception, to later move away from creating illusionistic spaces completely to modelling objects with their own agency in space, their activation by audience (as possible source of energy for the object to exercise its mission), and later his shift to the elements of water and air. His lecture stops there. *News* was produced the next year; it was activated by an electronic network and its medium was information. Another aspect of the artist's intent was to open up the art world to politics (notably, the work was created during Haacke's involvement in Art Workers Coalition, formed in order to pressure museums into ending discrimination and inequality in exhibition policy). Fifty

years later, in the age of mobile devices and ubiquitous connectivity these stakes no longer resonate as strongly (Bryan-Wilson 2009, 212), however they reveal that central to the piece are the ideas of movement of information and challenging the notion of a gallery as politically neutral space.

Like the components and coordinates of a changeable work, the artist's intent and the work's meaning are not a given either. To gain confidence in restaging such works, collecting institutions respond by accumulating documentation across systems and departments. However, when it comes to the exhibition, locating relevant bits of information often yields a painstaking process. This paper takes the case of SFMOMA's treatment of media installations and argues that documentation management is a threefold issue. Besides adapting information systems to the cause, of the same importance are the intra- and inter-institutional collaboration and the acknowledgment of the role of conservator as a content manager.

In what follows, we first discuss the current state of the affairs in documenting media installations. Afterwards we outline the institutional model for media conservation at place in SFMOMA. Then we turn to its recent efforts to assemble installation documentation on a 'wiki' and situate them in the context of designing a museum's information space.¹ This will create a contextual space for analysing the implementation of a wiki for its collection care. We use the case to determine to what extent and under what conditions a wiki is capable of supporting collection care sufficiently enough in terms of documenting time-based art. Finally, we discuss the consequential role of the conservator as an editor.

Documenting media installations

Media installations like Haacke's make evident the stakes involved in contemporary art conservation. The



Figure 1. Hans Haacke, *News*, 1969/2008. Newsfeed, paper, and printer. Installation view, SFMOMA, 2018. Photo: Dušan Barok.

presentation of these works demands supplanting the idea of restoring the original state of an artwork by that of installing its iterations and acknowledging the fact that through each installation the work changes anew. Besides technical and material components and parameters, conceptual and aesthetic issues have gained a crucial importance for conservation. The works consist of multiple components (sculptural elements, hardware, software, files, etc.) and after installation, they are taken apart and stored in different locations, depending on the type of medium and their relation to the work (e.g. monitors can be reused for other exhibits). So when not installed, the work cannot be perceived and only 'exists' in the form of instructions and documentation (Laurenson 2001; Phillips 2015, 173).² This condition poses greater needs on documentation and its management, which in the case of such works is a complex matter (Heydenreich 2011).

To document a time-based media artwork,³ Laurenson (2001) suggests to identify its components and elements (possibly including the space and acoustics), explain how they are connected, describe their roles in terms of aesthetics and functionality, and establish the factors most likely to prevent each component from fulfilling its role. Laurenson (2006) later introduced into conservation research the concept of *allographic* in order to expand the focus in media conservation from the materiality of painting and sculpture to also include temporality and ephemerality typical for media installations. Each time a media work is installed, 'decisions are revisited and sometimes remade as to what aspects of the work are significant to its identity.' Like in musical works, interpretation is often necessary and it constitutes the second phase of the work's creation. Building upon this concept, Phillips (2015) developed a model dividing the documentation work into two stages. The first looks at its 'score' in general that includes the work's identity and installation, and the second at its distinct iterations through the perspective of components, parameters and decision-making involved.

The importance of documentation in museum agendas varies widely, but it stands in the centre of the work of contemporary art conservation and is key in collection care since the lives of these works of art depend on it (e.g. Dekker 2013; Matos 2015). Knowledge about the artist's intent, intended behaviour, spatial and technical dependencies, criteria for non-dedicated equipment, past iterations, and many other aspects of the work is required to allow for interpretation. However, collections management systems are currently not fit to sufficiently support this cause alone. Taylor (2014, 129) describes challenges for collecting media art in terms of defining the work in collections management systems. Ippolito (2008) notes the inability of cataloguing systems to describe the roles and changing cast of characters for an evolving

work, nor the variability of its other identification elements. Van Saaze (2013, 165–168) discusses limitations of registering variable works in collections management systems developed for stable works, representing the single-artist, single-artwork paradigm. Furthermore, Engel and Wharton (2017, 294–295) observe that classification categories in standard database systems are at odds with uses of a single art object in multiple works and that the multiplicity of digital formats of artwork documentation and the relational character of complex works prevent them from facilitating searches through artwork documentation. And, most critically to our argument, Phillips states that since collection databases prescribe 'the notion of the artwork as a contained entity with a fixed set of components, reporting different iterations of the same artwork and tracking varying component constellations for these iterations is not easily possible.' These systems do not allow 'to isolate components from the artwork's component list – e.g. to create a relational history of component clusters – or even to document interventions and decision-making on a component level' (2015, 172).

Whether it is bound to the work in general or to its particular iterations, the process of documentation is hardly ever finished and rather leads to a growing cache of documents. The stages of its life in the collection – acquisition, exhibitions, and loans – generate a varied set of documents: installation instructions, identity, condition and treatment reports, artist interviews, artist statements, correspondence, preventive conservation requirements, etc. To complicate matters, these documents come in a variety of media formats as text, image, video, audio, and code. The documentation needed for restaging media installations therefore results in the complex structures of files, folders, and drives subjected to intricate hierarchies of access and distributed over multiple systems. This dispersion often results in 'siloeing' information inside various departments, which effectively prevents research and collaboration in museums. In the end, it becomes a challenge to get a good sense of the work in the usually limited time frame of setting up a new exhibition.

There is an obvious need to organise documentation in a way that prepares the artwork for its future display. To understand the piece, one needs to be able to easily navigate the great variety of elements related to its documentation and conservation. Besides having access to its recorded identity and installation instructions, one must also be able to consult various iterations of the work and, for each, learn about decision making involved on the component level as well as about relations between its elements, supported by multimedia content where necessary.

Beyond infrastructure, we argue that organising the access to dispersed, varied, and complex

documentation is an issue of collaboration across (and beyond) departments, and of the role of conservator as a content manager. The three aspects – infrastructure, collaboration, and content management – are mutually intertwined.

In recent years, several initiatives responded to these persisting challenges by implementing novel supporting platforms. Systems such as wikis came into focus as a prominent choice for managing documentation of complex artworks. The most well-known among them, MediaWiki, is a content management system originally built for the Wikipedia encyclopaedia. It is free to be repurposed practically without any restrictions. The ZKM Center for Art and Media Karlsruhe had been using MediaWiki to support work in a number of its departments, including media conservation, between 2006 and 2015.⁴ Guggenheim Museum's Panza Collection Initiative (2010-2016) employed Confluence wiki to address the long-term preservation and future exhibition of works of the 1960s and 1970s, primarily Minimalist, Post-Minimalist, and Conceptual art (Jill Sterrett, personal communication, February 26, 2018). In 2013, the San Francisco Museum of Modern Art (SFMOMA) started using MediaWiki as a resource integrating documentation of media installations in its collection (Johnson 2016; Haidvogel and Faust 2017; Haidvogel and Brost 2018). Between 2014 and 2017, SFMOMA used Confluence wiki as documentation resource for The Artist Initiative featuring research engagements with artists such as Ellsworth Kelly, Vija Celmins, and Julia Scher to support the preservation and display of their works in the collection.⁵ Also, New York University's Artist Archive Initiative, launched in 2017, has opted for MediaWiki to create knowledge bases on the oeuvres of artists such as David Wojnarowicz (Engel and Wharton 2017).⁶

Albeit the wikis of all mentioned initiatives respond primarily to the intentions to document more sufficiently complex art in respective collections, they vary greatly in their content structure, functionality, and design. This paper focuses on one of them. Since most of the mentioned projects are not active at the moment and the Artist Archive Initiative is not connected to a museum collection, we take the case of the SFMOMA MediaWiki.⁷

Institutional memory through collaboration

Time-based media arts form one of the pillars of the SFMOMA's collection and therefore one of the main domains of collection care.⁸ As a key strategy to address the needs of these works, the museum developed a model for media conservation. Acknowledging the necessary interdependence of curatorial, conservation, and technical support for this cause, it has

reinforced internal interdisciplinary collaboration as well as participation in cross-institutional networks.

The sustained focus on presenting and collecting time-based media art at SFMOMA came in 1988 when under director John R. Lane the museum established a curatorial post for media arts, taken up by Robert R. Riley.⁹ One of his first shows was *American Landscape Video*, which was instrumental for setting forward the path of exhibitions, collections, and conservation of these 'great ideas in fugitive forms' (Smith 2010, 16). From among the works displayed there, Steina Vasulka's 'horizontally drifting' 22-monitor video and sound installation *The West* (1983) was acquired by SFMOMA, becoming Vasulka's first museum purchase.¹⁰ The curator also carried out historical survey exhibitions such as *Bay Area Media* (1990), *The Projected Image* (1991), *Steina and Woody Vasulka: Machine Media* (1996), and *Seeing Time* (1999-2000).¹¹

Riley oversaw collecting not only contemporary works, but also aimed to establish a history of media arts, going back up to twenty years to retrieve works that in some cases have been lost and have required complete re-creation. Across museum departments, he argued that unlike other works, media art demands us to accept it as a changeable and durable object and to acknowledge the consequences for the institution:

I spent a long time scaring people, people in traditional disciplines of registration and collection and exhibition that it wasn't a static object, it was an experience, it was a time-based piece, what amounted to the work of art was often in opposition to what the traditional museum would think was a work of art. [...] [T]he most important thing to do to establish [the museum's] department [for media arts] was to share with the entire team of the museum and the conservation department, registration, everything else, about the type of respect for this kind of art that's very important for this time in the century.¹²

While Riley's role of media arts curator included preservation, media arts programme assistants assumed responsibility for its various aspects – 'the care, installation, maintenance, and tracking of components which comprise the artwork' (Graham and Sterrett 1997). Their job was 'part installation, part registration, and part conservation' (Graham and Sterrett 1997). Increasingly, registrars and conservators have also played a role in ensuring the long-term care of this collection section. They recognised the central role of collaboration and documentation. Conservator and the future director of collections Jill Sterrett spoke about the need for special care that media arts require: 'What is needed is an institutional memory which can recall a detailed account of the look, feel and intention of the piece and the institutional foresight to anticipate the future trajectory of its ongoing

technological evolution' (Sterrett and Graham 1997). As Phillips (2013) emphasises, the responsibility for building up this knowledge should not be outsourced 'by relying on the artist or the artist's studio to install or update the piece.'

To improve collaboration in the institution, in 1995 a working group – Team Media – was formed as a platform for dialogue across departments (Sterrett and Coddington 2017). The fluid group has included curators, conservators, collection managers, cataloguers, registrars, and A/V team and meets regularly to discuss time-based media works in the collection.¹³ Discussions and negotiations about their installations, accessioning, lending, and documentation have informed their recognition and treatment of these works in the museum. Sterrett, whose position of Director of Collections and Conservation makes her coordinator of this group, emphasises collaboration as its uniting element: 'We upped our game by leaning on each other and, as a result, a deep culture of collaboration took root. Team Media has been at the centre of our ever-expanding programme of acquisition, display, and care of electronic media arts and design' (Sterrett and Coddington 2017).

Laurenson (2013) identifies this institutional model for media conservation as the 'interdisciplinary team.' Laurenson notes that the model 'recognises that responding effectively to changing artistic practice involves an engagement throughout the museum.' She adds that it can only be successful with 'a commitment and an institutional culture of collaborative working,' while its strength is that it does not require recruiting more personnel or outsourcing the responsibility for works. Another example of this approach is MoMA's Media Working Group that was first set up in 2007. In contrast, other institutions such as Tate and Guggenheim rely mostly on their specialist conservation section, while the responsibility in Centre Pompidou is retained by a specialist curatorial department, as it was in SFMOMA before Team Media emerged.¹⁴

The existence of an interdisciplinary team increased the mandate and competency of SFMOMA to engage in cross-institutional collaboration in media conservation. Coinciding with the establishment of Team Media, in 1996 the museum hosted *Playback '96: Video Preservation Roundtable*, the first international working group and symposium bringing together the fields of conservation, museology, and media arts to address technical and ethical issues surrounding video preservation. Participants included conservators, scientists, video artists, media curators, television engineers, archivists, librarians, and preservation administrators.¹⁵ The two-day gathering was preceded by eight months of research in working groups examining various aspects of video preservation and the conservation of installation art.¹⁶ It had been assumed from the outset that preserving

video works has to take into account artist's intent and engage in appropriate documentation, as much from conservators as from curators. At her opening speech, the then museum's head of conservation Inge-Lise Eckmann emphasised the importance of documentation:

One of the key elements towards the preservation [...] is the documentation of those works. In some cases, the documentation is going to be a much more durable record than the work itself, and when the artist can be a part of that documentation process, including not only the physical characteristics and the technical aspects, but to some extent giving a clear idea to the museum what the artist's intent is, and what is the aesthetic component in the intent, as difficult as it is to distill that down and articulate it (BAVC 1997b).

In the following year, the museum participated in setting up a platform for these conversations on the national level, the Electronic Media Group (EMG) of the American Institute for Conservation (AIC).¹⁷ The *TechArchaeology: A Symposium on Installation Art Preservation* that followed in 2000 brought together 25 curators, conservators, and artists to examine the works from the exhibition *Seeing Time* staged at the museum.¹⁸ The project followed a similar model like in *Playback '96*, but instead of individual themes, working groups did case studies on particular works and explored common themes. With the arrival of Benjamin Weil as media arts curator, the launch of E-space online gallery in 2000, and staging of the instrumental *010101: Art in Technological Times* show (2001), the museum has dived into the issues of preserving internet art as well (Verschooren 2007, 7–8).

More recently, the museum acknowledged the importance of collaborative modes also in its architectural expansion of 2016. The media workstation is situated within the conservation department and includes a spatial studio space which is directly adjacent to galleries (Haidvogel 2013–2014).

These threads were part of the large-scale tendency of conservation research to embrace media arts that has ever since leaned towards working together across domains and geographies. Its landmarks included the international research projects *Preservation Video Art* carried out by the Dutch organisation NIMK (2000–2003), the *Variable Media Network* consortium founded by Guggenheim and the Daniel Langlois Foundation (2001–2004), *404 Object Not Found* managed by *medien_kunst_netz* in Germany (2002–2003), and *Inside Installations* coordinated by the Netherlands Institute for Cultural Heritage (2004–2007). In addition, between 2003 and 2015, SFMOMA had partnered with the New Art Trust, MoMA, and Tate in establishing guidelines for the care of media art, as part of the *Matters in Media Art* consortium.¹⁹

Assembling installation documentation

Even if artworks are well documented, based on the input of multiple stakeholders, it becomes clear that when it comes to access and exhibition, it is highly time-consuming to collect relevant documents many of which are accessible only to particular departments or persons, scattered various formats across databases, drives, and stacks. This section analyses the form, content, and use of binders that SFMOMA devised to deal with this problem.²⁰

In connection to the ongoing research in *Matters in Media Art*, the museum's media conservator Martina Haidvogel has designed a system to document complex art installations.²¹ In its early phase, the system involved maintaining a 'preservation dossier' for each work. The dossier was essentially a ring binder bringing together documentation of various

aspects of the work relevant for keeping it present in the institutional memory (Figure 2). Its structure has been devised in tandem with the museum's engagement in media arts conservation research. Describing in detail the 'look, feel and intention' of media installations is something that is practiced across positions and across departments. From the start, dossiers were designed as multi-authored, multi-voice records. Any department having relevant documents would make hard copies and file them in the respective folder for each concerned artwork. Curators would provide their descriptions along with contracts, A/V team and technicians would author 'technical narrative' and assemble installation instructions together with conservators and registrars who would add preservation requirements, collect interviews and correspondence with the artist and gallery, and contribute materials on respective exhibitions and loans.²²

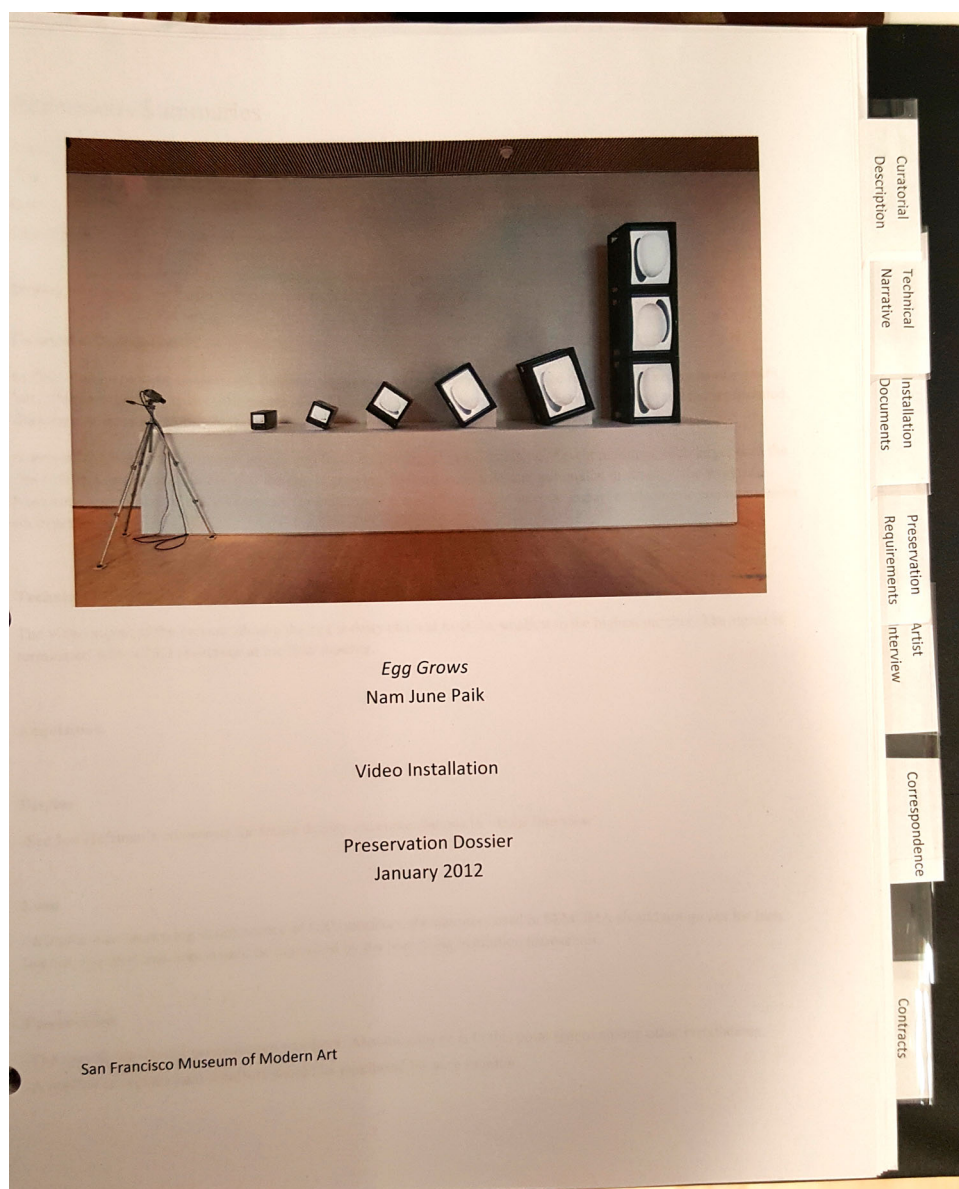


Figure 2. SFMOMA's preservation dossier on Nam June Paik's *Egg Grows* [1984–1989], 2012. The dossier is made up of several sections: curatorial description, technical narrative, installation documents, preservation requirements, artist interview, correspondence, exhibitions and loans, and contracts. Photo: Dušan Barok.

A dossier was created almost exclusively on the occasion of an exhibition. The reports and materials were compiled mostly after the initial installation process, before a work went down. Documents from across museum's information systems, intranet drives, and paper folders were filed in a single dossier per artwork. In result, dossiers brought documents from various formats into a common medium, paper. The complexity of access control was reduced to having all dossiers available on a single shelf above the conservator's desk in a relatively easily accessible office.

One of the main challenges was to coordinate this process. The original intention was that the members of staff involved in setting up an installation would print out relevant documents and file them in the respective folder. However, in practice, Haidvogel assumed the role of requesting particular people for particular documents with various levels of urgency, and of filing. The conservator hesitantly took up the role of managing the overall editorial process.

Dossiers were meant to aid collaboration in the institution, however besides the shared responsibility for their maintenance being reduced to a single person, their material form posed obstacles as well. Making a dossier is a laborious process because documents have to be copied or printed, perforated, and filed. In addition, by being bound in a ring the dossier resists easy reproduction and exists only as a single volume per artwork, unavailable when checked out.

Besides its great demands on coordination, the material form of a dossier created limitations in practical use in terms of access, production, and reproduction and it proved not flexible enough to serve as

inter-departmental communication medium. After several months, it became evident that in this approach to tying together documentation, shortcomings surpass benefits. An alteration addressing these shortcomings would be to make the dossier digital, and embed it within the museum's digital information space (Figure 3).

Museum information space

The SFMOMA's information architecture counts a wide variety of systems (Figure 4), each with its own idiosyncrasies and demands on the user. We will first introduce structure and context of the collection-related 'information commons' in order to understand how a new information system would fit in this framework.²³

From the perspective of collection documentation, information relevant to the sustainability of an artwork begins to be collected long before the work enters the building. Descriptions of components of the work, the intention behind it, and various spatial and technical dependencies are accumulated in mailboxes and hard drives of curators, conservators, and other staff. Large museums like SFMOMA operate a complex patchwork of digital systems and channels for organising information relevant to a specific artwork in their collections.

These computer systems span decades. The earliest is EmbARK, embraced by the museum in 1995.²⁴ Its original promise was simple – to *manage* collections using a single system present across the museum's computer network. EmbARK was created as part of the wave of a new generation of collections

The screenshot shows the 'View Object' window in the EmbARK system. The window title is 'View Object' and it has a standard Windows-style toolbar with icons for trash, edit, print, info, document, folder, checkmark, navigation, and zoom. Below the toolbar, the object details are displayed in a grid-like format:

- Accession Number:** 2008.232
- Temp ID:** x2008.669.026
- Display Title:** News
- Display Artist:** Hans Haacke
- ULAN Artist I:** [empty]
- Object Status:** Loan:Loan restrictions, Medium:Electronic Art, Verification:Checklist fields verified CIA
- Keywords:** [empty]
- Location:** see itemized locations (moved 9/16/2015)
- InActive:**
- Confidential:**
- Web Access?:**

Below these details is a tabbed interface with the following tabs: Page 1, Page 2, Page 3, Notes & Histories, Edition Info, Fund & User defs, Custom Fields, Images & Documents. The 'Page 1' tab is active, showing a detailed form with the following fields:

- Accession Number:** 2008.232
- Temp ID:** x2008.669.026
- Display Title:** News
- Display Artist:** Hans Haacke
- Artist Sort Name:** Haacke, Hans
- ULAN Artist No.:** [empty]
- Attribution:** [empty]
- No. of Components:** 1
- Whole object?:** Yes No
- Multiple Artists?:** Yes No
- State:** [empty]
- Editioned?:** Yes No
- Sort Create Date:** 1969-2008
- Century:** 20th-century
- Update Range:** 1969 - 2008
- Public Display Title:** [empty]
- Display Create Date:** 1969/2008
- Alt. Date:** [empty]
- Technique:** [empty]
- Alternate date type:** [empty]
- Medium:** RSS newsfeed, paper, and printer
- Medium 2:** [empty]
- Support:** [empty]
- Support 2:** [empty]
- Display Medium:** RSS newsfeed, paper, and printer

On the right side of the form, there is a small thumbnail image of the artwork 'News'.

Figure 3. The main screen of an entry on Hans Haacke's installation *News* (1969/2008) in EmbARK. Courtesy of SFMOMA.

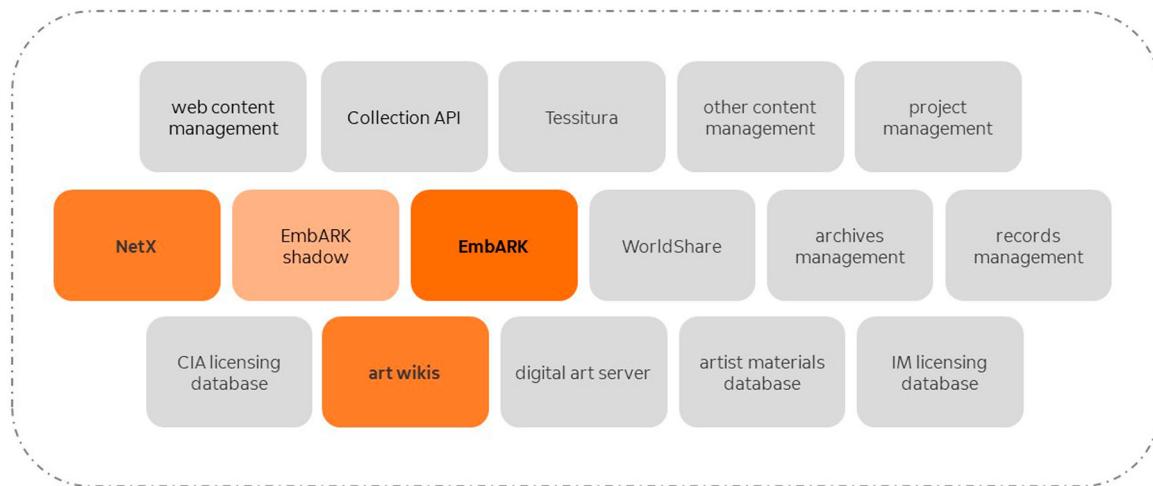
collections and exhibitions supporting technology @ SFMOMA

Figure 4. Diagram of SFMOMA's information space, highlighting current systems discussed in this paper. Courtesy of Layna White, SFMOMA.

management systems running on relational databases (RDMBS), which began to emerge in the mid-1980s.²⁵ The company behind it, California-based Digital Collections, Inc., saw business potential in licensing digital images of artworks.²⁶ It began developing EmbARK in 1993 as a next level, 'image-centric' CMS with the Fogg Art Museum of Harvard University and the SFMOMA among its original development partners (DAS 1997a; DAS 1997b). Shortly after the system was fully deployed at SFMOMA, the company was merged with Gallery Systems, the firm responsible for The Museum System (TMS), a CMS originally developed for the Metropolitan Museum of Art.²⁷ Today, while TMS has been claimed as the most extensively used CMS for the management of conservation documentation in art museums (Green and Mustalish 2009, 8), EmbARK is generally considered its 'junior version.'²⁸ It is used only rarely, despite being more lightweight and affordable (Green and Mustalish 2009, 38).²⁹

EmbARK was built as desktop software, in principle as the computerised database version of the collection catalogue enabling such new functions as automated search and remote access. Despite the current status quo of web-basedness of applications, it remains bound to a desktop. The software was designed in the mid-1990s using the then fast-spreading technology of relational database that was then bound to desktop applications. Around that time, the World Wide Web also started to gain traction, however it represented a different tradition. Websites offer graphical extension to networked communication and data transfer. Unlike databases that are relational on the level of meticulously structured data items, websites offer relationality on the level of linked 'freestyle' documents. It would take several years before MySQL clients and Apache webservers would gain traction and bring these two paradigms together.³⁰ However, EmbARK remained a desktop application without a

programming interface (API) and its further development is greatly limited by its employment of the now little used 4D database system.³¹

In spite of all of its idiosyncrasies, EmbARK CMS has been central to SFMOMA's collection management.³² This is where registrars compile identification data and create additional records for each component. Collection managers, curators, and conservators add notes specific to the work, even though many of the staff and collaborators do not interact with the CMS at all and keep documents using their own means. The proper documentation of an installation usually happens before it goes down from the show. This is the point when the piece has been 'stabilised' and members of the team are confident to retrospectively describe how they reached this point. Reports are stored in CMS and on shared drives or paper folders of respective departments. Photographs and visual documentation are collected on shared drives from where it is meant to be copied further to 'Digital Garden,' the digital assets management system (DAMS) the museum has been running since 2013.³³ Contrary to EmbARK, Digital Garden comes with a clean and easy to use interface and it is available through a web browser.

Introducing another system into this framework demands addressing justified concerns over creating redundancy and further scattering of documentation. Another concern is that learning and maintaining a wiki requires a special lasting effort from the members of the staff. Hence its embedment in the information space needs to be negotiated.

Digital dossiers

The next question is to determine what digital solution would be suitable to replace the paper-based preservation dossiers. It should meet the key criteria for

supporting media art documentation which are not provided by the systems already put in place (CMS, DAMS), while not yielding additional obstacles in the conservation process. The criteria discussed above include:

- Straightforward navigation through documentation associated with an artwork.
- Support for differentiating between identity and installation of a given work on the one hand, and its respective iterations on the other.
- Support for documenting decision making on the component level.
- Support for linking components and elements of a work.
- Support for multimedia content.
- Version control including history of changes and identification of their authors.
- Integration of the platform within the information infrastructure.

To make a paper dossier digital, one could simply scan it into a PDF file. The PDF (Portable Document Format) is now an ISO standard for digital documents.³⁴ The self-contained and compact format is readily usable for electronic distribution, display on the screen, and professional printing. However, for the purpose of creating a reference for preservation, this is impractical, if for no other reasons than for the hassle with inconsistent versions of dossier due to changes and additions. It would exist as a paper dossier and simultaneously as multiple copies of PDFs of its various versions.

Instead, one may opt to minimise the need for printing and scanning and rather collect source files from which they were printed for a dossier: Word documents, images, PDFs, email threads, and scanned documents. It does make sense to have a shared space where they can be situated together. This space, presenting a collection of multimedia documentation on artworks, would primarily serve not a single department, but museum staff in general, ideally generations of museum staff. The variety of file formats in such a collection however presents a problem for concise presentation. One option would be an intricate file manager known to the staff from operating their shared drives through Finder and File Explorer. However, this is only a partial solution to the problem, especially due to the fragmentation of information into individual files, the lack of file previews, the lack of versioning, and the lack of remote access. A more distributed solution such as Git would help the issues of access, versioning, and previews of some formats, however it too offers only a highly fragmented and impractical perspective on the artwork and, in addition, requires relatively high technical skills.³⁵

Another candidate, collections management systems (CMS), generally lack sufficient support for multiple

iterations of an artwork, for relations between its elements, and often also the above-mentioned features. Digital assets management systems (DAMS) are highly adequate for handling large quantities of multimedia content such images and video however they fall short of structuring and describing context around artworks.

Instead, Haidvogel foresighted utilising a content management system, a web-native space with inclusive interface design where respective files from a dossier would be displayed side by side in a continuous succession of narratives.³⁶ Multimedia and other files would be linked, ideally embedded within. Entries on artworks would be structured as in a dossier. The system would have version control. As the work of Team Media has shown, media installations have the ability to bring people across departments together and this place should be their platform, at hand to everyone in the group.

The choice fell on a wiki, despite being employed in the museum context only scarcely. Wikis emerged in the mid-1990s as software and websites allowing users to comment on and change one another's text. They were designed to link together people's experiences to create a new literature documenting their shared areas of interests, and to harness people's natural desire to talk and tell stories with a technology that would feel comfortable to those not used to 'authoring' (Venners 2003). Since the early 2000s, wikis have been increasingly adopted as collaborative software used for project communication, intranets, and documentation. The single most popular wiki software today, MediaWiki, has been deployed as free and open-source content management system to serve the needs of the Wikipedia encyclopaedia ever since its foundation in 2002. It is attached to the ideas of stability and scalability (Wikipedia is able to sustain itself, and it is vast). Even though it is able to serve such a massive project, MediaWiki is relatively simple to get running. The open source approach to both the wiki software and website has helped to attract a community of editors and developers sustaining a large ecology of readily available plugins and extensions. Today it serves not only as a major encyclopaedia, but also library, glossary, and news media.³⁷

Adapting MediaWiki for media art documentation

Since MediaWiki is a general-purpose content management system, it does not meet the special needs of media conservation out of the box. It has to be adapted in terms of user interface, structure, functionality, and workflow.

The SFMOMA Media Wiki was set up in June 2013 by the museum's technology consultant Mark Hellar (Figure 5). First running on default interface, Haidvogel later greatly modernised it and aligned it with the museum's identity design. The platform operates as a

News

 Actions


Artist Name	Hans Haacke
Artist Description	German, born 1936
Title	<i>News</i>
Year	1969/2008
Description	RSS newsfeed, paper, and printer
Credit Line	Collection SFMOMA. Purchase through gifts of Helen Crocker Russell, the Crocker Family, and anonymous donors, by exchange, and the Accessions Committee Fund
Accession Number	2008.232

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Figure 5. Top section of the page documenting Hans Haacke's *News* in SFMOMA Media Wiki. Courtesy of SFMOMA.

website, internally available through a web browser from stations and devices inside the museum.

The shift from paper dossiers to wiki involved the gradual update of the structure of its artwork page

template (Figure 6). The sections include identification information, installation shots, curatorial description, technical narrative, the listing of components, exhibition history, installation instructions, detailed

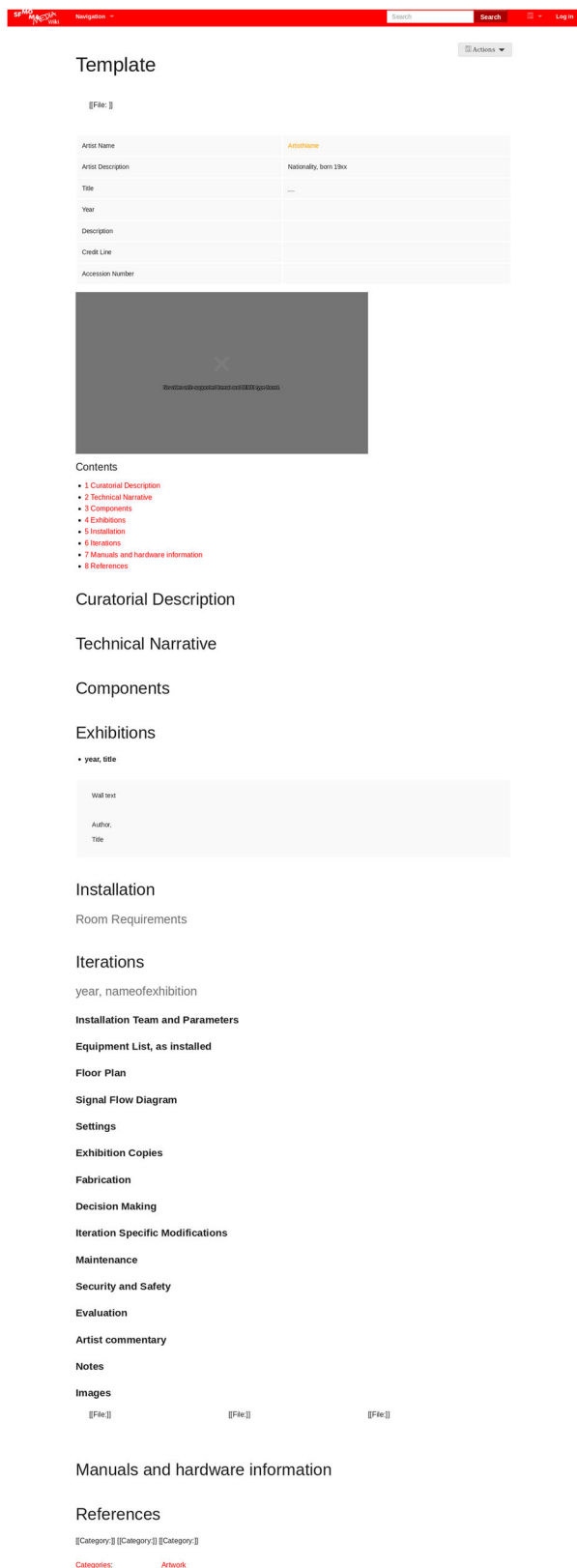


Figure 6. Page template of SFMOMA Media Wiki. Courtesy of SFMOMA.

description of respective installations of a work – its iterations, a section with manuals and hardware information, the list of all references in the article, and general categories (to enable listings of artworks per artist, production year, and type).

A second, multi-page template, was created for large-scale complex installations (Figure 7) such as Julia Scher's *Predictive Engineering*. This work was reconceived with the artist's input for three distinct museum's locations since 1993. In order to maintain the concept of the work to 'encourage viewers to confront the ways in which security and surveillance can serve as mechanisms for social control,' the installation setup and media were updated for each iteration to correspond with the state-of-the-art technology.³⁸ Its respective iterations are documented on three sub-pages entitled 'episodes' (as the artist likes to call them). Several other works in the collection are documented based on this template (for example William Kentridge's immersive kinetic installation *The Refusal of Time*). The majority of the works however exist as single pages.

The entry on Hans Haacke's work *News* was created following its first installation after the adoption of MediaWiki in the museum, in 2018. The staff produces wiki entries, like dossiers earlier, almost strictly on the occasion of exhibitions because this is when the knowledge about installation and maintenance of a given artwork is generated. This also explains why the artwork did not have its own dedicated dossier: the dossier procedure was put in place only years after its previous installation of 2006 and by now it had been replaced by a wiki page.

During the five months of exhibition, three members of staff each made changes to the page. First, in the second month of the exhibition, the media conservator created a dedicated page based on the wiki artwork template (see Figure 6) and populated some of its sections: identification data were copied from the CMS, installation views were taken from the DAMS, a curatorial description from curatorial defense written for the artwork's acquisition back in 2008, components from the CMS, and artist's parameters for the printer, news sources, software, and room were taken over from email correspondence. The conservator also wrote down the names of members of the installation team and the list of (non-dedicated) equipment, and linked the entry to categories corresponding to the artist, year of production, and media ('Live', 'RSS feed'). A week later, the curator responsible for the piece included wall texts (for both the work and the exhibition it was part of) and wrote a short safety report about behaviour and instructions for visitors on interacting with the printer and print-outs. Before the work went down, at the point when it was 'stabilised,' a member of the installation team wrote a report about its maintenance – the frequency and timing of replacement of ink cartridges and paper rolls and adjustments of paper pile – and uploaded the user manual for the printer (sourced from the company website). The authored section on maintenance as well as that on safety also discuss

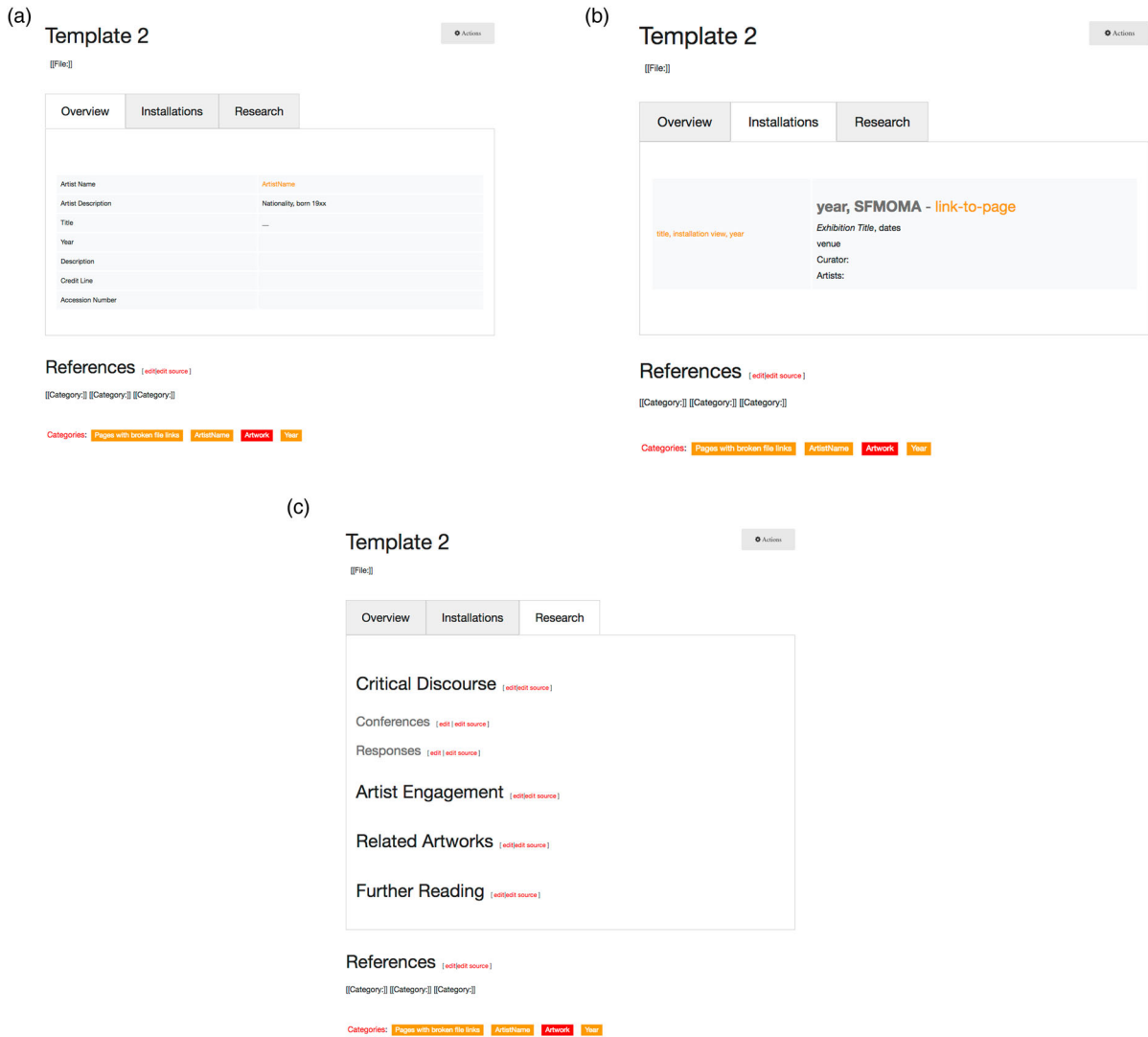


Figure 7. (a–c) Page template 2 of SFMOMA Media Wiki, used for more complex artworks. Courtesy of SFMOMA.

decision-making involved in the process. Most sections have references describing their original sources. Still missing from the page is a technical narrative which would explain the configuration and control of the printer and software.

While most of this information can be located in the CMS and the DAMS, the approach based on MediaWiki introduces a number of improvements. Rather than being spread across multiple systems and menus, information here is presented on a single page. The page can be structured at will, even using multiple tabs per screen, which means it does allow for nuanced composition consisting of multiple sections and subsections, while providing enough space for contextual description, including multimedia content. In this way, a wiki provides most of the practical knowledge necessary to consider an installation of the artwork in the future, ready to be presented to a third party interested in its loan as well. The sharing capacity is however only non-direct, since MediaWiki does not offer a way to safely provide external access to selected pages on an otherwise private instance. A workaround is to export PDFs that can be shared beyond the walls of

an institution, although this solution does not preserve the functionality of links and multimedia. Other critical limitations include the absence of nuanced file management and the need for users to get acquainted with its structure and mark-up language. These require serious efforts on the side of both technical administrators and operators of the system. Still, MediaWiki is geared toward collaboration: it comes with version tracking functions, it is highly configurable, and to a certain degree it can also interface with other systems. The system has a built-in reference functionality allowing users to identify sources of the information entered. In summary, MediaWiki has the capacity to format art documentation as multimedia publication, without sacrificing basic database functions, and if designed with care it may indeed offer straightforward navigation through documentation associated with an artwork (Barok, Boschat Thorez and Rossenova forthcoming; Barok et al. 2019).

The structure of iteration documentation employed by SFMOMA was originally inspired by Guggenheim's *Iteration Report* published in 2012 (Guggenheim 2012) (Figure 8). In principle, both models capture

iterations through their components, parameters, decision making, and other aspects. An interesting difference between these two models is in what constitutes a single report. Phillips's (2015) model understands documentation as a process of producing a series of object reports. First, an identity report is produced, from which installation instructions for particular iterations are derived and in turn, each iteration is documented in an iteration report. The iteration report feeds new findings about identity of the work back to identity report, and so on. This distinction follows the two-tier structure, built upon Laurenson's (2006) concept of allographicity, where the identity report together with installation instructions represent

the score that is each time interpreted as an iteration, documented separately. On the other hand, the practice on SFMOMA MediaWiki is such that all this information usually rests on a single page. Even if structurally and conceptually the iteration documentation is divided from the other content on the page, it is not trivial to identify which reporting corresponds to the score, and which belongs strictly to an iteration. In the case of Haacke's *News*, the page includes sections containing curatorial description, the listing of components, and brief installation instructions provided by the artist on the occasion of acquisition (following the first display of the work in the museum in 2008), all of which are relevant for the work's score,

GUGGENHEIM

Conservation Department

Iteration Report

Artwork	Accession No.:	<i>Thumbnail Image</i>	
	Artist:		
	Title:		
	©, Year:		
Exhibition	Title:		
	Date:		
	Venue:		
Iteration	Created / supervised by: <i>(Who had an impact on the appearance of this iteration?)</i>		
	<input type="checkbox"/> Curator(s):	<input type="checkbox"/> Registrar(s):	<input type="checkbox"/> Art Handler(s)/ASaP:
	<input type="checkbox"/> Exhibition Designer(s):	<input type="checkbox"/> Artist(s):	<input type="checkbox"/> Consultant(s):
	<input type="checkbox"/> Media Technician(s):	<input type="checkbox"/> Artist Assistant(s):	<input type="checkbox"/> External Company:
	<input type="checkbox"/> Conservator(s):	<input type="checkbox"/> Fabricator(s):	<input type="checkbox"/> Others:
	Who installed the artwork, for how long? <i>(List names, and/or skill-sets, and add the hours/days per person.)</i>		
	Was the artist present/represented during the (entire) install? If not, how (closely) did the artist monitor/influence this iteration?		
	Evaluation of this Iteration:		
	1. <i>Was the iteration considered to be successful, or less successful? Why? (Source, Date)</i>		
	2. <i>Did the artist(s) see and/or approve this iteration?</i>		
3. <i>Were there any unsolved problems or suggestions for future improvements? (Source, Date)</i>			
Images, as installed:			

Figure 8: The first page of four of Guggenheim's Iteration Report. Courtesy of Guggenheim Museum.

while lessons learnt about its maintenance during its 2018 exhibition are described only in the iteration documentation.

Another, and for our argument crucial difference between Guggenheim and SFMOMA's reporting of iterations has to do with the affordances of the medium of reporting. Whereas Guggenheim's reports are forms with a fixed structure, kept as PDFs or Word documents on file drive (which returns us to our review of 'digital dossiers'), SFMOMA's reports are much more fluid. The structure of each artwork page is based on one of the two wiki templates; however contributors are free to adapt its structure to the particularities of a given artwork. Titles of headings may be adjusted, sections embedded in one another, new sections introduced if necessary, and iterations split into separate tabs or pages if they are too complex.

This fluidity is crucial. Artworks have different needs, media works and performances especially. For example, the artist may have a particular vocabulary in place for the work, such as when Julia Scher calls exhibitions of her *Projective Engineering* 'episodes,' rather than 'iterations.' Software-based works have dependencies on operating systems and online services that need to be specified in a distinct manner. Performances operate with a different vocabulary than installations: they are executed instead of installed, run on script instead of 'installation instructions,' they employ performers or interpreters – not fitting the 'components' category, etc. Participatory works such as Miranda July and Harrell Fletcher's *Learning to Love You More* (2002-2009) contain thousands of distinct objects – an archive of items rather than a set of 'components'. Adhering to a strict report structure would make it harder to accommodate certain types of artworks, causing documentation to again flow over to other systems. In consequence, while standard collections management systems are subjects to data entry where conservators fill out pre-existing forms, wikis are primarily publishing systems, allowing them to adapt templates to specificities of each artwork and so shape documentation in both content and form.

The conservator as an editor

As indicated above, standard museum information systems do not leave much room for variability and reduce artworks into fixed categories (Van Saaze 2013, 167). One consequence of this situation is that the amount of forms and entries per artwork is so high they need to be split into numerous panels, sidebars, menus, and screens. The resulting complexity prevents staff from consulting more than only certain aspects and fragments of a given artwork at once. This makes it hard to grasp changing artworks such as installations and performances. The descriptive fixity of systems leads to complex interfaces that in

turn prevent staff members from operating at their level of proficiency. One reason to employ a content management system to document complex works is to allow for a more holistic view on artworks. As shown in the example of SFMOMA MediaWiki this can be achieved by bringing together relevant elements of identity and iteration of an artwork into a single wiki page.

The consideration of content management alongside collection management requires rethinking the conservator's role in documentation as well. We argue that rather than data entry, the conservator documenting an artwork in this way does the work of editing. The tradition of editing offers a useful framework to conceptualise further this aspect of conservation.

In her book proposing the development of a new field of Editing Studies, Susan L. Greenberg (2018) broadens the definition of editing from its rooting in book publishing to account for the variety of media, channels, and genres of publishing existing today. Her understanding of editing as 'a decision-making process, usually within the framework of a professional practice, which aims to select, shape and link the text, thereby putting it into a context that helps to deliver the meaning and significance of the work to its readers' (Greenberg 2018, 14) is inclusive enough to also span digital publishing. Traditionally, editing referred to the work needed to prepare a text for publication, that is, releasing it in printed form. However, in digital publishing, and in web publishing especially, 'the line between before and after becomes permeable and it is now common to see ex post acts referred to as editing' (117). Because of its website format, a wiki page is hardly ever finished.

Greenberg further describes the three key aspects of editing as 'the choice of content (selection), the choice of language (shaping), and the overall context in which the content appears (linking)' (91). As described in the example of documenting Hans Haacke's installation *News* on SFMOMA Media Wiki, the ensemble of conservator, curator, and technical assistant has been following similar lines. They selected content for most of the sections on the page from documentation amassed across the variety of systems, including the CMS, the DAMS, the file server, the email server, and the Web. The key decision was to include the materials crucial for installing the work in the future, making explicit also assumptions and procedures otherwise taken for granted by current staff. Greenberg (2018, 16) aptly notes that '[s]election involves decisions about what gets published and by whom [and] what to leave out as well as what to include.' 'The editors' of *News* have also had to adjust the template and decide which of its sections should be populated and which should be left empty for the time being or dropped from the page completely. They might have further shaped the

page by making changes in headlines and the text itself. Greenberg (2018, 17) describes shaping as concerning ‘everything [that has] to do with changes to the content itself at both macro level (developmental concerns such as structure, focus, tone and voice) and micro level of copy-editing (including grammar, spelling and usage).’ And finally, embedding the page within site-wide categories and adjusting page layout correspond to Greenberg’s concept of linking that adheres to ‘[t]he specific material conditions of its making and reception, and the way it is linked to other texts’ (2018, 17).

In contrast to large wikis such as Wikipedia, SFMOMA has not explicitly outlined its editing standards and left them as subject to process, even though pages for more extensive works such as Julia Scher’s *Projective Engineering* have been highlighted as examples of best practice for editors. As a result, whether staff members are authoring or revising the text, they are always already editing. The line between authors and editors becomes permeable, since as a collective work, a wiki page is co-authored and co-edited by all its contributors.

Even if the wiki system the page is part of is intended for museum staff in the first place, the authorial and editorial practises aimed at delivering the meaning and significance of a given artwork to its readers show it is indeed being treated as a publication. Ultimately, its potential readers also include third parties interested in loans and even artists commissioned to conceive new installations for collected artworks (Frieling 2014, 147–149). The tasks of selecting, shaping, and linking that used to be the sole province of the professional editor are in case of the wiki potentially practised by any staff member involved in documentation.

Conclusion

This paper has examined how an implemented collections management system may be supported by another application, a content management system, in its mission to document changing artworks. Even if it is still in experimental phase, the relatively smooth embedding of MediaWiki in the conservation and documentation workflows in SFMOMA has been possible due to the combination of the initiative of a conservator and its positive cross-departmental collaborative environment, institutionalised in the form of an interdisciplinary team. We argued that in contrast to ‘departmental’ models, the interdisciplinary model equips the institution better to align its digital information space to its changing needs. While the wiki system is suitable for this purpose in many respects, we identified a number of its critical limitations such as its absence of nuanced file management, the need on users to get acquainted with its structure and

mark-up language, and its limited selective sharing capacity that prevents collaboration beyond the walls of the institution. If an organisation is capable of overcoming these limitations, MediaWiki could stand as a relatively affordable means to meet the needs of documenting media art, and potentially contemporary art in general.

We have also argued that the consequence of adapting a content management system into conservation and documentation workflows brings conservators and other staff members into the roles of editors. Rather than the work of data entry, preparing an artwork’s digital dossier requires shaping documentation in both content and form. This process has parallels in the established procedures of editing that require making decisions in selection, shaping, and linking.

Operating content management systems in museums has been mostly the domain of ‘digital’ departments operating the websites of their institutions. The people in those departments are the ones to reach out for collaboration. At the same time, documenting and editing artworks on a wiki may bring together the many voices of conservators, registrars, curators, and technicians in articulating the contributions of their own professions to the meaning and significance of works in their care. It also sheds a new light on the often repeated statement that art installations only exist when they are installed. Compiling and editing relevant documentation not only prepares us better for their live episodes in galleries, but helps us treat them as being present and alive in institutional memory.

Notes

1. Wiki is a website on which users collaboratively modify content and structure directly from the web browser.
2. Many conservators see the actual exhibition as the main condition of existence of installation art: ‘Essentially [time-based media installations] do not really exist until they are installed’ (Laurenson 2001); ‘[A]rtists’ installations only truly exist in their installed state’ (Scholte and ‘t Hoen 2007, 44); ‘[some] time-based media works only really exist in their installed state’ (Tate 2012); ‘[T]he large majority of time-based media works [...] only exist when they are installed’ (Phillips 2015, 173); ‘[Time-based media works are] often only fully realized in their installed state’ (MoMA 2018).
3. Laurenson (2001) says the term is useful to ‘describe installations that have a duration and therefore have to be experienced in the context of the passing of a period of time.’ The Electronic Media Group of American Institute of Conservation (EMG AIC) defines time-based media art as ‘any artwork that has both physical and temporal dimensions.’ http://www.conservation-wiki.com/wiki/Electronic_Media. In this paper, the term is used synonymously with media arts.
4. The use of wiki was discontinued following the decision to reduce the number of information systems after the merge of ZKM’s Media Museum and Museum of Contemporary Art into a single entity

- (Morgane Stricot, personal communication, April 13, 2018).
5. Presentation by Meredith VanDyke at SFMOMA's 'Study Day' meeting, March 1, 2018. For more on the Artist Initiative see Clark and Barger (2016).
 6. More instances of the use of wikis for collection care may exist, however no such survey has been published so far.
 7. The paper is based on field research conducted by Dušan Barok at SFMOMA in February–March 2018.
 8. As of 2016, the museum holds 300 interactive art installations (Johnson 2016).
 9. SFMOMA's media arts curators included Robert Riley (1988–2000), Benjamin Weil (2000–2006), and Rudolf Frieling (since 2006). Assistant media arts curators included Kathleen Forde (1999–2002) and Tanya Zimbardo (since 2009).
 10. On acquiring the work see Smith (2010, 33–35).
 11. Instrumental for staging and preserving media works has been the museum's close collaboration with Bay Area Video Coalition (BAVC), an organisation founded in 1976 to provide broadcast quality equipment access, technical services and assistance, training and information to the nonprofit sector and since the 1980s pioneering video preservation.
 12. He continued: '[W]e'll think about the material of this nature, and how it's very important for understanding our own times, how it's very important for understanding this quickly accelerated phenomenon of our own perceptual capacities, as we've gone from the projected image in a gallery situation, to a whole socially bound culture that seems to be connected to electronic media, so we want to, of course, preserve all these early experiments for the benefit of time to come' (BAVC 1997c).
 13. For an account from one such meeting see Westbrook (2016).
 14. Finally, organisations such as LIMA in the Netherlands operate as external agencies.
 15. The symposium was organised by BAVC with assistance from AIC and Media Alliance and was supported by the Getty Foundation and the Andy Warhol Foundation for the Visual Arts. <http://web.archive.org/web/20080405003111/http://palimpsest.stanford.edu/byorg/bavc/pb96/>
 16. The themes included the maintenance of installation art using technology, ethical considerations in videotape preservation, changes in technology and practice, etc. For a full list of sessions and transcripts see BAVC (1997a).
 17. The Group was officially formed after its first two sessions, in 1998. It is hosted by Stanford University.
 18. The symposium was organised by BAVC.
 19. <http://mattersinmediaart.org>
 20. This section is largely based on interviews by Dušan Barok with Martina Haidvogel, SFMOMA, February 22 and 26, 2018.
 21. Haidvogel, a video conservator working with Agathe Jarczyk in Bern, Switzerland, was invited in 2011 for a fellowship at the museum and eventually took on a full-time position as media conservator.
 22. On technical narrative as documentation tool see Engel and Hellar (2014).
 23. Layna White, the museum's Head of Collections Information and Access, employs the term 'information commons' as a preferred one to 'CIA' her department is colloquially referred to (personal communication, February 20, 2018).
 24. Following its reopening in a new facility (Mitroff, Misunas, and Wise 2004).
 25. Early collections management systems for minicomputers include Vernon Systems (first introduced in 1985), Argus (1986), KE-EMu (1986), The Museum System (1987), and Re:discovery (1989). They are all based on the relational database.
 26. The company provided access to digital images through the Internet and CD-ROM discs, similarly to Bill Gates' Corbis (Flores 1995).
 27. For a review of The Museum System see Swank (2008, 37–41) and Carpinone (2010, 79–92).
 28. For a functional analysis of EmbARK and TMS see Carpinone (2010, 79–92). For an authoritative overview of CMS systems see <https://collectionstrust.org.uk/software/>.
 29. For a full list of clients as of 2009 see GallerySystems (2009). For a comparison of prices of selected CMS systems, see Carpinone (2010, 67).
 30. In 2003, the museum began employing the recently developed web module for EmbARK in order to bring identification information and images of artworks to its public website, even though it proved not to be compatible with the site-wide search and demanded workarounds. For more see Mitroff, Misunas, and Wise (2004). As of 2018, this process is managed through daily exports of data from EmbARK to a 'shadow database,' from which they are passed to Django content management system that handles the website.
 31. 4D is a proprietary database system and programming language developed in the mid-1980s as Apple's 'brand' database. However, it was never deployed on this scale.
 32. The museum is currently working on replacing the system with an alternative.
 33. Between 2006 and 2013, the museum had been using MediaBin as its DAMS. The decision to present new DAMS in the museum as Digital Garden instead of its product brand, 'NetX', has been purposeful, coming from a conviction that setting a specific tone and vibe around it as experience is crucial. It is made to be a pleasant place after all (Layna White, personal communication, February 20, 2018).
 34. Adobe Systems Incorporated, original developer and copyright owner of the format, decided to relinquish control of PDF to ISO in 2008.
 35. For an assessment of the use of Git for archiving and conservation of digital art see Barok et al. (2019) and Barok, Boschat Thorez, and Rossenova (forthcoming).
 36. Confusingly, content management systems abbreviate as 'CMS' just like collections management systems. As will be shown later, we understand them distinctly: content management systems primarily as web publishing platforms, while collections management systems fundamentally as cataloguing systems with additional features.
 37. See <https://wikipedia.org>, <https://wikisource.org>, <https://wiktionary.org>, and https://en.wikipedia.org/wiki/Portal:Current_events, respectively.
 38. For more see SFMOMA (2017) and SFMOMA (n.d.).

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ORCID

Dušan Barok  <http://orcid.org/0000-0002-0691-0748>
 Julia Noordegraaf  <http://orcid.org/0000-0003-0146-642X>
 Arjen P. de Vries  <http://orcid.org/0000-0002-2888-4202>

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