Originalveröffentlichung in: Art style : art & culture international magazine 4 (2019), Nr. 4 (December), S. 11-24

The What, the Why and the How of Media Preservation

Hans Dieter Huber

Abstract

On the one hand, there are general cultural and theoretical considerations, on the other hand, specific problems that need to be solved. There is still a big gap between the two areas. The general considerations concern questions of how we should deal with our digital cultural heritage. What should be preserved for posterity? Why should the things selected be preserved? What strategies, practices or models have evolved over the last decade in media preservation? Special questions arise with concrete problems. They are always media- and case-specific. Basically, a distinction must be made between the digitization of analog media such as photographs, films, audio tapes or videos and the preservation of digitally born media. The translation of analogue media into digital objects is in a more comfortable situation, as there is still the analog "original", which can be played back under good conditions. More complicated is the case with digital born media. Their preservation and conservation requires more complex approaches.

Introduction

If we talk about the preservation of digital media for posterity we are confronted with two completely different sets of questions - general and case specific ones. The general considerations concern questions of how we should generally deal with our digital cultural heritage. What should be preserved for posterity? Why should the things that are selected for posterity be preserved? And what strategies, practices or models have evolved over the last decade in media preservation?

What is a digital object?

First, I would like to define a central concept of my presentation. The term 'digital object' is taken from the Open Archival Information System (OAIS) developed by NASA and ESA in 1999.[1] (Fig. 1) A digital object is defined as an object composed of a set of bit sequences.[2] Anything that can be stored and processed with a computer can be called a digital object. These can be simple text or image files, complex multimedia applications, interactive digital systems or complete operating systems.

In our context we can distinguish two different types of digital objects. The first group is (a) digitized copies of analogue media, for example photographs, films, videos or audio tapes. If we have an analog magnetic videotape from the seventies, which begins to dissolve into its components, one proceeds to the digitalization of the content. Today, digitization is often the only way to preserve an obsolete analogue medium in the long term. The advantages of the transformation from analog to digital objects are that you still have an analogue original, even if it may no longer be functional in the near future and can only be studied in terms of its form, design or materiality. A second group (b), however, are those digital objects that are already digital when they are created. That's why we're talking about digital born media. Here, too, the long-term preservation of this genuinely digital heritage is increasingly important for posterity. However, these objects represent a completely different challenge for long-term preservation.

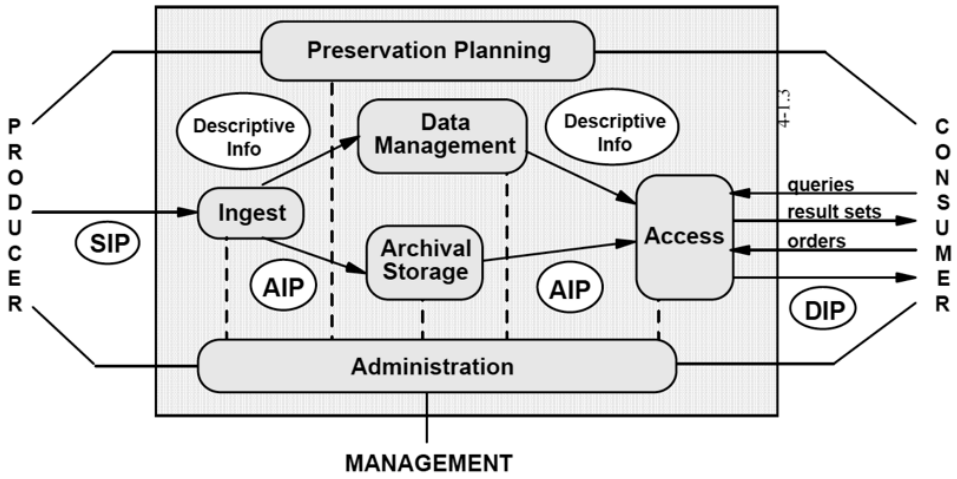

Figure 1: Open Archival Information System (OAIS) developed by NASA and ESA in 1999.

Musealization

In the process of its musealization, a digital object or media artwork undergoes a profound transformation, although nothing changes in itself. The musealisation is a transformation of the original context. It is completely exchanged and replaced by another, namely the context of the museum. In the museum, media art becomes musealized. It becomes a museum's object. What does it mean that an object becomes a musealized object? If you take a closer look at how media artworks find their way into a museum, you can distinguish between the following activities: creating, searching, finding, selecting, purchasing, managing, preserving, presenting, interpreting, understanding, evaluating and publishing.

In this large bow which ranges from the creation of an art work under the hands of the artist to the publication of musealized artifacts, which are important for the memory of a society, preservation is only a small but important link in a chain of causal conditions and possibilities for a responsible historical approach to one's own history. But it also becomes clear that each phase of musealization depends on the preceding phase. Where nothing has been selected for a museum, nothing can be preserved. Where nothing is managed, nothing can be explored. Where nothing is displayed to the public, nothing can be remembered.

In the museological context, the choice of a digital object for a collection is understood as a targeted search and active selection of those digital objects from overall reality that are potential bearers of museality.[3] From the wealth and richness of the objective fund of reality, the curator should actively select those digital objects that represent a cultural value whose preservation and remembering lies in the interest of society.[4] The musealized object as a materialized information documents a certain stage of development, a style, a time or epoch of society. As a scientifically well documented and integrated document, it is equipped with an additional value of authenticity and trustworthiness.[5]

Whatever we do in a museum depends on our values. These values are of central significance for future preservation.[6] Collecting is always a statement to the world. Only an active selection based on clearly structured collection criteria can guarantee that a historical argumentation which is later derived from a totality of a museum's collection is sufficiently representative.[7] Such an assumption is of course an ideal one and usually does not correspond to the actual history of a museum's collection.

Which criteria should determine whether digital objects are handed down or perished?

In general, one could argue that it is the cultural significance of a work of art for posterity that should decide whether it is preserved or forgotten. What does that mean? In sciences we are speaking of the impact factor. In the present it is practically very difficult up to impossible to recognize which digital objects of today's time could be of great importance in the future. In order to measure the influence that an artwork has exerted on others, there must be a historical distance between the time of creation of an artwork and the determination of its historical influence or significance. But what criteria can be applied for "historical impact"? The frequency with which a work is accessed, quoted or depicted in art-historical literature says something about its possible significance for the art system. This could be a possible impact factor for a digital artwork among other criteria. The history of a work's exhibitions could perhaps be a good indicator of its historical influence and estimation.

The historical significance of a musealized digital object does not result from its storage alone, but also from its inventarisation, documentation and presentation.[8] The historical and cultural significance of a musealized object thus arises through a re-contextualization within the framework of the scientific reappraisal within a museum. The museums contextualization is a re-contextualization. For the object is taken out from its original context in the art world and transferred into a new, artificial museums context.

Long-term preservation

When it comes to the long-term preservation
of media artworks, we have to deal with
various special starting points.

1. On the one hand, a digital object like a media artwork is usually only available in a single version, which means it exists only once in the world. It is precisely this characteristic which plays an important role especially in installation art that makes long-term preservation so precarious. These objects do not exist as an industrial mass product in thousands or millions of copies but only once in the world.

2. The second aspect concerns the heterogeneity of the materials, their different properties, functions and their respective state of preservation. Especially in media works of art, one encounters an interplay of the most diverse materials, which require different optimal conservation conditions with regard to light, temperature and air humidity, which are often mutually exclusive.

3. Therefore it is very difficult or even impossible to store a work of media art in an optimal condition such as a Nam June Paik sculpture for instance.

4. Materials can have a different ontological status, which means a different authenticity.

5. There may be objects and materials that were created, modified, reworked or substituted by the artist himself at a later date. However, there may also be elements which are industrial mass-produced and were only purchased and used by the artist.

6. There may also be units and elements manufactured by third parties, such as programmers or television technicians, but which are genuine components of the digital artwork without it would not function.

7. Media art installations very often contain technical components and units that are not part of the visible surface of the installation, but are located behind the scenes. These units can be substituted more easily than objects made by the artist himself or which play an important aesthetic role in the appearance of a work.

Figure 2: The Church of Our Lady, Dresden 2011. Photo: Hans Dieter Huber.

Substitutes

The relationship between exchangeable and non-exchangeable components of a digital object is part of its historical authenticity. Compared to the richness of an original component, a substitute offers only a very reduced possibility of reference to the social and cultural meanings of the original time in which the work was created. A substitute can only trace the historical reference and authenticity back to its own time of origin and not beyond. Substitutes block the relationship of the present to the original time and context in which a work was created. This gradual crumbling of reference by substitutes becomes all the more problematic the more components of a work are substituted over time. Nevertheless, even a work in which there are only very few original components left like in the rebuilt Church of Our Lady in Dresden (Fig. 2) can still be an authentic, historical original.[9] The dark stones are original stones from the Baroque, the bright ones are from the 21st century.

Strategies

New media age much faster than old media. Already after three to four years you have to reckon with hard disks failing to work and causing serious data loss if you have not developed a regular backup strategy. Integrity, authenticity and trustworthiness of digital objects are endangered in their long-term perspective above all by the obsolescence of data carriers, software programs, operating systems and hardware. In general, different strategies for long-term preservation of digital objects are being discussed today. Not all of these strategies are equally suitable for every object type. The integrity and authenticity of digital objects are changed in different ways by the various conservation strategies. The different strategies are: hardware preservation, bitstream preservation, migration, emulation and reconstruction.

Hardware Preservation

The standard strategy for most museums is to physically store a work, whether that means packing selected equipment on shelves or archiving digital files on tapes, CDs or hard drives. (Fig. 3) What does this putaway strategy mean for digital objects? What could a museum or archive physically store in the case of a digital object? It would have to store the complete digital system, the hard disk, the software, the operating system, the computer, the monitor, the peripherals, the cables and the interfaces. Shortly, a trusted archive would simply have to store everything together in its original functionality as a heterogeneous mix of different materials and media, each of which in the worst case require different and mutually exclusive storage conditions.

Figure 3: Herbert W. Frankes original computer equipment
from a donation of 2007, Karlsruhe 2012. Photo: Hans Dieter Huber.

There are two different intentions for hardware preservation. In the first case, hardware preservation is used by archives as a strategy for archiving the content of the digital objects. The goal is to maintain the information, the readability and functionality of the digital objects, but not the original hardware. For these reasons, they try to keep the hardware and software platform running as long as possible and then they replace it. In the second strategy, which is particularly pursued by art or design museums, hardware preservation is used to preserve also the authentic "look and feel" of the original hardware and software platform for aesthetic experience.[10] While repairs and spare parts primarily serve to preserve the functionality of digital objects in the first conservation strategy, ethical and aesthetic aspects of the original hardware and its authentic preservation also play an important role in this collection area. Maintaining the functionality of digital objects is no longer the only criterion. Rather, devices and components should be used that are as historically appropriate as possible in order to make an authentic aesthetic experience with a historical computer platform. The advantages are obvious. No other strategy can convey so much of the intrinsic value of historical, original, digital objects. The look and feel of such a functional unit cannot be surpassed in authenticity and possibilities of later aesthetic experiences.

In order to preserve a file or program with its specific functionality and original environment of hardware and software, it is necessary to preserve the computer with the original operating system, the original software and the original files as well as the associated interfaces and peripherals, complete and functional. But even large quantities of spare parts are subject to natural aging and physical deterioration, even if they have been stored completely unused and brand-new. If the storage of spare parts as a conservation strategy no longer helps, the conservation of the bitstream is the next step.

Bitstream Preservation

The basis of all archiving activities is the physical preservation of digital objects, the so-called bitstream preservation. Storage strategies are used here that provide redundant data storage on at least two different storage media. The storage media used are regularly replaced by newer systems to prevent both the physical deterioration of the storage media and the obsolescence of the technologies used. There are four types of bitstream preservation: refreshment, replication, repackaging and transformation.[11] During refreshment, individual data carriers are exchanged for new, similar data carriers. The files, such as a DVD, are copied directly to a new DVD disc, the data from a CD to a new CD and the data from a hard disk to a new hard disk of the same size. This means that an older medium is replaced by a newer medium of the same type and size. [12]

In replication, data is also copied from an older data carrier to a new one. However, it can be a data carrier of a different or bigger size. Replication takes place, for example, when you copy the data from several CDs or DVDs onto a single Blue-Ray disc or a bigger hard disc. The new data carrier can therefore usually no longer take the place of the old one. In contrast to the refreshment technique, changes in the structure of the physical storage take place here. Repackaging is a preservation process in which the archive package is changed. The change does not affect the data contents, but only the structure of the archive package. The data is repacked and rearranged. [13] Transformation, on the other hand, is a migration process in which the content data of an archive package is also changed. This happens, for example, when converting an old Word file into RTF format to make it easier accessible for future Word versions or when converting a JPEG file into the TIFF format suitable for long-term archiving.

Migration

The aim of migration is to ensure that digital objects together with their ingest informations and their context remain available and readable over longer periods of time in the environment of their time-related hardware and software architecture. What does the strategy of migration mean for the preservation of digital objects? Migration is not a major problem as long as the archived object can be preserved in all its functionality on a younger operating system and with younger software. But we know of numerous digital objects, for example complex websites from net.art, which depend on a whole bundle of controls, scripts and protocols which today are hardly used any more and are no longer processed by newer formats such as Flash and thus produce error messages. The next solution, when the strategy of migration has come to an end, is emulation.

Emulation

The emulation concept was proposed by Jeff Rothenberg of Rand Corporation in 1995, who considered the migration concept too unsafe in the long run. (Fig. 4) In principle, the concept of an emulator is based on replicating the functionality of an obsolete operating system from the time in which the archived digital object was created. This means that a hardware and operating system environment that no longer exists anymore is to be simulated in such a way that the digital information in its original software environment and thus also in its original functionality and aesthetics can still be made accessible and maintained for later times.

Figure 4: Jeff Rothenberg of Rand Corporation in 1995. Photo: Hans Dieter Huber.

There are three different types of emulation in this area. It can be used on the hardware level, on the operating system level, but also on the software level. For example, the original hardware of a digital object can be simulated as software with an emulator that can load the archived operating system and the software components based on it. An example of an operating system emulation would be an MS-DOS emulator that can run the programs for this outdated operating system on contemporary, current computers. "Unlike migration, which creates a new and more current version of the digital object itself, emulation does not change the original objects."[14] However, there is now a more elaborate approach that seems to be promising for the future of emulation, namely the so-called Universal Virtual Computer (UVC) from IBM. The UVC is a well-documented virtual computer that can be replicated on various computer architectures, including those of the future. Based on this virtual computer, further programs or emulators can be written, with which one can execute older digital objects.

The advantage of emulation is that the original objects remain unchanged. A conversion is not necessary. In addition, less storage space is required, since migrated objects do not have to be saved in addition to the originals. The disadvantages are that emulators are technically difficult to implement for complicated digital objects or systems. In addition, there is a high expenditure for each hardware generation change. The basic and unsolvable problem of emulation is that the emulator itself depends on a specific operating system and only runs on this operating system. The problem with the emulator is that it ages and you would have to write an emulator for an emulator for an emulator. In theory, a new emulator must be developed for each new operating platform. If emulation is no longer a possible solution for long-term preservation, the last possibility at the present time is a radical reinterpretation or reconstruction of the work.

Reconstruction

The most radical preservation strategy is to reconstruct a digital object or a media artwork each time it is re-installed or displayed. Ion Ippolito of the Variable Media Initiative in New York has proposed this strategy under the term Re-Interpretation for certain works such as performances, installations or networked art. But he himself is very sceptical about reinterpretation. He writes:

> The most radical preservation strategy is to re-interpret the work every time it is re-created. (…) Re-interpretation is a dangerous technique when not warranted by the artist, but it may be the only way to re-create performance, installation, or networked art that designed to vary with context.[15]

The re-construction, re-installation or re-enactment of a digital object should be based on a precise notation, instruction or detailed documentation. At that point the issue of an extended documentation together with the artist comes into consideration. If possible, the conditions and possibilities of a re-construction should be documented in a joint conversation with the artist and the preservation management during his or her lifetime. An agreement should be sought as to which parameters of an artwork may not be altered and which parameters may be varied or substituted by other components. Because then a reconstruction is authorized by the artist him- or herself for future display. The Variable Media Initiative has developed an extensive questionnaire in which the fixed and variable parameters of a work can be documented for posterity through a precise questioning of the artist.[16]

The current state of conservation science is to conduct and document extended interviews with the artist regarding an authorized re-installation, re-enactment or re-construction. The Stedelijk Museum in Amsterdam for instance did this in 2010 with the main work of Joan Jonas *Organic Honey's Visual Telepathy /Organic Honey's Vertical Roll*, which was created during several performances and in various installation versions from 1972 to about 1994. (Fig. 5) They developed and documented both the unvariable and the variable parameters of that installation together with the artist herself.

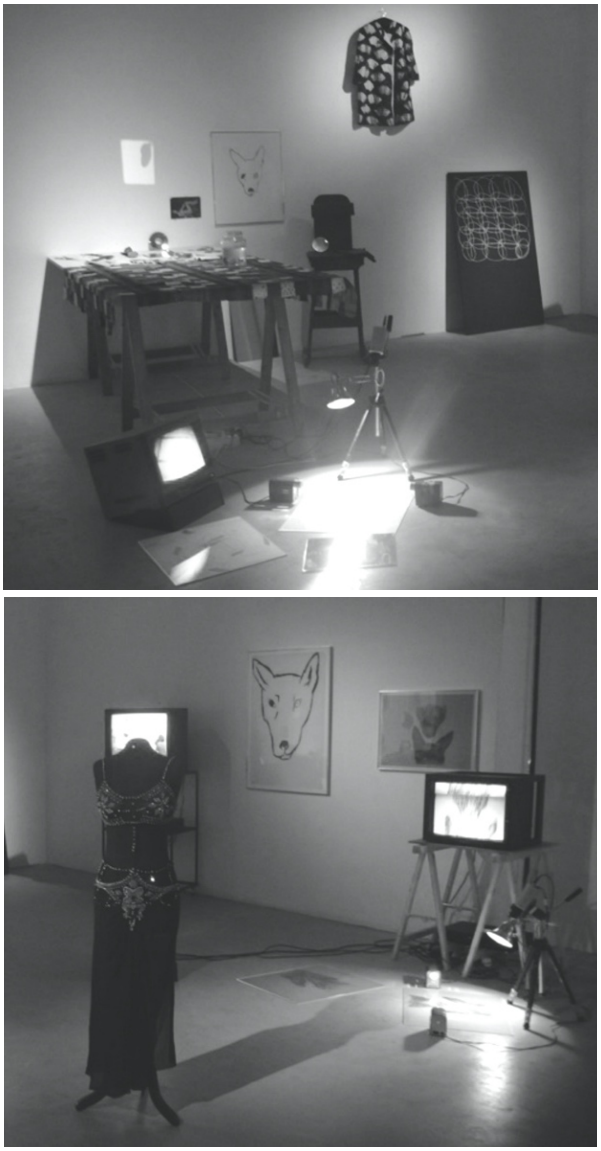

Figure 5: Joan Jonas *Organic Honey's Visual Telepathy, Organic Honey's Vertical Roll Joan Jonas' 1972-1994.*
The Stedelijk Museum in Amsterdam, 2010.
Photo: Hans Dieter Huber.

Summary

Collecting is, in essence, an irrational human behavior.[17] Collecting is a statement to, an interpretation and evaluation of the world. Collecting digital objects means creating and producing a world, preserving and presenting it to posterity.[18] Museums among others are the collective memories of mankind.[19] A museum should therefore have written collection guidelines according to which it actively collects digital objects and works of media art. If possible, avoid passive collection and replace it with active selection criteria for the objects you are looking for. Musealized digital objects are looked at from two different perspectives, namely firstly under their historical reference and secondly under their present significance. Authentic digital objects can serve as historical evidence and testimony to something that was once the case in society. They are evidence and narrators of past realities. Their history is authenticated by its musealization. The narration of a true story turns any object into a historical document that stands for something else and represents that story. Particularly in societies where freedom and democracy are threatened by oligarchs or totalitarian dictators, museums also have an eminently political role in the preservation of democracy, freedom and autonomy of our cultural life of the past.

Author Biography

Hans Dieter Huber, born 1953, lives in Stuttgart. 1973-77 studied painting and graphic arts at the Academy of Fine Arts in Munich, 1977-1986 studied art history, philosophy and psychology in Heidelberg. 1986 Doctorate with the work ‚System and Effect. Interpretation and meaning of contemporary art' (Munich 1989). 1994 habilitation with the work ‚Paolo Veronese. Art as a social system'. From October 1997 to September 1999 Professor of Art History at the Academy of Visual Arts, Leipzig; from October 1999 to September 2019 Professor of Contemporary Art History, Aesthetics and Art Theory at the State Academy of Fine Arts Stuttgart. From May 2006 to October 2011 he was head of the International Master Program "Conservation of New Media and Digital Information" at the State Academy of Fine Arts Stuttgart. From March to June 2007 he was Senior Fellow at the International Research Center for Cultural Studies in Vienna. From December 2006 to November 2009 he was Associate Professor at the Research Training Group Image, Body, Medium at the HfG Karlsruhe. Since October 2007 member of the International Council of Museums (ICOM). Since March 2009 member of the Scientific Board of the Society for Interdisciplinary Image Science. Since May 2013 member of the Scientific Advisory Board of the International Institute for Subjective Experience and Research (ISER) at the MSH Medical School Hamburg. Since December 2016 Deputy Chairman of the Württembergischer Kunstverein Stuttgart. Since June 2017 Member of the Board of Trustees of the Adolf Hölzel Foundation, Stuttgart. Website: http://www.hdhuber.net/

Notes

1. Consultative Committee for Space Data Systems 2001. https://public.ccsds.org/default.aspx; last access 05.12.2019
2. Funk, Stefan E. (2010): *Digitale Objekte und Formate.* In: Neuroth, H./Oßwald, R. [u.a.] (Hg.): nestor Handbuch. Eine kleine Enzyklopädie der digitalen Langzeitarchivierung. Version 2.3., 2010, ch. 7:3. http://nestor.sub.uni-goettingen.de/handbuch/artikel/nestor_handbuch_artikel_445.pdf, last access 05.12.2019.
3. Friedrich Waidacher: *Handbuch der Allgemeinen Museologie*. 3., unver. Aufl. Wien [u.a.]: Böhlau Verlag 1999, 147.
4. Waidacher 1999, 158.
5. Waidacher 1999, 32.
6. Kathrin Janis: *Restaurierungsethik im Kontext von Wissenschaft und Praxis*. München: Martin Meidenbauer Verlagsbuchhandlung 2005. See also the Nara Document On Autheniticity. Published in: Larsen, Knut Einar (ed.): *Nara Conference on Authenticity in relation to the World Heritage Convention*, Nara (Japan), 1. -06.11.1994, Proceedings, Trondheim 1995, p. XXI-XXXI, esp. §9.
7. Waidacher 1999, 35.
8. Friedrich Waidacher: *Museologie – knapp gefasst.* Wien [a.o.]: Böhlau Verlag 2005, ch. 4.
9. Winfried Nerdinger (Hg.): *Geschichte der Rekonstruktion – Konstruktion der Geschichte*. München: Prestel, 2010.
10. Huth, Karsten: Computermuseum. In: Neuroth, H./Oßwald, R. [u.a.] (Hg.): nestor Handbuch. Eine kleine Enzyklopädie der digitalen Langzeitarchivierung. Version 2.3., 2010, ch. 8:25 http://nestor.sub.uni-goettingen.de/handbuch/artikel/nestor_handbuch_artikel_451.pdf, last access: 05.12.2019.
11. Ullrich, Dagmar: Bitstream Preservation. In: Neuroth, H./Oßwald, R. [u.a.] (Hg.): nestor Handbuch. Eine kleine Enzyklopädie der digitalen Langzeitarchivierung. Version 2.3., 2010, ch. 8:3. http://nestor.sub.uni-goettingen.de/handbuch/artikel/nestor_handbuch_artikel_402.pdf, last access: 05.12.2019.
12. Ullrich (2010), ch. 8:5.
13. Ullrich (2010), ch. 8:6.
14. Funk (2010), ch. 8:16
15. http://variablemedia.net/e/index.html See under ->terms -> strategies. Last access 05.12.2019.
16. The Filmmaker database with the list of questions can be found at http://variablemediaquestionnaire.net/, accessed on 14.10.2011.
17. Waidacher 2005, 11.
18. Waidacher 2005, 34.
19. Waidacher 2005, 15.