OPERATIVE MEDIA (ART) PRESERVATION. Adopting to the techno-logical time regime

Lecture at Media Art Preservation Symposium, March 23/24 2017, Museum of Contemporary Art (Ludwig Museum), Budapest [long version]

Preserving the signal: Media theory in support of media art preservation

Preservation of media art does not simply require care for the material endurance of the artefact any more. Preservation of time-based technologies itself must be processual, as an ongoing act of up-dating the analog or digital art work.[1] Still, a media-archaeological veto insists: To what degree does the hardware of so-called "born-digital" art matter?

That is the moment when conservation specialists ask for epistemological advice. It is the primary task of media theory to take philosophical care of technical terms like the "emulation" of early computational media art works by contemporary operating system. What seems evident on a practical level turns out to be a delicate challenge to the ethics of museum preservation. Media archaeology describes the techniques of cultural tradition and develops criteria for a philosophy of dealing with the tempor(e)alities of techno-logical agents. Any piece of media art is subject to time in its hardware embodiment (physical entropy), in its logical, almost time-invariant design (circuit diagrams and software codes), and in its actual time-critical processing. Any epistemology and aesthetics of media art preservation aks for the foundation of its arguments in the technological ground, against all seductions of reducing preservation of media art to its shere phenomenological appeal.

There are different museological degrees for media art preservation: conceptual (design), functional (circuitry), and actually operative (time-critical) re-enactment. While in historical re-enactment, the theatrical drama aims at the effect of the original event; *media* theatrical enactment aims at the "functional intactness in archived program software"[2]. In order to keep technologies from the past "contemporary", it is not sufficient to simply display the device like a painting hanging at the museum wall or an ancient sculpture placed in the museum court. What constitutes the "original" in technological culture is not just its materiality but its processual media-existence. This either requires the provision of operational hardware from the technological past, "or a functional equivalent"[3] - which can be, miraculously, software of a second

---

1 As has been expressed in a ground-breaking series of exhibitions, symposia and the resulting publication by the Karlsruhe Center for Art and Media Technology (ZKM): Bernhard Serexhe (ed.), Konservierung digitaler Kunst: Theorie und Praxis. Das Projekt digital art conservation, Karlsruhe (ZKM) / Vienna (AMBRA) 2013; esp. Jussi Parikka, Maschinenkonservierung - Datenhauerei und die Zeitlichkeit technischer Zeit, 262-275

2 Doron Swade, Collecting Software: Preserving Information in an Object-Centred Culture, in: History and Computing Vol. 4 No 3 (1992), 206-210 (209)

3 Swade 1992: 208

order, the "emulation" of past hardware in a present Operating System - such as the functional time-adequate simulation of the loading process of computer games from Datassette to Commodore 64 computer

Different from the notion of the historical original in cultural tradition, the material replica of a media artefact from the past allows for its authentic re-enactment even if the replica is not the original materiality but principally (*en arché*) replaced by a functional equivalent. Only when signal processing, the media-artistic object from the past becomes a "source" of knowledge.[4]

Museological media arts preservation might therefore be metonymic in terms of cultural heritage: taken as partial examplification as case studies to ensure future insight into its technological ground, a testimony of a specific techno-cultural epoque. In terms of McLuhan's media theory, preserving artistic content should reveal its underlying technological message which is its true potential "historical significance"[5]. While in pre-electronic times, the tools of art making, as cultural techniques like painting with brush and oil on canvas, were public knowledge, contemporary media art encapsulates the hidden knowledge of electronics and algorithms.

["Als Medienträger sind für uns sowohl die Leinwand als auch die Medienapparate niemals zugänglich" = Boris Groys, Unter Verdacht. Eine Phänomenologie der Medien, Carl Hanser Verlag 2000, 21]

Since there are few other institutions to preserve such technological knowledge, art museum might take that addition chance to claim to transmit the memory of the media cultural age.

Preservation strategies for media art require at least two definitions: of "media", and of "art". As expressed by the combinatorial term (instead of a neo-logism), different from traditional art works which have been directly resulting from the performative actions of the human artist, media art unfolds primarily in its technological existence. Different from "re-enactment" of past events in artistic live performance, in criminal forensics or in "experimental archaeology"[6], the re-enactment of media art is by definition operative in the technological sense. Instead of an idiosyncratic corporeal theatrical re-enactment, technological experience of the past in the present is based on the re-operativity of the very machine (the technical configuration) itself.

In 2002, Rod Dickinson re-enacted (at CCA in Glasgow) the psychological experiment once conducted by Stanley Milgram in 1961, concentrating on the command of electric shocks for punishment to non-learning subjects in the next

---

4 See Christian Sichau, Die Replikationsmethode: Zur Rekonstruktion historischer Experimente, in: P. Heering / F. Rieß / C. Sichau (eds.), Im Labor der Physikgeschichte. Zur Untersuchung historischer Experimentalpraxis, Oldenburg (Bibliotheks- und Infomrationssystem der Universität Oldenburg) 2000, 10-23 (10, note 3)

5 https://rhizome.org/art/artbase, accessed March 20, 2017

6 See the "Foreword" to the exhibition catalogue: History will repeat itself. Stragegies of Re-Enactment in contemporary (Media) Art and Performance, edited by Inke Arns / Gabriele Horn, Frankfurt/M. (Revolver) 2007, 6 f., and Inke Arns' conceptual introduction "History will repeat itself", ibid., 36-63

room. The "reconstructed" installation can only be called "media" art if the aesthetic message pedends on the electric action of a functionally equivalent apparatus with a voltage range from 15 to 450.[7]

[Video clip: Rod Dickinson's re-enactment of the Stanley Milgram experiment, CCA Glasgow, 2002: http://www.roddickinson.net/pages/milgram/project-milgram-video.php]

The cries of pain by the victims in the original scenario were actually communicated from pre-recorded tape already; such recorded presence can be time-shifted without loss of authenticity.

Technologies are *in being* as "media" only in the moment of signal processing, and media "art" is defined by its time-based modality rather than space-based sculpture and painting (Lessing 1766). Already in photography, the exposure time has been co-defining the iconology of the image - a *Delta t* which increasingly shrinked almost to zero.

Technological media are experienced in performative ways from the human side, but in operative ways from within. In museum display of media art based such as sound and video installations, "[t]he physical objects on display are not to be regarded as aesthetic objects per se [...]. *It is predominantly the process which is on exhibit*".[8] Whatever the aesthetic content may be (to be well documented by a conceptual text by the artist-creator himself), the message of "media art" is its time base and its active chrono-poetics.

Therefore, an art museum necessarily turns into a media theatre for re-operating techno-aesthetics, where the media are the main actors - the agency of the machine, linked with a signal laboratory for re-activating data processing and with a library of audiovisual records or source code content, since any media operativity needs signal food to process. All such processes are grounded in actual media technology - their material key elements (*techné*), and essential in terms of governing principles (electric circuitry diagrams, source code of software).

Against the curatorial veto, infra-structural cables and circuitry in electronic art works - like the agorithms in digital works and the protocols of Internet art - belong to the functional, but not "ideal"[9] aesthetic enunciation, and therefore are allowed to be replaced for re-enactment. The aesthetic content of media art aks to be displayed in action to be revealed; otherwise a medium like a video set is nothing but a piece of metal, glass and rare earths.

Traditional works of art are subject to time in the material sense; it is their physical entropy which requires curatorship and restauration. A painting *endures* in time, different from media-art which unfolds in a different time singularity. A technological object, in addition, is time-based in a conditional sense; their "media" state only reveals when in operation, in signal-processing.

---

7 Entry "The Milgram Re-enactment", in: Arns / Horn (eds.) 2007: 94 f.

8 From the Ars Electronica exhibition catalogue *Eigenwelt der Apparatewelt*, ed. David Dunn, Linz 1992, 20

9 Julia Meuser, Copyright and the Integrity of the Work in Video Art, in: Kunstmuseum Wolfsburg (ed.), How durable is Video Art?, Wolfsburg 1997, 79

The core requirement for the preservation of media art, therefore, is re-enactment, since its being only unfolds as a time-object. This message of media art (apart from the superficial audio or visual content) is temporal, therefore the focus of "preservation" is on actual re-enacment or documentation of its former temporal action, that is: the archival *time diagram*.

Media epistemology contemplates the *being-in-time* of technological art, and its archaeology grounds in precise technological inspection. There is knowledge to be gained from technical hardware. The media archaeological approach requires in-depth knowledge of the associated technology. For inductive media archaeology, every piece of media art is idiosyncratically different; it deserves artefact-, circuitry- and code-related answers and adaptive tactics rather than an overall strategy of preservation - technological historicism.

The specific way of not simply representing but "re-presencing" media-artistic works from the past requires re-generating and re-storing its signal processing. This approach is decidedly materialist and antinarrative in terms of social contexts. The conditions under which media arts from the past can be said to have 'presence' in the present"[10] are strictly techno-logical.

Operative media museology

In 20th century, the familiar agency of the museum has been confronted with the challenge of electronic exhibits. In most museums of technology, for example, television sets of the late 1950 are usually exposed as a "dead" object like any other material artefact. An electronic device that is not processing signals is not in its medium state but just a piece of furniture. Most museum visitors actually look at old television and radio sets like a piece of antiquated design: they recognise the style and maybe become nostalgic about it, but do not attend to it as an operative medium. To exhibit an old TV or video set (like a musical instrument from the past) in action is a challenge for museum conservators when, for example, a couple of condensers have to be exchanged for re-activating their signal processing: Then it is not the original anymore. And when the electronic image is unfolding again, should historical footage from the period of the television be shown, or up to date content?

[If we remove the external (protective or decorative) case of a radio from the 1940s and look at the technological structure, it looks almost ahistorical. As a technological object it principally works as a radio from much later periods. The electronic tubes (or valves) have been replaced by transistors and microchips in the meantime but functionally it operates in exactly the same way, as amplitude or frequency modulated FM / AM radio. Considered this way, such electronic objects, are structurally not historical at all, they are invariant against temporal change until their infrastructure is replaced by a completely new system, in another temporal rhythm.]

---

10 Vivian Sobchack, Afterword. Media Archaeology and Re-presencing the Past, in: Erkki Huhtamo / Jussi Parikka (eds.), Media Archaeology. Approaches, Applications, and Implications, Berkeley / Los Angeles / London (University of California Press) 2011, 323-333 (323)

In museums of industrial science and technology, one often sees steam engines actually running. But media art which starts with electronic technology is of a different kind; they are not primarily related to energy transformation like industrial machines. What should be displayed in a museum if the object is electronic media? If the display is reduced to the surface or interface, then we miss their essence, but it is difficult for visitors to have a medium opened and understand what is going on within. It is a big challenge to museum education and didactics to explain what is really happening there, a challenge to the design-orientated, surface-orientated display.

As a consequence, the imperative for museological preservation of digital media art is to lay bare the underlying algorithms in a kind of techno-anatomy like artist Jan-Peter Sonntag's conceptual opening of media theorist Friedrich Kittler's electronic synthesizer modules, revealing the *arché* of the technological *archive* (in Foucault's, not in the bureaucratic sense), as claimed by Boris Groys: the "submedial space" behind the surface or interface.[11]

[Fig.: Media-archaeological “excavation” and subsequent re-processing of one of the earliest relics from cybernetic media art (New Tendencies, Zagreb): Vladimir Bonačić's “Dynamic Object” no. GF.E16S (1969), a random number generator (Galois Field) for light patterns Photo: Miro Cimerman = BONACIC-SIGLAB-1969.pdf]

Materiality matters: electronic media art (esp. video)

[The core decision for media art museums is between preservation of aesthetic content vs. preservation of technological form, as has been discussed for the cultural heritage of a century of cinematography already. "The material experience of film is neither celluloid nor its electronic variants as magnetic tapes or circuits, but rather the flow of light that reaches our eyes."[12] This is the phenomenological, content-focused experience of media art. But the aesthetic message comes from within the technological structure of the work itself. Technical vulnerability is not an external threat but an essential feature of "enduring" media-artistic articulation. Photographical negatives and prints are subject to physical entropy - different from the informational entropy in digital photography[13]]

[Material memory starts with its basic matter, such as electric condensers and the circuitry of technological configurations. Art history studies know the heuristics of "material iconography" (Monika Wagner). Scientific (rather than

---

11 Boris Groys, Unter Verdacht, xxx, 21

12 Barbara Flückiger, Material properties of historicla film in the digital age, in: NECSUS. European Journal of Media Studies 2012: 3 = www.necsus-ejms.org/material-properties-of-historical-film-in the-digital age

13 See Wolfgang Hagen, Die Entropie der Fotografie. Skizzen zur einer Genealogie der digital-elektronischen Bildaufzeichnung, in: Herta Wolf (ed.), Paradigma Fotografie. Fotokritik am Ende des fotografischen Zeitalters, vol. 1, Frankfurt/M. (Suhrkamp) 2002, 195-235

hermeneutic) analysis of cultural artefacts is media-active archaeology, operated by non-human agents like measuring devices as active media archaeographs.[14] The preservation of material semantics and aesthetics[15] is an ever-growing problem for analog media art starting from old photographs, which have had a surprising endurance over 150 years, but increasingly turn yellow. Early cinematographic films with their chemical material tend to burn when stored somewhere too hot, or in colour films the colours fade away. So there is physical entropy, the tendency to particular disorder within the material. With the magnetic audio tape, one can listen to a 50 year old magnetic tape and still hear a lot - which is a positive surprise, but at the same time there are increasing dropouts. Only here "time" passes as physical intrusion.]

[When Ampex company introduced the video image tape recording in April 1956, it looked like a memory device. In the Platonic sense of media critique of alphabet writing, it is obvious that (like writing on a wax tablet) its real message is obilivion, since it allows for the immediate erasure and over-writing of the recorded signals.[16]]

Different from immobile museum objects in *stasis*, time-based technological artifacts are in their "media" (art) state only when being in dynamic operation. In order to functionally re-enact Dan Graham's video installation *Present - Continuous - Past(s)* (1974), the analog recorder tape delay may be emulated in digital signal processing. But the media-artistic message (the irritation of "presence") can only be preserved in its spefcific materiality which once triggered the idea of delayed presence, the reel-to-reel video tape and loop. Graham's installation has been a pure function of an electronic diagram: the *feedback circuit*, creating a re-entry within the actual present, as effect of technically delayed video tape signal transduction.

["Lossy" image compression in digital conversion of analog video art tapes to DVD, as a practice in preservation, makes sense in terms of storage space economy, but leads to non-restorable signals which require interpolation.[17] The preservation philosophy oscillates between restoring the tape *versus* restoring the recording.[18]]

---

14 See Josef Riederer / Alheidis von Rohr (ed.), Kunst unter Mikroskop und Sonde. Naturwissenschaftliche Untersuchungen an kulturhistorischen Objekten, Handbuch zur Ausstellung der Staatlichen Museen Preußischer Kulturbesitz (Berlin 1973)

15 See W. E., Zeit, die an Medienmaterie haftet. Erkenntnismöglichkeiten technoarchäologischer Hardware, in: Irene Schubiger (ed.), Schweizer Videokunst der 1970er und 1980er Jahre. Eine Rekonstruktion, Zürich (Ringier Verlag) 2009, 188-194

16 See Jens Schröter, Einige Bemerkungen über löschbare Bilder, in: Katalog Videokunstfest Bochum 2000 (?), 116-124 (116)

17 See Memoriav (ed.), Memoriav Empfehlungen Video, Bern, February 2006. Editing: Felix Rauh

18 See Sherry Miller Hocking / Mona Jiminez, Video Preservation - The Basics (2000)

[According to *http://experimentaltvcenter.org/video-terms*, "noise" is any unwanted signal present in the total signal. But what if nois eis part of the media-artistic intention itself, like in Bill Viola's video called *Information* (1973)? The signal-to-noise ratio (S/N), as defined in communication engineering (Claude Shannon), refers to the proportion of desired audio and video information to undesired signals (which still might become aesthetic "information"). And on the most basic media archaeological layer of video art works, the chemical vinegar syndrome refers to the decomposition of an acetate based magnetic tape. It results in a faster loss of the backing, or in so-called "crosstalk" and "print through", the interference of the taped signal by another signal, resulting in distortion of the image or sound. This can occur if signals on the tape imprint themselves onto nearby areas of the tape without artistic intention. It is most noticeable on audio recordings; one may be able to faintly hear a ghost of the other unwanted signal when the tape is played back.[19]]

[Bill Viola's definition of the electronic image as "sound" of one-line scanning"[20] once unintentionally resulted from such laboratory signal-eventality. His videotape *Information* (1974, color, sound, 30') has been "the manifestation of an aberrrant electronic nonsignal passing through the video switcher in a normal color TV studio, and being retrieved at varous points along its path. It is the result of a technical mistake made while working in the studio ...When the record button was pressed, the machine tried to record itself. The resulting electronic perturbations affected everything else in the studio: ... there was sound where there was no audio connected ... After this error was discovered and traced back, it became possible to sit at the switcher as if it were a musical instrument and learn to 'play' this nonsignal. Once the basic parameters were understood, a second videotape recorder was used to record the result. *Information* is that tape."[21] Implicitely, the title *Information* anticipates the digital image which actually measures aesthetic value in binary information units: neg/entropy.]

[Mathematician George Birkhoff defined the "aesthetic measure" for paintings and other random patterns as a ratio between order and complexity, and those works deemed to be most satisfactory had a proportionately highest degree of symmetry to the number of angles, curves, or irregular forms flowing from one to another; see Jasia Reichardt, in: Paul Brown, Charlie Gere, Nicholas Lambert, and Catherine Mason (eds.), White Heat Cold Logic: British Computer Art 1960 - 1980, Cambridge, MA (MIT Press) 20xx, 85]

---

19 See Amia Videotape Preservation Fact Sheets, authors: Jim Wheeler and Peter Brothers, editor: Hannah Frost for the Amia Preservation Comittee, 2002; http://www.amianet.org/publication/resources/guidelines/videofacts/about.html

20 Bill Viola, "The Sound of One Line Scanning" in: Dan Lander / Micah Lexier (Hg.), Sound by Artists, Toronto / Banff (Art Metropole & Walter Phillips Gallery), 1990, 39-54

21 Bill Viola, as quoted in: Bill Viola. Installations and Videotapes, ed. Barbara London, New York (The Museum of Modern Art) 1987, 24

Synchronizing signals are recorded on a video tape itself, along with picture and sound information. This sync information enables the images to be played back in a stable fashion, oriented properly both vertically and horizontally. Changes in these synchronizing or timing signals cause time base errors that result in disturbances to the images, to be matched by the Time Base Corrector (TBC). Video itself takes place not simply in cultural time but is always already a technological "time object" (Edmund Husserl) itself, chrono-poetically manipulated by artists.

[David Claerbout's video projection *Ruurlo, Bocurloscheweg, 1910* (1997, no sound, s/w, 60' loop) takes its departure from an ancient postcard but delicately "animates" the leaves on the central tree in this landscape image. Long-time preservation of such a video installation requires the most precise time-base correction of the electronic image lines. The TBC, developed esp. for colour signal correction, is a delay-line and master-clock (sync genrator) based digital device for intermediary buffering and feeding back image frames, with the delay interval (delta-*t*) ranging between zero millisecond and the length of one complete frame. Distortions of the electronic image derived from mechanical friction in analog videocassette recorders.]

Video art *master* tape restauration means bringing it into playable condition again, which requires preservation of its signal processing state. This is technical rest*aura*tion, restoring its post-Benjaminesque "aura" by preserving its processual temp*aura*lity. Such technical reproduction of electronic signals basically preserves its processual authenticity, even when resulting in linear distortions of the signal.

A media art work is "copied" when resting within the same format; moving it onto a different format (analog transfer or digital "migration") means its transformation of substance.

It has been not with photography or film but with video art that "media art" as category emerged; in 1965 Sony's Portapak enabled independent Television art. Contemporary media arts festivals like the Berlin Transmediale and the Ars Electronia in Linz started as video art festivals.

[The real *arché* of electronic media art is its inherent sonicity, from which the "musicality" of the generic term Fluxus Art as concert-like live event happening is derived, with Nam June Paik's tape-music experiments, and John Cage et al., relating to the volatile, transient character of the acoustic / electronic signal, different from the rather typographic film frame (McLuhan 1964).]

Nam June Paik's legendary *Exposition of Music - Electronic Television* in the Wuppertal Galery Parnaß from 11 to 20 March, 1963 allowed for the distortion of the live television image by magnetic modulation as "participative". Fluxus art emanated from the electro-magnetic field: *Participation TV* . Such *performative* media art requires co-originary re-operation (rather than arbitrary re-enactment) of the electro-magnetic effect on functionally equivalent machines in its analog idiosyncacies, f. e. Nam June Paik's seminal installation

Participation TV.[22]

[See Johannes Gfeller, Das Kunstwerk im Zeitalter seiner elektronische BeNetzbarkeit, in: Melitta Becker (ed.), Archiv am Netz, xxx 2009, 142-151; further: Wulf Herzogenrath, Der Fernseher als Objekt: Videokunst und Videoskulptur in vier Jahrzehnten, 110-123, in: same author (ed.), TV-Kultur, Dresden 1997]

[Eric Siegel once reminded of the electro-magnetic fields as the true essence of the video "image" by moving a magnet across the electronic TV tube, distorting the image without damaging the set.[23]]

A film documentation would not tell anything about the conditions which made such appearances possible. Only the preservation of actual electronics allows for re-enactment whose *a priori* radically depends on the analogue electronic tube (it does not work with pixel monitors).

Since the electronic image, different from film, is rather dematerialized and rather transmission (live signal) than representation (like the traditional museum painting), the criterium for such media art preservation shifts: from emphasis on materiality to processuality.

[The thermionic tube can be regarded as a major player in media art, if it is not just perceived in its external iconic appearance. It began its career as a radio amplifier and picture tube, but was used much later as a digital switch for the pure processing of information. Electromagnetic waves are not transmitted in a real or fictional medium, but themselves behave as a media channel. They can be used as information carriers and as material and/or the theme of artworks.]

Materiality in electronic media does not refer just to hardware. The question that arises is whether, in addition to their value as aesthetical information, media art from the past has an external value linked to the original form of its hardware – which is not sufficiently preserved after its transformation to a digital information carrier. It is not sufficient to migrate the artistic content without saving the original carrier - which would suggest that for an electric video image or a musical tone it is insignificant whether it is recorded on schellack disc, on Compact Disc or as computer file. Whereas for coded, that is: symbolically expressed art forms like literature the essential enunciation can be migrated via copying alphabetically, the analog signal depends on its material implementation - unless it becomes digitally sampled and thereby ingegrated into the symbolic order which literally transsubstantiates its essence. "The characteristic hiss and crackle of 78 rpm pressings, played by a stell needle, was a part of the listening experience" of a gramophone record.[24] If the material carrier remains transitory, only artistic content becomes the object of preservation. But McLuhan himself insisted, partly in accordance with the

---

22 See http://www.youtube.com/watch?v=JHC1CdgfkVo

23 On Shamberg & Raindance Corporation, Guerilla Television, 1971, see Ina Blom, The Autobiography of Video, xxx

24 Ray Edmondson, AV archiving philosophy - the technical dimension, in: Proceedings of the IAMI-IASA Joint Anjual Conference, Perugia 1996, xxx no. 8 (November 1996), 28-35

communication engineering model, that noise was part of the communication process, pointing at the hidden ground of the apparent technical figure. "What they [Shannon / Weaver] call "noise", I call the *medium* - that is, all the side-effects, all the unintended patterns and changes. [...] all media tend to be subliminal in their structures [...]."[25] But here McLuhan might have expressed more accurately (in comparison to Shannon): the medium *has* a (hidden) message.

Media archaeology does not bury techno-logical eventality by con-textualizing it in art historical narratives but helps for media devices to let it "speak for itself". Such enunciative media archaeography focuses on essential, knowledgable (epistemogenic) sections which normally escape human interface perception (like the "racing" of the beam in early computing games, or the "latency" image in iconoscopic television) - a plea for "material semantics" without reductive materialism. The access to the archive is no bureaucratic decision any more but requires proper technologies and algorithms for signal re-play - which makes all the difference between traditional arts and genuine electronic media art. The internal value of all electronic technology lies in its configuration and circuitry, in its interlacing of aesthetic appeal and material form of transmission. To reveal this implicit knowledge is a cultural value in itself and therefore belongs to the tasks of media art preservation in museums. Digital signal processing (DSP), with which one can simulate analogue sounds and images, up to and including interference, acoustic noise, and virtual reconstruction of the original performance space, is an example of the ambivalence between physical carrier and aesthetic content. Here, as in works of audiovisual media art, the performative (better: operative) behavior of time-based media art works becomes the decisive criterion in the analysis. For this reason, processual "re-presencing" (Vivian Sobchack) is a key operation in media-art archaeology. In the case of the video tape, the storage medium itself moves, while current flash memory in computers stands still and data movement becomes a function of programming. The obvious materiality of electronic analogue media enters the space of the calculating media by means of the simulation, for example, of a magnet tape video installation as a time event in a computer. The sampling theoreme allows for the digital to re-create the analog signal.

Media-active archaeology is time-reversed, such as the restored wonders of original recordings from the dawn of television technology, made in the era of mechanically-scanned television. "Not until the computer era came on us could we study these images."[26] by means of algorithmic signal detection and filtering software.

[For an ironic echo, see Gerhard Sengmüller´s *VinylVideo* project, which he calls a "piece of faked media archaeology"[27].]

---

25 National Archives (Canada), H. M. McLuhan Papers, H. M. McLuhan to Jerry Agel, 26 March 1976

26 McLean 1998, http://www.tvdawn.com/index.htm; Zugriff 15.März 2008

27 visomat inc., asciiVision, in: Thomas Y. Levin, Ursula Frohne / Peter Weibel (eds.), CTRL[SPACE]. Rhetorics of Surveillance from Bentham to Big Brother, Cambridge, Mass. (MIT) / Karlsruhe (ZKM) 2002, 372

[One straightforward strategy for video art preservation simply is filming it from the monitor. The media-archaeologically formative times of television broadcast technology just knew "live" transmission; the Marconi Company (GB, 1957) developed the Marconi Telerecording, a recording from screen by film camera with fast intermittent mechanism, while sound was recorded on a sychronized tape recorder with perforated recording material (double tape). But parallel to this kind of "iconic" documentation, it is mandatory to preserve the circuitry diagrams of electronic media art, which were explicit in the diagramatic "scores" of David Tudor's electro-acoustics at the *Nine Evenings* in New York, 1969): towards the diagrammatic archive.]

[There is even a media-ecological aspect of hight-energetic cooling systems for video tape preservation; the cultural impact of the museum, especially the preservation and memory of media art, can be sustained only through the materialities and energy costs of its own "media" infrastructure[28] - a trade-off between thermodynamic and informational entropy.]

[Un/intended video noise]

A challenge of early video art hermeneutics is intentional "noise" as critique of contemporary television culture, as applied e. g. by Jean Otth in his *TV-perturbations* from 1972[29]; in museological preservation, it becomes incerasingly difficult to separate this intentional noise from unintended noise resulting from the preservation of early video art works = See Shannon; cryptography of the medium itself. In the time-critial realm, there is jitter or time base errors, mechanically resulting from delay in tape speed either already in recording (then irreversible), or by later hardware deterioration = Compendium 2012: 66. Dropout appears on the picture as small white spots or streaks. It can be internally caused by physical deterioration of the tape itself, or by external contamination of the tape with dirt or dust. It results in signal loss because the heads that read and display the picture information become clogged or dirty.

Physical damage to either the upper or lower edges of the tape results in playback problems. The upper edge contains audio information; the bottom edge contains control track information.

If the chroma level is too low, the colors look faded. If the chroma level is too high the colors are overly saturated. If there is noise in the area of the tape which contains the color information, the colors appear to be moving inappropriately.

In electronic imagery, beam and focus of the cathode ray and its bias (voltage) "haben einen entscheidenden Einfluss auf die Charakteristik des Bildes - sie

---

28 See Samir Bhowmik, xxx = PhD Helsinki, xxx; see as well Lisa Parks / xxx (eds.), Media Infrastructures, xxx

29 See Kompendium der Bildstörungen beim analogen Video / Compendium of Image Errors in Analogue Video, in: Johannes Gfeller / Agathe Jarzyk / Joanna Phillips, Zürich (Scheidegger & Spiess) 2012, 150 ff.

bestimmen sozusagen die Materialität, die es auf dem Weg in die digitale Zukunft unbedingt zu erinnern und zu konservieren gilt"[30]. With digital culture, there is a growing disteance to the aesthetics of the analogue, which becomes a knowledge matter in itself, a surplus of analogue video preservation.

For preservation, reconstruction and re-enactment of closed-circuit installations based on CRT cameras, solid knowledge of such electronic assemblages is a *conditio sine qua non*.[31]

Sustaining images from signals and as data

[The Electronic Records Program at the National Archvies and Records Administration in the U. S. offers a model for defining digital (art) objects on three levels: its physical embodiment (such as magnetic charges on tape), its logical existence (formats in software), and its conceptual existence which refers to the phenomenon appearing at the machine-human interface.[32] Kirschenbaum analytically separates forensic (hardware) and formal (software) materiality while admitting its increasing interlacing.[33] An EEPROM, for example, is an electrically erasable programmable read-only memory. The climax of this oxymoronic blurring is the software emulation of previous computer hardware itself.]

Materiality is still the blind spot of the information age and in electronic media. Digital media provide for materiality only by means of the 3-D printer, transforming the information of the object into its material replica. But a media artistic object has more information in it than a recording or scanning would ever provide. If the "aura" appeal of a work of art is rooted in its quality being here and now (Walter Benjamin), it is dependent on its material presence which is lost in reproduction and differs from the ephemeral presence of the electronic signal.

["[D]ie Aura ist an sein Hier und jetzt gebunden. Es gibt kein Abbild von ihr": Walter Benjamin, Das Kunstwerk im Zeitalter seiner technischen Reproduzierbarkeit [*1936], Frankfurt/M. (Suhrkamp) 1969, 14]

[Ephemeral media (art) which is process orientated undermines the traditional evaluation of the museum object in its principal claim for long-time endurance. There is a conscious transformation in the time-economy of cultural value. The advantages of using creative media like online access to the Internet and computer (software) opens more immediacy and creative possibilities than ever

---

30 Gfeller, Videotechnische Grundlagen, in: Compendium 2012, 116- (117)

31 Gfeller ibid., 117

32 Kenneth Thibodeau, Overview of Technological Approaches to Digital Preservation and Challenges in the Coming Years, in: The Starte of Digital Preservation. An International Perspective, Concil on Library and Information Resourses, pub107 (2002), http://www.clir.org/pubs/reports/pub107/thibodeau.html; quoted here from: Kirschenbaum 2008: 3

33 Kirschenbaum 2008: 111

but for the price of almost immediate obsolescence. Media artists since Fluxus Art times are conscious of this time-critical contract (creative processuality vs. museal endurance); from that derives that the preservational imperative itself diminuishes into an extended present.]

Analog signal recording media like phonographic, magnetophonic and video image recordings are subject to entropic ageing; they degrade over time and quality with every copy they (re-)produce, and in themselves. But once the signal has been digitized, it becomes timeless. Digital information - even if actual computing takes place in energy-absorbing, thereby temporally irriversible machine systems - is conceptually suspended from physical time in information theory. The present as temporal denominator looses its plausibility with the *binary information digit*.

[The Videodisc - technological scene (or condition) of a couple of media art works - in close reading looks digital, but it is analog video signals which are recorded discretely, different from the Audio Compact Disc which actually stores binary information, not the acoustic signal itself (like the phonographic record). Finally the CCD (charge-coupled device) camera, with its frame-transfer system, transforms the electronic image in data blocks.[34]]

With digital preservation of analog media art heritage, the data file becomes a complete substitute of the original image relating to the visual content.[35] This epistemological dilemma changes when it comes to "born-digital" media art. The American Standard Code for Information Interchange (ASCII) has been based on a seven bit structure, which in early days of computing was used for transmitting photos and graphics as well by pixeling the visual information and translating it into the available 128 characters. Different art projects refer to this digital Stone Age like *ascii Vision* in the works of the *ascii-art-ensemble*.[36]

The media archaeological approach to preservation of (digital) media art preserves the conditions of possiblity of such aesthetic expressions, not primarily the surface appearance (the aesthetic "content") which is figuratively exposed. The inherent quality of a technological work of art is not addressed to human senses only. In works of ASCII art, the hidden media message ("ground", in McLuhan's sense) is expressed by the work of art itself.

]There have been moments when the hidden technological ground expresses itself, like in the Williams-Kilburn Cathode Ray Tube memory in early electronic computing. Each phosphor charge, on and off on the screen, not only represented but embodied a binary "zero" or "one". This is not video art but functional TV. Since the charge would decay within 0,2 seconds, a detector was placed in front of the CRT, obstructing human insight, allowing for an electronic

---

34 See James Monaco, Film verstehen. Kunst, Technik, Sprache, Geschichte und Theorie des Films und der Medien. Mit einer Einführung in Multimedia, Reinbek b. Hamburg (Rowohlt) 1995 [EO: How to read a film, Oxford 1977], 465 ff.

35 Gschwind 2006 185 ff. "The Potential of the Digital Code", here: 187

36 visomat inc., asciiVision, in: Thomas Y. Levin, Ursula Frohne / Peter Weibel (eds.), CTRL[SPACE]. Rhetorics of Surveillance from Bentham to Big Brother, Cambridge, Mass. (MIT) / Karlsruhe (ZKM) 2002, 372

beam again to refresh the charge just in time to keep it.[37] The actual observer, here, is the computer itself.]

In early computing technology from 1947, the Cathode Ray Tube was actually used as a storage device for a number of bits itself - thereby revealing the medium message on the "interface" itself, in an act of almost media artistic engineering. But the only audience to observe this display was meant to be the computer itself.[38]

[The task of long-term preservation of technological artefacts aims at communication with a future audience, an intelligence which might not be necessarily "human" any more. "A robot historian would write a different history than would its human counterpart"[39], and Norbert Wiener adds in reverse hat a message need not be the result of a conscious human effort for the transmission of an idea; "the record of the thickness of a roll of paper kept by a condenser working an automatic stop on a [...] machine is also a message [...]."[40]]

[As expressed in an online resource for the preservation and legacy of (signal-)time-based (analoge) and new media (computational) works of art, in order to create a secure storage environment for media-artistic data, in digital preservation, this is achieved by generating checksums for your files which are monitored by re-checking, on a regular basis. The file is run through a certain algorithm (the most commonly used algorithms are MD5 and SHA) that produces a unique alphanumeric sequence. The slightest change to your file will produce a completely different checksum. With this simple process, it is possible to identify any changes to your files. The types of changes which can be identified with this method are those which indicate corruption, loss of data, or unintended manipulation. If you have an automatic monitoring system in place, it would alert you if such a change occurs. Calculate checksums as soon as you've received or created a file. This could mean creating checksums as you export a file from the hard drive on which an artwork was received, or as soon as you have exported a file from an editing program or after digitizing a tape."[41]]

The "two bodies" of computer-based art

---

37 R. B. E. Napper, in: Rojas / Hashagen (eds.) 2000: 366; Fig. 1

38 See David Link, There Must Be an Angel. On the Beginnings of the Arithmetics of Rays, in: Siegfried Zielinski / ders. (Hg.), Variantology 2. On Deep Time Relations of Arts, Sciences and Technologies, Köln (Walther König) 2006, 15-42

39 Manuel de Landa, War in the Age of Intelligent Machines, New York (Zone Books) 1991, 3

40 Wiener 1942 3 f.

41 http://mattersinmediaart.org/sustaining-your-collection.html (www.tate.org.uk/about/projects/matters-media-art = Tate (ed.), Matters in Media Art

Different from previous technologies, the computer as *turingmachine* is a theory-born medium. Still, a symbolical machine (equalling the algorithm, according to Turing 1936), in order to become operative in time, needs to be implemented in the physical world, i. e. in time. While its main quality is software, such code needs to be implemented in actual and active matter. Media archaeologically, this reminds of a legal fiction from the Renaissance, created in Elisabethan England to maintain the continuity of the state even in the *interregnum* between a king's death and his successor's inauguration: The king has to bodies: his biological one (subject to ageing and mortality), and his office body which endures even when the throne is empty.[42] The same is true for computational art.

A museological gap opens between material preservation and functional re-enactment, especially in preserving computer art.

[Regarding his early computer graphics, Georg Nees insisted that they were *not* works of art but models for works of art. "They belonged to the domain of aesthetics, but to a different category than that of art that requires a human imperative."[43] Therefore, "computer arts" is a hybrid term. Programming differs from making a sculptural or painterly art object; code does not violently manipulate raw physical matter but cybernetically decides *re-configurable* electro-physical hardware).]

When a present computer emulates a previous Commodore 64 in order to run a vintage video game, it functionally (not historically) *is* in the C64 *present* state. The concept of emulating another machine is essential for the very definition of the Universal Turing Machine: Once a mechanism has been transcribed into a discrete sequence of states, it can be initially inscribed onto the "register", that is the tape of the TM.[44] A UTM can emulate any other specific Turing machine, by defining its sets of program states and writing it as data symbols on the tape. "The Universal Turing Machine is remarkably similar to the Von Neumann model of a computer, where both programs and data can be stored on the same medium. [...] it follows that a UTM could emulate itself."[45]

[Although the TM is construct in mathematical theory rather than a physical computer, it therefore ultimately leads to the material 3D printer.]

That makes computer-generated art different from previous analog media works. At the same time, in the background the contemporary operating system is running. So we are in both a historical and a trans-historical state.

---

42 See Ernst H. Kantorowicz, The King's Two Bodies, Princeton 1957

43 As quoted in: Paul Brown, Charlie Gere, Nicholas Lambert, and Catherine Mason (eds.), White Heat Cold Logic: British Computer Art 1960 - 1980, Cambridge, MA (MIT Press) 20xx, 86

44 Alan M. Turing, On Computable Numbers, with an Application to the Entscheidungsproblem, in: Proceedings of the London Mathematical Society (2) vol. 42 (1936), chap. 6

45 Mike DeHaan, The Universal Turing Machine is a Turing Machine Emulator [2012]; https://www.decodedscience.org/what-is-universal-turing-machine/12081 accessed February 9, 2017

The timing of the present system speeds the emulation up, so that the characteristic C64 time behaviour as once coded in BASIC language has artificially to be simulated. With the temporal dimension functional emulation (the matahistorical realm of techno-mathematical logic) becomes "hight fidelity" in terms of micro-temporal behaviour. So-called "Retro Computing" resembles what is known as *reverse engineering*. It liberates the primary artefact, the C64 computer, from its overwhelming historisation and musealisation, and rather identifies the time-tunneling immediacy of its operational being.

The different quality of computational media art

Even if most of digital computing is embedded in a body of integrated electronic circuitry, what (literally) "counts" in actual computing is not only the materiality but its algorithmicized logic. What the symbolic order of culture distinguished for a long time as *physis* can now be negotiated alphanumerically as information. The re-presentation of digital works of media art in particular is enabled by functional emulation; at the moment of the configuration this concerns not a historical citation, the invocation of a chapter in digital art history, instead the new computer *is* in the state of the old. The category of the “historicity” of media art may therefore be reconsidered.

[Paul Brown, Charlie Gere, Nicholas Lambert, and Catherine Mason (eds.), White Heat Cold Logic: British Computer Art 1960 - 1980, Cambridge, MA (MIT Press) 20xx, 127: Ihnatowicz' re-translation of digital data into analog computing, to increase the speed of the installation. "The output from the computer was latched as sixteen data bits [...]. All sixteen bits were also taken to light bulbs for debugging purposes. [...] This was a very low position resolution but was overcome by the use of a circuit called the 'predictor.' Each set of five bits was passed to a digital-to-analogue converter and thence to the predictor. The predictor was a sophisticated arrangement of op-amps [...]." pdf 118: "Fortunately, the circuit diagram for the predictor survives and was simulated using SPICE, a standard circuit simulation software package."]

A conflict arises between preserving material hardware and preserving software, with an emphasis on the concept of "emulation" as preservation strategy. Emulation as different ontology is inherent already to the character of the Turing machine, different from electro-material-only artefacts.

G. E. Lessing's *Laocoon* theorem from 1766 once defined the medium-specificity for different arts. For analog media art, this refers to the electronic technologies which are the pre-condition for any subsequent specific aesthetic effect. Behind the phenomenal appeal, the essential *message* of such media works derives from the conditioning hardware and circuitry which have become co-authors of the artistic production.

With computational art, though, previous media art differences are not rooted in their brute materialities any more but have become formats within the software regime. Source code on the one hand (algorithms), and the formating frameworks (operation systems, browsers et al.) are the core "engine" of New

Media art. From that derives the option of "emulation" for re-creating (rather than passively archiving) a work of code art even if its original software environment has become obsolete. Computational art exists in "turing time" (Friedrich Kittler) which fundamentally differs from the historicist temporal order which has concerned media (art) preservation so far.

The philosophy of media art preservation therefore is less *art* specific but makes it a metonymy of the challenge in media-cultural heritage itself. Discussions on media art preservation should proudly claim this general relevance, beyond the museological case-studies in the more limited sense. Media art is evaluated on the basis of its technical properties which subject it to temporal ageing. But with digital media, there is an additional logical level of techno/logies involved which is neg-entropic in principle.

The digital sublime (to make use of a Kant's and Burke's category for an-aesthetic sensation) has become the core experience of "virtual" space. While the binary and algorithmic features of computational art works are not what humans perceive in their interface encounter with the machine it is the more urgent to remind of the material aspect of computerized data. Technological economics is still fundamental in both the design of computer hardware and software.

The qualities of new media art are neither reducible to material nor to its software tools. Rather, new media art is process-based practice with limited duration, including artistic research. Documenting dynamic media art (be it site-specific installations or internet art) is one task; preserving and re-enacting the interactive experience another for which the "webrecorder" provided by Rhizome (New York) as free software allows. A gap opens between the phenomenological appeal and its intra-structural technical condition. Taking into account audience participation and (web-)site-specificity, it becomes clear that for processual media art works there is no such original state at any given moment from the phenomenological perspective. The technological conditions for such interactivity itself, though, on the contrary, are not allowed to change within the artwork from moment to moment, even if *in-situ* conditions mean that the installation must constantly adapt to new circumstances.

The challenge of algorithmic art preservation may be compared with the musical score. Performative media art only exists in actual operative realizations; the Berlin Computer Games Museum has developed experience in preserving such interfacial situations for interactive ludic media. Alternative to a focus on the phenomenological appearance of ephemeral media art installations is the epistemological focus on the knowledge embedded within the machines, which is revealed by a specific work of media art, as process-oriented ontology. Terms like "emulation" are not just functional in the context of media art preseration but deserve unfolding their epitsemic delicacy in terms of object-oriented ontology.

For dynamic media art preservation, the ephemeral phenomenal visitor or user experience is not the only cultural value worth to be preserved. While for the inaugural exhibition event, priority is on the affective experience and human-machine communication ("media art"), what becomes more interesting for future memory of past artistic research is the testimony of its technological

ground ("medium art") as implicit knowledge for which the interfacial, phenomenal appeal has been rather a symptom. Central for the preservation of "streaming media" is the algorithms and micro-processing electronic units which run digital media formats and compression - the real knowledge *archive* as pre-condition of media art action in terms of Foucault's *Archaeology of Knowledge*. A radical museological strategy aims at revealing computing architecture from within instead of surface display.[46] Here, the logic of enunciation in fact corresponds with machinically implemented logics, to be expressed in algebraic formulas and program code. The notion of "logical preservation" as developed in documentary science[47] therefore extends to the media-active "archaeo-logical preservation" of a continuously re-presencable techno-aesthetic past.

46 See W. E., Towards a Museology of Algorithmic Architectures from Within", forthcoming in: When Is the Digital in Architecture?, ed. by Canadian Center for Architecture, Sternberg Press 2016 (English / French)

47 Hans-Joergen Marker, Data Conservation at a Traditional Data Archive, in: Edward Higgs (ed.), History and Electronic Artefacts, Oxford (Clarendon Press) 1998, 294-303 (296)