

MATERIALISM OF TECHNO-ARCHIVAL MEMORY

[abstract]

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[abstract]

Beyond the traditional archive which is a depository and framing of textual records *external* to current administration, digital records take place in a techno-archival structure *within* computation (be it data storage and processing in the single computer, or in its alliance called Internet or "the cloud"). Its chronopoetics results from both the material ("monumental" hardware, *techné*) and the logical layers (algorithms, "documentary" software) of the technological archive. Inbetween, the notion of the record archive extended to analog media (like the photographic image or the phonographic sound, magnetic tape and video), a memory which is capable of addressing human time perception by materially re-enacting signals from the past.

In spite of imaginary terms like "virtual reality" and metaphors like "cloud storage", the archival value and authority of analog and digital record(ing)s is still media-archaeologically and techno-mathematically rooted in its media materialities. From that derives the plea (and necessity) for an archive of computational hardware. At the same time, the institutional notion of archival space transforms into dynamic intermediary storage. The digital archive keeps this double sense: algorithmic speed and material resistance. Conceptually, the conventional understanding of the institutional archive needs to be supplemented by a more Foucauldian, media-archaeological notion of *l'archive*.

Archival *Eigenzeit*

While traditional record offices are symbolic orderings of textual documents in archival *space* which is provided with a sense of historical time by external narratives only, mechanic or electronic storage technologies have their inherent temporality, their proper *Eigenzeit* as memory agencies.

The oscillatory term "tempor(e)alities" refers to the two-fold temporal essence of techno-archives as storage apparatus, with its conflicting time regimes. On

the one hand, the archive is meant to suspend or delay its records in order to keep information for future memory (negentropic time); on the other hand, it is subject to time at work in the physical sense (entropic processes, material decay). Finally, with electronic archives, the speed of access, data migration, and short-time memorial functions increase.

In terms of Harold Innis, the archive belongs to the tools of empires which are "biased" by time-conquering (rather than space-conquering) to keep legal claims and laws in long-term endurance.¹ "Bias" originally is a technical term in electronic engineering describing the necessary electric tension to operate a vacuum tube (esp. triode) - a literally pre-conditioning, a ground tension for making the circuitry work at all, an electric (thus truly media-archaeological) *a priori*. For magnetic recording, the "bias" names the pre-magnetization of the tape by high frequency signals to improve the signal-to-noise ratio (dynamics). The proper informative time signal thus is overlaid or pre-conditioned by a different *a priori* temporality.

Between textual document and material monument

In terms of historical research, a photograph from the past is almost immediately subjected to contextual knowledge. Such a reading transforms it from being an autonomous physical *monument* into a historical document. Michel Foucault decided to re-define this historiographical operation in favor of treating a record(ing) from the past rather in media-archaeological terms as an artefact in its proper material mediality: "There was a time when archaeology, as a discipline devoted to silent monuments, inert traces, objects without context, and things left by the past, aspired to the condition of history, and attained meaning only through the restitution of a historical discourse; it might be said, to play on words a little, that in our time history aspires to the condition of archaeology, to the intrinsic description of the monument."²

Temporalizing the archive and its material resistance

Archives emerged with alphabetic writing. Their understanding therefore refers to symbol operations and manipulations (letters, words). The symbolical code can be transmitted (now "migrated") with a high degree of fidelity in copying, almost regardless the material support which is subject to physical ageing. The symbolic code is mostly invariant towards circumstantial change. While in storage of analog writing, the signal formation is directly depending of the materiality of the recording medium (like the gramophone groove in its shellac matter³, or the probability of electrons as cloud in a thermionic tube), the notation of discrete, coded symbols literally *abstract* from its concrete embodiment. Medium materiality becomes a condition (*arché*) for operations in another archaeo-logical sense, such as mathematical calculating numbers by

1 Harold Innis, *The Bias of Communication*, University of Toronto Press 1991

2 Michel Foucault, *Archaeology of Knowledge*, transl. A. M. Sheridan Smith [*1972], London / New York (Routledge Classics) 2002, "Introduction", 3-19 (7f)

3 See Elody Roy, xxx

position with pebbles in sand or the *abacus*. Al Quarizmi's *erasable* writing into sand in Bagdad around 800 resulted in the notion of operative algorithm. Claude Shannon's radical reduction of the alphabet and decimal numbers to a binary measure unit called *bit*⁴ enabled information to raise beyond the constraints of matter and energy (as expressed by Norbert Wiener 1948), actually treating sequences of letters not as writing any more but literally like *calculi* (pebbles), as material, therefore mechanizable objects.

Traditional storage media have been physically inscribed (*graphein* in its old Greek sense); writing the symbols (alphabet) or signals (gramophone) literally in-formed the device⁵. Latent storage devices such as magnetic tape for audio and video, on the contrary, only reveal their memory content in the dynamics of the electro-magnetic field as induced signals - an "archive" which human eyes can not decipher any more immediately. Electronic storage media take place in a sphere which is different from the scriptural regime of the classical archive, but this scriptural regime, on the level of alpha-numeric codes, unexpectedly returns *within* techno-mathematical machines. With computational data, the "archival" symbolical regime re-occurs in a different form.

Once digitized, the familiar archival record becomes subject to techno-mathematical operations; in their electromagnetic latency, bits become randomly addressable. Algorithmic access allows for the coexistence of different orders without destroying the record structure itself (as long it is kept in an "institutional" archive called Read Only Memory).

Can the authority of the record be preserved in a new medium? A digital photograph or any other document can be "altered" without (almost) leaving a trace of such manipulation. Archival materialism might be reinterpreted as a form of resistance against the manipulations by computational data processing. The fluidity of binary data has often been seen as a liberation from the restrictions of archival immobility (*stasis*), but the very materiality of the primary support, the material authorization of the archival record as *monument*, is its critical potential. Be it a medieval parchment, an Edison cylinder or a celluloid film strip - such materiality already is a resistance against streaming data after digitisation.

Monumentality as suspense (*epoché*) from the temporal economy

The electronic getting-in-motion of the digitized archives invites for a counter-analysis of archival in- and resistance. The archive might now - as a retro-effect - re-discover its virtue as institutional monument: to take out values from the ever speeding circulation and electronic economy, to arrest and fix and maintain chosen items, thus turning floating records from contextual *documents* (files) into discrete *monuments*, *epoché* as sublation, taken out of time.

4 Claude Shannon / Warren Weaver, The Mathematical Theory in Communication, xxx [*1948] xxx

5 Ira M. Sage, Making Machines Remember, in: Product Engineering, Bd. XXIV (April 1953), 141-149 (141)

Archives of electronic memory media (such as the magnetic tape) are "characterized by latency and significant limitations on access" due to their fragile techno-material nature.⁶

With the current liberal, broadened, electronically biased use of the term archive (thus liberated from spatial and material restrictions), "online data collections labeled archives could in fact be better characterized as perpetual transmission rather than permanent storage"⁷. What used to be secret spaces, secluded from public insight - the *arcana* of political administration and of their archival memory, the "secret archive" -, is now directly wired to the communication circuit of the present. The archive loses its temporal exclusivity as a space remote from the immediate present (access).

The traditional remoteness and secrecy of archival records implodes once they become digitized, thereby electronically coupled *online* to Internet-based access. "Die Residualzeit des digitalen Archivs schrumpft gegen Null."⁸ More or less immobile cultural materialities of memory (books in libraries, material artefacts in museums, medieval parchment in record archives) lose their heterotopic and heterochronic quality of resistance against the technologocentric desire for immediacy.⁹ Media-ironically, the archive reoccurs, but this time from within: Records from the Internet, during transmission and downloading, dissolve into micro-archives which only exist temporally: compressed files (appropriately to be "unarchived" from ZIP files for reading after download) and *cache*-buffered frames for streaming video.

Intermediary storage technologies become an integral part of present data circulation and processing; the present itself transforms into a short-time intermediary memory. Central to the success of streaming media (digital audio, video) are the algorithm (codecs) which run their compression and decompression.

Archives (or rather virtual libraries) of sound and moving images, in the age of YouTube and UbuWeb, themselves get in motion.¹⁰ In an age of increasing mobility, should we rather ask for an immobile archive as its "katechontic"

6 Rick Prelinger, The Appearance of Archives, in: Pelle Snickars / Patrick Vonderau (eds.), the YouTube Rader, Stockholm (National Library of Sweden) 2009, 268-274 (271)

7 Frank Kessler / Mikro Tobias Schäfer, Navigating YouTube: Constituting a Hybrid Information Management System, in: Snickars / Vonderau (eds.) 2009: 275-292 (276)

8 Hans Ulrich Reck, Metamorphosen der Archive / Probleme digitaler Erinnerung, in: Metamorphosen. Gedächtnismedien im Computerzeitalter, ed. Götz-Lothar Darsow, Stuttgart / Bad Cannstatt (Frommann-Holzboog) 2000, 221

9 See Michel Foucault, Des espaces autres [*1967], in: Architecture. Mouvement, Continuité, no. 5 (October 1984), 46-49; English translation: Of Other Spaces, in: Diacritics vol. 16, no. 1 (1986), 22-27, esp. 26 on heterochrony

10 See Ekehard Knörer, Trainingseffekte. Arbeiten mit YouTube und UbuWeb, in: Zeitschrift für Medienwissenschaft vol. 5, no. 2 / 2011, 163-166

virtue? In ephemeral electronics, "memory is transitory."¹¹ Archival resistance against change is a virtue in the time of networked documents which dissolve into memory-buffered *streaming data*. What resists such *online* acceleration is the very materiality of techno-archival records.

The technological developments in the 20th century have inevitably forced the archive to confront the question of mobility, both practically and conceptually. Technically, it could be said that the archive *of* motion was introduced during the late 19th Century with the scientific urge to store and analyze temporal phenomena that culminated with the introduction of the phonograph and film in the late 19th Century. The transition from an archive *of* motion to the notion of an archive *in* motion is associated with the advent of computer technologies and ultimately, the Internet, where constant transfer and updating functions redefines the temporality of the archival document itself.

The new immediacy of archival time may be compared to a situation from the area of visual recording of movement. The production and projection of documentary film since the beginnings of cinematography had been a rather heavy and slow apparatus-dependent process, and copies were expensive. Around 1968, with the arrival of the first Sony portapacs as portable video recorders (used, e. g., by Nam June Paik), "meant a breakthrough, because you could immediately play back what you had recorded."¹²

In need for an archive of hardware

The notion of "archival materialism" is less a neo-Marxist or media-ecological ideology but a focus on its physical meaning. Magnetic tape in audio-visual archives is a fragile medium; the "Vinegar Syndrome" (the chemical desintegration of the carrier material) can not be counter-chemically stopped, just slowed down. On the other hand, the very structure of the containing archive is negentropic: a symbolic order. Both converge in so-called "digitization", where no longer the media carrier in its physical entropy counts, but the content (signal) as information, stored in the symbolic (binary) code.

The chemical analysis of "endangered" analog signal storage like early video art by, e. g., Fourier Transform Spectrography, is a very close, truly media-archaeological reading of such archival media materialities. Micro-technologies are at work in what discourse emphatically calls "cultural heritage".

A large portion of electronic records from the 20th century is kept on tapes that can be read only with a magnetic tape recorder for analog signals or (unless copied and converted) by an early computer platform.

Particular tape drives have often become obsolete, resulting in a significant engineering challenge for preserving the data. The migration problem of digital media data and the physical vulnerability of electronic storage media is not just a techno-logical question, it has an epistemological dimension as well.

11 Vannevar Bush, *As We May Think*, in: *Atlantic Monthly*, July 1945, xxx

12 Tjebbe van Tijen, *We no longer collect the Carrier but the Information*, interviewed by Geert Lovink, in: *MediaMatic* 8#1 (translation: Jim Boekbinder)

Consider, for example, the case of the 1960 Census in the United States of America: "As it compiled the decennial census <...>, the Census Bureau retained records for its own use in what it regarded as "permanent" storage. In 1976, the National Archives identified seven series of aggregated data from the 1960 Census files as having long-term historical value. A large portion of the selected records, however, resided on tapes that the Bureau could read only with a UNIVAC type II-A tape drive. "By the mid-seventies, that particular tape drive was long obsolete."¹³ When the computer tapes containing the raw data from the 1960 federal census came to the attention of the National Archives and Records Service, only two machines in the world capable of reading those tapes: one in Japan and the other already deposited in the Smithsonian as a relic. "The data rescue effort was a signal event that helped move the Committee on the Records of Government [...] later to proclaim that 'the United States is in danger of losing its memory'" <ibid.>.

The digitization of cultural, administrative and artistic articulation (be it literature, sound or video) tends to move the archive toward an informational economy of circulation: permanent transformations and updating "which can also paradoxically result in a static archive of physical artifacts."¹⁴ From archival statistics (memory) to stochastic time series analysis (dynamic transfer), the New York Stock Exchange Virtual Trading Floor and the NYSE Command Center has been designed between 1997 and 1999 by Asymptote Architecture (Hani Rashid and Lise Anne Couture) to visualize real-time high frequency trading data, in order to detect suspicious irregular activity, and track the impact of global news events on the market. For a future cultural heritage of such time-critical media installations, it is mandatory to preserve both the "virtual architecture" (*executable* software) and its material computational condition (re-enactable hardware) in emulation systems. Documentary science has developed the notion of "logical preservation".¹⁵

There is an micro-media theatre where both regimes, the archival and the computational operation, literally meet: in the *registry / register*. The essence of archival memory, like the computer as algorithmic *machine* (Turing 1936), is not in its material embodiment but in its logistical structure, its so-called *tectonics*. The archive has been architecture (hardware) and tectonics (logistics) already, a *Ge-stell* in two respects: its material architecture and shelves, and actual algorithms which operate upon these data, a symbolic regime in Lacan's and Kittler's sense which equals the logical and the material machine.¹⁶ It is only discursive software (narratives) which transforms such

13 Committee on the Records of Government 1985:9, 86-87, as quoted in:
<http://lyra.rlg.org/ArchTF/tfadi.intro.htm#fragility>

14 David M. Berry, *The Post-Archival Constellation: The Archive under the Technical Conditions of Computational Media*, = chap. 4 in: Ina Blom et al. (eds.), *Memory in Motion. Computation threatens to de-archive the archive*, referring to Ernst 2013: 26

15 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)

16 See Friedrich Kittler, *Das Reich des Symbolischen - eine Welt der Maschine*, in: same author, *Draculas Vermächtnis. Technische Schriften*, Leipzig (Reclam) 199x

data into the imaginary ("historical imagination").

There are two complementary approaches to the conservation of analogue signal (audio-visual) carriers: preserving the physical, especially chemical and electro-magnetic properties of the concrete media body - since all media technologies are hardware in the first place. The opposing approach tends to preserve media-based memory as information, up to the extreme point of view that the material body might be abolished after its essential transformation into its pure binary information units. "We no longer collect the carriers, clay tablets, books or floppies, just the information"¹⁷

Emulation of both ancient computer hardware and operating systems software in contemporary computers is a truly "digitally born" answer of contemporary media culture beyond traditional archival care.¹⁸

Against historical time: archival resistance

Transforming storage into (re-)circulation belongs to the logic of late capitalism and thus is part of a memory economy. In a contrary way, a virtue of the traditional archive has been exactly that it was outside (historical) time. This *refugium*, this temporal exile, is archival resistance against complete mobility as the signature of modernist discourse. The old institutional archive served as a bedrock against the complete mobilization of records, as opposed to distributed digital archives and their open access in the Internet of today. More and more, archives find themselves both inside and outside the "Web 2.0" or "social Web" economy. A gap opens between the necessity for archival services to the public *versus* defending archival secrecy (the *arcanum*).

It is with its becoming electronically *online* that the archive is being deprived from its traditional power: its "privacy" in the literal sense (from Latin *privare*), its *secrecy* from public discourse. The former *archivum secretum* (be it in the Roman Vatican, be it in the case of the Prussian State Archives) is not just an old-aged power instrument to be overcome in favor of open access. But the contemporary archival secrecy in media culture is of a new kind, hidden within technology itself, the "protected mode" of micro-processors.¹⁹

Archival materialism

Inspired by Ernst Kantorowicz's classical study on the Renaissance political fiction of *The King's two Bodies*, the awareness arises that analogue recording media very realistically consist of two bodies as well - though in a different way. This is especially true for digital media.

¹⁷ Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: MediaMatic 8#1 (translation: Jim Boekbinder)

¹⁸ See Friedrich Kittler, Museums at the Digital Frontiers, in: Thomas Keenan (ed.), The Ends of the Museum, xxx

¹⁹ See Friedrich Kittler, Protected Mode, in: same author, Dracula's Vermächtnis. Technische Schriften, xxx

There are two complementary approaches to the conservation of analogue signal carriers. The one cares for preserving the physical, especially chemical and electro-magnetic properties of the concrete media body - since all media technologies are hardware in the first place. The other, sometimes opposing approach is to preserve media-based memory as information, up to the extreme point of view that the material body might be abolished after its essential transformation into pure binary information units. "We no longer collect the carriers, clay tablets, books or floppies, just the information."²⁰

To what extent does archival authority of a record still depend in its material physical embodiment? Is it no longer important by which carrier one generation passes on its information to the next?

Already for the oldest analogue signal-based medium in the technical sense, photography, Oliver Wendell Holmes in 1859 identified this symbolic trade of media and material: "From now on, form is separated from material. In fact, the material in visible objects is no longer of great use, except when being used as a model from which the form is constituted. Give us a couple of negatives of an object worth seeing ... that's all we need. Then tear the object down or set it on fire if you will ... the result of this development will be such a massive collection of forms that it will have to be arranged into categories and placed in great libraries."²¹

Once the mechanically engraved (phonograph) or magnetically embedded (magnetophon) signals on a material carrier has been transformed (sampled) into digital, immaterial information units called "bits", it can be (virtually lossless) "migrated" from one storage computing system to another. Permanence and archival endurance thus is not being achieved in the traditional way any more (which has been monumental fixation, *stasis* so far), but by dynamic refreshing. With the hard disc drive, the notion of "the material" gets in motion itself.²²

Materialist media ecology: The techno-archive in metahistorical time

While time-critical processes take place in the sub-historical present, media ecology deals with metahistorical times of media. For Jussi Parikka's geologically-oriented notion of depth of media materialities, the mineral basis of technological devices is central, like germanium enabling communication industries (fiber optic cables)²³ Such stratigraphic insights emphasize "the cycle of chemicals and geological materials essential to Internet and computer technologies in their passage from underground mining to post-industrial waste" - the *longue durée* of media" in Braudel's sense. Non-human ecologies are intimately bound up with media technologies and their archaeology. "[O]ne

20 Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: MediaMatic 8#1 (translation: Jim Boekbinder)

21 Quoted from: Wolfgang Kemp, Theorie der Fotografie I (1839-1912), Munich 1980, 121

22 See Matthew Kirschenbaum, Materialism, xxx

23 Jussi Parikka, A Call for An Alternative Deep Time of the Media, in: Machinology, September 28, 2012 = <http://jussiparikka.net/2012/09/28>

might adopt a material perspective in terms of ecological temporality."²⁴ The media archaeological approach radically pays respect to the material constitution of media *and* their organizing ratios (techno-logics) which extends "beyond merely human durations"²⁵, resulting in the current discussions about the *anthropocene* earth age and in terms like "deep time", employed by Siegfried Zielinski's *Media Archaeology* as well, inspired by Stephen Jay Gould's study on Lyell's *Principles of Geology*

Material media have their individual, characteristic probabilities of physical endurance - *Eigenzeit*. Physical media differ from the software-based media by embodying a fundamentally different temporal destiny.

It makes a world of difference between the customary phenomenon of material degradation to the new phenomenon of obsolescence of multi-media data. E-waste here becomes an issue²⁶ in contrast to informational entropy. The well-known danger to cultural goods, physical entropy, in fact has been the justification of the notion of the emphatic time arrow of "progress" respectively "evolution" in history and historical discourse. This is currently being replaced by a flat, almost anachronistic temporality.

Conflicting archival tempor(e)alities: Symbolic order *versus* indexical signal (case phonography)

"All those documents of and on an era, made accessible by lists, card-indexes, computer catalogues, together with material facilities such as tins, files, boxes and cupboards and all kinds of reading equipment, constitute a 'time machine'."²⁷ Is this true? As symbolic order (which according to Jacques Lacan always already implies the machinic²⁸), archives are no time machines at all. They need external processing to generate a sense of time.

As long as the archival records consist of strings of symbols (i. e. alphabetic writing), a cognitive distance - in spite of the auratic qualities of handwritten manuscripts or autographs - can be more or less kept, since an act of decoding has to take place which involves the cognitive apparatus. But once

24 Jussi Parikka, 2012a = "A call for an alternative deep time of the media". September, in: *Machinology*; online <http://jussiparikka.net/2012/09/28/a-call-for-an-alternative-deep-time-of-the-media>; accessed 31 October 2013

25 Michael Goddard, Opening up the black boxes: Media archaeology, 'anarchaeology' and media materiality, in: online journal: *New Media & Society*, published 28 April 2014;

<http://nms.sagepub.com/content/early/2014/04/27/1461444814532193>

26 See Michael Goddard, Opening up the black boxes: Media archaeology, 'anarchaeology' and media materiality, in: online journal: *New Media & Society*, published 28 April 2014

<http://nms.sagepub.com/content/early/2014/04/27/1461444814532193>

27 Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: *MediaMatic* 8#1 <Jahr??>

28 See Friedrich Kittler, [Ordnung des Symbolischen / Welt der Maschinen], in: same author, *Draculas Vermächtnis*. Technische Schriften, Leipzig (Reclam) 19xxx, xxx-xxx

photography and phonography, the first apparative media in its modern sense, became subject of the archive, the sense-affective, presence-generating power²⁹ of signal-based media cuts short the distance which is a prerequisite for *historical* analysis, in favor of mnemonic immediacy - the electric choque.

The phonograph as storage device does not only carry cultural semantic like words and music, but (like any *oeuvre* of Media Art) is at the same time a persistent hardware memory of cultural engineering as well, by its very material fabrication - a kind of frozen media knowledge, which - media-archaeologically - waits to be de-frozen, liquified.

Bela Bartók once commented on the media memory conditions of the phonographic recordings of oral poetry by Milman Parry which he transcribed into a musical score: "The records are mechanically fairly good <...> . Aluminum disks were used; this material is very durable so that one may play back the records heaven knows how often, without the slightest deterioration. Sometimes the tracks are too shallow, but copies can be made in almost limitless numbers."³⁰ While the body from which the song originated apparently has aged, being subject to physical entropy, the recorded signal in principle stays invariant against the passage time.

Media archaeology is aware that any replay of signals from the technically recorded past is first of all media memory, not human voices, and that we are not speaking with the dead but dead media still operate.

The noise and scratch of the wax cylinder are the pure message of the medium; inbetween, the human voice is literally incorporated. But what has been continuously preserved by analogue recording technologies, becomes quantified in the transfer to digital recording (CDs) instead of simply being analogue recording. This is epistemologically new, dramatically.

In digitizing a continuous wave form with an analog-to-digital converter, the sampling rate controls how many samples are taken per second (as it used to be "per year" in the case of Medieval *annals*) - all depending of the quantization level. *Oversampling* for archival purpose registers the material scratches as well; the media archivist more sensitively not only listens to the recording, but to the material "record" as storage as well.

The negentropic effort

Physically temporality is subject to entropy - e. g. the material deterioration of Edison cylinders and magnetic tapes. In contrast to this, symbolic archival permanence, as code, is almost time-invariant, sublated from change with time, leading to ahistorical immediacy in the moment of re-play.

29 See Hans Ulrich Gumbrecht, *Production of Presence. What Meaning Cannot Convey*, Stanford University Press 2004

30 "Parry Collection of Yugoslav Folk Music. Eminent Composer, Who Is Working on It, Discusses Its Significance", by Béla Bartók, in: *The New York Times*, Sunday, June 28, 1942; Dokument aus dem Internet: Milman Parry Collection © 2006 = GUSLARIBARTOK>

According to media philosopher Vilém Flusser, the essential cultural desire is the negentropic effort to maintain order against the physical tendency towards equally distributed disorder.³¹ "We may think that libraries and archives have stemmed the tide of cultural memory loss."³² But caution, there is a difference between informational Shannon entropy and physical Boltzmann entropy. Two different times are at work here: physical time (the *tempus edax* known from allegories of Chronos in the Baroque) on the one hand, and information time on the other, rather invariant towards "historical" change.

From space-based to time-critical archives

With the increasing digitization of traditional material records, archives are becoming time-critical. As opposed to the procedures in the institutional archive, the time it takes for access to records in the electronic archive shrinks to a momentary flash. The traditional archive gets deconstructed by the implications of "online" access. Since antiquity and the Renaissance, mnemotechnical storage has linked memory to space. But nowadays the residential archive as permanence gets replaced by intermediary storage. A drama with an epistemological dimension takes place: the transformation of the classical, datacarrier-based, material storage-"archive" into an archive in algorithmic motion, in electromagnetic ephemerality and latency.

Digital data, which is: "information", *per definitionem* (Norbert Wiener, Cybernetics 1948) are neither matter nor energy.³³ The gain of flexibility and computability is paid for with a dramatic loss of durability. When recently the Cologne Municipal Archive materially collapsed, it became apparent that most records, though being dirty and mutilated, materially survived this catastrophe, astonishingly robust against the pressure of stones. In a similar way the first-generation ("analogue") audiovisual storage media turned out to be surprisingly resistant against temporal entropy (like the Edison-cylinder and gramophone records, as well as daguerreotypes, photographic negatives and film on celluloid). More delicate is the destiny of cultural memory based on electromagnetic storage; digital media, finally, tend to divest themselves completely from their material embedding. But the metaphor of "cloud storage" is a deceit, dissimulating the material grounds of even "virtual" data traffic in glass fiber cables inbetween server farms, and the very chemical basis of transistors in microprocessors. Therefore media-archaeological analysis still *matters*. Technology is not immaterial *logos* only; it is material *techné* as well. Even the computational Turing machine, in its simplest form, depends on material surface (paper) and inscription (pencil) to calculate. The Silicon Compiler (developed in 1979 by Carver Mead and David Johannson) which literally mediates between a programming language for computer chip designers (software) and the complex pattern of the integrated circuitry

31 Vilém Flusser, *Kommunikologie*, xxx

32 <http://lyra.rlg.org/ArchTF/tfadi.intro.htm#fragility>

33 See Rudolf Gschwind / Lukas Rotenthaler (interviewed by Ute Holl), *Migration der Daten, Analyse der Bilder, Persistente Archive*, in: *Zeitschrift für Medienwissenschaft* 2, 1/2010, 103-111 (104)

(hardware)³⁴ is representative of such new kind of archive (understood in the Foucauldian sense. There is a well-developed terminology restricted to conventional archival science, bureaucracy, and administration which resists metaphoric transfer. To redefine or replace such familiar cultural memory agencies like archive, library, museum, communication engineering offers more precise technological terms.

The traditional materiality of paper records (with its own problems of durability) has been a passive storage medium so far, embedded into an external archival structure. In the meantime, archivists face the challenge of electronic records.³⁵ where the carrier itself (called computer) becomes a technological "archive" itself in its internal operations of data management. "The technical structure of the *archiving* archive also determines the structure of the *archivable* content even in its very coming into existence and in its relationship to the future."³⁶ Traditional media-archival techniques such as sound or image annotation, in digitally automated content-based retrieval "promise to outsource the process of tagging, naming and organising memories to the computer, using complex algorithms to approximate a kind of 'machinic vision'. [...] far from representing the dematerialisation of the object, digitisation represents a significant shift in the way in which memory is constituted. Drawing on the field of software studies, the relationship of materiality to memory is problematised through an analysis of software and algorithm in the construction of digital memories"³⁷ - inaugurating a new, truly media-philological kind of critical examination of the archival record.

Processed through a software-machine (algorithm), records become readable, writable and executable "and therefore the material is provided with the ability to 'speak' for-itself" (Constant)³⁸; no meta-dating (tagging), rather hashing, recovering sub-archival data patterns from within

Rethinking the "archive"

In "cyberspace" the notion of the archive has already become an anachronistic, hindering metaphor; it should rather be described in topological, mathematical or geometrical terms. Digitalization of analogous stored material means trans-archiving. Enduring material records are "liquified" in electronic writing and replaced by short-term, regenerative transfer (data migration).³⁹ The old rule that only what has been substantially fixed can endure and be located does not

34 See Michael S. Malone, *The Microprocessor*, Berlin et al. (Springer) 1995

35 See Charles M. Dollar, *Archival Theory and Information Technologies. The Impact of Information Technologies on Archival Principles and Practices*, ed. by Oddo Bucci, Information and Documentation Series No. 1, University of Macerata, Italy, 1992

36 Jacques Derrida, *Archive Fever: A Freudian Impression*, trans. Eric Prenowitz (Chicago and London: University of Chicago Press, 1996), 16 f.

37 Katrina Sluis, *Algorithmic Memory? Machinic Vision and Database Culture*, in: *New Media and the Politics of Online Communities*, ed. by Aris Mousoutzanis / Daneil Riha, Oxford (Inter-Disciplinary Press) 2010 (in eBook format), 227-236 (*abstract*)

38 Cox et al. 2015: 134

count any more.⁴⁰ In the Internet, the hierarchical controls of files that the traditional archive entails have shifted to the transmission protocols itself - a new kind of "archontic" quality.⁴¹

Explicitly inspired by Clement Greenberg's analysis of the materialities in modernist painting, Marshall McLuhan's *Understanding Media* (1964) focuses on the message of electroic media itself. Applied to memory agencies and especially the "digital archive", this method demands a close analysis of both its material and alphanumeric techno-logics.

The archival order of discourse has already been about interfacing material things and symbolical addresses; therefore the operative "archive" behind the institutional archive, as operative agency, is both its physical and technological laws.

One current misunderstanding of the media-archaeological usage of the term "archive" is due to Foucault's idiosyncratic redefinition of *l'archive*, (itself a derivative of Immanuel Kant's philosophical definition of the *a priori*), not to be confused with French *les archives* as legal term for an institution in state bureaucracy. In this understanding, the archive is first of all the rule of what can be said, the system that governs the appearance of statements as actual events. Further, *l'archive* is what ensures that enunciations which have been expressed are arranged in distinct figures, connected on the basis of multiple relationships according to specific regularities⁴² - which is algorithms in the computational present.

Material archives are not endangered by despotic regmines or violent burning any more, but by mathematics itself. Archival science is progressively being replaced by the art of computer programming (relational or dynamic data banks).

While the traditional archival format (spatial order, classification) will in many ways necessarily persist, the new archive is radically temporalized, ephemeral. New kinds of search engines⁴³ not only answer the desire for new ways of access to digitized media arts but develop into an dynamically renewed "art of the archive" itself which can be addressed in terms of cybernetic reasoning.

[According to Von Bertalanffy's biological approach, there are insistent regularities or invariances which *govern* (in terms of feedback-loops) the operative communication of a system with its environment, maintaining a steady state ("Fließ-Gleichgewicht").⁴⁴

39 See Aleida Assmann, *Das Archiv und die Neuen Medien des Kulturellen Gedächtnisses*, in: Voßkamp / Stanitzek (eds.), *Schnittstellen*, Cologne 2001, 268-281

40 Harriet Bradley, *The seductions of the archive: voices lost and found*, in: *History of the Human Sciences* Vol. 12 No. 2 (1999), 107-122 (113)

41 Jacques Derrida, *Mal d'archive*, Paris (Gallimard) 1985

42 Michel Foucault, *Archaeology of Knowledge*, trans. A. M. Sheridan Smith, New York (Pantheon Books) 1972, 130

43 For Constant's *Active Archive*, see Cox et al. 2015, xxx

44 See Ludwig von Bertalanffy, *General Systems Theory*, New York (George

This micro-material level corresponds with a dynamic user culture which is less concerned with records for eternity but with order by fluctuation - based on the brute fact that any digital calculation is "clocked", derived from a crystal quartz timer from within the mother board of computers. The delicate diagram of data processing within microprocessors (with all its command registers, program counters, buffers for intermediary number storage et al.) immediately declares the different quality of the techno-archive when compared with the traditional archive: It is radically time-biased.

With mathematized machines (*alias* "computer"), the archival regime returns more mighty than ever. This time it does not depend upon being processed by human archivists and users, but is directly coupled with electronic materialities, the programmable circuitry in / as micro-processors. Once provided with algorithmic intelligence, it can perform itself according to its internal material and matheamtical laws - *l'archive* and technology merge into one.