GOOD-BYE, "ARCHIVE". Towards a media theory of dynamic storage

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The topic of the "archive" as memory agency and its intersection with visual arts, photography, film, sound, literature and philosophy has been academically and aesthetically exhausted in the last years. The ever-present "archive" has become much of a metaphorical umbrella term for all kinds of memory, while in theoretical writings the Foucauldean *archive* is frequently confused with the institutional state archives. The "archival fever"[1] in the cultural field has become inflationatory, and many of the artistic projects which are called "archive" are rather idiosyncratic collections. The term "anarchive" has been liberating but obscuring as well.

Let us, nevertheless, make instructive use of this phenomenon. The "archival turn" is the symptom of a nostalgic (even melancholic) reaction in memory culture when confronted with the challenge of contemporary media culture: technological storage (both "big data" and ephemeral micro-storage), different from the "library", the "museum", and individual or collective "memory". To face this challenge rather aggressively, most advanced algorithmic approaches are required.

Archival memory vs. magnetic latency (case Boder's wire spools)

Let us get *medias in res* with an almost techno-traumatic archival incident. "[...] sometimes we find things that we did not know we had, or even existed", Jon Endres from the Dorothy Cummings Center for the History of Psychology, University of Akron in the US state of Ohio, wrote on occasion of a special finding in the course of his institution's digitizing of historic audio recordings from wire spools.[2] There is a technological equivalent to "latency" as defined by Sigmund Freud for unconscious memory in psychoanalysis indeed. Wire

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1 Jacques Derrida, Archive Fever. Freudian Impression, in: Diacritics 25: 9-63 (1995)
2 Jon Endres, entry "Dr. Boder and the Missing Songs" (September 2, 2016), https://centerhistorypsychology.wordpress.com/2016/09/02/dr-boder-and-the-missing-songs (accessed 8th February, 2017)

recording, like the magnetic tape, keeps signals in magnetic latency, since human senses have no direct access to its reording.

It requires appropriate machines to re-activate such time signals into auditive or visual or binary form. Some of these spools were recorded by David Pablo Boder in 1946 when he traveled across Germany, Italy, France, and Switzerland and collected interviews with displaced persons, many of them Holocaust survivors, in the aftermath of World War II. Most of the recordings were "uncovered" (Endres) in the late 1990s between the Library of Congress and the Illinois Institute of Technology. This is not an archival act but media archaeology, with the technological apparatus itself becoming the primary archaeologist (rather than archivist). Electronic signal processing knows no "archive" (which is the symbolic order), while all signals in electronics are not textual records but physical events.

Especially, one wire spool had been referenced in Boder's work - that is, in the symbolic register or the archival regime like the "ledger" in Beckett's one-act drama *Krapp's Last Tape* (1958), but had not been found in the various Boder collections. This spool was of Jewish songs from a displaced persons camp in Henonville, France. As the archivist went through the boxes of spools that his institute has at its archives, he began to take stock of what he *knew* the archive had on spools, *versus* what there had been no idea about. Among these "confused" wire spools was one which had been erroneously entered into the finding aid as "Heroville Songs" when the collection was originally processed in the 1960s. It did not take long to realize that the tin says "Henonville? Songs". "But this was no guarantee that this was the content on the spool. Even the tin itself seemed a bit unsure about its own content" (Endres). At that point, the symbolic regime of alphabetic coding (the "archive") and the world of the technological signal (recording the real acoustic event) clash.

The archive is the regime of the symbolic scriptural order, vulnerable to coding errors, different from the unmistakable signal memory kept on the audio wire spools. In terms of Friedrich Kittler's technological application of Jacques Lacan's psychoanalysis, the "real" here insists, media-archaeologically undermining all psychology.[3]

A Blog response on September 4, 2016 by Ludy Benjamin, calls this finding "a wonderful example of the joys of archival research". But it does not require an trans-humanist attitude but simply an engineering eye to realize that it takes a *non-human* interpreter in two steps (an actual wire recorder electronics and the subsequent digitization) to make such an archival source listenable to humans at all - interfering between the analog record and the present ear. Media co-determine the cultural memory situation - just as the Actor Network Theory (Bruno Latour) includes non-human agencies into the concept of "society". It took the archivist-engineer a few days to get comfortable enough with the medium to put the Henonville Songs on to digitize; even if such wire is rather not fragile, he "did not want to risk destroying history – but when I did I was blown away" - techno-traumatically. "It felt like I was helping in some way to bring these voices to the present, voices that had become somewhat lost to the

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3 Friedrich Kittler, Grammmophon-Film-Typewriter 1985: 27 f.; engl. transl: Stanford UP 1999

historical record" (Endes) - in fact all the difference between archival "record" (scriptural) and media-recording.

The "archive" as *terminus techn(olog)icus*

- The use of the term "archive", in the techno-mathematical context, differs from its meaning of a state archive as the symbolic order of administrative memory; the world of digital computing (which is software/algorithm-driven, in finite-state-machines) is rather characterized by micro-"archival" states which means moments of temporal configurations. The Turing machine scans an entry in a square from the paper tape, which in combination with the instruction by the command list results in a specific "m-configuration" at a given time.[4] "The behaviour of the computer at any moment is determined by the symbols which he is observing, and his 'state of mind' at that moment" (Turing 1936, section 9). The behavior of such a machine is a linear sequence of events in time. "These events occur only at discrete 'moments' - between which nothing happens [...] like the ticking of a clock [...]."[5] This is archival, symbolically ordered temporality, a kind of kinematographical apparatus where the read/write head takes chrono-photographic snapshots of the machine state, "up-dating" the archive in a multiple sense: different from traditional alphabetic text records, the currency of the present "archive" is "data", *numerical* bit streams.[6]

A most radical theory of storage comes from within the essence of computation itself, the *turing machine* as described in 1937: "The machine is supplied with a 'tape' (the anlogue of paper) running through it, and divided into sections (called 'squares') each capable of bearing a 'symbol'. At any moment" - that is, in reverse of a mechanical clock - "there is just one square <...> bearing the symbol <...> which is 'in the machine'. <...> The 'scanned symbol' is the only one of which the machine is, so to speak, 'directly aware'."[7] Follows the step from one-conditional to interchangable ("software") *archive*: "[B]y altering its *m*-configuration the machine can effecticely remember some of the symbols which it has 'seen' (scanned) previously. The possible behaviour of the machine at any moment is determined by the *m*-configuration <...> and the scanned symbol <...>."[8] By their very discreteness, the machine states, if prolonged as Delta-*t*, can be understood as micro-storage, since according to Turing, the processing might at any moment be interrupted, to be resumed later.[9]

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4 William Aspray, John von Neumann and the Origins of Modern Computing, Cambridge, Mass. / London (MIT Press) 1990, 176
5 Marvin L. Minsky, Computation. Finite and infinite machines, Englewood Cliffs, New Jersey (Prentice-Hall) 1967, 12
6 See Vilém Flusser, Die Auswanderung der Zahlen aus dem alphanumerischen Code, in: Dirk Matejowski / Friedrich Kittler (Hg.), Literatur im Informationszeitalter, Frankfurt a. M. / New York (Campus) 1996, 9-14
7 A. M. Turing, On Computable Numbers, with an Application to the Entscheidungsproblem, in: Proceedings of the London Mathematical Society, ser. 2, vol. 42 (1936/37), 230-265, section 1
8 Ibid.

There is a well-developed terminology restriced to archival science, bureaucracy, and administration which resists metaphoric transfer. The challenge is: how to re-define or replace familiar cultural memory agencies like archive, library, museum, by more precise technological terms?

The mis-understanding of the term "archive" as metaphor is due to Michel Foucault's idiosyncratic redefinition of *l'archive*, not to be confused with French *les archives* as legal term for an institution in state bureaucracy: "The archive is firstly the rule of what can be said (the system that governs the appearance of statements as individual events). But the archive is also that which ensures that all these things which have been said do not accumulate eternally [...] but that they are arranged in distinct figures, connected on the basis of diverse relationships [...] according to specific regularities"[10] - which is algorithms in the computational present".

[Does the archive require to be read or just preserved? In such readability, technological "scanning" itself has intervened. Here the trinity of the "digital record" unfolds which is physically inscribed as meaningless signal, logical as "recognized and processed by software" (the algorithmic grammar) and only media-phenomenologically "conceptual", that is: recognized by humans and / or socio-economic systems). "The rules that govern the logical object"[11] - the Foucauldean *archive* - are independent of how the data are written on a physical medium (which means invariant over time) and independent of human understanding.]

The condition of possibility in media culture (Immanuel Kant's *a priori* in its technological understanding) can neither be reduced to the material nor to the intellectual (Hegel's "spirit"); the contemporary conditions of media culture is rather "infrastructure" than "archive"[12], an interlacing of material channels with the logistical, in fact: symbolic order (software, replacing the older notion of "library").

For the analysis of dynamic storage technologies which defined the always "deferred" computational present, the category of the "archive" even becomes a hindrance; expressions like the "archive in motion"[13] sound poetic but are an oxymoron when observed strictly.

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9 See Warren Sack, entry "Memory", in: Matthew Fuller (ed.), Software Studies, Cambridge, MA (MIT Press) 2008, 188

10 Michel Foucault, Archäologie des Wissens [FO 1969], Frankfurt/M. (Suhrkamp) 1981, 187, transl. Charlotte Kreutzmüller, in: Barbara Büscher, Lost & Found. Archiving Performance, in: Barbara Büscher / Franz Anton Cramer (eds.), Fluid Access. Archiving Performance-Based Arts, Hildesheim / Zürich / New York (Georg Olms) 2017, 66-82 (71); see Michel Foucault, Archaeology of Knowledge, trans. A. M. Sheridan Smith, New York (Pantheon Books) 1972

11 Kenneth Thibodeau, Overview of Technological Approaches to Digital Preservation and Challenges in Coming Years; http://www.clir/pubs/reports/pub107/thibodeau.html (accessed May 2017)

12 See Lisa Parks / xxx Starobinski (eds.), Media Infrastructures, xxx

13 See Eivind Rossaak (ed.), The Archive in Motion, Oslo (Novus) 2010

- For an archivology for contemporary media culture which is computer-algorithmic in its operational essence, close mathematical reading is mandatory - therefore the claim for "radical", non-nostalgic media archaeology. While there is actual obsolescence in media materialities, there is no obsolescence in the principles (*archai*) of technology; hardware degradation (the physical "archive") is redeemed by its logical preservation.[14]

Operative memory from within technology: Dynamic storage

An example for a more object-oriented notion of memory has been the popular cassette storage technology used in early Personal Computers like the *Commodore 64*. There is, notably, a crucial difference between the technical format of data storage on tape which is, first of all, addressed to the microprocessor, and the popular culture where the same cassette tape has served as an almost anarchival device of non-legal distribution immediately addressed to the human ears for musical memory."

The "sound of the archive" in computation could still be experienced from the "Datasette" storage technology in early Personal Computing, when e. g. loading a computer game such as the Sinclair ZX81 Flight Simulation, 16k RAM, with initial instruction: "Load and run by typing LOAD 'FLIGHT'"

Side A says: "LOAD 'FLIGHT'", while side B (different from the more familiar use of such a device as music cassette) says "Blank Tape". The instruction announces "Load time: 6 min. approx.", while the "POKE" command in BASIC allowed for direct access to the internal RAM and its data location, allowing for a direct "imaging" of the storage grid on the computer screen.[15]

When such a "Datasette" has being loaded from external cassette recorder to a Commodore 64 computer, we were listening to the sound-of-a-modem (or Fax) like rhythm of software memory., to its implicit sonicity which radically reminds that digital memory is never *ready-at-hand* as an archive but comes into being only in "musical" operativity.

So let us not confuse the symbolical order of the institutional archive with human memory (or even recollection), neither neuronal memory with technological storage.

Digital micro-memory architectures, its topology and organization, turns out to be a mirror of traditional archival and administrative practice - but merging both areas, which have been discursively separated rather emphatically in cultural use, into one operational horizon, by including the storage elements *immediately* into the current action (and the action of the electric current, cut digitally)

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14 See Doron Swade, Preserving Software, in: xxx
15 See Nick Montfort et al., 10 PRINT CHR$(205.5+RND(1)); : GOTO 10, Cambridge, Mass. / London (The MIT Press) 2013

Up-dating "the archive"

- "Radical" media arche/ology (in alliance with Kirschenbaum's "digital forensics") is rooted (*arché*) in logified matter which means electronic assemblages and electric circuitry on the material matter, and algorithmic code as the symbolic machine. "*Arkhe* [...] names at once the *commencement* and the *commandment*" (Derrida 1995: 9). In operative technologies, this *arkhe* is not abstract but locatable in temporal and material action. Techno/logified matter (hard- and software) constitutes a non-discursive *archive* in the Foucauldean sense; its being is not simply subject to human discourse; the material and mathematical *veto* intervenes

Foucaults neo-logistic application of concepts like "the archive" is well-defined in *L'Archéologie de Savoir* (1969) but has lead to an ongoing confusion with the institutional archives in academic discourse and cultural studies.

Media theorist Friedrich Kittler once "grounded" philosophical terms like the Kantean transcendental *a priori* in actual technologies. In Foucault's distinctive usage of the term *archive* in his *Archéologie du savoir* , "the archive cannot be described in its totality", since the observer is himself still part of that archive (transl. Foucault 1969/1972: 130). The describability of the technological *archive* only arises at the moment when its practices just start to recede into the past - the pre-archival *registry*, the intermediary repository of current acts. This corresponds with the echoic memory of the operative present within the Central Processing Unit of the computer, the "register". The complex algorithms of the Google search engine, as long as they are *archive* in the technological, not bureaucratic sense of "protected mode", remain mainly inaccessible.

[The administrative archive in the strict sense is a read-only memory; nor can the archival order as such (key term "tectonics") be easily changed according to a new discursive will - just like in computing, a rewriting of code in the operating system would make the whole function collaps. It is exactly the non-discursive and non-narrative structure of the archive which makes it such a uniquely powerful institution. The order of records in the administrative archive is tightly coupled by its metadata and rarely open for modification; active intervention is stricty forbidden. Therefore the avantgardistic concept of an *active archive* is oxymoronic; once archival records are re-negotiated and up-dated[16], there is no more archive at all. There is a solution to this dilemma in the concept of "the archive's two bodies"[17]: the physical record (or born digital file respectively its archivally preserved "disc image") has to remain radically untouched, while its digital *double* invites for all kind of knowledge-based algorithmic experimentation.]

Already in its traditional notion, the "archive" has been a term both for an architecture (hardware) and a rule for processing of records (filing)

Media *archivology*, in addition to Foucault, proposes a metonymic shift in which the technological devices themselves *are* the archive, an operative rather than

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16 Cox et al. 2015: 127
17 Alluding to Ernst H. Kantorowicz, The King's Two Bodies, 1957

historicizing agency. It can process discourse since it is in itself non-discursive, not negotiable unless by re-wiring or re-programming.

Against intellectual or artistic phantasies of "the anarchival"[18] in "computer-networked culture, digital data processing is still rigorously rooted in its techno-mathematical structure. It is tempting to call this media infrastructure an "archive"[19], as long as this is meant in the Foucauldean sense of material discourse analysis.

But in academic discourse, the analytic distinction between then Foucauldean and the institutional archive has failed (just as the Foucauldean *archéologie*) - sometimes including my own writings, I have to admit. A simple search operation in my digital texts (different from the book-printed versions) can eliminate fuzzy applications of "archival" terminology and even replace it by the proper technological terms.

For critical reasons, let us radically un-do the inflational metaphorical mis-use of the "archive" for memory agencies. Up-dating the archive, in digital culture, means: radical cleaning of discourse from "the archive". The terms has to be replaced by its more precise *termini technici* when it comes to the technological "a priori" in hard- and software

- "The media archive is as much about archiving recordings as it is about storing machines."[20] But technology does not archive but store signals resp. data. "And the latter, the configuration of the storing of the machines, is also configuring our future access to the archive" <ibid. - which is rather access to technological data carriers in the sense of "memory" addresses. The archival criterium of record authenticity becomes not only a matter of future access but of "processing of the *stored* data, not memory (or 'history')" <Sondergaard 2015: 196>. Archival authenticity becomes non-human. There is technological storage; even the term computer "memory" has been a metaphorical application by engineers, when written explicitly in quotation marks. Before John von Neumann's *First Draft* "conflated the computer with the biological metaphor of memory, computing devices were envisioned as 'storage' devices"[21]. Only diagrammatically, but not technologically, "like an archive", a store "is both what is stored and its location" <ibid.>. An archive is a cultural technique, whereas technological "memory" is storage of a different kind.

- While in public discourse the archive is mostly (mis-)understood as the "content" of the archive (its records, its data banks), in archival sciences the term rather refers to the organizing structure. Therefore items of the technological *archive* (in Foucault's sense) can in fact be traditionally administered by a traditional archive as instition, like media artist Erkki

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18 See Claudia Giannetti (ed.) / Eckhard Fürlus (eds.), AnArchive(s). Eine minimale Enzyklopädie zur Archäologie und Variantologie der Künste und Medien, Oldenburg (Edith-Russ-Haus für Medienkunst) 2014
19 See Lisa Parks / xxx (eds.), Media Infrastructures, xxx
20 Morten Sondergaard, Interfaces of Future Authenticity, in: Krysa / Parikka (eds.) 2015: 191-202 (195)
21 Sondergaard 2015: 197, referring to: Wendy Hui Kyong Chun, Programmed Visions: Software and Memory, Cambridge, MA (MIT Press) 2011, 8

Kurenniemi's textual, audio and video record(ing)s. In the Finnish National Gallery's Archives, Library and Collections section at Helsinki, his pre-estate is deposited since 2006. "Kurenniemi himself would probably call his archive not an archive, but a database [...] not to be used for studying the life of Erkki Kurenniemi but for accessing his perceptions and consciousness [...]."[22] It is the non-human knowledge which is preserved here in the media channel: "In the case of the voice diaries recorded on cassettes, it is often impossible to distinguish noise from information (Kurenniemi's own voice, radio shows, music, and ambient background sounds are all heard). [...] many of the digital videos shot with 1990s mobile phones have notably poor image quality and sound resolution to the degree that the audiovisual 'data' are barely accessible. The balance and ratio between the signal and noise is contantly unsteady [...]" <ibid.>. What is required for the memory of the present age is a media archaeological theory of tradition which encompasses both cultural and non-cultural messages.

"Entropic" media memories

From the digitization of vast amounts of records - mostly by necessity of preserving the data against progressive material obsolescence - arises a creative chance which is progressively performed by so-called "digital humanities": applying creative algorithms to experiment with new forms of navigating enormous amounts of archival signals and data from within (be it textual or audio-visual), resulting in new insights by mathematical intelligence like stochastic analysis and similarity-based retrieval and information as measure of Shannon entropy, rather than its metaphorical understanding in the thermodynamic sense of Boltzmann entropy (as has been expressed in the video work *Entropia* by Andreas Müller-Pohle showing the destruction of photographies by a shredding machine).

The negentropic digital persistence against entropic material decay roots within the mathematical theory of communication engineering itself: "The quantity which uniquely meets the [...] requirements that one sets up for `information´ turns out to be exactly that which is known in thermodynamics as *entropy*. It is expressed in terms of the various probabilities involved - those of getting to certain stages in the process of forming messages, and the probabilities that, when in those stages, certain symbols be chosen next. <...> an entropy-like expression appears in the theory as a measure of information. <...> In the physical sciences, the entropy associated with a situation is a measure of the degree of randomness <...> in the situation; and the tendency of physical systems to become less and less organized <...> gives time its arrow - which would reveal to us, for example, whether a movie of the physical world is being run forward or backward."[23]

Digital communication entropy ows its ahistoricity rather to its different form of registering: not simply by signals recording of the physically real event, but by encoded signals which symbolically keep the information. This information is

22 Susanna Paasonen, Fleshi Intensities, in: Krysa / Parikka (eds.) 2015: 33
23 Weaver 1963: 12 (referring to Eddington)

suspended from physical time, leading to literally "spectral" memory latency. The (Foucauldean) *archive* thereby recedes into the coding and protocol, the truly media-*arché*ological (in fact media-archivological) layer.

With(in) the computational *archive*, the familiar historicist order of cultural time, the chronological sequence, "as the emptiest of all kinds or order in which stored things are to be put, could be replaced by an order of co-presence once their combinatory connections were located."[24] Such operations in computational space are epistemologically productive since they do not destroy the material integrity of the existing record. "Digital archiving could break up the alliance that the institutional archives have maintainted with historiography and historicism since 1800"[25],

This differs from experimenting with the "digitally born" archive as performed by the research art collective Constant in Bruxelles with their project "Active Archive" (Nicolas Malevé / Michael Murtaugh).[26] Within the computational context of Digital Humanities, criteria borrowed from communication engineering like informational entropy make more sense than the out-dated architectures of memory classification.

The core experience in cultural modernism, the perpetual change, corresponds to a shift of emphasis to *actual* archival memory - the file (as part of present administration) rather than the enduring record; *acta* are provided with a functional vector of immediacy, they are meant to *activise*.[27] The archi(ve)texture of techno-logical administration is captured better in processual rather than structural terms.

Rather detached from its former almost exlcusive orientation to state bureaucracy, archival sorting and preservation of administrative records is being replaced by the incremental date of arrival (*numerus currens*) as a pure series. As inventory technique, the so-called *accession principle,* in numerical sequence, links a file to the actual address space of data; the assignment of addresses is vital for the operations of "memory" in digital computing as data-storage (Scriverius, 1983: 59 f.).

In the archive we are not confronted with historic memory (which is shaped only in historiography), but with spatially-configured storage. The technical *archive* is not a place for the conservation of a memory content from the past; media archaeology rather discovers its techno-archival *message*. Derrida shifts the temporal bias of the archive from past to the present and pre-emtive

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24 Friedrich Kittler, Museums on the Digital Frontier, in: Thomas Keenan (ed.), The End(s) of the Museum, Barcelona (Fondació Antoni Tápies) 1996, 67-80 (75)
25 Kittler 1996: 75
26 For a case study, see Geoff Cox / Nicolas Malevé / Michael Murtaugh, Archiving the Databody: Human and Nonhuman Agency in the Documents of Erkki Kurenniemi, in: Joasia Krysa / Jussi Parikka (eds.), Writing and Unwriting (Media) Art History. Erkki Kurenniemi in 2048, Cambridge, Mass. (MIT Press) 2015, 125-141
27 Meisner, 1953: 44 f.; on German *Akte* vs. *Urkunde*; see Cornelia Vismann, xxx

future: "[T]he 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" (Derrida, 1995: 17).

To give an example: Whole sections of the former GDR's secret service (Staatssicherheit) archives are not legible any more. Electronic metadata of files processed in former GDR computers were deliberately destroyed by the revolutionary committees of 1989-90. Nowadays, for the Federal Archives in Bonn and Berlin, magnetic tapes without the code containing the instructions to convert bit strings into meaningful sections are useless and illegible. Special programs for rendering these data banks legible as character strings may be written; at present they can be electronically read, but not be understood - a media-archaeological situation.[28] When memory transforms into digital *latency* within computer codes, the ancient notion of "secret", *Privy* State Archives, recur on a technological level as *arcanum imperii*. This unreadability of electronic files does not only relate to software, but to the hardware of memory as well. Who will preserve (or emulate) the digital memory machines themselves, the discontinued generations of former socialist East Europe ESER system computers?

A radical archaeology of media follows Foucault´s *Archaeology of Knowledge* in not looking for metaphorical uses of media in public discourse but in reconstructing the generative matrix created by mediatic dispositivs. Athanasius Kircher´s term for his machine for automatically composing music (we learn from Zielinski´s *Media Archaeology*) has not by coincidence been named "arca", a term which has been used as well as the old name for "archive" - a Foucauldean use of the term *avant la lettre*, referring to the generative set of rules and material mechanisms (the "active archive") which produce the musical impression (like programming in a software called SuperCollider today, algorithmic compositions). Computer programming, the cultural force of today, is non-narrative in favor of algorithmic forms of writing - an alternative form of minimal, serial time-writing (rather registering), close to the paradigm of computing itself.

The archive of contemporary digital culture is techno-mathematics (algorithms, microchip circuit diagrams); therefore media *archivology* is exploring the techno-logical archive: its material and logical operations. Its media-theoretical language is *archeographical* by using transitive expression, close to the machine; re-translating (re-"compiling") machine language into verbal code, like the *disassembly* operation in computer-"textual" forensics: electro-magnetically reading out, e. g. from an obsolete computer game, bit charges in program memory (ROM chips). Assembly code is the *logos* of computational *arché*. *Media archaeology* inquires such "prehistories of technological media. Here, the prefix "pre-" does not refer to a "before" in its temporal or geological sense, but rather to a structural pre-condition.

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28 Michael Wettengel, German Unification and Electronic Records: The Example of the "Kaderdatenspeicher", in: S. Ross and Ed. Higgs (eds.), Electronic Information Resources and Historians: European Perspectives, St. Katharinen (Scripta Mercaturae) 1996

If the *archive* is the ensemble of techno-logical "conditions of possiblities" (Kant), this pre-structuring "before" takes place in hardware *and* in logical control (software). In a more radical techno-mathematical sense: the algorithm *is* the machine (Turing).

Towards a medium-specific theory of technologies: Storage as media channel

In favor of a genuinely media-specific theory of memory technologies, storage must be strictly defined as media channel. The dynamics *within* memory devices deserves close description to reveal its potential for a refreshed terminology of "memory" and "even of time".

Dynamic micro-media memories induce a cultural shift of emphasis from permanent storage to restless transfer. With the aesthetics of re:load, the affinity between the archival operation and cybernetics turns out, resulting in feedback memory and timeshifting.

What makes a theory of storage a "media" theory is Claude Shannon's very definition of the communication channel itself (which he called "merely the *medium*", 1948). Storage may be redefined as suspended value of transmission, as slowed-down ("cooled") transmission within a channel.

Different from analog electronic media (culminating in radio and television "live" broadcasting which is based on time-critical signal transmission), with digital communication technologies, an irreducible micro-moment of intermediary storage is involved - memory not in its culturally emphatic, but in its sense of processing the present.

Among the five elements of Claude Shannon's mathematical theory of communication from 1948 ranges the transmitter which transduces the message (a selection per unit of time from an "alphabet" of possible messages in the information source) *via* modulation (in the analogue channel case) or suitable coding into a technical signal - "something which is quite impossible in the discrete case without intermediate data storage"[29]. Even if the proper "medium" in Shannon's diagram is a *memoryless channel* (with the output signal being a direct function of the input signal without processing inbetween), the digital variance with its compression algorithms puts emphasis on the intermediary memory momentum.

Intermediary storage in forms of signal delay has been already applied in high-electronic systems like colour TV (system PAL, as indicated by its acronym); even the phenomena of magnetic hysteresis and remanence might be taken into account.[30] But these intermediary memories are not of a logical, calculating nature like the intermediary storage of bit values in registers of

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29 Friedrich Kittler, The History of Communication Media, im *online*-Journal www.ctheory.net/articles.aspx?id=45; Publikationsdatum: 7/30/1996
30 For methods to clear magnetic data remanence see the entry "Degaussing" in http://en.wikipedia.org (accessed April 7, 2014)

Central Processing Units in computing. In a delicate way the memoryless channel here transforms into delay lines which might be called a micro-memory

Every digital *sampling* of time-continuous signal events in the physically real world must first convert the signal in time- and value-discrete signals which micro-techno-mathematically is most generally be performed by the "sample-and-hold" mechanism involving a micro-memory operation: a temporal delay (catechontically deferring the momentary time-value) at the margin of becoming "memory" (as storage).

Dynamics *within* memory devices

The core of digital random access memory is the single storage element with its smallest unit being a flip-flop, a binary unit to store or change one bit of information, or a dynamic charge device which constantly needs to be refreshed.

Different from analogue storage media which entropically "fade" away with time (like the baroque allegories of transient time - "tempus fugit"), digital memory - due to its address structure - has a binary character not only in its elementary units but overall: It is either available 100 %, "or completely gone"[31]; on / off here correlate with the emphatic notions of cultural time no more, which is still based on the smooth transition from the present into the past. In most cases, "digitally saved information can either be read without loss of quality, or it is illegible and hence 'completely lost'"[32].

[The temp*aura*lity of archival storage]

Walter Benjamin defined the *aura* as peculiar interlacing of time and space.[33] The archival "aura" in this sense does not simply emenate from its air of secrecy and power-relation; it stems from a specific temporality as well, in fact: its temp*aura*lity. The archival temp*aura*lity which used to be based on the indexial trace from the past (the Barthean *punctum* in analog photography) is being replaced by non-linear time-critical, even bit-critical operations (like the Chargede Coupled Device as basis for digital photography nowadays).

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31 Gschwind 2006: 183
32 Gschwind 2006: 184. On memory in the age of digital media, see as well
Timothy Scott Barker, Time and the Digital. Connecting Technology, Aesthetics, and a process Philosophy of Time, Hannover, New Hampshire (Darmouth College Press) 2012
33 "Ein sonderbares Gespinst von Raum und Zeit: einmalige Erscheinung einer Ferne, so nahe sie sein mag": Walter Benjamin, Kleine Geschichte der Photographie, in: ders., Gesammelte Schriften, eds. Rolf Tiedemann / Hermann Schweppenhäuser, Frankfurt/M. (Suhrkamp) 2nd ed. 1989, 368-385 (378)

[Photography, literally understood as a photonic emanation of an object, memorizes rays of light to the viewer in the present - a delayed transfer of what otherwise would have vanished into the dark. This inscribes physical tempor(e)ality into the image. In addition, chrono-photography then apparently records temporal movement itself - but the discrete (in its double sense) archival essence of technical cinematography is mostly hidden to human perception.]

The *aura* of archival memory used to be based in a temporal remoteness of the material record from the past, even if we managed to access the archive and get close to the record. With the informatisation of archival documents, they loose their physical, material characteristics (the "taste" of the archive, in Arlette Farges sense[34]) in favor of a standardized electronic immediacy with no appeal of distance at all any more. Digital memory looses its temp*aurality*.

The present as a function of memory

Within the temporal window of what humans perceive as "the present", real time signal-to-data processing happens subliminally. Time-critical memorization take place in the neuronal net, representing a kind of dynamic micro-archive for moments. Both neurological perception and so-called digital culture turn out to be radically memory-based, even if this memory shrinks to ephemeral short-term storage.

[The actual state of a discrete physical system (in accordance with Turing's machine concept) is always already a memory since it involves recorded information (just like a flipflop circuit represents the smallest electro-technical storagte unit for a "bit")]

In *Matiére et Mémoire* (1896), Henri Bergson expressed that memory does not go back from present to past, but in reverse: a re-call of images takes place in the short-cut between immediate perception and virtually stored perception from the past. Thus dynamical re-collection (remembrance) is closer to the electronic image than to the archival order.[35] Digital devices - different from live transmission in electronic media like analog radio and television - are based on micro-memories indeed (be it registers, flags, "cache", et al.). Not only that memory becomes part of presence (which it has been always already), but the present dissolves itself into micro-archival and micro-mnemotechnical moments.

Digital video compression is in fact a delicate temporal operation based on micro-archival operations; only parts and sections of the image are updated at a temporal moment. MPEG technologies for video compression transform the plenitude of movement into partial sampling of stills and below.

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34 Arlette Farge, Le goût de l'archive, Paris 1989
35 See Maurizio Lazzarato. Videophilosophie, Berlin (b_books) 2002

[Each frame is being divided into small blocks of pixels in order to analyze changes from one frame to the next. A group of frames is established around one key frame at intervals.]

On the basis of key frames, predictive pictures are established in between to predict the location of each block of pixels. Movement only takes place through updates of certain sections of the image, while the rest of the frame is replayed as before."[36]

With programmable media, remembrance (as defined by Platon and more specifically by Aristotle as *anamnesis*[37]) is not exclusively human any more, but becomes a (Latourean) non-human agency - algorythmic memory.[38] The term "algorithmic" is used here in its widest sense: a) operations based on the Indian-Arabic use of numbers, and b) a rule-governed notational solving of a given problem by its sequential analysis (and synthesis in reverse) in single steps.

Generic memory replaces the fixed record, like in digital image compression an image is not transferred in its entirety but algorithmically being compressed and condensed to be re-generated. Even more radical (in the epistemological sense) are "virtual" media: any object which exists not by indexical reference to an origin in the physical world like chemical photography, but is generated genuinely by calculation. The virtual archival record is thus not being preserved in its materiality on which its traditional authority has been based, but re-generated on demand - just like Leon Battista Alberti in the early Italian Renaissance invented a numerical procedure for reproducing the map of Rome without loss in the act of copying.[39] The rules (i. e. algorithms) of such regeneration are the new *archive* (in its French writing) in Foucault's neologistic sense, the conditions of a possible actualization at any time. This actualization is a form of temporal existence which dramatically differs from the physical re-call of a material record.[40]

- Once the coded message is trusted to a storage medium, it is suspended / locked in a temporal non-"channel". Symbolical ("coded") memory has a good chance to be transmitted with high fidelity against noise, since alphabetic letters as a shape are to a high degree resistant to entropical degradation since they can be copied ("refreshed") within a broad range of individual variance.

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36 See Trond Lundemo, In the Kingdom of Shadows. Cinematic Movement and Its Digital Ghost, in: Pelle Snickars and Patrick Vonderau (eds.), The YouTube Reader, Stockholm (National Library of Sweden) 2008, 314-329 (316f)
37 Aristotle, Peri mnemes kai anamneseos, as part of the *Parva naturalia* in: Aristotle, vol. VIII: On Soul, Parva Naturalia, On Breath, Cambridge, Mass. / London 1986
38 See 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
39 See Mario Carpo, Alphabet und Algorithmus. Wie das Digitale die Architektur herausfordert, Bielefeld (transcript) 2012, 72-76
40 Carpo 2012: 144

"The quality of the medium is of secondary importance, as long as the 'code' can still be decoded."[41] From that results a rather ahistoric form of tradition, different from the scratchy audio signal as phonographic record or the "stealthy disintegration due to the relatively low stability of photographic material"[42].

Knowledge and memory in the Gutenberg era, once trusted to an official publication ("Imprimatur!") or to the archive, claimed to be (in principle) time-invariant. With the fluidity of electronic publishing and online access, though, knowledge and the archive becomes dynamically updatable an any temporal instant.

[From archival space to storage time]

Archives have long been the institutional basis for remembering and forgetting in societies across history"[43], but as a description of technological storage the archive as metaphor fails. The archival itself has become part of the current crisis of memory terms. A shift of emphasis has occurred from 'archival space' to 'archival time' owing to the dynamics of computational data transfer. For cyberspace the notion of the archive has already become anachronistic; it should rather be described in topological, mathematical or geometrical terms, replacing emphatic memory by reverberative transfer.[44]

Discrete time is embodied in the para-archival mechanism built into the transfer process of data in the Internet as such. Once messages have been fragmented into data packets, they are disseminated to find the most effective routes in the net composed by a grid of servers world-wide. This flood would block the Internet very soon unless there was its Time To Live (TTL) stamp. The existence of data packets has the *being-to-death* (Heidegger) value of 255 (according to 8 bit logic). With each passage across a server relays (a "hop"), the value decreases at one. If this amounts to zero without the data packet having arrived as its destined address, it is being deleted.[45]

Micro-processors in data processing assign intermediary storage locations to current data and provide them with addresse; our "digital present" in *online*

41 Rudolf Gschwind, Digitisation and Long Term Archival of Digital Data, in: Lioba Reddeker (ed.), Gegenwart dokumentieren / Archiving the Present, Vienna (Eigenverlag basis wien) 2006, 183-195 (185)
42 Gschwind 2006: 183
43 Andrew Hoskins, Media, Memory, Metaphor: Remembering and the Connective Turn, Parallax 17:4 (2011), 19-31 (25), chapter "Space, Time, Archive"
44 See Wendy Chun, The Enduring Ephemeral, or The Future Is a Memory, in: Erkki Huhtamo / Jussi Parikka (eds.), Media Archaeology. Approaches, Applications, and Implications, Berkeley / Los Angeles / London (University of California Press) 2011, 184-203
45 See Martin Warnke, Digitale Archive, in: Hedwig Pompe / Leander Scholz (eds.), Archivprozesse. Die Kommunikation der Aufbewahrung, Cologne (DuMont) 2002

data communication is never in the "now" but always already computationally delayed. Any transmission of signals in digital networks (different from "live" analog media broadcasting) needs to be coded. In both its electro-physical infrastructure and its metadata (transfer protocols) the internet is *archive*; but in terms of its content, the internet is not "archive" at all, just ephemeral storage. Let us therefore restrict the pronunciation of the term to *l'archive* in French.