["TEXTS AND NOTES ON TECHNO-ARCHIVES"]

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I "TECHNO-ARCHIVE" (nearly edited):

ARCHIVAL STATES

Archival states: *l'archive*

"Archival states" is a double-valued expression. On the one hand, the notion refers to the fact that the memory of the state consists of institutionalized archives (the *archeion* since Greek antiquity) where it consists of symbols (alphabetic letters and more recently alphanumerically coded documents). In a more media-archaeological meaning, "archival states" refers to the essence of technical memories which consist of discrete data sets which are being discontinuously reconfigured or refreshed - like a Turing machine. Hegel once differentiated between a mechanic memory and organic re-membrance. The archival *apparatus* is hardware; ideology takes place in its very configuration already. Its software is narratives (historiography) which operate upon these

data.

Michel Foucault's very distinctive use of the term "l'archive" in his *Archéologie du savoir* (Paris 1969) does not refer to the totality of all received documents (since „the archive cannot be described in its totality“[1]) nor its bureaucratic institutions but, more abstracted, the systems which governs the emergence and the processing of enunciations - dealing with signal and symbol transfer rather than files. The archive is a diagram that formalizes processes; the tectonics of the archive is an active rather than passive medium of historic memory. The technical act of archivization produces as much as it records the event[2] - *archivologically*.

Mechanization of the archive: The Weimar Republic and data processing in the Third Reich

Already during World War One in a highly mobilized economy, the only way of reducing entropical complexity to order occasionally was the flat storage of documents by *numerus currens* (the pure temporal order of occurrence) or by key-terms, replacing meaningful archival structures by pure series, reflecting the order of the temporal real itself. It required sophisticated tools of inventories to link the information on files to the actual location of data, providing an address system (vital for all operations of memory) which is not unfamiliar to data storage in *computing* today. At the end of the 1920s, the flux of incoming files exceeded the real-time registering capacities of the Düsseldorf archivists; therefore, the system switched to registering incoming files simply according to incrementing the access number, the *numerus currens*. Memory became a function of address spaces: "Eine Konkordanz sollte dann dafür sorgen, daß die Kluft zwischen Lagerung und Verzeichnung überbrückt wird, die Auffindung einer Lagernummer in einem Findbuch durch eine Liste […]."[3]

When the nationa-state is troubled, this metaphor of the "archival body", expressing a somewhat historicist idea of the archive, is being replaced by the machine. Indeed, archival data processing became mechanical - the very condition for the subsequent implementation of hardware systems like the punched card.

The traditional archive so far had rather been a cultural technique, the engineering of administrative memory. But with the introduction of punched-card tabulating machines, the Hollerith machines (operated by IBM), which were originally introduced around 1900 to speed up the calculations of the US census but since 1933 used to filter data of Jewish population in the National Socialist regime of Germany as well, the automatization of retrieving archival mass-data has been an issue which led to speculations on the cybernetization of archival memory.[4]

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1 Michel Foucault, Archaeology of Knowledge, New York 1972, 130

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

3 Scriverius, 59f

4 See Edwin Black, IBM and the Holocaust, New York (Crown) 2001

The archive becomes medium in a strict sence only when it is part of a circuit with feed-back options ("online"). Thus the title of the company journal of Dehomag Berlin (the German branch of IBM) is not just metaphorical: *Der Stromkreis* (The Circuit of Current). This corresponds with the memory model of capitalism; according to the systems theory of Klaus Krippendorff[5], capitalism simply demands for a memory system of *reverberating circuits* which are permanently refreshed and fed back into the system operations - as opposed to totalitarian societies based on "memory involving records", demanding for permanent archives and the storage principle. Here we come to a critical point: as long as the general data from the *Reich* census of May 17 were registered and calculated separately from the additional data on racial matters (genealogical origin) in the single households, the tabulating machines were not directly coupled with the deportation program.[6] It was the head of statistics at the SS who asked for a punched card technology equipment for his department, referring to the successfull use of such machinery at the Statistisches Reichsamt, Reichsbahn, Reichspost, Reichsbahn, and research institutions like Rasseforschung. Here comes the difference, which separates automated data propcessing from archival procedures: "The organization of file keeping today excludes any possibility of fast, time- and work-efficient data processing. In order to answer a single aspect of racial data retrieval, it would take a months-long search."[7] As opposed to the old archival system, data processing by the medium of punched cards technology could answer any question almost immediately - the archive became time-critical.

The post-war archive: Memory in the GDR

The collapse of the East Berlin regime after autumn 1989 suddenly confronted the West German state archives with a mass of unreadable electronic data from the GDR, coinciding with a growing transformation from paper records to digital memory in West German administration itself. The return of history in 1989 on the political level coincided with the end of the traditional recording system of historiography - alphabet writing.

The collapse of the East German regime in 1989/90 resulted not only in a political but radically media-archaeological discontinuity. All of the sudden, parts of the memory of the GDR were not legible any more. Electronic data from former GDR computers without description are being thrown away by the Federal Archives in Koblenz; without code which teaches to cut bit strings into meaningful sections, such lists are useless and illegible. In case such a description is preserved, the Federal Archives try to preserve the data independent from both hard- and software (current programs are not being stored for being outdated soon), as flat files, als sequential strings of bits,

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5 Klaus Krippendorff, Principles of information storage and retrieval in society, in: General Systems vol, 20 (1975), 15-34

6 See Friedrich W. Kistermann, Locating the Victims: The Nonrole of Punched Card Technology and Census Work, in: IEEE Annals of the History of Computing, vol. 19, No. 2, April-June 1997

7 "Vorschläge zur Erfassung des im RuS-Hauptamt ruhenden erbwissenschaftlichen und bevölkerungspolitischen Materials", November 11, 1941, p. 2, Bundesarchiv Berlin, NS 48/6

accompanied by the necessary minimum of metadata. In the future, special programms for rendering these data banks legible as texts may be written; so far they can be read, but not be understood - a literally media-archaeological situation, data latency, re-addressing the question of information access, the ultimate „postmodern“ challenge (according to Lyotard[8]), on the electronic level.

„The experience with securing East German data files showed that the creating organizations were not the best custodians of machine-readable archives. Many data files were no longer legible and data documentation was at least incomplete or missing in most cases. Federal offices only cared for these electronic records in so far as they could use them for their purposes.“[9] Luckily (for preservation of electronic memory), electronic data from the GDR were kept in modes close to the machine (having been written in Assembler code); unluckily, this implies a strict dependency on *Robortron* hardware which is museum pieces now. Which state archive keeps the relevant hardware for reading such a new type of documents as well? All of the sudden, parts of the memory of the GDR are not legible any more. Electronic data from former GDR computers without accompanying program description are hermeneutically worthless, while still technically readable as signals, media-philologically decode. Without code which teaches to cut streams of bytes into meaningful sections, such lists are useless and illegible. In case such a description has been preserved, the Federal Archives try to preserve these data independent from both hard- and software for future use, as "flat files", that is: sequential strings of data, accompanied by the necessary minimum of metadata to make them executable again at all.

New options for the archive: endogenic media memory

In the future, special programms for rendering data which are at present not legible may be written; so far they can be read, but not be understood - a literally media-archivological situation, re-addressing the question of information access, the ultimate „postmodern“ challenge (according to Lyotard), on the electronic level.[10] In digital culture, the archival record transforms into streaming data - a new kind of dynamic archives. Once being digitally sampled, textual documents, images and sounds in archives become calculable and capable of being subjected to pattern-recognition algorithms. Such procedures will not only media-archaeologically "excavate" but as well *generate* unexpected evidence from an audio-visual archive that can, for the

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8 *La condition postmoderne*, Paris 1979

9 Michael Wettengel, German Unification and Electronic Records: The Example of the „Kaderdatenspeicher“, lecture at Annual Meeting of the Society of American Archivists, Washington, D.C., 2. September 1995, session 59: Bit by Bit: Perspectives on Managing Electronic Records; fothcoming in: Seamus Ross / Edward Higgs, Electronic Information Resources and Historians: European Perspectives, Oxford UP 1996, quoted here after the typescript, p. 2

10 "Die Öffentlichkeit müßte freien Zugang zu den Speichern und Datenbanken erhalten": Jean-François Lyotard, Das postmoderne Wissen. Ein Bericht, Wien (in: Theatrum machinarum 3/4) 1982; 2nd edition Vienna (Passagen) 1993, 192 (FO: La condition postmoderne, Paris 1993)

first time, organize itself not just according to humanly tagged meta-data but according to its inherent informational criteria. From an aid to cultural memory, media storage develops a knowledge according to its own logo-technical rules (*l'archive*), from within the algorithmicized data matrix.

ARCHIVES OF MOTION VS. ARCHIVES IN MOTION

Terminologies of the "archive"

Kinetic phenomena have not been subject of archivization in the traditional sense of its alphabetic regime of administrative textual records. But with techical recording media, a dynamization of "the archive" itself takes place with time-based and data-processing media (the algorithmization / rhythmics of the digital archive). Next to the archive *of* motion, the storage of audiovisual and textual recordings of dance, the archive as a concept itself gets *in* motion. This requires to differentiate between "memory", "storage" and "archive", between "analog" and "digital" recording of movement, between performative "re-enactment" and archival record.

Time, number, movement

Techno-epistemological media studies are concerned with dynamics, with the essential processuality which is inherent to all operative media. Artful ("technical" in its original Greek sense) operations are the technological equivalent to human "performance" (such as dance). Therefore a media analyst is sensitive to questions of movement and their temporal order, to which the Aristotelean definition of time itself refers: time is the effect of numerical measurement of movement. The "digitalisation" (as arithmetisation) of movement is always alread implied when it comes to so-called time-based arts. If time is defined like this, the essential mathematicity of dance is implicit: *touto gar estin ho chronos, arithmos kineseos kata to proteron kai hysteron.*[11] Even stand-still thus turns out to be a temporal form (the interval), as later expressed by St. Augustin in his *Confessions*.

Storage unequals archive

The function of the archive proper is the orderly documentation of conditions in the production of events (administration, economical data, contexts) which is the logistical "paratext", traditionally fixed on paper or in textual electronic files. Against this function, technological storage is a different regime of keeping records from the past in latency for re-enactment in the present.

Notation of dance and kinematography

Only quite recently in the course of long-term history dance as cultural form could be dynamically registered by storage media: cinematography first, then

11 Aristoteles, *Physics*, book IV (219b 1-2)

videography, and thus became reproducable as movement. Different from symbolical dance notation which leads to the re-generating of movement sequences always individually, audiovisual recording is cultural engineering in a specific way, being able to register artistic expression like music and dance in high temporal fidelity to the unique event, thus suspending it from history in favor of re-presentation. When we watch a video from the archive, even though we cognitively know about the historicity of the performance, our senses cannot but treat it like a present event. This is liveness by kinetics which no graphical notation can ever approximate.[12]

At that point, recording media change from passive to active archival functions, from pure storage to genuine re-play. But more than this, audiovisual recording leads to artistic forms *sui generis*, from reproductive *mimesis* to technologically induced *poiesis*. This technological *apriori*, in the case of dance, leads to performance which is not just recorded by the camera, but produced for the camera eye only (post-production inclusive), different from the gaze of the human spectator in the traditional auditorium or theatre, and has resulted in the sub-genre of "screendance" (*alias* "videodance", "cinedance") which edits time (artful movement) itself, free from the restrictions of physical gravity and duration.[13]

As long as scores (like in the time of the Baroque) referred to rigid form of dance governed by fixed sequences of gestures and steps, symbolical notation could indeed fix that algorithm of movement. But with the dynamisation (if not to say liberalisation) of dance since late 18th century as part of a quite revolutionary acceleration of change in society, dance required a more flexible form of notation for individual artistic expression, from sequenced patterns to individual expression varying with each new perfomance - a variety which only cinematography could finally document.

Retro-digitalisation of cinematographically or videographically documented performance art for the sake of preservation makes it more volatile than ever. Long-term preservation of such data still requires the stability (thus immobility) of an institutional frame called "the archive"; but in its technological essence, this archive gets in motion more than ever: Text files and audiovisual formats, once dissolved from physical inscription (like phonography) and informationally bodyless, need to be converted and copied to new carrier technologies again and again - in "permanent migration"[14]. This necessity, at the same time, opens new options of "reading" the records. While kinematography cuts down movement in single photograpic moments (frames), digital registration analyzes moving images down to sub-iconic elements and makes every pixel mathematically adressable. All of the sudden, moving images and the knowledge of dance can be linked on the elementary level and calculated down to the last pixel. Thus the digitalisation of dance archives, with "movement"

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12 Dietrich Schüller, Von der Bewahrung des Trägers zur Bewahrung des Inhalts, in: Medium Nr. 4 (1994), thematic issue: *Archive - Medien als Gedächtnis*, 28-32 (28)

13 Such has been the argument in the lecture "Screen-Dance/From Stage to Film and Back" by Claudia Kappenberg (Brighton) at the International Symposium ARCHIVE/PRACTICE in Leipzig and Dresden-Hellerau, December 10th-13th, 2009

14 Andreas Kellerhals-Maeder, Archive in der schönen, neuen Welt. Auf dem Weg zu einer klärenden Position, in: Geschichte & Informatik, 12 (2001), 89-87 (91)

being subject and object of such archives, has a *paradigmatic* position for the discussion and aestehtics of memory in the age of technomathematical media.

"Really" archiving movement

Widening the horizon leads to archival research into the epistemological implications of artful movement such as the early biometrical and ergometric recordings of human gestures by Marey in Paris or by Gastev in Moskov. This brings us back to the ancient Greek notion of *mousiké* which encompassed sound as well as dance and other phenomena of articulation in time.

Music is artful organisation of sound in time, such as dance is the temporal organisation of forms and bodies in space. Drama always meant the revealing of structures of time streams.[15] In the age of *streaming media* such cultural performances get an additional, tecnical meaning. The protagonist in this media theatre is a decent letter: "*t*", the symbol for the parameter of the physical time axis. After all, every performance art refers to *chronotechnologies*, understood here in the sense of the ancient Greek musicologist Aristoxenos who defined *chronoi* as the smallest units of rhythmical time (long, short, intervals). His definition referred to poetic prosody and dance especially, but counts in a more general sense as well.[16] In the age of algorithm-driven computing, such a notion can be extended to the rhythms of digital data processing.[17]

The subject of archiving movement extends to the dynamisation of the archive. The essential operation to create an archive of moving arts like dance, of course, is recording: either symbolically (by dance notation in the tradition of writing / *graphé*), or by media endowed with the capacity to register the physically real audiovisual signals (media-archaeologically starting with the phonograph and with chrono-photography), thus literally engraving ("groove") - in respect to Aristotle's correlation of time-number-movement - the over-countable event. Countable movement, whcih at first sight sounds like an oxymoron, can be analyzed only by use of real numbers which can not fully be catched by symbolical notation but only take place in correspinding signal-based media. Only analog media like the phonograph allow for an archivisation of the essential of movement, i. e. its dynamics, and electromagnetic storage media like the magnetophon and video tape are especially capable to catch that *momentum* since their reproduction mechanism is irreducably dynamic itself, being a function of one and only real variable: the time axis.[18] Once

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15 Hans-Thies Lehmann, Postdramatisches Theater, Frankfurt/M. (Verl. d. Autoren) 1999, 61

16 Lionel Pearson, introduction to: Aristoxenus, Elementa Rhythmica. The Fragment of Book II and the Additional Evidence for Aristoxenian Rhythmic Theory, Oxford (Clarendon Press) 1990, xxxiv

17 Shintaro Miyazaki, Das Algorhythmische. Microsounds an der Schwelle zwischen Klang und Rhythmus, in: Axel Volmar (ed.), Zeitkritische Medien, Berlin (Kulturverlag Kadmos) 2009, 383-396

18 See Friedrich Kittler, Die Welt des Symbolischen - eine Welt der Maschine, in: same author, Draculas Vermächtnis. Technische Schriften, Leipzig (Reclam) 1991, 58-80 (68)

dance is not only graphically, but technographically recorded, its dynamic re-play challenges the classificatory order ot the archive itself, to be replaced by probabilities which is the field of mathematical stochastics. William J. Mitchell writes in *The Reconfigured Eye*: "We must abondon the traditional conception of an art world populated by stable, endunring, finished works and replace it with one that recognizes continual mutation and proliferation of variants - much as with oral poetry."[19]

Only by means of a complete mathematical (literal) *analysis* of recordings of artful movement (in terms of real numbers) its archive can become a *dynarchive* which is reconfigurable in order to reveal new analytic insights without destroying the recorded event itself. Cumulative memory is one thing; adaptive (algorithmic) storage another.[20]

Digitization and hypertextualization

Digitalisation in its precise sense is a techno-mathematical practice of analog-to-digital conversion by sampling. Once data are digitally stored, they can be made accessible in networks such like the World Wide Web. But not only do dance archives need to go *online*; networking means as well to create epistemological connections. This implies that dance in archives is not just connected to other dance archives, but to archives of other forms of movement as well, such as the *Encyclopedia Cinematographica* at the Institute for Scientific Film in Göttingen. Since 1952, this project has generated an archival matrix of elementary 2-minute film records of whatever moves, from human (most ethnic) dance over "animal locomotion" (to take an expression of Muybridge) to movements in material metal.

Another opening link from a dance archive to archives of movements leads directly into the laboratory. Norbert Wiener, author of *Cybernetics* (1948), was one of those mathematicians for whom contact with actual phenomena in physics, engineering, or biology would sometimes play a fruitful role in protecting his mathematics from becoming empty and artificial."[21] The place where mathematics and physics actually meet is technical media, and it happens musically. Wiener preferred in his research this middle ground, and "it is in this way that the phenomenon of Brownian motion focused his mathematics" (ibid.), and any scientific recording of such a motion looks like an avant-garde dance proper.

Re-enactment and the archive

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19 William J. Mitchell, The Reconfigured Eye. Visual Truth in the Post-Photographic Era, MIT Press, 1992, 52

20 See Heinz von Foerster, Gedächtnis ohne Aufzeichnung, in: same author, Sicht und Einsicht. Versuche zu einer operativen Erkenntnistheorie, Braunschweig / Wiesbaden (Vieweg) 1985, 135

21 Steve J. Heims, John von Neumann and Norbert Wiener. From Mathematics to the Technologies of Life and Death, Cambridge, Mass. / London (The MIT Press) 1980, 68

When watching audiovisual recordings from a dance archive, a disruption takes place: between the technology of recording which is measuring, belong to mathematical, physical time (Henri Bergson calls this *temps espace*), and the phenomenological experience of time (Bergson's *temps durée*).[22]

This brings research close to the question of artistic practices of reconstruction, of re-enactments and of (self-)archivisation. For the re-exposition of historic media art, the crucial question has raisen: Does this require the original *versus* functionally equivalent technological hardware? Do the same criteria count as well for re-enacting art based on human bodies (as in the case of dance)?

There lies a world of difference between technology-based and body-based re-call of the past. The difference is between real signal recording and symbolic order: between the video recording (on magnetic tape) of a dance which can thus be identically reproduced in its "punctual" (Roland Barthes) singularity as temporal event at any later point in time, and the re-enactment of such a piece on the basis of a score in symbolic or graphical notation which demands ever new interpretation and allows for improvisation (the un-notated). In the case of Samuel Beckett's play *Krapp's Last Tape* (1958) where the human protagonist, on occasion of his birthday, listens to the tape-recorded diary spoken in previous years, the gap widens between his former and his present voice - different from his hand-written records in the invenotry to this tapes. The act of reading leads to cognitive neuro-calculation, while the acoustic channel performs physiological signal processing.[23]

There has been almost no option to catch the authentic visual of sonic gesture before the age of technical recording media, the phonograph, the Welte-Mignon recording piano, and cinematography. The historical performance practice (for dance, theatre and music) can only be reconstructed by scriptural sources, or indirectly by re-using ancient hardware (be it historical architecture, or historical music instruments).

Technical repeatability leads to almost a-historical functional re-enactment; the experience of hight-tech media time is closer to the criteria of experimentation in natural sciences than to the historicist idea of empathetic history. The technological reproduction of a sequence of sound or vision succeeds in exactly the same way as the original, even if it successively uses modern formats such as the Compact Disc instead of the previous vinyl record. This involves the media-archaeological question in its material sense: What difference lies between a functional electronic component of previous generations and its actual embodiment (such as the electronic vacuum tube and its functional replacement by the transistor)? In most cases, the performance is as good, exactly because techno-logics is basically operative and not performative - *gleichursprüngliches* re-enactment.

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22 See Henri Bergson, Perception du changement, Oxford 1911, and same author, Données immédiates de la conscience, Paris 1889

23 Carl Wiemer, Im Rauschen des Realen. "La dernière bande" - Becketts medientechnologische Antwort auf Prousts *Recherche*, in: Romanistische Zeitschrift für Literaturgeschichte 25/1-2 (2001), 169-176 (173); from a different point of view: Michael Lommel, Synästhetsie der Erinnerung: Becketts *Krapp's Lat Tape*, in: Franziska Sick / Beate Ochsner (ed.), Medium und Gedächtnis. Von der Überbietung der Grenze(n), Frankfurt/M. (Peter Lang) 2004, 255-264

Sometimes technology itself becomes an "archaeologist" of visually recorded movements. The earliest known recording from a Television Transmission is the revue *Looking In*, performed by the Paramount Astoria Girls on the BBC Baird television system (30 lines) in April 1933, recorded by an enthusiastic amateur on his recording equipment (the Baird Phonovision system) on aluminium disc.[24] Processed and restored by digital filtering, the key to clarity seems to be movement itself. Any reproduction of one of the 30-line television broadcast as stills in a printing medium (photography in the book) gives a wrong impression of what had been actually seen. Here the time-critical comes in, since printed records (be it texts, be it images) miss a crucial element: time.

"A single frame of the Paramopunt Astoria Girls may be crudely recognisable, but when seen as a moving dynamic television image, / the girls come to life before our eyes. <...> it has much more to do with what we perceive than what is there in pixels, lines and frames. What we are experiencing is not the detail that the eye sees, but the recognition of movement that the brain sees. <...> our brain somehow builds up a model of what we are looking at."[25]

Archive, diagram and movement

From cinema studies it is well known that the filmic motif cannot be reduced to the iconology of the single frame but turns out to be a relational web which diagramatically unfolds.[26] Any archive of temporal figures is marked by such vectors.

The most decisive real physical aspect, to which only technical media like the phonograph with its recording of actual acoustic waves can refer, is temporal processuality. With such kind of recording emerges an archive of the dynamic, itself leading to a kind of *dynarchive* in mimesis to its temporal objects. The monopoly of alphabetic writing in the storage of cultural information (in fact the traditional message of the medium archive) has been broken, leading non-grapical recording and "archival" readings of signals which have never been written.[27]

Analog media allow for the memory of non-intentional records which elapse the symbolical notation by the alphabet, thus leading to what Marcel Proust (in the age of chronophotography, phonography and kinematography) has identified as *mémoire involontaire*. The recording of dance as well is part of such an audiovisual *anarchive*. But attention once more, let us not confuse *recording*

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24 See http://www.tvdawn.com/recordng.htm = The Restored Video Recordings 1927-1935

25 Donald F. McLean, Restoring Baird's Image, London (The Institution of Electrical Engineers) 2000, 211 f.

26 André Wendler / Lorenz Engell, Medienwissenschaft der Motive, in: Zeitschrift für Medienwissenschaft 1/2009, 38-49 (42), referring to: Michael Walker, Hitchcock's Motifs, Amsterdam (Amsterdam University Press) 2005, 270ff

27 John Durham Peters, Geschichte als Kommunikationsproblem, in: Zeitschrift für Medienwissenschaft 1/2009, 81-92 (86)

and the archive. *Records* represent the content of the archive; the archive itself, though, is rather an address structure, a logistical function, closer to *logos* than to *physis*.

Media archaeology is concerned with media not only on their structural but as well on their *operative* level, thus becoming "post-structural" or "diagrammatic" defined as the "rôle intermédiaire <...> entre le geste et le symbole".[28] A generative archive: "Le diagramme n'est pas inséré dans une machine, dans un système des règles, il est un générateur" <Mazzola ibid., 154>. This diagrammatic vector of media archives places it beyond semiotics ("loin du sémotioque", as expressed by Mazzola) and closer to signal analysis, with a signal being the physical representation of a temporal event.[29]

From spatial to time-based archives

From a media-archeological point of view, the traditional archive (as indicated above) gets deconstructed by the implications of digital techniques. Since antiquity and the Renaissance, mnemotechnical storage has linked memory to space. But nowadays the static residential archive as permanent storage is being replaced by dynamic temporal storage, the time-based archive as a topological place of permanent data transfer.

Are there objects which are non-archivable, like Fluxus art in its self-estimation once claimed (though it later became subject of documentation)? Or does the electronic technology of the new archive itself provide for permanend chance? The authoritative stability of the archive liquifies in the age of electronic communication; even the signature becomes digital.[30] Electronic memory is transitory and thus comes closer to the dynamic essence of dance itself.; The electronic archive transforms from a stabile data storage to a dynamic, self-organisational system of fluid data.[31] The principal storage in computers is a kind of temporary archive, a short-time memory which has been called "register". It is the essence of digital data processing that memories become more and more intermediary.

Beyond the archive?

The key paradox of the current archival situation remains: The 21st Century will increasingly become an epoch *beyond* the archive. For media memory, archival dynamics replaces „archival space“ (Michel de Certeau). The archive means in many ways the opposite of what digital storage entails, which is the loss of selection and classification, indexing and critical revision. The new archival

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28 Guerino Mazzola, La Véritè du Beau dans la Musique, Paris (Delatour France) 2007, 153

29 Karl Küpfmüller, Die Systemtheorie der elektrischen Nachrichtenübertragung, Stuttgart (Hirzel) 1974, 393

30 See Jacques Derrida, Archive Fever, xxx

31 Aleida Assmann, Das Archiv und die neuen Medien des kulturellen Gedächtnisses, in: Georg Stanitzek / Wilhelm Voßkamp (ed.), Schnittstelle: Medien und kulturelle Kommunikation, Cologne (DuMont) 2001, 268-281 (280)

technical approaches still arrest the archived and depend on immobility, for instance in the case of archiving web pages. This can only be achieved through freezing the page in time, and thus losing the dynamic quality of its updates, reconstructions, etc. So let us distinguish between the archive *of* motion, the storage of films and sound recordings, which requires that the archive is immobile in itself, and an archive as a concept *in* motion.[32]

SIGNALS AND SYMBOLS. A media-archaeological approach to "textuality"

Textuality in the age of digital computation

Media-archaeological analysis oscillates between symbolic code and signal indexicality; a book title like Friedrich Kittler's *Gramophone - Film - Typewriter* addresses the relation between signal-based and symbol-based media. The age of digital textuality proudly proclaims the option of "lossless" copies (and the legal hybrid of *Originalkopie*). Symbolically coded recording beats the physial decay of its storage materialities to a large degree: "Which is why anything that ever happened ended up in libraries."[33] Foucault has been the "the last historian or first archeologist" (Kittler) in a special sense: His use of the term *l'archive* (not to be confused with the institutional archive which is *archives* in French) refers to „the entropy of a post office"[34].

The early phonetic alphabet with its explicit usage of single letters for vowels to symbolically express the musicality of oral speech has been developed as a kind of *gramma-phoné* but in fact remained type-writing, i. e.: writing in discrete characters. Although this invites to a word play (early Greek writing as a pre-phonographic[35] recording of the spoken word), phonography is not "gramophone". Emile Berliner's name given to his variation of Edison's invention had strategic, disctinctive reasons.

Rather than symbol-writing in printing culture, a real "sense" of time (the tempo*real*) is related to signal recording since the age of the phonograph. Alphabetic writing has not simply been transformed but radically challenged by signal-based recording media like the mechanical phonograph which does not simply record the symbolic value of speech but the physical trace of the actual voice – all the difference between the elementarisation of speech by writing (Aristotle) and the recording of the sub-literal frequencies of actual *parole* (in terms of de Saussure for whom the early phonograph was a decisive tool for linguistic analysis). The ultimate return of symbolic "writing" though takes place within the alphanumerically coded computer.

Alphabetisation of movement: cinematography

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32 See Eivind Røssaak (ed.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010
33 Kittler 1999: 4 f.
34 Kittler 1999: 5
35 See Anthony Moore, xxx, in: Siegfried Zielinski / xxx Fürlus (ed.), Variantology 4, xxx

With cinematography a similar divide takes place. Even if all the media power of the cinematic apparatus stems from its deceiving human perception to create the impression of continuous movement, cinematography – in spite its „graphic“ name - is not steady writing at all, no (kymo-)graphical method of registering varying continuous singnals in Étienne-Jules Marey's sense, but a discrete sequence of photographic stills. This is why Marshall McLuhan still subsumes cinematography under the „mechanic“ Gutenberg age. Images recorded on celluloid are technically configurated like in printing.

Radical media archaeology vs. contextualism

Media archaeology thinking first of all addresses the structural level of media practice; the governing techno-logical laws, such as Internet protocols or the von-Neumann-architecture of digital computers. Furthermore, it is an aesthetics of anlysis: the "cold gaze" of distanced understanding. Then it is an "archivology", that is: deeply obliged to archival evidence and technological precision (circuit diagrams as source of evidence, f. e.), and finally, it might even result in an art form (as exercised f. e. by Paul de Marinis) which displays media in its archaic basics as opposed to the intangible hiddenness of micro-chip based processes.

In addition, media archaeology is a form of generating knowledge with the media themselves as active agents respectively archaeologists, like digital signal processing which restored early "phonographic" records of John Logie Baird's experimental electro-mechanical television. It is a gesture of "open source" (de-constructing hardware) not only in the sense of public usage of source codes in programming, but as well in the sense of dis-mantling media from their designed enframing, like "platform studies" perform it.

Finally, media archaeology is an approach close to the materiality of media, here akin to Classical Archaeology which deals with the material remains of a culture (as opposed to philological hermeneutics). But let us not be seduced by the archaeological metaphor. Admittedly, a certain nostalgia for so-called "dead media" (Bruce Sterling) and "the analogue" is a driving bias, but this melancholy should be kept private. Media archaeology is n o t about beginnings, about origins in the temporal sense, but rather about the *arché*, the laws governing media in action. These principles are rather structural than temporal, though it happens that at its emergence a medium most openly reveals its structures before it becomes dissimulated by interfaces.

This is a techno-deterministic, that is: machine- and code-centered form of media studies indeed[36], an archaeological / archivologicalbeing rooted as much in Foucault's definitions[37] as it is connected with Marshall McLuhan's non-

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36 As expressed in Wendy Hui Kyong Chun, Introduction. Did Someone Say New Media?, in: New Media, Old Media. A History and Theory Reader, eds. Wendy Hui Kyong Chun / Thomas Keenan, New York / London (Routledge) 2006, 1-10 (4)

37 The archive "governs the appearance of statements as unique events", whereas archaeology "questions the already-.said at the level of its existence <...> and the general archive system to which it belongs": Michel Foucault, The

contentist media analysis. The field of (new) media theory seems split between two very different approaches: "Media archaeologists, like Kittler, Wolfgang Ernst or Alexander Galloway describe the non-discursive practices of the techno-cultural archive. Media phenomenologists like Katherine Hayles, Tara McPherson or Mark B. N. Hansen analyze how phenomena in various media appear to the human cognitive apparatus, that is, to the mind and senses"[38] - an epistemological positioning maybe in the best sense of Heraclit's pre-Socratic notion of *harmonía*[39].

In the discussion of, e. g., what is an "image" in the age of new (that is, electronic and digital) media, phenomenology, in an explicit Bergsonean tradition, insists on the coming-into-being of the mediated image in the "enframing" acts of the human bodily cognition.[40] Radical media archaeology as a form of "posthuman cultural studies"[41], rather takes the point of view (*theoría*) of the machine itself.[42] Non-discursive media archaeology (different from, e. g., Zielinski's version of media archaeology, recently re-phrased as "variantology"[43]) is going to the roots (Greek *arché*) in two ways: to the archive (in order to open the time-critical *momentum*[44] and its temporal horizons), and in the sense of the mathematical square root "√" as a constitutive force in algorithmic, techno-mathematical media.

Media archaeology exercises a close examination of technical media as they actually operate, while maintaining a hermeneutially distancing look (akin to the "passion of distance" which Friedrich Nietzsche once declaired to be his method of analysis).[45]

Archaeology of Knowledge, New York (Tavistock) 1972, 129 and 131

38 Kjetil Jakobsen, Anarchival Society, in: Eivind Røssaak (ed.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010, 127-154 (141)

39His fragment B8 defines the harmonic juncture of the different.

40 Mark B. N. Hansen, New Philosophy of New Media, Cambridge, Mass. (MIT Press) 2004, 13. See Henri Bergson, Matter and Memory, New York (Zone Books) 1988, 35 f.

41 Geoffrey Winthrop-Young, Cultural Studies and German Media Theory, in: Gary Hall / Clare Birchall (eds), New Cultural Studies, Edinburgh (Edinburgh University Press) 2006, 88-104 (100)

42 In their introduction to *Critical Terms for Media Studies* (Chicago 2010), the editors W. J. T. Mitchell and Mark B. N. Hansen take the title of Marshall McLuhans seminal *Understanding Media* (1964) at face value: understanding current culture from the perspective of media.

43 Siegfried Zielinski, Deep Time of the Media. Towards an Archaeology of Hearing and Seeing by Technical Means, Cambridge, MA / London (MIT Press) 2006, and the book series on *Variantology* edited by same author, starting with vilume I (co-edited with Silvia M. Wagnermaier), Variantology. On Deep Time Relations of Arts, Sciences and Technologies, Cologne (Walther König), 2005

44 See Axel Volmar (ed.), Zeitkritische Medien, Berlin (Kulturverlag Kadmos) 2009

45 See Helmut Lethen, Cool Conduct: The Culture of Distance in Weimar Germany, Berkeley / Los Angeles (University of California Press) 2002

Media studies acknowledge both the non-human agencies (Bruno Latour) and their discursive dependencies[46] but tends to privilege rather semiotic than signal-based approaches to technologies. "Software studies" (Matthew Fuller[47]) and "platform studies" (Bogost / Montford), and a refreshed materialist (forensic) approach[48], links both cross-Atlantic schools.

Siegfried Zielinski, in his book (Berlin 2012) *Jenseit der Medien* ("beyond media"), argues for a "philology of material things" - a reminder of the term "monumental philology", once coined by Eduard Gerhard for the method of classical archaeology in the 19th century. To analyse a material technical artefact in its own terms (as *monument* in terms of Foucault) differs from deriving this evidence from the accompanying texts - unless reading circuitry diagrams. As a partial off-spring of the literatures department, media archaeology practices techno-material and techno-mathematical philology, material *aisthesis*. Sobchack even identifies the archetypal *emplotment* of media archaeology as still adhering to the historicism of the post-enlightenment Romantic age: the preference of ancient artefacts and the desire to re-vive them (first by literature, later by film).[49] It is on the argumentative level that media archaeology differs from the discourse of history: "Unlike contextualism, media archaeology's aim is to set these objects a spotentially *transhistorical* - that is, not necessarily context dependent."[50]

Different, non-textual shapes of time

Symbolic (textual) writing of "historical" time differs from actual signal-based time-writing. A science of signals from the past which has opened a new field of memory research (not just as an additional source for historical inquiry). With photography, the phonograph, and electro-physiology an alternative agenda has been set. So-called Humanities (as defined by Wilhelm Dilthey) have not been concerned with the physically real - due to the limits of hermeneutics as text-oriented method, to the privileging of narrative as dominant form of representation and because of an essential lack of non-symbolic recording media. Battles have been described and interpreted, but the real noise and smell of a combat could not be transmitted until the arrival of the Edison phonograph.[51]

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46 As an exemplary study from the German side see Cornelius Borck, Hinrströme. Eine Kulturgeschichte der Elektroenzephalographie, Göttingen (Wallstein) 2005; same author: Electricity as a medium of psychic life. Electrotechnical adventures into psychodiagnosis in Weimar Germany, in: Science in Context vol. 14 (2001), 565-590

47 See Matthew Fuller (Hg.), Software Studies. A Lexicon, Cambridge, Mass. / London (MIT Press) 2008; Jussi Parikka, Digital Contagions. A Media Archaeology of Computer Viruses, New York et al. (Peter Lang) 2007

48 See M. Kirschenbaum, Mechanisms. New Media and the Forensiv Imagination, Cambridge, MA (The MIT Press) 2008

49 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, referring to Hayden White, Metahistory. The Historical Imagination in Nineteenth-Century Europe, Baltimore / London (Johns Hopkins University Press) 1973

50 Sobchack 2011: 329

Still textuality, but organized in non-linear ways

As lamented by Henri Bergson, the process of “spatializing time” which is a by-product of chronophotography, the mechanical clock (Heidegger's “vulgar time”) and mathematical *analysis*, transformed the nature and experience of time as duration and flow, replacing it by the quantification (mathematization) of time into a static, spatial, divisible entity.[52] Logical electronic circuitry is text under current. In a way, only with the arrival of techno-mathematical notation systems which are numeric rather than alphabetic, true textuality takes place in the cultural engineering, resulting in time-discrete media tempor(e)alities

What happens to text in the age of computer-based literacy?

The nondiscursive operators and operations of technological media can not be communicated in the form of textual stories. Should once say "logotec" instead of "technology"? Contrary to Gottfried Wilhelm Leibniz' vision of a universal language expressed in mathematical symbols (a *caracteristica universalis*), Hegel rejected the option of mechanized reasoning, while Hegel's contemporary Charles Babbage, while constructing his Differential, then Analytical Engine, in fact declared himself a "philospher" as well. Different from Hegel's *Logik* is Charles Sanders Peirce's first "electrification" of logical operations (as machine) by drawing the first electric circuit. Media archaeological analysis is applied epistemology in the sense of Peirce's "diagrammatic reasoning" - operative media diagrammatics.

While for human reading, minor corruptions of a single letter mostly do not seriously affect the meaning, the hidden textuality of computer programs ("operative texts") is highly bit-critical. An algorithm might be reduced to shere logical textuality; its material implementation as a computer program, though, is in the (physical) world and thus subject to temporal (entropic) and time-critical ("kairotic") noise. The value of magnetically stored information is vulnerable to physical disturbance. All of the sudden, traditional textual criticism (as known from close examination f. e. of medieval parchments) is required on the level of hard drives in computers again - as argued by Matthew Kirschenbaum's *Mechanism*. Textual studies can be extended to "textual forensics"[53], taking the physical embodiment of texts on paper and in books further to the analysis of its media-archaeological sitatuations.[54]

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51 See Bernhard Siegert, Das Leben zählt nicht. Natur- und Geisteswissenschaften bei Dilthey aus mediengschichtlicher Sicht, in: Claus Pias (ed.), Medien. Dreizehn Vorträge zur Medienkultur, Weimar 1999, 161-182 (175), referring to: Wilhelm Dilthey, Die Abgrenzung der Geisteswissenschaften. Zweite Fassung, in: same author, Gesammelte Schriften VII, 311

52 See Mary-Ann Doane, Does time become Space?, in: Liv Hausken (ed.), Thinking Media Aesthetics, London (Routledge), forthcoming

53 D. C. Greetham, Textual Forensics, in: PMLA, January 1996, 32-51

54 Matthew Kirschenbaum, Mechanisms. New Media and the Forensic Imagination, Cambridge, MA (The MIT Press) 2008

The curator of the department *Computing and Control* at the National Museum of Science and Industry in London, Doron Swade once described the situation.[55] Software is a cultural artefact, but no material object any more, since it unfolds only in performance, that is: algorithmically. Software belongs to the "generic objects (media)"[56]. A computer which only passively is on museum display is not in any "medium" state; it is much more of a challenge to display its time-critical and bit-critical data processing - maybe by transposing them into acoustic frequencies which can be literally „understood“ by the human ear - a sonic computer museology. "A piano score, even a 19th century one, is software when its instruction code can be executed by a human pianist as well as on a player piano."[57]

So-called Software Art is embedded in a long tradition such as combinatorial poetry[58] with its inherent desire of the self-executable text; Lucretius' scientific poem *De rerum natura* which is not only written in alphabetic letters but makes them represent the literary „elementary“ moves of nature itself. This tradition is continuing with Raimundus Lullus' textual knowledge machine in the Renaissance. But the inherent textual desire of becoming performative itself only materialized with the algorithmic Turing machine which takes its origin in textual operations literally by providing moves like "read" and "write", on the basis of a kind of typewriter dispositive reduced to two (thus binary) keys and an ink ribbon extended to infinity - the endless tape to write upon and to read from (reminding of the magnetophone tape which co-originated in Turing's time).

If software is defined as executable formal instructions, logical scores, "[t]he first, English-language notation of the Dadaist poem qualifies as software just as much as the three notations in the Perl programming language. The instructions only have to meet the requirement of being executable by a human being as well as by a machine."[59] "The Perl code version of a Dada poem "can be read and executed even without running it on machines" (Cramer ibid.), with the human becoming a "paper machine" in such an algorithmicized reading state (Alan Turing 1937) at that moment. But be it human "brainware", pencil and paper, or hardwired electronics: there is no software in operation without the physical medium it runs on. The link to the physical world insists, the necessity of material implementation of all logical systems in order to become dramatically active. Symbolical analysis ("Schaltalgebra") in itself can not operate, only when being implemented into swichting circuits (like electro-magnetic relays).[60] There is a crucial difference between the mathematical model of a logical machine and the really implemented machinery called "computer" today which brings time as a critical parameter into the event. Even mental processes depend on their implementation in bio-cybernetical hardware (neural synapses).

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55 Doron Swade, Collecting Software: Preserving Information in an Object-Centred Culture, in: History and Computing, Bd. 4, Heft 3 (1092), 206-210

56 Swade 1992: 208

57 Cramer 2002

58 See Florian Cramer, xxx

59 Cramer 2002

60 See Claude Shannon's master thesis: A symbolic analysis of switching relays, in: xxx

Like Foucault's example of the difference between a mechanical keyboard of a typewriter and its representation in a handbook, printed computer code in programming handbooks "rarely ever executed on machines, but provides examples which readers follow intellectually, following the code listings step by step and computing them in their minds."[61] This concerns the critical edition of Friedrich Kittler's code *Manual* which remains on the hard drive of his computer in the Kittler estate. A media philology of Kittler's self-written source code can not be limited to human reading, asks to be but read operatively, executed by the machine. "Usually, hard drives of scholars in the Humanities end up as dead media and are perceived as mere storage units of texts that continue to exist on paper. Friedrich Kittler's UNIX system, however, forms a living entity, in which text, source code and executable programs produce a consistent system of philosophical and scientific invention, rather than just an inventory of data."[62]

The term "archaeography" is meant to indicate alternative models of writing the being of technologies in time: their governing principles, their archaic essentials, their variabilities and invariances. For early computers, software execuation oscillates between the real (hardware) and the symbolic: One welding point in wiring failing or one bit wrong and the system crashes. "In archaeological terms the operational continuity of contemporary <"text"> culture cannot be assured."[63]

For a long interval of culture, there have been just symbolical, not technically real means of storing, ordering and administrating physical time signals. There were just alphabetic texts, musical scores, mathematical algorithms. On the contrary, "whatever ran as time on a physical or (again in Lacan's terms) real level, blindly and unpredictably, could by no means be encoded. Therefore, all data flows, provided they really were streams of data, had to pass through the bottleneck of the signifier. Alphabetic monopoly, grammatology."[64]

Latin language is clear on that: *res gestae* (what actually happens) differs from the *historia rerum gestarum* (the narrative). The dichotomy between signal-processing and merely symbolic time-writing became (again symbolically) suspended with Leibniz' differential calculus - the mathematical analysis of physical dynamics itself. Such a symbolic machine equals its material implementation (the Turing machine).

The media-induced temporal affect

A "museum" technology from the past, when being functionally re-enacted in the present, is suspended from history. "In einer materialistischen Untersuchung wird die epische Kontinuität <...> in die Brüche gehen"[65], Benjamin concludes almost in media-archaeological terms, in favor of a short-

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61 Cramer 2002
62 Draft of talk Paul Feigelfeld to Yale University conference *Beyond Textuality*
63 Swade xxx: 209
64 Friedrich Kittler: Gramophone - Film- Typewriter, Stanford UP 1999, Introduction, 4
65 Walter Benjamin, Gesammelte Schriften, Frankfurt/M. (Suhrkamp) 1972-1989, vol. I, 1252

circuiting Now-ness („Jetztzeitigkeit“) where antiquity (the *arché*) becomes co-original to the presence: "So war Robbespierre das antike Rom eine mit Jetztzeit geladene Vergangenheit, die er aus dem Kontinuum der Geschichte herausssprengte"[66] - a kind of chrono-cinematographic cut-up or *montage* indeed. "If the film called history rewinds itself, it turns into an endless loop."[67] The symbolic regime allows for time-reversed operations (which for the regime of alphabetic letters G. W. Leibniz defined in his thought experiment as *Apokatastasis panton*[68]). This concerns the level of human interaction with physical time (aka "history"). Media archaeology rather focuses on inherent media temporality - below textuality, the subliminal tempor(e)al affects induced by machines. While film philology argues in terms of image sequences, media archaeology concentrates on the single frame which just for a fractal of a moment appears to the eye and to (subliminal) consciousness. "Das wahre Bild der Vergangenheit *huscht* vorbei. Nur als Bild das auf Nimmerwiedersehen im Augenblick seiner Erkennbarkeit eben aufblitzt, ist die Vergangenheit festzuhalten."[69] At first glance this analysis seems to refer to the material film frame which at the moment of projection indeed is being arrested for a fraction of a second in order to evoke the physiological after-image in the eyes of the audience. But by naming the temporality of lightning, in fact Benjamin already implicitely describes the aesthetics of the electronic television image (just emerging at his time) - a regime of electrified *Weltbilder*. In the most literal sense Adorno during his work at the Princeton Radio Reseach Project summed up this tele-presence („live“ signal transmission) under the title *Current of Music*. The temporality of the television and video images with its 64 micro-seconds per line is much too time-critical to be physiologically noticed by the human perception at all, different from the 24 frames per second for cinema which still can be detected as a subliminal massage and of what Leibniz' had termed *petits perceptions*.[70]

Not just different histories, but different from history: signal-based tempor(e)alities

The signal-based chrono-sphere is alienated from history. Alphabetically coded documents of and on an era, made accessible by lists, card-indexes, computer catalogues, together with material kinds of reading equipment which constitute a "time machine"[71] - but only in a symbolic way. Only when signals instead of symbols become the basic operators (which is true for classical "analog" media technologies, ranging from telegraphy to radio and television), a different temporality takes place (as known from "live" transmission which is electro-physically authentic, even "indexically" true to physical time (in Thomas Levin's sense, as opposed to pre/calculated "real time" windows of presence). Signals are (electro-phyiscally called) "time signals" in most cases, with *t* as the

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66 Benjamin, GS, vol. I, 701

67 Friedrich Kittler: Gramophone - Film- Typewriter, Stanford UP 1999, Introduction, 4

68 xxx

69 Benjamin, GS, vol. I, 695

70 See Maurizio Lazzarato, Videophilosophie, Berlin (b_books) 2002

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

constant parameter). As opposed to mere written or printed characters, signals take place in time itself.

Audio-visual media address humans at the existential level of affective sensation of being which is the temporal sense. They re-generate temporal experience by addressing the human on the sensory (aisthetical, physiological) level as radically present, while mental cognition distances it into a "historical" con*text.*

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

As symbolic order which, according to Lacan, always already implies the machinic[72], archives are no time machines at all, while audio-visual records - when operated within machines - take place in time itself, different from the scriptural regime.

"Bias" originally is a technical term in electronic engineering describing the necessary basic electric voltage to operate a vacuum tube (esp. triode) - a pre-condioning, a ground tension for making the circuitry work at all, an electric *a priori*.[73] In terms of Harold Innis, the archive belongs to the tools of empires which are temporally "biased"[74]; it has to be temporally charged or rather "biased" in order to become a memory base.

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 - is more or less being kept, since an act of decoding has to take place which involves the cognitive apparatus. But once photography, the first medium in its modern sense, entered the archive, the sense-affective, presence-generating power[75] of signal-based media cuts short the temporal distance in favor of mnemonic immediacy - the photographic *punctum* (Barthes), chrono-electric *choque* (Benjamin).

Negentropic encoding

Once a cultural message has been transduced into the symbolical code, such as a musical score from the hands of Mozarts, it can be transmitted with a high degree of fidelity in copying, regardless the material support[76]; like the genetic

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

73 For magnetic recording, the "bias" names the pre-magnetization of the tape by hight frequency signals to ameliorate the signal-to-noise ratio (dynamics). The proper informative time signal thus is overlayed or pre-conditioned by a different *a priori* temporality.

74 Harold Innis, The Bias of Communication, University of Toronto Press 1991

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

76 See Rudolf Gschwind / Lukas Rotenthaler (interviewed by Ute Holl), Migration der Daten, Analyse der Bilder, Persistente Archive, in: Zeitschrift für

code), especially the phonetic alphabet, is mostly invariant towards historical, i. e. entropical time. Digital data is just a special case of such alphabets. Documentary science has developed the notion of „logical preservation“[77]. But any information must take place in or on a material support which introduces another, different tempor(e)ality. Does the concept of „information“ (which is measured by the binary digit) dispense with the material link? To what extend is software independent of the carrier used for transport?[78] In order to be executable, any algorithm has to take place in matter - even if this is just paper. The metonomy which takes the Floppy Disc as a material support for the software itself is a hint to the material link.

Retextualizing the sonosphere: digitized sound

There is an implicit "sound" of the temporalized archive. For the electric age Marshall McLuhan identified a „culture without writing“[79] which he calls „acoustic space“. Against the immediate impression, this expression does not simply mean sound and music, but a specific form which he correlates with the electronic media sphere - the sphere of resonances. Thus a different kind of tempor(e)alty is introduced, resulting in a different *media theatre*. To conceive the operational theatre not from the optical-perspective but from the acoustic dimension opens access to the awareness of time-based and time-critical processes - the signature of high-technological media.[80]

In a variance of the notorious *incipit* of Kittler's *Gramophone* book, media determine our *temporal* situation. When coupled to technical media interfaces, humans are being placed in a different temporal "situation" than normally experienced. In alliance with Günther Stern's (alias Günther Anders) unpublished habilitation from around 1930 *Philosophische Untersuchungen über die musikalische Situation* the question arises to what degree operative media („im Vollzug“) perform *ekstasis* of (or: from) historical time.[81]

What is called "Hörspiel" as an art form in German, the radio play, in the anglophone world is often called "radio drama"[82]. This is still oriented at the definition of drama as literary script, logocentristic (orientated at literature), as opposed to a radical different approach which is medium-centristic (radio-

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Medienwissenschaft 2, 1/2010, 103-111 (104)

77 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)

78 Doron Swade, Preserving Software in an Object-Centered Culture, in: Higgs (ed.) 1998: 195-206 (195)

79 See Herbert Marshall McLuhan, Kultur ohne Schrift, in: Martin Baltes / Fritz Böhler / Rainer Höltschl / Jürgen Reuß (eds.), Medien verstehen. Der McLuhan-Reader, Mannheim 1997

80 Frank Hartmann, Instant awareness. Eine medientheoretische Exploration mit McLuhan, in: Soundcultures. Über elektronische und digitale Musik, hg.v. Marcus S. Kleiner / Achim Szepanski, Frankfurt/M. (Suhrkamp) 2003, 34-51 (35)

81 Siehe Veit Erlmann, Reason and Resonance. A History of Modern Aurality, New York (Zone Books) 2010, 325f

82 See Tim Crook, Radio Drama. Theory and Practice, London / New York 1999

phonic)[83], the acoustic-based "Schallspiel" (Friedrich Knilli)[84] which dramatizes the signal materiality of radio transmission - a genuinely media-dramatic approach.[85] McLuhan defined the (literally) „current“ state of media-induced communication as "acoustic space", since the ear perceives signals simultaneously (which indeed is the implicitely sonic situation of electro-magnetic waves as well). Such signals are beeing processed in the right hemisphere of the brain, as opposed to the sequential processing of signals in the left hemisphere which has been privileged since the invention of the phonetic alphabet for processing of information. Beyond the *Gutenberg Galaxy* as described by McLuhan 1962), with "live" signal transmitting electronic analog media, non-Euclidian temporal synchronicity has emerged.[86] With contemporary realtime data processing, however, "textuality" returns in algorithmic computing more strictly than ever.

Active media archaeology (such as the opto-electronic reading of otherwise unaccessible groves from recording) retrieves past sound signals by digital sampling and quantification. Thus, was appears to the ear like the restituted sound, in fact is already the function of a mathematical matrix. The digital *close reading* of sound dissolves any signal into discrete blocks. Digitized signals resemble the tradition of music notation; they wait to be algorithmically executed. The textual regime returns in alphanumeric codes. Algorithmic archaeology is the return of textuality in the representation of the past, but this time, the text itself becomes media-active - a kind of operativity which the handwritten or printed text never knew.

Im/mediacy: towards a dynamic technology of image retrieval

It is possible, in the age of high-frequency computing, to navigate through large amounts of data below orientation at verbal language. There is an im-mediate access to data patterns, unfiltered by metadata. Expressing texts, sound and images in numerical or logical values subjects all phenomena to the Turing machine. As expressed by Vilém Flusser for the "technical image", all continuous signal-systems thereby becomes divisible into discrete units which can be transmitted and reproduced as code.[87] But what is an image in computable space: a set of data, a format, an „epistemological thing“ (Jörg Rheinberger)? From the media-archaeological point of view, such an "image" is just a visualisation of what been translated into a two-dimensional mathematical matrix (just like the sound from a CD player is nothing but a sonification of a serial array of binary data, that is: square-shaped signals). This symbolisation in form of bits, while being an abstraction from the real world, does not mean though that the relation between the information and the

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83 See Friedrich Knilli, Das Hörspiel, xxx

84 See Elke Huwiler, Sound erzählt. Ansätze einer Narratologie der akustischen Kunst, in: Harro Segeberg / Frank Schätzlein (eds.), Sound. xxx, Marburg (Schüren) 2003, 285-307

85 Klaus Schöning, Zur Archäologie der Akustischen Kunst im Radio, in: WDR (ed.), Klangreise. Studio Akustische Kunst: 155 Werke 1968-1997, Cologne 1997, 1-11

86 See Tony Schwartz, The Responsive Chord>, New York (Zone) 1974

87 See Vilém Flusser, Für eine Philosophie der Fotographie, Göttingen (European Photography) 1984

physical world has become purely arbitrary. When analog signals from the physical world are being sampled (i. e. time- and value-discretely quantized), the resulting strings of bits ("words") as still quasi-indexically shaped by the original physical event which, in the case of digital visual recording of dance, is the moving bodies.

At what moment is such a set of data interpreted as a cultural image? By the agency of human perception only, by verbal description (*ekphrasis*), or independent from human awareness already? Without human interpretation of certain visual patterns, the image would just be a cluster of data. Optical signals become information in the eye of the human beholder only, while the computer can deal with the symbolical analysis of such data without the imaginary.

What digital space allows for instead is the option of navigating images in their own medium - without changing the channel from visual to verbal language. In digital space, the task of *searching images* does not only mean searching for images, but has a second, reverse meaning as well: movement sequences can be automatically matched to similar movements, without the interception of words. This is dynamic navigation in *Dataland* (as designed in 1973 by William Donelson), not in the alphabet or in dance notation. Different from printed letters in a book, the symbols in digital dataland are arranged and distributed algorithmically - a dynamics which matches the kinetic nature of orderly movement itself.

One moving image sequences have been digitized and subjected to compression for economic storage and transmission (such as the MPEG or MP3 standard), for humans it is not possible any more to interface to movement for analytic use. Visual knowledge does not arise from meta-dating only, but from within the visual endo-data: entering movement immersively. As observed from the computer, kinetic information generates a kind of second-order visual knowledge, cartography, diagrams - infomapping. A critique of the notion of „meta-data“ draws on the assumption that there is knowledge already within the images, a kind of knowledge which either does not need to be meta-dated or can not even be grasped by verbal description at all - *endo-data*. Let movement be informative itself - by means of operating with values that are, already, intrinsic to the recorded movement. Such insights can be teased out once the operative unit is subjected to algorithmic data processing.

Any „digital image“ is an image no more in its emphatic cultural, phenomenal sense; what looks like images to humans, for the computer is rather a function of mathematical data sets. The media-archaeological hypothesis reads like this: There is a knowledge already implicit, „dormant“ within the electronic images, which - independent from external descriptions (metadata) - waits to be un-covered from within. Digital data banks of moving images, when cleverly adressed, render a kind of knowledge which would otherwise be unimaginable. Digital images render aspects of visual knowledge which only the *medium knows*, virtually in the „unconscious“ of the data-bank. Different from media phenomenology which is still oriented at human perception, the media-archaeological program is to uncover inherent *virtual visual knowledge*.

Navigating digitized cultural items is possible by means of their numerical

addressability, independent of verbal meta-dating. Most video extraction in archives of moving images is not based on the single frames (like in post-production editing tools like AVID) or even picture elements, but on whole image sequences. The computerization of such media archives now promises to decipher them as algorithmicised data sets, as clusters of pixels and colour values, edges, curves, sonic timbres. Strings of textual symbols, images and sounds have become calculable and thus capable of being exposed to pattern-recognition algorithms. Such procedures will not only media-archaeologically "excavate" but as well *generate* unexpected perspectives from an audio-visual archive that can, for the first time, organize itself not just according to meta-data but according to its proper criteria - visual memory in its own medium. Contrary to traditional semantic, musicological or iconological research in the history of ideas, such an endogenic visual archive will no longer list images and sequences according to their authors, subject, and time and space of recording. Instead, digital image data banks will allow visual sequences to be systematized according to mathematical rather than narrative *topoi*, revealing new insights into their informational values.

Even if algorithmic search operations in computing have not been capable, so far, to identify sophisticated forms of visual rhetoric (at least: the whole of an object from the sight of a part of it), with the "deep learning" concept of recursive "big data" processing, the computer has been trained to spot associations between seemingly unrelated pieces of information and derive generalizations on the basis of new protocols.[88]

ARCHIVAL SAMPLING, ITS PROVOCATION BY SIGNAL RECORDING, AND FINAL SYNTHESIS IN DIGITAL SIGNAL PROCESSING. "Photofilm" in a media-epistemological perspective

Technical sampling as archival action

Academic and artistic analysis has been concerned with "the archive" for years, in its sense as agency of cultural memory. This perspective has been turned upside down by focussing on the precise technologies of storage itself (be it analog, or "digitally" coded).

A media archaelogical approach will less concentrate on a genre in cinema culture such as "photofilm" and its roots in the contemporary image archive, but take the subject *Sampling the Archive* more literally. Time-discrete digital *sampling* is the core operation of transducing, transforming and quantizing analog signals from the physical world into binary information - a "transsubstantiation" indeed, almost in terms of Catholic religious liturgy. This functional technical operation is embedded within a media-epistemological frame (the Heideggerean *Ge-stell*) of "technified" temporal intervals, cuts, slices. The discrete nature of the archive, in chronotechnical analysis, is therefore not identified in its administrative sense as institutional agency of cultural memory (especially Photo- and Film Archives and related Media

88 See Duncan Davies, Diana Bathurst u. Robin Bathurst, The Telling Image. The Changing Balance between Pictures and Words in a Technological Age, Oxford (Clandendon) 1990, 64 f.

Libraries), but in its micro-archival operations. This comes close to Foucault's neologistic application of that term (French *l'archive*), which rather relates to the Kantean notion of "conditions of possibility" (*a priori*) for memory in media culture.[89] Central topics are therefore the governing principles behind the so-called "digital archive", the techno-numerical micro-drama of A/D-conversion as a concretisation of photofilm-like discretization of the present moment, and finally the algorithmic essence of digitisation as micro-archival operation resulting in data compression.

Different from the electronic video or television image which has been analog 625 line-by-line sampling of visual evidence split into half-frames within a time window of 25th of a second, cinematography has initially been most literally "photo-film" already: the chrono-photographical sampling of movement or objects with a 24 frames / sec. frequency. If the essence of cinematography on celluloid is understood in its time-discrete act of recording, it is not simply an old medium outdated by digital cinema, but re-appears as the core operation of digital sampling. "Sampling the archive" of the past may be understood as a way of creative artistic research and recollection, but ifsampling is used as a *terminus technicus* of digital recording, recent technologies are "archiving the present", first of all.

An intermediary level between the genre "photofilm" and operative sampling are experiments with the photographic form, such as Douglas Gordon's installation *24 hours Psycho* from 1993 which slows down Hitchcock's film classic *Psycho* from 24 frames/sec. to 2 frames/sec., resulting in a projection of 24 hours. A reverse version of photofilm is Hiroshi Sugimoto's classic long-time photographic exposure of classic movie theatre screens when finally all the projected images merge into one bright light - "an extreme condensation of time."[90] This reminds of a sonic equivalent, the "photosound" like performance of John Cage's composition for organ Organ²/ASLSP (As Slow as Possible) at Burchardi church in Halberstadt, Germany, where every tone lasts for years until the next key is dramatically struck. In synaesthetic consequence, the DVD "documentary" of the Halberstadt organ installation has been composed partly as "photofilm", partly chronophotographically.[91] Furthermore, there is Martin Reinhard's *tx-Transform* which implements the Slitscan recording technique reversing the time- and the space-axis (like an "explosion" diagram of a technical artefact)[92], and other technological or algorithmic explorations in cinematic time axis manipulation. But most radically, chrono-photographic sampling of the present moment returns within current digital signal processing itself.

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89 Michel Foucault, Archaeology of Knowledge, New York 1972

90 Mary Ann Doane, Has Time Become Space?, in: Liv Hausken (ed.), Thinking Media Aesthetics. Media Studies, Film Studies and the Arts, Frankfurt/M. et al. (Peter Lang) 2013, 89-108 (90)

91 Sabine Groschup / Georg Weckwerth (eds.), (JC{639})#1-89, including a DVD version of the experimental film (JC{639}) by Sabine Groschup (A 2006 / 2012), Künstleredition 2013

92 *tx-transform* is the title of a short film produced by Martin Reinhart with Virgil Widrich (35 mm, Austria 1998)

A real archive of movements: The *Encyclopaedia Cinematographica*

"Photofilm" deconstructs cinema back into its single frames and treats its elements as independent components. In that sense, photofilm is counter-balanced by the oxymoron of "photography of mouvement" which is cinematography in its most literal sense. At the Göttingen Institute for Scientific Film, between 1952-1994, on initiative by Gotthardt Wolf and ethologist Konrad Lorenz, the *Encyclopaedia Cinematographica* project has collected up to 4000 2-minute film samples (so-called *Bewegungspräparate*) of periodically repetitive expressions, mostly animal motion like birds on-the-fly, and occasional ethnologic ritual dance - which is a media-archaeological recursion of Muybridge's *Animal Locomotion* and Marey's chronophotography.[93] The filmic encyclopedy has been organised in a systematic matrix, intended to map the world of movements. Instead of sampling the film archives, film here, by samples of the moving world, results in an archive of motion. The depiction of movement is the true, media-archaeological message of cinematography. The recording into elementary so-called "cinematograms" gains coherence not from external (alphanumeric) metadata but from the sequence of "stilled movements" itself. The Encyclopaedia Cinematographica, while (mostly) being composed of animal locomotion, comprises non-organic physical "dance" as well: material mouvement performed by inanimate matter like the steam machine. With the machine rhythm, the film-mouvement becomes subject and object of cinematography itself.

Typographic temporality

Has "photofilm" in its aesthetics of apparently motionless image sequences realized what Henri Bergson has missed in early cinematography which is film itself as endurance, *durée*? Or is it a remediation of photography to film, a quality which Marshall McLuhan claimed for an appropriate "media ecology" where the new technologies do not discard with the old media but rather subtly displace them, while maintaining qualities and virtues of the preceding ones?[94]

The phonetic alphabet as cultural technique of speech-writing once "made possible the visual and uniform fragmentation of time. [...] In the space-time world of electric technology, the older mechanical time begins to feel unacceptable."[95] McLuhan affiliates cinematography to the Gutenberg era of mechanical print technology, in contrast to the "flying spot" of the cathode ray tube, with its beams of electrons with no real momentary fixation (except the Iconoscope capacitor mosaic for intermediary storage and amplification). In linear scan line video and television, there is no discrete "picture element" like in alphabetic writing or photo-based film, rather a volatile, transient electron bombardment. The subtitle of Otto von Bronk's German patent from 1902[96]

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93 Rudolf Geigy, Gedanken zur Schaffung einer Film-Enzyklopädie, in: Research Film, vol. 2, no 3 (1956), 145-150

94 See Baruch Gottlieb, Towards a Reasonable Ecology among the Media themselves, Den Haag (West) 2017

95 Marshall McLuhan, Understanding Media, New York (McGraw Hill) 1964, 147

96 DRP 155528 "Verfahren und Vorrichtung zum Fernsichtbarmachen von Bildern bzw. Gegenständen unter vorübergehender Auflösung der Bilder in

expresses the descriptive dilemma for that new form of media-temporal existence; the floating image is arrested into punctual stills. The inverse correlation to the "photofilm" is the hypothesis of so-called "picture elements" in electronic images indeed - an oxymoron which erraneously oscillates between the analog scan line video image and the digital pixel.

Geometrization of time

Film-artistic communicating and processing of archives is a personal, subversive reinterpretation of official documents, and is "concerned with the emergence of memories that result from the programmatic processing of photographic archival material, as well as the archaeological excavation of previously stored 'impressions'"[97]. But let us not be seduced by the archaeological metaphor. Any film-artistic working with(in) an archive is only phenomenologically "based on the experience of memory" (ibid.); in fact it is subject to the radically non-mnemonic logics of administration (the symbolic order) and the techn-logics of storage.

The field of media theory is split between two very different approaches to this photographic and cinematographic memory. While media archaeologists describe the nondiscursive practices of the techno-logical archive, media phenomenologists analyze how phenomena in various media affect the human cognitive apparatus, its mind and senses.[98] The media-archaeological understanding of the archive is biased by the technomathematical analysis (the techno-*studium*), not mistaking storage for memory or even remembrance. The phenomenological reading of the archive corresponds with the Barthesean *punctum* when miracolously something like an electric spark crosses and short-circuits the temporal gap between the record from the past and its present reading.

An encounter with the past as personal "unearthing" of various material at an official place of memory authority only in the human imagination consists of a "search for the lost time"[99]. The term *temps perdu* itself, even if is has the literary connotation of *A la recherche du temps perdu* nowadays, in fact has been borrowed by Marcel Proust from Hermann von Helmholtz' techno-physiological measuring of human nerve signal runtime and latency[100], which is time-critical, pre-cinematic nervous (re-)action in the subconscious. According to Bergson, the human act of memorization is kind of an inner cinematography; the philosopher criticized the chrono-photographic sampling of continuous movement as a "mathematic" delusion. This technical metaphor matches G. W. F. Hegel's

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parallele Punkreihen", granted June 12, 1902

97 As expressed in draft for the conference *Photofilm: Sampling the Archives* Samstag, November 18, 2017, at Open Society Archive, Budapest, 14th VERZIO Human Rights Documentary Festival

98 Kjetil Jakobsen, Anarchival Society, in: Eivind Røssaak (ed.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010, 127-154 (141)

99 *Photofilm* conference draft

100 See Henning Schmidgen, Die Helmholtz-Kurven. Auf der Spur der verlorenen Zeit, Berlin (Merve) 2009

concept of cold mechanic memory as opposed to remembrance as subjective interiorization, literally expressed in the German term "Er-Innerung". While photography geometricizes the temporal moment into two-dimensional space, chrono-photographical recording, just like digital signal processing, mathematizes movement itself indeed.

Sampling the archive

The photographic image saves the volatile present moment from passing away, for future memory. The momentary recording exempts the present moment from disappearance, resulting in negentropic storage; on the other hand, such a recording is itself subject to entropic time at work: material decay and technical obsolescence. Once digitized, the speed of access and migration of photographic data increases, realligning the past to the present. Is photography and the cinematographic film from the past, once translated into pixels, still an archival medium at all? Conventional film reel or videotape extraction in archives of moving images did not grip on the single frames (like in post-production editing tools like the Steenbeck or the AVID), but on the whole reel tape, the storage medium only - entering the archive, but not accessing its smallest elements which are called *stocheia* in ancient Greek, the name for both physical atoms and alphabetic letters or mathematical numbers.

The primordial archival act, in fact, *is* sampling already, discretely filtering the (administrative) present, as symbolic ordering: discrete alphabetic notation, different from mechanical and electronic signal recording by the kymograph, magnetic recording and wireless transmission of audio or video). But with(in) computing, the symbolic order or the archive returns, with a decisive, literally time-critical difference: discreteness is introduced by clocking. In such a perspective, the archive is not about the past at all. "Storage is just a slowed-down transmission of an event - like the "freeze frame" in cinematography.[101] Archival stillness and processual media time are interlaced.[102]

Frequency rate 24: chronophotographic sampling

As long as there has been celluloid-based cinematography, every film has been "photofilm" in the most literate sense. When it is not subjected to narrative emplotment, chronophotography results in the "statistic image" (Abraham Moles), which is rather diagrammatical than iconic. Marey decomposed movement into a multiplicity of equal and discrete units[103], while for Bergson, chronophotography are images not of movement through time, but of position and succession[104]. In its epoque, the chronophotograpical frame series has been perceived as a "true" representation of moving life; the cognitive

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101 See Stefanie Diekmann / Winfried Gerling, Freeze Frames. Zum Verhältnis von Fotografie und Film, Bielefeld (transcript) 2010
102 See David Green / Joanna Lowry (eds.), Stillness and Time. Photography and the Moving Image, Manchester (Cornerhouse) 2006
103 Martha Braun, Picturing Time. The Work of Etinne-Jules Marey (1830-1904), University of Chicago Press, Chicago / London 1992, 277
104 Braun 1992: 280

apparatus quickly adapted to the cinematographic frequencies of the technical time axis.

The edited diary of Johann Wolfgang von Goethe is still patterned by the symbolic day-by-day rhythm[105], while in cinematography, the 24 hour frequency implodes into seconds. A 90 minute film contains around 130000 single frames. With its frequency rate of 24 frames / sec., each single frame is optically visible to human perception for a temporal micro-interval (Delta-*t*) of roughly 0,4 seconds. The kinematographic frequency performs a micro-differential form of "photofilm" already. This sublimely differs from the alternating current network of 50 hz which used to drive analog electronic television and video image timing (the interlacing frame rate in Europe); from such time-critical asymmetries in machine time result subliminal, rather unconscious irritations of human time consciousness. Machine time itself is irritated by asynchony in its hardwired and softcoded temporality; the difference to the US-American video frame rate of 60 cycles / sec. requires temporal translation by the Timebase Corrector.

In Salcher's and Mach's ballistic photography, the aim to catch a projectile on the fly required ultra-short momentum photography - actually positivizing Zenon's arrow paradox, achieved by short-circuited electric sparks both for illumination and triggering the photographic camera.[106] Nowadays, Femto-photography is "computational photography", coupled with realtime analysis of the present moment. With a frequency of 1 billion / sec., the elementary event of what is called "light" (the photonic emission itself) has been registered and can now be identified in "slow motion", folding the term "chrono-photography" upon itself.

Different tempor(e)alities in digital culture - a micro-archival regime

As technical media event (the intermittant celluloid transport) there has been the "moving still" always already, of which the experimental sub-genre of the "photo film" is a secondary re-entry on the media-dramaturgical level. The 16mm and 35mm film frame in traditional cinema relates to the pixelised new media imagery indeed. Digital culture, when analyzed from the perspective of storage theory, is a set of "moving still". This correspnds with contemporary digitally computed images, since the digital computer in its von-Neumann-architecture can not but perform one step at a time. In contrast to the discrete frame mechanism of the cinematographical apparatus, analogue signal recording media like electronic video registers even stillness by "moving" scan lines which is the physical nature of the time-signal. Remember the anlog video "still": When striking the video recorder "pause" key, the resulting "still image" still flickered, since the cathode ray tube had to re-write it again and again. Mechanical cinematography belonged to the "digital" regime already while analog signal recording (like the phonograph) came inbetween - which leads to

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105 Robert Steiger, Goethes Leben von Tag zu Tag, vol. 1: 1749-1775, Zurich / Munich (Artemis) 1982

106 See Peter Berz, Mach I, in: Christoph Hoffmann / ders. (Hg.), Über Schall. Experiment und Medium in Ernst Machs und Peter Salchers Geschoßfotografie, Göttingen 2001, 372-451

a configuration of media which is different from any linear history of technologies. Digital sampling reconnects to chronophotographic film, by-passing the line-based electronic CRT image.

The immediate technical recording of the present has been a phenomenon of media culture since the shrinking exposure times of classical photography and cinematography, before electro-magnetic waves were applied to transmit signals with the speed of light. But different from "live" transmission in analog electronic radio and television, digital communication happens in "realtime" which suggests instantaneity but - when viewed under a time lense - is a process of constant micro-archiving of data for further processing. Whereas analog electronic broadcast media like radio and television have been "live" indeed in terms of electro-magnetic signal transmission, digital data processing is "archival" per definition: it takes intermediary computation. "Should the record-based approach to the archive be replaced by the functional approach in terms of algorithmic processing?"[107] Digital media culture is an archival structure - though a micro-archival one, the "algorithmic archive". With digital culture, for the first time, we are really living in an archive culture - not in its institutional cultural memory sense but in terms of micro-archiving procedures which dominate digital data processing.

The *moving still*

Like the photographic film already, but more radically, digital images are never transmitted "live". With CCD chip based digital photography, in the microprocessor memory the image desintegrates into single lines which are attributed with individual numerical addresses; thereby the rendering of a still image - this time different from flickering video electronic image - as well as nonlinear forward and backward search can be achieved if not live, but in computational realtime.[108]

There has been 'Slow-Motion' and 'Fast-Motion' almost co-originary with the mechanization of cinematography itself. The digital difference, though, is in its mathematization, becoming an intelligent micro-archive. Random access to stored data is a key quality of digital media indeed; any storage can be adressed almost equally fast.[109] While celluloid film samples time but still preserves its linear ordering on the micro-level, digital media abondon with the human-centered phenomenology of temporal sequence, to put time fully under algorithmic control, transforming time into space, mapping the one-dimensional time signal into a multi-dimensional matrix.

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107 Arnoud Glaudemans / Jacco Verburgt, The Archival Transition from Analogue to Digital: Revisiting Derrida and Flusser, in: Frans Smit / Arnoud Glaudemans / Rienk Jonker (eds.), Archives in Liquid Times, 's-Gravenhage (Stichting Archiefpublicaties) 2017, 121-137 (135)
108 See Johannes Webers, Handbuch der Film- und Videotechnik. Die Aufnahme, Speicherung, Bearbeitung und Wiedergabe audio-visueller Programme, Munich (Franzis) 1991, chap. 1.3 "Abtaster mit Halbleiter-Zeilensensoren", 561
109 See Lev Manovich, The language of the New Media, Cambridge, Mass. (MIT Press) 2001

Even if the digital computer was not born from time-discrete cinematography, a Turing Machine, when supplied with a perforated tape for forwarding the program data punched into that tape, looks like a film projector mechanism - with the difference that the tape can not only be read in ony direction, but can be rewritten by moving in both directions.[110] The Turing machine diagram reminds of the typewriter as well, with its rhythm controlled by a clock mechanism. All such highly differentiating machines arise from one overarching epitemic dispositive which is time-discrete data processing.

While for Roland Barthes photography has been a message without code, the digital image consists of coded units entirely. With image-creating apparatuses like tablets and smartphones, the metaphor of photo or film is already an aesthetic anachronism, a retro-nostalgia where the content of the new medium is the older one for "remediation".[111] The deeper media-epistemological truth is the always already discrete essence of both chronophotogratography and digital media. In an unexpected techno-logical (rather than evolutionary or "historic") recursion, the digital image returns to the time-discrete mechanics of cinematography. Cinema had prepared for digital media since it has already been based on sampling the present moment, or rather: movement, which in Aristotle's definition generates the notion of "time" by discrete counting in numbers "between the before and the after".

Decisively different from the electronic video and television image in analog signal tranduction, the so-called "pixel" again provides for an elementary unit in digital *imaging* indeed. Even if it still contains a minimum amount of electric energy (voltage), different from the high-voltage produced cathode ray, its significance is not in its energy any more (apart from its secondary effect of light emission by LED) but a micro-embodiment of information as defined by cybernetic communication theory (Wiener / Shannon). When single photographic frames are digitally sampled, "photofilm" escalates from the humanly perceived screen event into technology itself.

Media artist Angela Bulloch took a film sequence of Michelangelo Antonioni´s film *Blow up* (1966) - where the closer the camera looks, the less is the apparent murder an evidence. Bulloch enlarged its digital scan in great blocks of its single pixels[112] - a desillusion of the image betrayal of the human eye, reavealing the scanner-gaze of the computer which is media-archaeological, looking at a different kind of film archive. Pixelization is the radical up-dating of "photofilm". Bulloch's digital sampling of Antonioni's film *Zabriskie Point* (one frame / sec., instead of 24 in mechanical projection) not only slows down the projection of its single image pixels, but enlarges them to 50 x 50 cm shining

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110 Alan Turing, On Computable Numbers, with an Application to the Entscheidungsproblem, in: Proceedings of the London Mathematical Society (2), vol. 42 (1937), 230-265; see as well Lev Manovich, Cinema and Digital Media in: Hans Peter Schwarz / Jeffrey Shaw (eds.), Perspectives of Media Art, Ostfildern (Cantz) 1996, 42-48

111 See Jay David Bolter / Richard Grusin, Remediation. Understanding New Media, Cambridge, Mass. / London (MIT Press) 1999

112 Installation *Blow_Up T.V.* by Angela Bulloch, gallery Schipper & Krome, Berlin, Oktober / November 2000

cubes, like an archival monument of the units of sampling and a media-archaeological reminder of what actually happens within a CCD chip in digital photography and video.[113]

It requires media archaeological aesthetics for an *analytic* "close reading" of high-speed media processes, by freezing the motion, slowing it down, and enlarging the single frames. This is *archaizing* in the spatial & temporal sense, reducing movement to its smallest units. Konrad Zuse's first programmable binary computer Z1 has been driven by hand crank, thereby calculating with cycles of 4 Hz. Close to the transport mechanism of a film camera; in fact, Zuse later, for his improved Z3 computer, applied punched celluloid film from discarded cinema rolls for program instruction input: a re-entry of the conceptual discreteness from within the materiality of film storage medium itself; with the rhythm of the time-discrete, escapement-driven clock-work.

Digital no-time

In the world of the digital, physical entropy (which gives time its direction) is replaced by informational entropy. At least in principle (as mathematical "theory" of communication), the digital image does not degrade by copying, while silver-based photography is subject to such degradation.[114] Rodowick criticizes the digital image for its inability to convey a sense of passing time or pastness. The digital "image" is just a function of numerical symbols, not iconic in the sense of photo-chemical impressions at all[115], resulting in counting with numerical differences (*zählen*) rather than symbolical narratives (*erzählen*). In return, this allows for sampling the digital archive by similarity-based image matching. In algorithmic space, not only every film sequence, but every still in a film, even more: every pixel in a film frame can be discretely addressed, no longer subject titles reduce images to words, but alphanumerical source code refers to alphanumerical numbers. The archive transforms into a mathematically defined space; genuinely image-based image retrieval generates an archive beyond iconologicial semantics.[116]

Turning movement into a techno-mathematical archive: MPEG

"Photofilm" is a sequence of repetitive stills, arranged in a poetic order, metadated by narrative text or voice-over into drama, its single *Einstellung* consists of identical photographic frames which are redundant in terms of communication theory - which is the reverse ratio of digital video compression by interframe coding. "In the compression algorithm of a digital image, only

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113 Angela Bulloch's exhibition *Z Point* at Kunsthalle Glarus (Switzerland), September / November 2001, curated by Beatrix Ruf
114 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
115 D. N. Rodowick, The Virtual Life of Film, Cambridge, MA (Harvard UP) 2007
116 See W. E. / Stefan Heidenreich / Ute Holl (Hg.), Suchbilder. Visuelle Kultur zwischen Algorithmen und Archiven, Berlin (Kulturverlag Kadmos) 2003

what changes in the shot is renewed."[117] Digital video compression as basis for *streaming images* is sublimely based on algorithmic operations, resulting in a qualitative reduction of movement into mathematical vectors. 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, dividing each frame into small blocks of pixels in order to analyze changes from one frame to the next. Therby, the elementary unit of photofilm is deconstructed into the sub-frame segment. 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.[118] In such a delicate operation based on micro-temporal events; only parts and sections of the image are updated at a temporal moment. The conventional film frame is not simply transsubstantiated by digitization; it is numericized and thus becomes accessible for computation, making explicit operative reality of Bergson's critique of the implicit mathematicity of discrete chrono-photographic image sequences. At that moment, photofilm has imploded into micro-archival action.

ARCHIVAL METAHISTORY AND INHUMAN MEMORY

The relation between the topic of "Arctic memory" to the institutional archive and especially technological storage is more than just a metaphorical one. Within a society increasingly dominated by storage practices, cultural memory itself "cools" down. The very definition of "information" itself is closely linked to mathematics which has been developed in physical thermodynamics. Therefore the current interest in the "Arctic discourse" turns out to be a symptom of current media culture itself.

"Archives" of the Arctic and the metaphorical risk

There are geological times and clima changes on the one side and cold technological storage on the other. Both temporalities have one common denominator: They challenge what is familiar in cultural knowledge as "historical time".

The attractive figurative surface of the conference topic *Archives of the Arctic. Ice, Entropy and Memory* immediately triggers academic, cultural and artistic imagination. But behind there lurks a challenge on the epistemic ground level: Is it possible to keep a reasonable balance between the discursive effects induced by the Artic ice as metaphor and a precise discussion of terms like

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117 Babette Mangolte, Afterwards: A Matter of Time, in: Richard Allen / Malcolm Turvey (eds.), Camera Obscura, Camera Lucida, Amsterdam (AUP) 2003, 261-275 (264)

118 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 (316 f.)

archive, memory, (neg-)entropy and storage, or is it rather advisable to keep both ways of analysis strictly distinct?

Ice is a frequently used metaphor for the archive indeed, both popular and artistic as well as in the scientific imagination. But in terms of archival science, there could be no natural archives since the criterium of purposeful selection is lacking. Geological and thermodynamic time dramatically differ from symbolically organized time.

How to resist extending the term "archive" to all kinds of metaphorical denomination of memory forms? The archive is a symbolical, cultural, thus (in Vilém Flusser's terminology) a "negentropic" form of memory organization, different from physical "recording".

A tactical answer to the metaphorical challenge is to take the ancient Greek sense of *metaphorein* in its media-archaeological sense: long-time *transmission* by ice memory. The Artic ice is literally "metaphorical" in that it carries frozen states into a different time. But different from cultural "tradition", this transmission is non-intentional.

A physical "memory" of energetic processes ("Materialgedächtnis") is not an archive since it is not inscribed into and by the symbolical regime. The memory of the past, metaphorically "frozen" in archival records, traditionally used to be de-freezed by historians turning this *cool* classified memory into *hot* historical imagination expressed in historiographical stories.[119]

Today, the traditional extremes of long-time storage (or even memory for eternity) for which the Arctic ice serves as a metaphor, and short-time memory (within the perceptual "window of presence" within the human brain and in computing CPUs) for which electricity serves as an index in McLuhan's media theory, merge into one. When the temporal economy of recall becomes time-critical itself, streaming media and storage become increasingly intertwined.[120]

Storage is just a slowed-down event - like the "freeze frame" in cinematography[121]. Archival stillness and processual media time are interlaced.[122]

"Arctic Discourses": De-freezing the archive and delayed transfer

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119 According to McLuhan, "cold" media demand active participation and interpolation by human senses as opposed to high-definition signals which "heat" a singel human sense: Marshall McLuhan, Understanding Media, New York (McGraw Hill) 1964, chapter 2

120 See Wendy Hui Kyong Chun, Programmed vision. Software and Memory, Cambridge, Mass. / London (MIT Press) 2011

121 See Stefanie Diekmann / Winfried Gerling, Freeze Frames. Zum Verhältnis von Fotografie und Film, Bielefeld (transcript) 2010. See as well Gusztáv Hámos / Katja Pratschke / Thomas Tode (eds.), Viva Fotofilm. bewegt/unbewegt, Marburg (Schüren) 2010

122 See David Green / Joanna Lowry (eds.), Stillness and Time. Photography and the Moving Image, Manchester (Cornerhouse) 2006

The climate change as induced by the industrial warming of the earth, resulting in melting (ant)arctic ice, serves as a macro-physical analogy to the heating up of communication in Internet real-time, time-flow, water instead of ice, short-term intermediary memories instead of the eternal archive.

Imagine Alpine mountains in early springtime. While the sun already starts to warm the wanderer, snow and ice on the ground still resists. It takes until actual summer to see this finally melt away. Eveidently ice is less a metaphor for eternal memory than for delay: rather an equivalent to the electric condenser than to the archive. The time-critical counterpart of the archival long-time preservation memory is condensed time in frozen ice indeed. With frozen water, instead of archival endurance, we confront what Wendy Chun in terms of dynamic computer memories calls "the enduring ephemeral"[123].

Delayed energy storage, in Norway, are artificial lakes on top of the mountains, with their water flow to be released in times of energy shortage; the Δt itself is the symbolical notation (and shape) of an ice-berg. "Delay", as well known from early computer "memories", names the variable, scalable temporal interval replacing the emphatic notions of eternal memory.[124]

Rocky fields: on "metahistory"

If the Arctic ice does not represent an archive in its proper sense, does it rather embody a kind of involontary memory of "anonymous" history in terms of Siegfried Giedion?

Let me here introduce the term *metahistory* as the supra-time-critical transcendence of historical, man-made time. My use of the term archival "metahistory" differs from Hayden White's notorious definition of *Metahistory* (1973)[125] as the forms of rhetorical prefiguration in emplotments of past events which transform the tectonics the of archival storage into narrative.

The historian of economics Friedrich von Gottl-Ottlilienfeld, in his lecture at the German Historians convention in Heidelberg 1903 on "The limits of history" (*Die Grenzen der Geschichte*), reserves the term *Metahistorie* for temporalities in the natural sciences as opposed to "historical" time in the humanities.[126] For illustration, Gottl-Ottlilienfeld describes geological formations in the Odenwald

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123 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

124 See T. Kite Sharpless, Mercury delay lines as a memory unit, in: Proceedings of a Symposium on Large-Scale Calculating Maschinery, Cambridge, Mass. (Harvard University Press) 1948, 103-109

125 Hayden White, Metahistory. The Historical Imagination in Nineteenth-Century Europe, Baltimore / London (Johns Hopkins University Press) 1973

126 Reprinted in: Friedrich von Gottl-Ottlilienfeld, Wirtschaft als Leben. Eine Sammlung erkenntniskritischer Arbeiten, Jena (Gustav Fischer) 1925, 337-379 (420). I owe this reference to Ferdinand Fellmann.

region of South-West Germany analog to the arctic formation. Two temporalities have been at work here, the macro-geological and the cultural-historical.

While the geological formations dissolved into a field of dissipated rocks (the "Felsenmeer" close to the city of Reichenbach) and represent macro-temporal physical entropy (the tendency to equally distributed disorder), the remains of ancient Roman carvings out of these rocks are traces of history, of neg-entropic, in-formative (Flusser) energy invested against the physical evolution ("historical" time).

To the present specator, though, the macro-dimensional and the historical time dimension aesthetially merge into one, since in many cases it is undecidable whether marks on or in the rocks have been the result of physical decay or or ancient Roman carvings.

As opposed to bare material memory, how to decipher symbolically "encoded" past if the hermeutical cue ("code") is not known?

Sometimes it is difficult to separate naturally distributed rocks from a ruined human setting. The cognitively learned macro-temporal dimension is affectively perceived as condensed time.

Conventional philosophy of history differentiates between geological and historical time as *epoché*. In the case of the field of rocks which at the same time served as stone quarry both temporalities suddenly appear undistinguishable.

Entropic time can not be grasped by historical imagination and is only symbolically accessible through Ludwig Boltzmann's formula which is engraved on this tomb stone at the Vienna Südfriedhof. Such a reading of thermodynamic entropy explicitely "compares with C. E. Shannon's discussion of telecommunication which can be examplified this way: information is being coded as a telegram which in transmission creates negentropy in the cable. When the electric pulses are received, information can be retrieved.[127]

This equals the formula for emphatic cultural tradition indeed: alphabetically coded information is sent by the institutional archive to be decoded by historians and transformed into narrative (historiography).

(Ant-)Arctic data clouds

Media archaeology looks at the circumpolar area in terms of information theory. Any symbolic transformation of entropic physical states into information is negentropic itself, oscillating between physical and informational entropy. Roald Amundsen's cartographer during the first crossing of the Northwest-passage, Godfred Hansen, described the polar explorer's erected stone look-outs as "[...]

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127 See L. Brillouin, Maxwell's Demon Cannot Operate. Information and Entropy, in: Journal of Applied Physics, vol. 22, no. 3 / 1951, 334-337 (335). I owe this reference to Matthias Wannhoff, Media Studies, Humboldt University, Berlin

his journey's traces against time's erosion, [...] when his name is gone as the melting snow."[128] In its interactive virtual environment *Dialogue with the Knowbotic South* (1994)[129] the media art collective Knowbotic Research (KR+cF) devised a model of a computer aided Antarctica based upon the available computer-processed information on current antarctic research as it appears in public data networks. Apparently the Antarctic as informational space actually happens outside the Antarctis, as artificial nature in data representations of measuring and sensoring instruments covering this area and procuding, every second, a stream, a flood of data (like satellite vision or US-American NSA data surveillance within the PRISM program). These data can be grasped and administrated by articial intelligence only (learning algorithms, so-called knowbots) in computer networks. These agents create objects out of the flood of information.[130] The data resulting from material measuring have no deep semantic meaning themselves but rather equal the Wiener / Shannon definitions of information through communication channels. Data clouds here replace cultural narratives - like Iannis Xenakis' stochastic compositions for music.

When the physicist makes an observation, he hyper-ecologically transforms negative entropy into information which nature never produced beforehand. The terms of thermodynamics are the only non-metaphorical language (and mathematical symbolism) to link "Arctic memory" with the archive and with storage media.

Archival emergency and the cold archaeological gaze: *Quick freeze*

In media archives films rolls are frozen down in order to withstand time. The vocabulary of storage media is significantly dominated by the language of temperature indeed. In administrative and mass media terms, "quick freeeze" - a term taken from preservation of nutrition (*Schockfrosten*) is a preservation order, an administrative *Speicheranordnung* to prevent the almost immediate erasure of telecommuncation data in companies just in case there is need to de-freeze them for legal investigation - the suspended interval. Thus the icy freeze is not just about long-time memory but a time-critical short-time-memory technology as well.

In the United States there is a huge image archive permanently located in the Iron Mountain, Pennsylvania.[131] The Corbis Corporation there keeps the physical photographs and negatives of which it commercializes their digital distribution

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128 Godfred Hansen, Mod Kung Haakon VII's Land, in: Nordvestpassagen, Roald Amundsen, Kristiania (Aschehoug) 1907, 488, as quoted in: Hanna Eglinger, "Traces against Time's Erosion": The Polar Explorer between Documentation and Projection, in: Ryall et al. (eds.) 2010, 2-18 (8)
129 For a curated documentation see http://www.medienkunstnetz.de/werke/dialogue-with-the-knowbotic-south (accessed September 2013); for a video documentation see http://www.youtube.com/watch?v=dJ3ZbD5uGkE (accessed September 2013)
130 For a report on the digital installation of *Dialogue with the Knowbotic South* in Kunstraum Wien see Arnd Wesemann, Datenschwärme aus der Antarktis, in: Frankfurter Rundschau, 2nd September 1995

and rights. In the cold technical language *memory* is nothing but a metaphor for storage which is not about remembrance but simply a numerical function of logistical addresses. The archive is a mnemonic agency in a technological sense, while remembrance is a human (if not social) bias which drives record traces from beyond the archive.

In technical terms, "cold storage" means signal or data storage (such as Flash Memory) at the lowest possible expense of electric energy.[132] MO I RANA is the cold location of the memory-technological branch of the National Library of Norway in the far North - embedded within a mountain, cold storage here serves for audiovisual media storage as opposed to the culturally "hot" spot of the printed books library in the center of Oslo.

Practically speaking storing digital data carriers in ultra-low temperatures (be it a refrigerator or an iceberg) exponentially increases the probability for undamaged preservation; "arctic" digital memory.

But just like in the case of the Corbis image agency, which stores its photographic originals within a mine operated by the Iron Mountain/National Underground Storage company, the resistance to climactic change, earthquakes and other physical or man-made accidents is paid for by unaccessability. Physical memory becomes literally remote. For research, the user is directed to the Corbis *digital* archive; instead of analogue photographies from the past, the researcher is presented with their information. „Analog is having a burial and digital is dancing on its grave."[133]

Frozen sound

It is the technomathematical condition of our media culture which triggers our metaphorical interest immediately once the Arctic subject is named - "cold" in terms of hardware and of mathematics which requires a research method associated with Friedrich Nietzsche's "passion of distance"[134].

The "frozen" corresponds with the techno-mathematical approach such as the electronic synthesis of the human voice. Among others with parallel approaches, Boris Yankovsky in Moscow in the 1930s developed a method of computing the human voice which treats the sound matter in a fully formal approach: a combination of a mathematical model of the synthetic tone ("syntone") and its implementation in a processing mechanism (Yankovsky's Vibroexponator). "To synthesize the human voice singing a vowel, one would need to choose several templates related to formants [...], to add extra

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131 See Jorinde Seijdel, Cold Storage, in: Open 2004, no. 7 "(No)Memory", 66-77

132 See Cade Metz, Facebook Wants New Breed of Flash Memory for Storing Old Pics, in: Wired (June 17, 2013); *online* www.wired.com/wiredenterprise/2013/01/facebook-cold-storage (accessed September 2013)

133 Commentary by Sarah Boxer in the New York Times, April 15, 2001

134 "Pathos der Distanz", as expressed in Friedrich Nietzsche, Jenseits von Gut und Böse, Leipzig (Naumann) 1886, § 257, 227

templates as needed [...], to recalculate their sizes according to the desirable frequencies and intensities of formants, and then to mix them. The final waveform would sound like a 'frozen' vowel", as described by Andrei Smirnov.[135] "Frozen" - aha. But caution, soon we are trapped by the metaphorical risk again.

"The phonograph as media artifact not only carries cultural meanings like words and music but is at the same time an archive of cultural engineering by its very material fabrication - a kind of frozen media knowledge that - in a media archaeological sense - is waiting to be unfrozen, liquefied.

Digital archaeology operates both below and beyond the sensual or even cognitive thresholds of sight and sound - a level that is not directly accessible to human senses because of its sheer electronic and calculating speed. Synesthetically, we might see a spectro-graphic image of a tiny section of previously recorded sound memory - a straight look into the real media archive. The microphysical close reading of sound, where the materiality of the recording medium itself becomes poetical, dissolves any semantically meaningful archival unit into discrete blocks of micro-sound. Instead of applying musicological hermeneutics, the media archaeologist suppresses the passion to hallucinate "life" when he listens to recorded voices.

"The idea of 'cool' and now 'frozen' actually becomes a figure for the way in which media as time machines 'package' sense data in order to endure time. It plays with the idea of the traditional task of heritage, storage, and preservation of freezing time and dynamics of life"[136] in terms of technical media.

Ice-cold video memory (Nomi)

Phonographically recorded signal memory defreezes once it is being re-played by an appropriate record player.

One step further is the technological de-freezing of electromagnetic latency, which is audio and video recordings on magnetic tape. In Henry Purcell's opera *King Arthur* the de-freezing of the "Cold Genius" figures prominently with its repeated *staccato* outcry "Let me freeze again to death." This drama has been re-encacted by the singer Klaus Nomi.

While the melting of ice is part of physical entropy, the video recording of Nomi's performance shortly before his death caused by the AIDS virus is a suspense of decay as media archive, a technical negentropy as long as the tape can be actually re-played on available hardware.

According to Norbert Wiener, "the time in which we live has an obvious direction and cannot be reversed without the production of effects which are

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135 Andrey Smirnov, Sound in Z. Experiments in Sound and Electronic Music in early 20th Century Russia, London (Koenig Books) 2013, 215

136 Jussi Parikka, Archival Media Theory: An Introduction to Wolfgang Ernst's Media Archaeology, in: W. E., Digital Memory and the Archive, edited by Jussi Parikka, Minneapolis / London (Univ. of Minnesota Press) 2013, 1-21 (12)

more than paradoxical"[137] - like the video-recording of Nomi's *Cold Song*. Such a recording preserves an icy memory of the Nomi song. The *staccato*-like articulation "Let - me - freeze - again - to death" is the semantic message of the recording technology itself. The tentative de-freezing of Winter ice here takes place step-wise (frame by frame) like the stop-motion essence of chrono-photography and cinematography itself does to any recorded life movement. Nomi looks very much alive with his eye movements, but what we are looking at an iceberg of electro-magnetic signals. The older the analog tape gets, the more it entropically dissolves into equally distributed dots on the video monitor. De-freezing death is still undead here.[138] Phonographic audio recordings might actually be created not on vinyl, but on ice. The sound literally melts away, returning to its originary fugitive tempor(e)ality.

Freezing Streaming Media

Digital media culture itself de-metaphorizes expressions like "cold memory". The hot data trading in the WWW and the "social web" takes place (Derrida's "archival fever") very literally, since all data processing requires thermic cooling of the micro-processors. An example is the economic transition of the North-Swedish town Lülleor from previous steel industry to Information Technology; the Facebook provider installs a server farm for cloud computing. Here, the shift of emphasis from materiality and energy to information is not only true in Norbert Wiener's sense, but economically as well. The data in Face Book are being "mirrored" two to three times, for security reasons (which is creating data redundancy). What is it that makes icy conditions attractive for the digital "ice" age? The energy and cold water supply for such a data center equals the previous needs of industrial steel factories; on a global level, two percent of energy consumption is actually due to computing.

Arctic conditions for signal and data storage

The "cold" Arctic memory metaphor is close to non-metaphorical storage technologies, but it takes the language and knowledge of thermodynamics and its derivative information theory to analysze this alliance and that the media-archaeological gaze it the appropriate method to cope with that constellation.

In terms of archives of the moving image, it takes hours to dehydrate stored film material. Here, the archive is not a metaphor for icy memory, but the Arctic becomes a denominator for "cold" media memory itself. In fact, freezing slows down entropic degradation. Information is not completely independent of temperature when it comes to digital storage; for the storage of 1 Bit a minimal energy is necessary. In a refrigerator at around 10 degree Celsius the data endurance of a typical flash memory (like a USB stick) is secure for thousands of years.[139] Does the NSA, for example, thus demand artificial Artic glaciers to

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137 Norbert Wiener, Time, Communication, and the Nervous System, in: Annals of the New York Academy of Sciences, Bd. 50, 1948/50, 197-219 (198)

138 See http://www.youtube.com/watch?v=wQrqgSK8-XU (accessed September 2013)

139 As optimistically articulated in: Chip no. 5 (2012), 128

secure their data avalanche created by spying programs like PRISM? But in millenia ahead, the heating of the refigerator will have increased the earth's negentropy to a deathening degree - Maxwell's demon maximized to the "max". But in millenia, no being will be able to decipher a frozen electrostatic storage unit as a symbolical bit. In order to teach the reading code to future non-humans, a media archaeologist will first have to be frozen into Artic ice as well - maybe the author of this text.

TIME, TEMPERATURE, AND ITS INFORMATIONAL TURN. De-metaphorizing "temperature" in / as times of information media

De-metaphorizing "temperature" in / as times of information media

Biased by the desire to de-metaphorize the notion of temperature when applied to contemporary digital culture, the media archaeological focus is on the term *entropy* as much as on the relation between cold storage ("thermal" objects) and hot data processing ("thermal" events).

Against the current discourse on "media ecology", let us analytically keep apart: There is temperature as infrastructural or environmental challenge (increasing heat within micro-processors, as well as energy costs for computing power); still, the core operations of binary information processing is *not* a matter of energy, but an understanding of "temperature" turned upside down: not physical thermodynamics (Boltzmann entropy), but informational Shannon entropy.

"Entropy" has been the measure unit of the second law of thermodynamics in physics which declares that the energy disorder of any closed system tends to increase and points to an uniform equilibrium, providing the metaphysics of an "arrow of time" with a scientific ground: everything decays, since heat tends to irradiate and dissipate. For a communication media source one can say just what one would also say of a thermodynamic ensemble: When this situation is highly organized, it is not characterized by a large degree of randomness or of choice - "that is to say, the information (or the entropy) is low."[140]

According to Michel Serres in *Hermes IV* , humans are immersed in "thermic noise"[141], while in technological media, thermic metaphors turn into processual materialities. Protagonist of cybernetical aesthetics Max Bense's radio play from 1968 *Der Monolog der Terry Jo*, starts from "thermal" noise: from entropic distribution of alphabetic letters, a computer successively generates character sequences which approximate human speech.[142] The actual case is a women

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140 Warren Weaver, Recent contributions to the Mathematical Theory of Communication (*1949), in: Claude E. Shannon / idem, The Mathematical Theory of Communication, Urbana / Chicago (University of Illinois Press) 1963, 1-28 (13). In fact, nowadays thermic heat elements are used within digital computers as source of true (instead of pseudo) random numbers.
141 Michel Serres, Der Ursprung der Sprache, in: idem, Hermes IV. Verteilung, Berlin (Merve) 1993, 278
142 Max Bense / Ludwig Harig, Der Monolog der Terry Jo (1968), in: Neue Hörspiel Texte / Partituren, ed. Klaus Schöning, Frankfurt/M. 1969, 57-91. See

found in a boat after a "thermal" catastrophy: a ship naufragy at the beach of Florida: Terry Jo is unconsciously, but continuously uttering meaningless speech. Once language is identified as a stochastic process, Markov chains can start to synthesize the symbolic order of "the human" artificial language.

a) From thermic time to informational value: Entropy between physical "medium" and techno-logical "media"

Boltzmann entropy and / or Shannon entropy

"Entropy" in transmission itself is not related to the physical temperature but to discrete sequences of impulses coded as zeros and ones. When Norbert Wiener proposed the very term "entropy" as measure of the mean probability of statistical binary decisions (bits), thereby correlating communication theory with thermodynamics, his student Shannon turned the term upside down. It is obviously from thermodynamics that Shannon borrowed the term of informational "entropy", which is central in his *Mathematical Theory of Communication* and until today, still is the condition of possibility for all "digital" communication media.

In the beginning, there was a demon, transforming the irreversibility of thermic time into informational atemporality. Nineteenth century physics, obscured by the clouds of industrial coal smoke, discovered the one-directedness of physical time. But even the actively informational observation by James Clerk Maxwell's "demon" is energy consuming.[143] Boltzmann entropy defines how distant a *physical* system is from thermodynamic equi-balance, while Shannon entropy in *communication* engineering defines how many bit-decisions, in the statistic average, are required for the recognition of a single character from a (limited) alphabet on the sender side. Here, the very term "entropy" oscillates between physical "medium" and techno-logical "media". In statistical "thermic" distribution over time, spatiotemporal islands against the tendency towards "heat death" emerge. In contrast to the law of increasing thermodynamic entropy, this occasionally is called "negentropic".

Electronic "temperature": the thermionic tube

According to Wiener's *Cybernetics* (1948), the essence of binary information is neither matter nor engergy which differentiates computation from energy-transforming machines in the 19th century. But the *actual* turingmaschine embodies both. Information is a specific measure of probabilities (where "low probability means negentropy"[144]), conceptualized in the *bit* and electronically embodied first in flip-flop circuits by means of cross-related thermionic tubes.

Bernhard Siegert, entry "Kulturtechnik", in: Harun Maye / Leander Scholz (eds.), Einführung in die Kulturwissenschaft, Paderborn 2011, 95-118 (112 f.)

143 Leo Szilard, Über die Entropieverminderung in einem themodynamischen System bei Eingriffen intelligenter Wesen, in: Zeitschrift für Physik, Bd. 53, Heft 11/12 (1929), 840-856

144 Leon Brillouin, Maxwell's Demon Cannot Operate: Information and Entropy, in: Journal of Applied Physics vol. 22 (1951), 334-337 (337)

By its electronic clouds, communicational Shannon entropy is enabled from within the physical vacuum as thermal Boltzmann entropy. Temperature becomes non-metaphoric when detected within the core device of electronics itself: the Schrot effect in what is appropriately called "thermionic" tubes, culturally objectifying the natural wonders of thunder and lightning.[145] All technical, even digital "information" media are physical channels; here, thermal noise in the physical sense (so-called *Schrotrauschen*) interferes. The thermionic tube as the essential non human agency of electronics (which means intelligent modulation of electricity by minimal voltage) translated energetic work into micro-energetic "temperature", the streams and clouds of electron flow within the vacuum. Especially the triode, once liberated technical media from mechanical constrains, thus from erasure in usage. Still, the tube or its subsequent functional equivalent, the transistor in semi-conducting matter, are subject to physical and chemical decay over time themselves; therefore "we are the first culture to experience our own archaeology on a daily basis"[146]. The electronic triode tube which had been developed for telegraphic, telephonic and radio signal transmission, has been mis-used as a binary switching decive in early electronic computing, forcing clouds of electron temperature (the physical real) into binary symbolic order.

The switching moment between "on" and "off" Wiener called - in an intuitive moment of epistemological poetry at a Macy conference - the "time of non-reality".[147] But even if in theory binary information is independent from physical entropy, in each concrete implementation, this time of non-reality is real material ageing and energy-absorbing. In a truely media-archaeological operation of slowing down this moment to the extreme (von Baer), the binary switching reveals its entropic *tempoReal*.

"Sonic" time and temperature with Fourier

The computer literally numbers the world processually. In an algorithmic operation, Fourier Transform identifies the individual frequencies constituting the mixed signal - a "musical" analysis indeed, revealing the time-based essence of any physical signal as inaudible, sound: implicit sonicity. It had been a thermal hallunication indeed which initiated such kind of analytics. Joseph Fourier got its initial impulse for developing his *Theory of Heat* when being part of the scientific task force in Napoleon's Egyptian mission.[148] Fourier(’s) analysis

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145 See Wiener, chap. I "Newtonian and Bergsonian Time", in:Cybernetics or control and communication in the animal and the machine, Paris (Hermann) / Cambridge, Mass. (The Technology Press) / New York (John Wiley) 1948, 40-56
146 Paul DeMarinis, Erased Dots and Rotten Dashes, or How to Wire Your Head for a Preservation, in: Erkki Huhtamo / Jussi Parikka (eds.), Media Archaeology. Approaches, Applications, and Implications, Berkeley / Los Angeles / London (University of California Press) 2011, 211-238 (211)
147 See Claus Pias, Time of Non-Reality. Miszellen zum Thema Zeit und Auflösung, in: Axel Volmar (ed.), Zeitkritische Medien, Berlin (Kulturverlag Kadmos) 2009, 267-279
148 On Fourier's Egyptian "temperature" *Urszene*, see Bernhard Siegert, Passage des Digitalen. Zeichenpraktiken der neuzeitlichen Wissenschaften 1500-1900, Berlin (Brinkmann & Bose) 2003, 249

turned implicitely "sonic" heat conduction into cold, silent (techno-)mathematical calculation. His decomposition of temperature into harmonic sine waves reaffirms the occidental epistemology of a world ordered by Pythagorean ratios, but this time in a time-based, dynamic way, and resulted in an over-profiled separation of sound from noise (for the pleasure of aesthetics). An apparently continuous thermal, that is: physical configuration is transformed into discrete computability by mathematical *analysis*. Non-periodic functions in fact can not be derived from Fourier series. The real challenge to this harmonic order therefore is thermal noise and thermodynamic stochastics.

Weather as data (clouds)

Media-mathematical analysis concentrates on the non-discursive (non-cultural) articulations and is therefore radically de-metaphorizing temperature. In 1922, Lewis Fry Richardson proposed weather prediction in numerical calculation by human "computers", calculating incoming data from weather stations around the globe which are telegraphically transmitted almost in real time. A human media theatre: "Imagine a large hall like a theatre"[149], directed by a "man in charge [...] to maintain a uniform speed of progress in all parts of the globe. [...] he is like the conductor of an orchestra in which the instruments are slide-rules and calculating machines": as parallel computer architecture in real time. "[...] senior clerks [...] are collecting the future weather as fast as it is being computed [...] coded and telephoned to the radio transmitting station" <ibid.>. A transformation of thermic energy into information takes place in this "computing theatre" <ibid.>.

Hydrodynamics has been the ultimate mathematical challenge for John von Neumann, such as the nuclear fusion for the atomic bomb, resulting in more speed-efficient computing: the stored-program EDVAC architecture. Computing thermic systems belongs to the ultimate challenges of the *turingmachine* itself. With Turing machines, humanity dares to trace the real physical world by computational analysis and synthesis. Mathematical machines since Charles Babbage's design of an Analytic Engine aim to compute discretely the continuous dynamics with a (limited) set of real numbers, with the mathematical tool of the infinitesimal calculus (Leibniz' *limes*).

Data temperature is sublime, and the new "weather" clouds are invisible: be it Ionospheric "weather" conditions determining the signal-to-noise ratio of short wave radio communication (and electro-smog), or nuclear pollution. The digital machinery retreats into algorithmic opaqueness since nuclear testing has been substituted by the almost incomprehensible power of computational simulation.

In its interactive virtual environment *Dialogue with the Knowbotic South* (1994), the media art collective Knowbotic Research once created a three-dimensional data cloud transmitted by the measuring stations in the Antarctic; digital communication media and measuring devices produce thermic

149 Fry Richardson, A Forecast Factory, in: same author, Meteorology and numerical analysis, ed. by Oliver M. Ashford et al., Cambridge / New York (Cambridge UP) 1993, 219

information that nature never produced itself - computed nature.[150] The Antarctic as informational space actually happens outside the polar region, as artificial nature in data representations of measuring and sensoring instruments covering this area and procuding, every second, a stream, a flood of data.[151] The data body of this Cyber-Antarktica is based on temperature data and Ozone values - scientific material which has lost any deep meaning, conforming with Shannon's mathematical transformation of thermodynamic entropy into informational probabilites through communication channels. Nowadays, terms like "cloud computing" are literally obscuring the techno-mathematical theory of information communication.

b) Temperature degree zero: "cold" technological storage

Transmission and storage in media communication is conventionally kept apart. Such distinct operations, under the perspective of the temperature/energy/time equivalence, turn out as two extemes of *one* process: fast (hot) and slowed down (cooled) signal transfer. Endurance of matter is linked to deep freeze (as expressed by the very term "permafrost" in Siberia), since the elementary molecules do not vibrate any more. Freezing signals is an extreme slowing down, an ultimate delay of signal transmission over a channel. While a "thermal" theory of signal (and data) transmission has been expressed in communication engineering, this approach can be extended to storage as well[152], resulting in a generalized model of cultural tradition. The technologies and -logics of tradition relate to both the physical and the informational notion of "entropy" - which, in turn, allows to describe *tradition* without using the noun "time" at all, dis- and replacing it by more precise *termini technici* of operative tempor(e)alities.

Applied "entropology" of storage media

Hidden behind the user interfaces of so-called "social media", there is the regime of a physical infrastructure of data centers and the energy amount to cool such facilities; "a single data center can require more power than a medium-size town"[153].

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150 Christian Huebler, in: Discovering CyberAntarctic. A Conversation with Knowbotics Research (1996), http://ctheory.net/ctheory_wp/discovering-cyberantarctic-a-conversation-with-knowbotics-research (accessed January 29, 2018); for a video documentation see http://www.youtube.com/watch?v=dJ3ZbD5uGkE

151 See Arnd Wesemann, Datenschwärme aus der Antarktis, in: Frankfurter Rundschau, September 2, 1995

152 See Hartmut Winkler, Prozessieren. Die dritte, vernachlässigte Mediendefinition, Munich (Fink) 2015

153 See Jennifer Holt / Patrick Vonderau, "Where the Internet lives": Data Centers as Cloud Infrastructure, in: Lisa Parks / Nicole Starosielski (eds.), Signal Traffic. Critical Studies of Media Infrastructures, Urbana / Chicago / Springfield (Univ. of Illinois Pr.) 2015, 71-93 (82 f.)

According to the "8 degree rule", such an increasing of the temperature shortens the endurance of data storage about a half. For digital storage, information is not completely unlike energy when it comes to storage; for the storage of 1 Bit a minimal energy is necessary. Here, we come close to the Boltzmann-*Konstante*. Time vs. energy: Longer storage endurance for digital data carrier can be achieved by lower temperatures.

In a refrigerator at around 10 degree Celsius the data endurance of a typical flash memory (e. g. a USB stick) is secure for millenia[154]. But in millenia ahead, the heating of the refrigerator will have increased the earth's entropy to a deathening degree. An alternative less vulnerable to thermic conditions is the recent development of optoelectronical storage media (e. g. nanostructured glass). Such records might even survive the so-called Anthropocene epoque as evidence of human civilization. But in millenia, no being will be able to decipher a frozen electrostatic storage unit as a symbolical bit.

"Arctic" storage and the metaphorical risk: Defreezing and delayed transfer

The vocabulary of storage media is "very much a language of temperature"[155]. Low temperature has become less a metaphor for eternal memory than for delay: rather an equivalent to the electric condenser than to the archive. The time-critical counterpart of "archival" long-time preservation is condensed time in frozen water indeed; instead of endurance, we confront what Wendy Chun in terms of dynamic computer memories calls "the enduring ephemeral"[156]. In terms of technological media analysis, there is a correlation between time and temperature, speed and heat, which is not just metaphorical. Storage is a "cooled", slowed-down event - "freeze frame"[157]. In the cinematographic "moving still", endurance and processual media time are interlaced.[158] Recording is a temporal "cooling", slowing down, or even freezing, of an otherwise transient signal. Friedjof Nansen's photos from his Arctic expedition still address posterity beyond his death.

The "record" is usually associated with a cristallization or steady inscription, ranging from a paleolithic fossil, over the archival textual document, and

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154 As articulated in the journal Chip 5/2012: 128

155 As expressed in the thematic draft for the conference *Archives of the Arctic. Ice, Entropy and Memory*, Humboldt University, Berlin, September 18 to 21, 2013. Forthcoming in: Susanne Frank / Kjetil Jakobsen / Mandy Buschina (eds.), Archives of the Arctic, Bielefeld (transcript)

156 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

157 See Stefanie Diekmann / Winfried Gerling, Freeze Frames. Zum Verhältnis von Fotografie und Film, Bielefeld (transcript) 2010. See as well Gusztáv Hámos / Katja Pratschke / Thomas Tode (eds.), Viva Fotofilm. bewegt/unbewegt, Marburg (Schüren) 2010

158 See David Green / Joanna Lowry (eds.), Stillness and Time. Photography and the Moving Image, Manchester (Cornerhouse) 2006

photographic chemistry or phonographic signal engraving.[159] But there are *transitory records*, traces of a physical element like the electron left on the screen on its measuring instrument (the oscilloscope), and dynamic memory by constant regeneration like the mercury-tube based Acoustic Delay Line discussed by Alan Turing for electronic computer memory. A critical problem with such a system has been thermal indeed: "the electronics required to perform the modulation, demodulation, amplification, and reshaping of the pulses was constructed mainly of vacuum tubes, and the heat given off by them would adversely affect the temperature stability of the delay lines"[160]; as a variation of the delay line for dynamic short-term storage of digital pulses, even air as memory was tried by mounting a loudspeaker on one wall of a room and a microphone on the other wall - rediscovered later in media art performance, by Alvin Lucier's notorious tape-based acoustic loop installation from 1870 *I'm sitting in a room*. A. D. Booth in Britain after the Second World War, due to the lack of suitable material for electronic devices, "was forced to experiment with almost every physical property of matter in order to construct a working memory" for digital computing such as thermal momory: a drum whose surface was capable of being heated by a series of small wires which would locally heat a small portion and, as the drum rotated, these heated spots would pass in front of a series of heat detectors. "When a hot spot was detected, it was immediately recycled back to the writing mechanism which would copy it onto a clean (cool) part of the drum."[161]

Entropy in / as memory in computing

With digital memory, there are no more institutionally stable record repositories but dynamic *archives in motion*[162] - a new condition which has been anticipated by the very technological nature of early digital computer working memories (RAM) for the intermedary storage of coded signals such as the mercury-based "acoustic delay line". Such instant memories were based on delay lines for the intermediary storage of coded signals, finally leading to the more enduring latency of magntic core memory. Practically speaking storing digital data carriers in ultra-low temperatures (be it a refrigerator or an iceberg) exponentially increases the probability for undamaged preservation. What has started as a "thermic" metaphor ("Arctic" freeze for storage), returns within the mechanism of storage itself. Frozen water is a metaphor for slowing down the dynamic present; not yet memory, its is rather a delayed present: an equivalent to the electric condenser. Laboratory techno-physics has even produced "time crystals" where the grid is not a spatial geometry any more but unfolds in temporary patterns.[163] Permanence and endurance is not achieved in the traditional way any more (which has been monumental fixation, *stasis* so

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159 Henning Genz, Wie die Zeit in die Welt kam. Die Entstehung einer Illusion aus Ordnung und Chaos, Reinbek b. H. (Rowohlt) 2002, 234 f.
160 Michael Roy Williams, A history of computing technology, 2nd ed. Los Alamitos, CA (IEEE Computer Society Press) 1997, 309
161 Williams 1997: 303
162 See Eivind Røssaak (ed.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010
163 Mike Beckers, Quantenmaterie in endloser Schwingung, in: Spektrum der Wissenschaft, June 2017, 25 f.

far), but by dynamic refreshing, reminiscent of the resonant circuit in electronics, consisting of a wire spool and a condensor which in delayed phase store and transmit energy as magnetic state and as electric dynamics.

Just like the phonographic record waits for the mechanic player to defreeze its analog signals in a technological act of re-enactment, there is a thermodynamic metaphor to express the relation of software to hardware in digital culture as well: "[t]he analogy between a computer program and a musical score - once described as 'frozen music' needing only an orchestra to melt it"[164]. If this looks like a seduction by thermal metaphors, in terms of a twin "entropic" analysis in both its physical *and* informational sense, it will be justified.

Micro-temperatures in time processing: the oscillating clock

The Long Now Foundation in the US installs a clock meant to keep time until the next Ice Age (in around 10000 years) driven by a mechanical oscillator.[165] But the wheel-driven mechanical clock as developed in the Benedictine monasteries of the late Medieval age is no ideal periodic oscillation, since there is an entropic dissipation implied in its material mechanism. There is no ideal pendulum, it always suffers from friction; that is why Hughens aimed at isolating (relieving) the time-giving oscillation (the pendulum's isochronism) from the actual technical realization. "Through isochronic oscillation the pendulum can exist as the autonomous embodiment of natural or physical time"[166], different from the radio controlled clock which periodically synchronize to a reference clock elsewhere. But there is always loss of energy in damped oscillation: the moment of contact between the suspended pendulum (as designed by Christiaan Huyghens to gain isochronism) and the actual clockwork. This momentum asks for desciption in strictly thermodynamic terms, as a dissipative system. The motions of the pendulum and the moments of its contact with the escapement convert potential energy to kinetic energy, and energy to discrete information to answer the clock-related question of actual time. The interlacing of time and temperature becomes tight in time-keeping mechanisms with their delicate and temperature-sensitive metal elements. Physical entropy, informational entropy and the (ir-)reversibility of the time arrow are interrelated in a trifold way. While the clockwork has served as model of the universe since late Medieval times, it has been succeeded by the theory of the universal computer (in its double sense), where the clocking returns from within. Every discrete step in computing requires only sub-critical thermic costs. A further escalation in this infinitesimal, itself "temporal" effort has been the *thermocompensated* piezoelectric quartz watch. Being a most exact resonator, the tuning-fork shaped quartz is still subject to a) entropical "aging as phenomenon in which the vibrational frequency of the oscillator slowly changes over time", and b) micro-ergodic ambient temperature changes (the coefficient fo thermal expansion). For most exact laboratory timekeeping,

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164 Martin Campbell-Kelly, Past into Present: The EDSAC Simulator, in: Rojas / Hashagen (eds.) 2000: 399

165 See Adrian Mackenzie, The Technicity of Time. From 1.00 oscillations/sec. to 9,192,631,770 Hz, in: Time and Society, vol. 10, no. 2/3 (2001), 235-257 (255, note 11)

166 Mackenzie 2001: 244

the mechanism itself might be sheltered by temperature agains environmental "temperature moods" (*temperare* in the Baroque sense): the Oven Controlled Crystal Oscillator. Another strategy is to install two crystal oscillators within one watch, with an analog compensation circuit which compensates for temperature-induced variance of frequencies by negative feedback. Here as well, the energy / information trade-off (neg/entropy) finally arrives: a major step in thermocompensation has been "the digital count adjustment method", where the crystal frequency is allowed to drift with temperature, but an independent sensor (a *thermistor*) is used to measure the exact temperature of the crystal.[167] Minimal variances are thereby rectified; thermic metaphors are driven out by techno-logical *analysis* of time.

ARCHIVAL TIMES. TEMPOR(E)ALITIES OF MEDIA MEMORY

"History" and the historical discourse belong to the cultural technique of alphabetic writing, formatted in linear texts on paper. Within that galaxy, the archives have served historians as a basis and resource, that is: to re-write alphabetic evidence in historiographic texts (basically narratives). But with the emergence of electronic media a shift of emphasis took place in the occidental memory sphere: from culture as a primary function of its storage (places, monuments, institutions) towards the dynamic recycling of data from the past, from emphatic long-time storage towards short-time affordances and immediate transfer. This affects the position of the archive and requires critical reflection from the side of both archival and media studies.

Media-theoretical analysis focuses on the message of the medium itself. Applied to memory agencies and especially the "digital archive", this method demands not only a close analysis of its technology but a new interpretation of its different epistemological and aesthetical dimension as well. While the traditional archival format (spatial order, classification) will in many ways necessarily persist, the new archive is radically temporalized, ephemeral, multimodal, corresponding with a dynamic user culture which is less concerned with records for eternity but with order in fluctuation. "Memory is transitory."[168] New kinds of search engines will not only answer the needs of knowledge retrieval but develop into a creative "art of the archive" itself. Technical storage favoures discontinuous forms of memory access, either by alphanumeric metadata, or by addressing digital items from within.

"The Archive in Motion"

At *The Archive in Motion* conference in the National Library in March 2009, cold temperatures and snow reminded of the "frozen time" aesthetics of the

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167 Bruce Reding / George Palasti, In Pursuit of Perfection: Thermocompensated Quartz Watches and Their Movements; http://forums.watchuseek.com/f9/thermocompensation-methods-movements-2087.html (accessed 24 May, 2017)
168 Vannevar Bush, As We May Think [*1945], online https://www.theatlantic.com/magazine/archive/1945/07/as-we-may-think/303881 (accessed January 29, 2018), section 6

traditional archive and practically even of the conservation conditions of audiovisual records in cool rooms (probably like in Mo I Rana, the storage facility for audiovisual records of the Norwegian National Library).

The National Library at Oslo with its Department of Research in fact belongs to the avantgarde of re-thinking the issues of information heritage in Europe. The National Librarian Vigdis Moe Skarstein proudly claims nothing less than the mandate to preserve and give access to Norwegian memory into the future - like the trajectory of a cultural missile, transmitting knowledge, the mission of this National Library. This claim is justified, since the updated Legal Deposit Acts from 1989 have achieved for Norway what the Institut National Audiovisuel (INA) in Paris achieved only years later and what a German media archivist could still only dream of. In 1989, when the Iron Curtain dividing West and East Europe opened in so many ways, the wall which separates the Gutenberg Galaxy of printed publication from the emerging new media of the 20th century, fell here in Oslo, opening a fundamentally new concept of the multimedia collection. The Oslo 1989 Legal Deposit Acts opened a new horizon of a national library for the 21st century; 200 years after the French declaration of human rights, this was a delaration of "media indepence" in the overall task of receiving, preserving and transmitting public knowledge from overall in Norway.

The emphasis here is not only on preservation of such heritage in its most obvious way, as known to museum, libraries and archives for generations. The Oslo policy adventurously faces the challenge of the new "digital structures" (and poststructurally: dynamic, temporalized structures) which transform such knowledge. This requires both technical and theoretical knowledge. Maybe there is nothing as practical as a good theory indeed; but let me envision here for a moment that conferences on archival theory and others which face the more practical challenges of preserving the new kinds of records, while being of highest quality in themselves, will not be conceptually separated any more, but f. e. the engineering questions of how to organize digitized phonographic records (like Edison cylinders) might be directly coupled with the theorems of media-archaeologist, thus short-circuiting the "two cultures" (C. P. Snow 1959) which do not only traditionally separate the Philosophical Faculties at universities from the Faculties of Science, but which separate the theoretical musing about archives from the practice of actually running them. The semingly purely practical questions of technical conservation can not be set apart from the theory of archival transmission in culture, but rather ask for integrating technical expertise with epistemological reflection. "In this moment of transition from analog to digital, theorizing archival practice is not only urgent for film archives, but also for media scholars."[169]

Electroenginners, technical conservators and computer programmers are much more open for such an immediate coupling with theory than usually assumed, and in reverse academics from the so-called humanities, dream of "grounding" their theories and knowledge in what actually happens, to arrive at a transitive, object-related implication of their theories.

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169 Giovanna Fossati, From Grain to Pixel. The Archival Life of Film in Transition, Amsterdam (Amsterdam University Press) 2009, 16

Archival time layers

The very term "tradition" shifts from its emphatic macro-temporal ("historical") notion to the analysis of the time-based and time-basing micro-mechanisms of transmission. While tradition has been associated with long-time memories across deep historical time so far, this emphatic horizon now seems to shrink to a mere extension of the present (as its re- and protentive short-time "working memory") - a dramatic shifting of the temporal prefix.

As a spatial structure and a diachronic memory the archive splits into two axes (like in a Cartesian diagram). The archival texture itself is a structure: a synchronic latticework, while its "content", the records, are diachronic documents of various age. Archives are not only in transition in macro-temporal perspective (as contemporary history); more concretely, on their very operative level, they are permanently in micro-time-critical transition (electronic signal and data processing).

The traditional archive model is emphatically static, residential, a storage space which delays time. The archive as fortress of memory is protected space in order to gain time. But with the acceleration of transport and communication media since the age of the Industrial Revolution a shift of emphasis from emphatic long-time preservation to ultra-short intermediary storage took place - a direct effect of electronic media culture itself.

The traditional mandate of the archive to preserve records for future use shrinks to the micro-temporal digital operations in the extended present. Intermediary storage here is necessary for "realtime" computation calculating the immediate future from memory of the immediate past.

"Temporalities" and "tempo-realities"

The typography of "tempor(e)alities" oscillates between "temporalities" and "time-realities" of the achive. Archival usage becomes time-critical. The temporalities of archives refer to the inherent temporal essence (the *Eigenzeit*) of archives as memory institution and storage media, wherease the tempo-realities refer to the function of the archive as *a priori* condition of historiography and cultural memory.

There are three conflicting time orders in the archive: on the one hand, it is meant to suspend time to transfer information for future memory (negentropic time); on the other hand, it is subject to time at work (entropic processes, material decay); thirdly, the speed of access, migration[170], short-time memorial functions of the archive increases with its digitization.

While the symbolical order (on the code level of archival records) is rather time-invariant, its material implementation is subject to entropy: temporal("historical") decay reminds of the physical real(ity) of the archive.

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170 See Dietrich Schüller, Von der Bewahrung des Trägers zur Bewahrung des Inhalts, in: Medium Nr. 4 (1994), 28-32

The negentropic "cultural" effort (Vilém Flusser) is meant to be that libraries and archives stem the tide of memory loss.[171] At this point, a precise differentiation is mandatory, between Shannon entropy and Boltzmann entropy. Two different times are at work here: a) symbolically coded information "time", rather invariant towards historical change, and b) physical time (the "tempus edax" known from allegories of Chronos in the Baroque). The fact that (as long as the code is familiar) an inscription can be deciphered against the deteroriation of its material carrier hints to the astounding invariance of symbolic inscription (the archival regime) against historical ("passing") time.

The archive equals the function of the channel ("merely the medium") in Shannon's techno-mathematical theory of communication, being the macro-temporal "inbetween" of what is generally called tradition of (alphabetically) *coded* records. In hermeneutic reading it is part of a communicative structure, thus containing messages to posterity, with the historian (and other readers) placing themselves as the "reveiver" of the archival content; in an anti-hermeneutic perspective, though, the archive is a set of multimedia monuments taken out of the consumptive economy of (historical and actual) time.

But the "time inbetween" ("media" time in its Aristotelean sense of *to metaxy* - the physical "inbetween" which he notices by the delay echo sound takes between sender and reveiver) replaces the monumental claim of virtually eternal storage of documents by the classical archive (and its records) on severel levels: both as an institution of temporality and in its material sense (the vulnerability and volatility of electronic data).

Computational micro-archives

Nowadays, with the direct coupling of the archive to "online" communication, a cybernetic short-circuiting of the formerly separate archive to the operational present takes place, shifting the archive's epistemological status and temporality. While in former administration there has been a clear separation between the "register" (the short-time depository for administrative records which are not in current use but might be at any moment be needed for re-use, close to the "op room", the administrative office itself) and the "archive" (physically reparated from the working office, a place to sort and select records for long-time legal claims), today the archive merges with the register itself.

At that point, a very seductive comparison with what happens within the computer imposes itself: In the Central Processing Unit, "registers" serve to store data for intermediary calculations - not to be called an emphatic "memory" at all. Directly associated with the CPU but external to it is the working memory which stores a) actual programs and b) the data to be processed, divided into ROM (Read Only Memory) and RAM (Random Access Memory).

171 See http://lyra.rlg.org/ArchTF/tfadi.intro.htm#fragility

Intermediary memory is well known from electronics, especially from with the heart of the digital computer, the Central Processing Units with its ALU (the arithmetic/logical unit). Here, registers in the techno-mathematical sense (a term borrowed from archival science) are devices built from bi-stabile relays (either electro-mechanical or fully electronic) for *transient* storage of digitally represented values.[172] The core function of such mirco-temporal storage devices is its passing essence and to let the data immediately become past - the other side of the archival dispositive, extended by the parameters time and clocked rhythm.

What in commercial trading logistically is known as so-called *chaotic storage administration* happens micro-archivally on computer discs as well. On the storage medium Compact Disc the data are interlaced: not sequentially in their temporal sequence, but dissipative. Archival order as precondition of tradition itself is being dynamically temporalized and undercut by the micro-dramaturgy of electronic storage media. "Colossus had to 'remember' a bit for a split second until its neighhour arrived. For this task, it used a bank of capacitors which it charged up and discharged as needed."[173]

Data extrapolation: The unfolding of time-critical processes into a temporal horizon

The grammatical time form "future in the past" has become technological, based on feedback operations. This horizon thus unfolded in the context of ballistic calculation (*linear prediction*) and analysis of time series was techno-mathematically absorbed into calculating space. The difference between machine time and human time[174] is being dialectically synthesised in the cybernetic model, as indicated in the sub-title of Norbert Wiener's classic of 1948 ("command and control in the animal and the machine").

From archival statistics (memory based on scriptural archives, listings and charts as distribution in space) we move to stochastic time series analysis (dynamic remembrance based on algorithmic signal analysis of temporal series).

This recalls central terms from Edmund Husserl's *Phenomenology of the inner temporal consciousness*: the falling-back ("Zurücksinken") of an immant temporal objects from the state of now into the past (retention), while it still affects the presence (in the sonosphere known as the echo of tones, with visual stimuli in the after-image which remains on the human eye retina for a moment even if the light source is already extinct). Complementary to this retention, human perception always already pre-calculates (and thus anticipates) the immediate future (protention).

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172 "[...] die vorübergehend eine Zahl speichern können": A. Huber, Programmgesteuerte elektronische Rechenmaschinen, in: Funk-Technik Nr. 24/1957, 828-830 (828)
173 Barry Fox / Jeremy Webb, Colossal Adventures, in: New Scientist no. 1081, May 10, 1997, 39-43 (41)
174 Name June Paik, Norbert Wiener und Marshall McLuhan, in: ders., xxx, 1992, 123-127 (125)

A techno-mathematical correlation to such analysis of temporal series is the compression algorithm developed by Jacob Ziv and Abraham Lempel: "We employ the concept of encoding future segments of the source-output via maximum-lenght copying from a buffer containing the recent past output. The transmitted codewords consists of the buffer address and the length of the copied segment. With a predetermined initial load of the buffer and the information contained in the codewords, the source data can readily be reconstructe at the decoding end of the process."[175]

What used to be the role of the emphatic archive in the context of macro-temporal cultural tradition becomes part of a permanently dynamics of the intermediary archive: the buffer.[176]

Order in fluctuation?

Different from the traditional script-based institutional archive, the electrified archive (as organized by the internet) becomes radically temporalized. It is rather hypertemporal than hyperspatial, being based on the aesthetic of immediate feedback, recycling and refresh rather than on the ideal of locked-away storage for eternity. The aesthetics of recycling, sampling and cultural jamming is a direct function of the the online-availability of (multimedia) archives. Once the archive is being coupled to the "online" economy of time, such a data disponibility has created a cybernetic system of re-cycling.[177]

Contrary to the familiarized occidental culture of knowledge (ranging from oral and scriptural tradition to electronic transmission), the age of electric media generated what the art world spotted as "Fluxus", literally: the flow (inculding steady-state in flow and order by disorder).

What is new in the so-called digital age, is the permanent temporality not only of the archival records themselves but of its archival infrastructure (called hardware and software) as well. So the traditional "time base" of archive itself becomes a function of temporal change. Leif Dahlberg (KTH Computer Science and Communication, Stockholm) actually proposes the term "streaming archive"[178].

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175 Jacob Ziv / Abraham Lempel, A Universal Algorithm for Sequential Data Compression, in: IEEE Transactions on Information Theory, Bd. IT-23, Heft 3 (Mai 1977), 337-343 (337)

176 See Wendy Hui Kyong Chun, The Enduring Ephemeral, or The Future Is a Memory, in: Erkki Huhtamo / Jussi Parikka (Hg.), Media Archaeology. Approaches, Applications, and Implications, Berkeley / Los Angeles / London (University of California Press) 2011, 184-203

177 Declared in the thematic abstract of the festival *Re-*. Recycling_Sampling_Jamming. Künstlerische Strategien der Gegenwart* (Berlin, Akademie der Künste, 26-28 February 2009).
See www.recycling-sampling-jamming.de

178 Oral communication to the author, Stockholm, 19. May 2009

Audiovisual memory: the moving archive

Only with the arrival of chrono-photography (Muybridge, Marey) and with cinematography an impossible dream came true: to catch the dynamic element in movement, the kinetic. Technical media (both for acoustic and visual movements) have created a new kind of archiv(e-)ability.

Whereas the scripture-based classical archive is a static array of records on the grand scale and letters on the microscale, which could be brought in motion only by the act of human reading line by line, the Edison phonograph at first glance looks like the first form of "archive in motion", since its recording and re-play is based on a continuously rotating, technically moved apparatus, parallel to discrete recording and projection in mechanical cinematography.

One of the ealiest application of sound film for ethnomusical research, a recording of the oral poet Avdo Medejowitch in former Yuguslawia by Milman Parry and Albert Lord around 1935. The archival way of preserving such cultural memory has been the transcription of oral poetry so far, as still practiced by Béla Bartók when transcribing the phonographic records into a musical score (with himself being literally the medium of analog-to-digital conversion, coupled inbetween the Edison phonograph and the paper).

But only when the original media record is being preserved, unexpected new computer-based ways of interpreting the event on its acoustic level can be applied[179] - an information which is lost in transcription, such as the bodily noise (f. e. Avdo's sudden coffing) which helps to answer the question whether the temporal rhythm of a sung stanza is more an effect of bodily economy (breathing), of cognitive notions, or of neuro-physiological embodiments of a time-window called presence.[180]

From spatial to time-based archives

What the French historian Michel de Certeau used to call "l'espace de l'archive" becomes radically temporalized. Read with Marshall Mcluhan, this is due to the fact that archives and libraries change from the "Gutenberg galaxy" to the electric, or to be more precise: the electronic age where streaming itself is both the technical condition and the phenomenon of archival information.

From a media-archeological point of view, the traditional archive (as indicated above) gets deconstructed by the implications of digital techniques. Since antiquity and the Renaissance, mnemotechnical storage has linked memory to space. But nowadays the static residential archive as permanent storage is being replaced by dynamic temporal storage, the time-based archive as a topological place of permanent data transfer. Critically the archives transforms

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179 See Meinhard Müller / Peter Grosche / Frans Wiering, Automated analysis of perfomrance variations in folk song recordings, in: Proceedings of the International Conference on Multimedia Information Retrieval (MIR'10), Philadelphia, Pennsylvania, 247-256, 2010

180 Siehe Fred Turner / Ernst Pöppel, The neural lyre. Poetic meter, the brain, and time, in: Poetry (August 1983), 277-309

from storage-space to storage-time. The archival data lose their spatial immobility at the moment when they are being provided with a truly temporal index (literally *dated*). In closed circuits of networks, the ultimate criterion for the archiv - its separatedness from actual operativity - is not given any more. The essential feature of networked computing is its dynamic operativity. Cyperspace is an intersection of mobile elements, which can be transfered by a series of algorithmic operations. In electronic, digital media, the classical practice of quasi-eternal storage is being replaced by dynamical movements "on the fly" as a new quality. Classical archival memory has never been interactive, whereas documents in networked space become time-critical to user feed-back.

Database art (George Legrady)

Following Marshall McLuhan, let us describe media art as an "early warning system" of ongoing changes in media culture. Current media art displays a hightened sensibility for temporal and time-cricital processes taking place in media as opposed to traditional, museum- or archive-orientated forms of expression.

The read-only-memory of the archive is currently being replaced by operational archival interaction, as illustrated by *Pockets Full of Memories*, an online and museum installation by the media artist George Legrady in which the audience *creates* an archive by contributing a digitized image of an objekt in their possession at the time of the exhibition visit. Interaction is an aspect Bertolt Brecht pointed at already in the 20s for the emerging medium radio, insisting that it can technically - on the (feed-)back channel - be used in a bi-directional way as well by the receivers to communicate instead of being unilaterally being distributed as broadcast.[181] The unidirectional communication of books still dominated the user experience. With different *hierarchives*, a network is not a text any more, rather an archi(ve)-tecture. As long as the key-board of computers is alphabet-based like a type-writer for printing just letters, the paradigm of printing remains dominant; progressively though the mouse-click replaces the key-board for directing the monitor, and orientation shifts to visually perceived information landscapes; in multi-media space, however, the act of re-activating the archive can be dynamically coupled with feedback.

The hybrid "classification" in self-organizing maps as applied by Legrady is that it translates both keywords (semantic information) which can be manually tagged by the human contributors and the algorithmized object description, and turns them into numbers; this is how the mathematically determined organization happens. "Many of the other metadata also influence the location, for instance, the date, possibly the object's origins, I now forget what else."[182]

In his more recent, technologically up-dated version called *Cell Tango*, George Legrady (with Angus Forbes) displays an installation (projection) of constantly changing cellphone photos (sent by individuals to pix@celltango.org), projected

181 Bertolt Brecht, Der Rundfunkt als Kommunikationsapparat, in: Gesammelte Schriften, vol. 18, Frankfurt/M. 1967, 117-134

182 George Legrady, e-mail to the author, 29th July 2010

rhythmically over a large, black screen in a variety of patterns. Fresh snapshops swiftly adjust to that mosaic according for formal criteria (image-based matching) and according to their tags (meta-data), thus mingling with photos taken from Flickr (the photo-sharing website). A gap between the visually associative and the linguistically semantic field opens - retrieval based on similarities (like in Renaissance curiosity cabinets) rather than on archival or library classification.[183]

In one of the four modalities of the installation, "Cell_Bin", first the most recent images are placed on the black screen, and an algorithms randomly distributes them. The space left inbetween is successively filled by smaller incoming photographies. This loosely coupled patterns evolve dynamically. This form of media art is called "Database art".

"'Database art, in which infomation is the artist's main medium, has been around for 20 years, and especially active in the last decade."[184] Legrady collects the ephemera of everyday life and databases them it in a rather associative than rigid way, combined with a cognitive influence by user tagging - a hybrid of intuitive (aesthetic) and cognitive classification.

This, of course, is different from a stricly ruled-governed classical archival structure. In fact, the archive derived its authority from the "veto" against permanent change, such like a book which is meant to last for decades is a rock of enduring textuality against the permanent up-dating of Wikipedia articles. Dynamic interaction between reader/user/visitor and the database is one thing; the resistance of a body of knowledge against permanent re-constellation is another (the task of libraries and museums and archives).

"The images arise and disappear in a hypnotic rhythm. Tags come up in groups, in a kind of free association. Images that you wouldn't think belong together somehow link up, leading the viewer down strange <...> pathways", The Boston Globe review comments. This is a contemporary, dynamical version of the rather spatial modernist aesthetics of montage (cut-up) and collage: close to Vannevar Bush's 1945 vision of a Memory Extender (which by Theodor Holm Nelson was developed into the the Hypertext practice). But the basis of this artful archive is still an algorithm, the Self-Organizing Map (SOM) once developed by Teuvo Kohonen - which represents the mathematized archive. Let us have a close look: archive(s) with and without "s". In French, Michel Foucault's use of the word *archive* in the singular is not idiomatic; the institutional archive is always a *plurale tantum* "archives". *L'archive*, Foucault's singular, has a different meaning: the prediscursive condition of something to be articulated at all. For the case of the Internet, this is the communication protocols.[185] Central for finally archivizing *streaming media* are the codecs

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183 See www.suchbilder.de: Pixel sorting at work according to colour affinity

184 George Fifield, director of Boston Cyberarts Inc., as quoted in: "Can you see me now?", report on the Wellesley College installation, in: The Boston Globe; online: http://www.wellesley.edu/DavisMuseum/exhibitions/exhibitions_celltango.html; accessed August 2010

185 Alexander Galloway, Protocol. How Control Exits after Decentralization, Cambridge, Mass. / London (MIT) 2004

which compress digital media formats (like sound and moving image) - the archive of motion in its algorithmic sense.

From space-based to time-based archives

While the traditional archive of predominantly textual records provides a spatial order, to be transformed into "history" by the very act of writing, the audio-visual archives themselves take place in time, beyond the scriptural regime.

AV media address humans at the existential sensation of being which is the temporal sense. They re-generate temporal experience, thus adressing the human on the sensory (aisthetical, physiological) level as radically present, while the intellectual mind puts it into a "historical" context: here, a dissonance takes place, a gap opens.

Media archaeologists describe the non-discursive practices of the techno-cultural archive. Media phenomenologists analyze how phenomena in various media appear to the human cognitive apparatus, "that is, to the mind and senses"[186]. Roland Barthes' notorious identification of the two disctinct qualities of photography when under analysis by humans, the *studium* (the rational contextualization) and the *punctum* (the touching affect time-tunneling the difference between past and present) can be applied to archival times as well. While the media-archaeological reading of the archive is biased by the technomathematical analysis (the techno-*studium*), not mistaking storage for remembrance, the phenomenological reading of the archive corresponds with the *punctum* when miracolously something like a flash crossing and short-circuiting the temporal gap between the record from the past and its present reading happens.

From archival statistics (memory) to stochastic time series analysis (dynamic remembrance)

The transformation of the classical, datacarrier-based, material storage-"archive" into an "e-motional" archive in electronic motion, in electromagnetic ephemerality and latency, has an epistemological dimension. The gain of flexibily and computability is paid with a 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 resistabe agains 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 grammphone 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 - loosing the "touch ground" by getting technically "virtual".

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186 Kjetil Jakobsen, Anarchival Society, demnächst in: Eivind Røssaak (Hg.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010, 127-154 (141)

Traditional physical storage media (whether with spatial or with temporal "bias" as described by Harold Innis) have been orientated towards being literally inscribed (*graphein* in its old Greek sense): "There must be a writing means by which the information to be stored is introduced into the device"[187]; against this latent storage devices (such as magnetic tape for audio and video) only reveal their memory content in the dynamics of the electro-magnetic field (thus rather "induced" than "introduced" in the traditional way of writing power and violence). Electrotechnical storage media have take place in a sphere which is different from the scriptural regime of the classical archive - a regime which, on the level of alphanumeric codes, unexpectedly returned within techno-mathematical machines.

Adapting and modifying Marshall McLuhan's major theses on media culture, the message of the traditional storage agency "archive" is the typographic world of alphabetic records (the symbolic ORDER of administration), with the discreteness of elementary units privileging analytic reading and classificatory listing. Both as inscription in stone and on paper reigns the alphabetically induced combinatorial aesthetics of collage, cut-up, actually opposed to the electronically induced aesthetics of flow (the streaming archive). But with the concept of a dynamic, relational archive, a problem remains. How can the archive be opened to "heterochronic" experimentation and at the same time fulfil its traditional task of keeping a well-defined order intact for transmission into future memory?

What is new in the so-called digital age, is the radical temporalization not only of the archival records themselves but of its archival infrastructure (called hardware and software) as well. So the traditional "space" of archive itself becomes a function of temporal change, requiring a differential analysis.

Different from the traditional script-based institutional archive, the multimedia archive (as organized by the internet) becomes radically temporalized. It is rather hypertemporal than hyperspatial, being based on the aesthetic of immediate feedback, recycling and refresh rather than on the ideal of locked-away storage for eternity. The aesthetics of recycling, sampling and cultural jamming is a direct function of the opening / the openness / the online-availability of (multimedia) archives.

Contrary to the traditional occidental culture of knowledge storage and transmission, the age of electric media generated what the art world spotted as "Fluxus", literally: the flow. Instead of managing static words and images, Fluxus interprets life primarily in "musical" terms of overlayed waves, resonances, changing patterns.

What looks like a static electronic video or TV image, is in fact a dynamic event, unfolding waves in micro-time. Does "the archive in motion" lead to Fluxus Arc, to the floating archive? The video artist Bill Viola in 1973 created a video installation with 20 miutes of just visual noise. But this highly improbable flimmering of electrons on the screen, according to the mathematical theory of

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

communication as developed by Claude Shannon in 1948 as the basis of all our today media communication systems, contains the highest degree of possible surprise; that is why Viola calls his piece *Information*.

The most informative archive is the one which does not produce what its researcher is looking for exactly.

Two archival tempor(e)alities

Archives emerged with the symbolical code of writing. The symbolical code can be transmitted (now "migrated") with a high degree of fidelity in copying, regardless the material support. The symbolic code, esp. in the alphabet, is mostly invariant towards historical, i. e. entropical time. Digital data, which is: "information", *per definitionem* (Norbert Wiener) are neither matter nor energy.[188]

Documentary science has developed the notion of "logical preservation"[189]. "*Prentice Hall's Illustrated Dictionary of Computing* (Nader 1992: 412) irreversibly severs the material link by noting that 'software is independent of the carrier used for transport'."[190] But the Floppy Disc as a material support for the software is itself a hint to the material link. Any information must take place in or on a material support (storage medium), which introduces another, different tempor(e)ality: entropy.

If past media records are not just symbolically emulated, their temporal (entropic) qualities must be archivized as well - like the scratch, the noise of an ancient Edison phonographic cylinder when being digitized.

With an ancient phonographic record, the media archaeological ear listens to the noise of the recording device as well (the ancient wax cylinder) besides the recorded voice or music. Here, the medium talks both on the level of enunciation and of reference: message (the formerly recorded songs) *and* noise (the wax cylinder scratch and groove).

Archival resistance once more: monumentality as *epoché*

With its massive going *online* the archive loses its traditional power: its *secrecy*, its informative temporal difference to the immediate usage and consumption in the presence.

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188 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)
189 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)
190 Doron Swade, Preserving Software in an Object-Centered Culture, in: ibid., 195-206 (195)

What if the Norwegian public will rather use Google than the internet portal of the National Library or the Europeana portal to get access and information on Norwegian memory? Will WWW, Web.2 and the emerging Realtime Net replace the traditional guardians of memory (archives, libraries) like Internet radio and IP-TV is about to replace the traditional broadcasting of information media?

Archival endurance is undermined when a record is not fixed any more on a permanent storage medium but takes places electronically; flow replaces the inscription. All of the sudden, an archival virtue might be - counterstrategically - archival resistance against complete mobility. The archive should stay both inside and outside the "Web 2.0" economies; both opening archival services and defending archival secrecy (the *arcanum*).

The so-called real-time Internet is a set of technologies and practices which enable users to receive information as soon as it is issued, rather than requiring that they check a source periodically for updates.[191] Among this figures *instant messaging*; in McLuhan's sense, notwithstanding its semantic content, the message of the communication medium here is: immediacy. With all that getting-in-motion of the traditional archive, it may now (as a retro-effect) rediscover its virtue as institutional monument: to take out data values from the ever accelerating circulation and electronic economy, to arrest and fix and maintain chosen items, thus turning floating records (documents, files) into monuments (in Foucault's sense[192]), into spatio-temporal chronotopes (Michail Bachtin), *epoché* as sublation, taken out of time.

DATA, "UNDEAD": Exorcizing the cultural prosopopoietics of the archive and other archival phantasms

Archivology of Media

Ephemeral articulations like speech and sound, movement and the instant moment have, as it were, become immortally archivable by technical media of recording like photography, phonograph, and film. But the relationship established between the classical archive (as an institution of processing textually coded records for memory) and such media of recording is a just metaphorical one. Such machines are for engineers what rhetoric is for the humanities. What results from a culture of non-discursive apparatuses is, on a discursive level, an epistemological aesthetics based on the figure of prosopopoietics, the desire to address the dead as something alive. Media-archaeology teaches to unmask this archival phantasm as a *mis*understanding of technical media. Media archivology - both subject and object of analysis - uncovers the hidden rhetorical trope which still governs the cultural phantasm of hallucinating speech and life in what is actually mute and mechanically dead; only after its exorcism, the media archive emerges which creates relationships not in the narrative frame of causes and effects, beginning and end, but through hardware circuitry and software networks.

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191 http://en.wikipedia.org/wiki/Real-time_web (Stand: 20. Januar 2010)

192 "Introduction" to his *Archaeology of Knowledge*

Re-presencing the past by signal recording: the "undead"

Dynamic processes in their temporal real can not be narrated, but simply registered by technical media.[193] As opposed to the historiographic, that is: symbolic timing of history, storage time is empty time.[194] What looks *live* to the beholder in visual media, might as well be recorded from tape (since the introduction of magnetic TV recording in 1958/59) - an uncanny, undeadly state of the moving image. "We must be informed whether or not what we are seeing is "live". [...] we cannot distinguish through our senses alone between what we take to be simply "alive" and what as reproduction, separted from its origin, is structurally posthumous [...]."[195]

As illuminated by René Descartes in his non-metaphorical comparison of the human body with a clock-work), the "undead" undoes the binary logic of life and death.[196] Already the emergence of the phonograph puzzled clear distinctions between absence of the past and sonic presence.[197] "Speech", as it were, has become immortal", reads the comment of the *Scientific American* from 1877 on Thomas Alva Edison´s recent invention. *Nota bene*: "as it were". Since such machines are for engineers, what figures of speech are for writers. What returns here, epistemologically, is the figur of prosopopy, the rhetoric of presenting the dead as alive - just like the first advertising images of the Edison phonograph presented the apparatus as growing out of an allegorical human figure. The 19th century is full with phantasies of making the dead sent decipherable messages to the living, such as the experiments with magnetic writing tables to see such messages appear.[198]

What had been a rhetorical figure so far, became positive evidence in the electro-physiological experiments of Duchenne de Boulogne in his 1862 publikation *Mécanisme de la physiognomie humaine*, where he describes the phantasm of self-registering life, when the moment electric current, sent through human flesh, is being coupled with photographic registration.[199] Subject of Duchenne´s experiments has been a patient suffering from the

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193 Quoted after: Gabriele Seitz, Film als Rezeptionsform von Literatur, 2nd. ed. Munich (tuduv) 1981, 413

194 „Das Konstrukt „geschichtlicher Zeit“, eines geschichtlichen Kontinuums ist untrennbar verknüpft mit dem Medium des Buches <...> Demgegenüber ist Speicherzeit *leere oder tote Zeit*“: Götz Großklaus, Medien-Zeit, Medien-Raum: zum Wandel der raumzeitlichen Wahrnhemung in der Moderne, Frankfurt/M. (Suhrkamp) 1995, 47

195 Weber 1996: 121

196 René Descartes, Über die Leidenschaften der Seele, in: Philosophische Werke, trans. and commented by Artur Buchenau, Leipzig (Meiner) 1911, chapter 6 "Über den Unterschied eines lebendigen und eines toten Körpers",

197 See David Kaufmann, Der Phonograph und die Blinden, 1899

198 One of these tables has been recently detected by a researcher of the journal *Natural History* in (of course) the archive of the Society for Psychic Research at Cambridge University, with still readable ghost-writing. See Richard Milner, Charles Darwin and Associates, Ghostbusters, in: Scientific American, Oktober 1996

199 See Hans-Christian von Herrmann / Bernhard Siegert, Beseelte Statuen - zuckende Leichen. Medien der Verlebendigung vor und nach Guillaume Benjamin Duchenne, in: Kaleidoskopien. Jahrbuch des Instituts für Theaterwissenschaften der Universität Leipzig, Jg. 3: Körperinformationen, Institut für Buchkunst Leipzig 2000, 65-99 (92)

Moebius desease, whose mimetic facial muscles (the *nervus facialis*) had been lame from the time of his birth. Such a face, devoid of expression and motion - as if he had put on "a lifeless mask of himself "[200] - is the reversal of archival prosopopy indeed, re-poled like the "+" and "-" in electric circuits itself. The *v-* or *compufrog* has transferred this scenario into the pure space of digital calculation.[201] The artificial life of electro-informaticized machines, in their contemporary generation, have become a function of their "deep learning", reacting by self-modifying algorithms on incoming „sensual“ data.[202]

It is the option of feedback-operations, given with integrated circuits, which sets the classical storage medium archive - a „trivial machine“ in the terms of Heinz von Foerster´s cybernetics[203] In mathematical terms (Markov chains), the awareness of a past state of a machine influences the probability of its future actions.

The virtual reactivation of a lost sound storage medium: Hornbostel´s *Phonogramm-Archiv*

Recently, the silence of data has been dissimulated by linguistic (ro)*bots* in cyberspace - algorithms making websites literally speak to the user.[204] Even if the dead can still not be interviewed interactively with a microphone, there is a memory of their recorded voice now. The notion of the archive is in transition - towards the audio-visual, resulting in unforseen options of retrieval under new media conditions - transcending the conventional notion of the archive itself.

In the same year as Sigmund Freud fixed his psycho-analytic interpretation of dreams (*Traumdeutung*, 1900), the psychologist of acoustic phenomena, Carl Stumpf, and in his sequence the music ethnologist Erich Moritz von Hornbostel, founded, at the Berlin university, a phonographic archive with world-wide recordings on wax-cylinder of the voices of people threatened to be extinguished.[205] At the end of the 20th century the archival character of von Hornbostel´s phonogram archive has been reversed: The frozen voices on the analogue, vulnerable storage medium of Edison cylinders are currently being

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200 Jan Schweizer, Mienen in Fesseln, in: Die Zeit no. 2 from 4th January 2001, 25f

201 See Burkhard, Strassmann, Frösche mit der Maus retten, in: Die Zeit Nr. 1 v. 28. Dezember 2000: 58, referring to: www.george.lbl.gov/vfrog (Lawrence Berkeley National Laboratory, University of California), and the morphological program *Compufrog* (www.kmr.net/bluecross)

202 Dirk Baecker, Was wollen die Roboter?, in: Carl Hegemann (ed.), Freude ohne Ende. Kapitalismus und Depression II. Berlin (Alexander) 2000, 134-152 (139)

203 See Heinz von Foerster, Prinzipien der Selbstorganisation im sozialen und betriebswirtschaftlichen Bereich, in: ders., Wissen und Gewissen. Versuch einer Brücke, Frankfurt/M. (Suhrkamp) 1993, 233-268

204 See Katja Schmid, Die unermüdlichen Agenten, in: Die Zeit no. 13, 22 March 2001, 49; furthermore xxx Svenbro, Phrasiklea, xxx

205 See W. E., Hornbostels Klangarchiv: Gedächtnis als Funktion von Dokumentationstechnik, in: Sebastian Klotz (ed.), „Vom tönenden Wirbel menschlichen Tuns“: Erich M. von Hornbostel als Gestaltpsychologe, Archivar und Musikwissenschaftler, Berlin / Milow (Schibri) 1998, 116-131; see as well Artur Simon (ed.), Das Berliner Phonogramm-Archiv 1900-2000. Sammlungen der traditionellen Musik der Welt, Berlin (VWB) 2000

defrozen by digital means.[206] The Berlin Society for the Enhancement of Applied Informatics has developed a method to gain acoustic signals from negative traces of galvano-copies from Edison-cylinders by opto-endoscopic „reading“ - scanning visual information into sound.[207] Thus the making of stored acoustic frequencies actually speak does not ask for rhetoric operations, but on the contrary a hermeneutically distant gaze, an exteriority of interpretation which the aesthetics of the opto-technical scanner only can provide.[208] Technical media provide a different option of reading without (premature) understanding.

Thereby one can listen again to the recordings taken by the ethnologist M. Selenka who went to the tribe of the Wedda in India in 1907. She made the natives speak or sing into a phonograph which she instantaneoulsy played back to the speakers - to their joyfully recognition.[209] With the media mystery of the recordability of the physically real of sound and images, humans are confronted with their multi-media mirror effect (in Lacan´s sense), sublating the clear-cut difference between presence and absence, present and past. Strange enough, we are able, today, to listen to this play-back in exactly the same quality as the Indian natives could in 1907, since an example of the above mentioned opto-eletronic archaeology of sound can be appropriately experienced right in the World Wide Web.[210] Message or noise? Only the media-archaeological operation of opto-digitally reading the inscribed traces make the otherwise unaccessible sound recording audible again. Synesthetically, we can *see* a spectrographic image of sound memory - a straight look into the archive.[211] The opto-digital *close reading* of sound as image, though, dissolves any semantically meaningful unit into discrete blocks of signals. Instead of musicological hermeneutics, the media-archaeological gaze is required here.

At the end of Second World War, the reels of a secret medical film project from between 1941 and 1945 at the Berlin hospital Charité were thrown by the SS into lake Stössensee near Berlin when the Red Army approached the capital. It was a literally media-archaeological moment when divers detected these films in 1993 and rescued them; just three of several hundred film rolls could be deciphered at all, one of them showing on the basis of heavily damaged film material the shape of a naked man who performs several movements, apparently directed by orders from outside. "More cannot be seen, comments the media artist who has re-presented this material to the public[212] - a ghostly

206 On pre-phonographic metaphors of writing in medieval times see Horst Wenzel, Die "fließende" Rede und der „gefrorene“ Text. Metaphern der Medialität, in: Gerhard Neumann (ed.), Poststruktuarlismus: Herausforderung an die Literaturwissenschaft, xxx

207 See Gerd Stanke / Thomas Kessler, in: Simon (ed.) 2000: 209-215

208 Siehe Jeffrey Sconce, The voice from the void. Wireless, modernity and the distant dead, in: International journal of Cultural studies Vol. 1, no. 2 (1998), 211-232

209 Quoted after: Max Wertheimer, Musik der Wedda, in: Sammelbände der Internationalen Musikgesellschaft Jg. XI, Heft 2 = Januar-März 1910, 300-309 (300)

210 http://www.gfai.de/projekte/spubito/index.htm

211 See the spectrogram of a reconstructed recording of Wedda chants in Ceylon 1907 on the SpuBiTo web page

212 Christoph Keller, Lost / Unfound: Archives As Objects As Monuments, in: catalogue *ars viva 00/01 – Kunst und Wissenschaft* for the exhibition by prizewinning artists of Kulturkreis der deutschen Wirtschaft im Bundesverband der Deutschen Industrie e. V., Berlin (Staatliche Galerie Moritzburg / Halle, January - March

media-prosopopy.

Every film is, always already, itself an archive of time-as-movements, of life as process in time which cannot be reproduced, only measured in moving-image form.[213] The pioneer of cinematographic *montage* in Russia, Wsewolod Illarionowitsch Pudowkin, produced a film together with the Leningrad researcher of behavioural patterns Pawlow in 1928 under the title of *Functions of the Brain* and comments on the articifiality of mechanic reproduction of life: Any movement shown by filmic projection is dead already, even if its original has once moved in front of the camera. Only the setting-in-relation of filmic moments by cutting them together into a visual synthesis provides them with „filmic life“.

Technological *prosopopeia*

Stephen Greenblatt once openly declared his *new historicist* impulse "to speak with the dead".[214] The kernel behind such hallucinations is a cultural technique: the archaic Greek modification of the Phenicean commercial writing system into the phonetic alphabet by adding single letters for vowels in order to record the musicality of oral poetry - the textual *grammophone* not *avant*, but *avec la lettre*.[215] Written letters, though, inevitably belong to the realm of the symbolic which is the order of the archive, as different from physically indexial traces - the immediacy of the real like rays of light on photography or tracks of sound on recordings. Such technical memories are archives or libraries no more.

A coupling between the rhetoric of prosopopy and technics already takes place in Sigmund Freud´s comparison of psychical latency „with a photographic shot <...>, which might, after a given temporal delay, might be developed into a positive image“[216]

The American painter Elihu Vedder (1836-1923) once drew the subject of *Questioning the Sphinx* (1863).[217] The postmodern painter Marc Tansey has given Vedder´s image a literally media-archaeological turn, by privoding the interrogator of the Sphinx with a microphone - with the option not only to listen to the dead, but as well to record this evidence. Electronic recording is the techno-fiction of reversing death; with the invention of the grammophone voice has lost its logocentristic priviledge of authorizing true presence. In Walter Rathenau´s novel *Resurrection Co.* the administration of a cemetery in the city Necropolis, Dacota/USA, after some scandalous cases of mistaken people buried still alive established a company called „Dacota and Central

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2000); transl. Jeanne Haunschild, Berlin 2000

213 W. Wicker, 1964, as quoted in: Keller 2000

214 Introduction to Stephen Greenblatt, Shakespearean Negotiations, xxx

215 See Barry Powell, Homer and the Invention of the Greek Alphabet, xxx

216 Sigmund Freud, Der Mann Moses und die monotheistische Religion III, paragraph „Latenz und Tradition“, in: same author, Studienausgabe, vol. IX, Frankfurt/M. (S. Fischer) 1989, 455-584 (571)

217 See the exhibition catalogue: Ägyptomanie. Ägypten in der europäischen Kunst 1730-1930, Electa <year xxx>, entry no. 180, 262f

Resurrection Telephone and Bell Co.“ with the aim of connecting the buried with the public telephone network - just in case.[218]

The silence of the archive

Both readers and historians long for making a textual body resound again - what has been theatrically been called *re-enactment* by Collingwood. Jules Michelet, historian of the French Revolution, hallucinated the murmurs of the dead in the archives, as if archival records had always been the logocentric variance of a phonogram (*avant la lettre*). Not yet being equipped with according technical media of recording and projecting, Michelet made use of the psychic medium of imagination: "Dans les galeries solitaires des Archives où j´errai vingt années, dans ce profond silence, des murmures cependant venaient à mon oreille."[219] The present multi-mediatic interface aesthetics of computers makes use of this prosopopoietic desire. The media-archaeological resistance to this techno-ideology of dialogue with data though rather looks at the signal-to-noise-ratio of electronic data transfer, from the point of view of communication theory which Foucault recognized in his 1966 essay „Méssage ou bruit?“, reminding us that „Freud a fait des énoncés verbaux des malades, consideérés jusque´là comme bruit, quelque chose qui devait être traité comme un message.“[220] Today, Foucault´s own recorded voice can be listened at on a CD-ROM. But here, human ears only, not the technical apparatus, make sense out of noise. What was once called cultural tradition is technical transmission of signals today. Digital video streams are compressed in order to make them storable and transmittable at all. While in the transmission of archived text in the occidental tradition every letter counts - for a discipline called philology -, by compressing and decompressing digital images subtle amounts of data are being lost. This might be almost undetectable for the weak human eye or ear (MP3) - organs which have been deceived in its perception since the origin of time-based media like film and phonography -, but in the world of military target calculation one bit of difference might lead to lethal errors.

Very titanically: So what happens to the archive?

The recent (re)search for the wrack of the ocean liner *Titanic* has been a true act of submarine archaeology. While the gaze of the camera is able to look at this archaeologically (that is, purely evidentially in the sense of remotely sensing data), the human eye though immediately confounds evidence with magic when it comes to re-presentation of the absence of the past. "Out of the darkness, like a ghostly apparition, the bow of a ship appears <...> just as it landed eighty-four years ago.“ When the submarine exploration device *Mir 1*

218 As reported in Friedrich Kittler, Gramophon - Film - Typewriter, Berlin (Brinkmann & Bose) 1987, 23

219 Jules Michelet, Histoire de France, preface of 1869, 24, in: Oeuvres Complètes IV, edited by Paul Viallaneix, Paris (Flammarion) 1974

220 Michel Foucault, Message ou bruit?, in: Concours médical, 88e année, 22 octobre 1966, pp. 6285f (Colloque sur la nature de la pensée médicale) = M. F., Dits et Écrits I, Paris (Gallimard) 1994, 557-560 (559)

set out for the search of the wrack in 1995 late-summer, limited visibility and strong currents were a constant threat to the expedition. Film director James Cameron recollects: "Initially, I had totally superimposed my vision on to the ship and made the mistake of not letting *Titanic* talk to me. I was like the astronauts who experienced the moon as a series of checklists and mission protocols" - which is truly media-archaeological perception. Cameron counter-reacted: "So, at a certain point I abondoned "the plan" and allowed the emotional part of my mind to engage with the ship."[221] Hermeneutic empathy instead of data navigating distance - a world of difference between an *archaeology of knowledge* and historical imagination. What is sonar echoing in submarine archaeology is rhetorically renamed empathetic *resonance* by Stephen Greenblatt.[222] The submaritime ruinscape (relics from the ground of the sea) is transformed into narrative in Cameron's film *Titantic*.[223] The real archival item, though, is the non-figurative board-register, containing the record of all orders, like the black box in an airo-plane as the most non-narrative evidence of human and technical enunciations.

The prosopopoietic rhetoric of the archive is currently being replaced by operational archival interaction, as illustrated by *Pockets Full of Memories*, an online and museum installation by the media artist George Legrady in which the audience *creates* an archive by contributing a digitized image of an objekt in their possession at the time of the exhibition visit. Interaction is an aspect Bertolt Brecht pointed at already in the 20s for the emerging medium radio, insisting that it can technically - on the (feed-)back channel - be used in a bi-directional way as well by the receivers to communicate instead of being unilaterally being distributed as broadcast.[224] The unidirectional communication of books still dominated the user experience. With different *hierarchives*, a network is not a text any more, rather an archi(ve)-tecture. As long as the key-board of computers is alphabet-based like a type-writer for printing just letters, the paradigm of printing remains dominant; progressively though the mouse-click replaces the key-board for directing the monitor, and orientation shifts to visually perceived information landscapes; in multi-media space, however, the act of re-activating the archive can be dynamically coupled with feedback. This does not lead to a return of rhetorically prosopopoietic intercourse with the digital archive, but rather is this figuration in space being dynamically replaced by figures in time. David Gelernter, points at the data flow called *lifestream* as a future alternative to the current desktop-metaphor of computer interfaces which still carry, with file-like icons, an anachronistic archivism dating from old-European times of secretaries and offices, instead of rethinking digital storage space in its own terms (in computing language, we still speak of *stacks*, *files* and *registers*).[225] If emphatic memory (data permanently stored on hard-disks) is being replaced by a future of the computer as a place of intermediary, *passing storage*, the digital medium becomes „a mere temporary holding tank

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221 Joel Avirom / Jason Snyder, James Cameron´s Titanic, foreword by James Cameron, New York (Harper Perennial) o. J., xii

222 See Stephen Greenblatt Resonance and Wonder, xxx

223 USA, Twentieth Century Fox, 1997

224 Bertolt Brecht, Der Rundfunkt als Kommunikationsapparat, in: Gesammelte Schriften, vol. 18, Frankfurt/M. 1967, 117-134

225 A media archaeoly of the file has recently been written by Cornelia Vismann, Akten. Medientechnik und Recht, Frankfurt/M. (Fischer) 2000

for data, not as a permanent file cabinet“.[226] Future, present and past then are but segments, functions of marking differences within the transitive data stream. This leads to a performative consequence as well. Is it possible to avoid simply writing *about* the archive, thus missing the archival mode of representation itself, by writing the archive transitively? The option thus is to represent the archive as loosely coupled medium, not as historiographically closed form[227]; this nonnarrative mode means to count (with) what is *given*: *data*.

PARA-ARCHIVAL DATASCAPES

Since the Internet is transversive communication[228], its memory does not endure[229] but rather consists of a series of temporal units, with the archival paradigm being replaced by (algo-)rhythmic transfer.

Within the notion of cyberspace, „space“ itself is already a metaphor for something which might rather be described in topolocigal, mathematical-geometrical terms. *Cyberspace* is not a new place (*locus*) of memory, but the transformation of *lieux de mémoire* into knots and nets of data transfer. While still being infrastructurally grounded in physical places and techniques, the virtual adresses exist in mathematical topologies only.[230]

With supremacy of selection over storage, addressability over sorting, archival terminology - or rather the archive itself - becomes literally *metaphorical* - a function of *transfer* processes. From location to pure address: „Only what has been stored can be located“ - rather *vice versa*.[231] In this sense the Internet generates a „new culture of memory, in which memory is no longer located in specific sites or accessible according to traditional mnemonics, and is no longer a stock to which it is necessary to gain access, with all the hierarchi<vi>cal controls that this entails.“[232] The matter of memory becomes an effect of techniques of recall. "The debates around the future development of WWW centre on the issue of whether the web is simply a technique of recall from a global archive, or whether it marks the beginnings of a new, inventive relationship to knowledge, a relationship that is dissolving the hierarchy associated with the archive" (ibid.).

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226 David Gelernter, Machine Beauty. Elegance and the Heart of Technology, New York (Basic Books) 1997, 106

227 Compare Niklas Luhmann, xxx

228 See Pierre Lévy, Cyberkultur. Universalität ohne Totalität, in: telepolis. Die Zeitschrift der Netzkultur Nr. 0, Bollmann Verlag, Mannheim 1996

229 Christoph Drösser, Ein verhängnisvolles Erbe, in: Die Zeit, 23th June 1995, 66

230 See Albert Lichtblau, „Cyberspatial Monuments of Memory“, 234ff, in: Gerfried Stocker / Christine Schöpf (Hrsg.), Memesis. The Future of Evolution, Wien / New York (Springer) 1996

231 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)

232 Howard Caygill, Meno and the Internet: between memory and the archive, in: History of the Human Sciences Vol. 12 No. 2 (1999), 1-11 (10). See Lisa Jevbrett's visualization of the Internet by a coloured array of its fabric of IP-addresses.

As a machinic network of finite automata (a kind of techno-rhizome) the Internet does not provide for an organized memory; there is no central automat. The Internet is being defined by the circulation of discrete states only.[233] Thus the net is conform with radical constructivism in philosophy: Phenomena are always being created actually, but not as permanent or storable entities.

The Internet *as* archive at all?

The term "archive" is properly applied to legal and administrative memory institutions, but this should be differentiated from storage media. "The possibility of using a hypertext network as a universal archive is a dramatic development."[234] But does such a net fulfill the criteria of an archive proper, and second, is such a network of archival value as such? The servers of *archive.org* (located at the University of Berkeley) undertake the memorization of the Internet as represented in websites, but the Internet is rather about links than about storage.[235]: "Das Internet ist nicht *per se* archivierungswürdig. Das Internet ist auch kein Archiv im Verständnis von ArchivarInnen."[236]

The primary effort of conventional archival labour is separation and exclusion rather than storage: "La question est de savoir quoi trier et quoi abondonner."[237] The Internet as well still orders knowledge: apparently without providing it with irreversible hierarchies any more (on the visible surface), but on the other hand the authoritative archive of protocols is more rigid than any traditional archive has ever been. Traffic overload in the computer networks led the Clinton administration to build a new, separtate system - the Internet II, restricted to scientific (and military) communications.

The internet adopts the so-called *chaotic storage* method known from economy: "[T]he World Wide Web and the rest of the Internet constitute a gigantic storehouse of raw information and analysis, the database of all databases. <...> The more serious, longer-range obstacle is that much of the informationon the Internet is quirky, transient and chaotically 'shelved'[238] - *organizational memory* rather than archive in the coventional sense.

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233 Gilles Deleuze / Félix Guattari, Tausend Plateaus. Kapitalismus und Schizophrenie, a. d. Frz. v. Gabriele Rick / Ronald Vouillié, Berlin (Merve) 1992, 31 u. 36

234 Theodor H. Nelson, Computer Lib - Dream Machines [*1974], Redmont, Wash. (Tempus Books) 1987, 33

235 See Howard Caygill, Meno and the Internet: between memory and the archive, in: History of the Human Sciences, Vol. 12 No. 2 (1999), 1-11 (2)

236 Andreas Kellerhals-Maeder, Archive in der schönen, neuen Welt. Auf dem Weg zu einer klaren Position, in: Geschichte und Informatik 12 (2001), 89-108 (95)

237 Farge 1989: 87

238 Editorial: The Internet. Bringing order from chaos, in: Scientific American vol. 276 no 3, march 1997, 494 (49)

Navigating (in) the archive

The archival definition of the basic unit of archives, the *fond*, is an "[e]nsemble de documents, quels que soient leurs formes ou leur support matériel, dont l´accroisement s´est effectué d´une manière organique, automatique, dans l´exercice des activités d´une personne physique ou morale [...] sans jamais le démembrer.[239] The internet "archive", on the contrary, has become radically temporalized. It is rather hypertemporal than hyperspatial. The difference between the classical archive and the Internet is its dynamic, no more just passive option. Such is the use of the term "archive" in the Internet itself, indicating its shift of emphasis on realtime or immediate storage processing, on fast feedback. Hypermail, e. g., has been a program that takes a file of mail messages in UNIX mailbox format and generated a set of cross-referenced HTML documents, so that the entire mail "archive" could be browsed in (literally) "a number" of ways.

There has been a definition of the function of archives in the internet in a narrower, precise meaning: "It was soon realised that each site providing its own anonymous *ftp* area with its won material would make it difficult to find and catalogue the information available. The answer to this problem was to provide archives; machines dedicated to the task of serving files via anonymous *ftp*. These archives collect together material from other anonymous *ftp* areas scattered through the Internet and present it in a single location. The job of the archive maintainers is to keep the archives up-to-date and to try and organise them in an orderly fashion."[240]

With Internet search engines like *Netscape navigator*, hyperspace remembered its essence in the etymological sense: cybernetics, that is: navigation of a ship on the basis of negative feedback steering.[241] With symbolically coded voltage, the „taste of the archive“ as described by Arlette Farge has gone: „Elle est difficile dans sa matérialité"[242]; by its organization in logical circuits, it still does not become amorphous. "Celui qui travaille en archives se surprend souvent à évoquer ce voyage en termes de plongée, d´immersion“ (ibid.) – a cyberspatial key notion indeed.

The power of archival memory resides not in the stored data, but in the external inventories which make data accessible at all. By making (once digitized) visual memory accessible *from within* (f. e. by search engines like QBIC which strive for image-based image retrieval by sililarity or „query by image content“), a real iconic turn has been achieved. The technical dispositive gains power over the cultural imaginary.

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239 J. André, De la preuve à l´histoire, les archives en France, in: Traverses 36 (January 1986), 29
240 "Information and archives on the Internet", http://www.hensa.ac.uk/www94/internet.html
241 See Wiener 1948
242 Farge 1989: 10

To what degree is the Internet archivable?

Is there a cultural need for digital time-capsulas? The loss of websites from the Internet is symptomatic for the systematic disappearance of digital cultural commodities. "It will take many years before an infrastructure that assures Internet preservation becomes well established“; media archivology attends to the chance to trace an emerging new medium *in statu nascendi*. Otherwise, "the opportunity to capture a record of the birth of a new medium will then be lost"[243] - memorizing the new-born internet in realtime.

The two bodies of Internet memory are both physical and topological. The *Internet Archive* "may provide the raw material for a carefully indexed, searchable library. The logistics of taking a snapshot of the Web are relatively simple. <...> The software on our computers `crawls´ the Net - downloading documents, called pages, from one site after another. Once a page is captured, the software looks for cross references, or links, to other pages. It uses the Web's hyperlinks - adresses embedded within a document page - to move to other pages.“[244]

Archival temporality is fractioned into hardware: „We chose hard-disk storage for a small amount of data that users of the archive are likely to acces frequently and a robotic device that mounts and reads tapes automatically for less used information. A disk drive accesses data in an average of 15 milliseconds, whereas tapes require four minutes. Frequently accessed incormation might be historical documents or a set of URLs no longer in use."[245]

Internet memory becomes differential, in terms of Delta-coding: „We plan to update the information gathered at least every few months. <...> In future passes throught the Web, we will be able to update only the information that has changed since our last perusal."[246] Such an "archive" can only me a selective mapping, a sampling of the Internet (while dynamic objects and the "secret Web" escape). „Still, the archive gives a feel of that the Web looks like during a given period of time even though it does not constitute a full record."[247]

Not only data, but their formats ask for preservation: "The Commission on Preservation and Access in Washington, D.C., researches how to ensure that data are not lost as the standard formats for digital storage media change over the years. In another effort, the Internet Engineering Task Force and other groups have labored on technical standards that give a unique identification name to digital documents. These uniform resource names (URNs) <...> could supplement the URLs that currently access Web documents. Giving a document a URN attempts to ensure that it can be trced after a link disapears."[248]

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243 Kahle 1997: 83
244 Brewster Kahle, Preserving the Internet, in: Scientific American, vol. 276, no 3 / March 1997, 82f (82)
245 Kahle 1997: 83
246 Kahle 1997: 83
247 Kahle 1997: 83
248 Kahle 1997: 83

Dissimulations of the cyberspatial techno-archive: virtual waste land

Internet communication has make the "old European" user accustomed to the shift from a culture of storage to an accelerated notion of "delayed transfer" (a term keyed by Jack Goody).[249] But there is a loss of the katechontic quality of deferral in cyberspace, undoing "tradition".

Hardware itself seems to be forgotten in metaphors like "cloud computing". David Gelernter formulates the ultimate goal of all software "to *break free of the computer*, to break free *conceptually*. <...> Cyberspace is unlike any physical space. The gravity that holds the imagination back as we cope with these strange new items is the computer itself, the old-fashioned physical machine. <...> every key step in software history has been a step away from the computer, towards *forgetting* about the machine and its physical structure and limitations – forgetting that it can hold only so many bytes, that its memory is made / of fixed-size cells, that you refer to each cell by a numerical address.[250]

Against the totalizing vision of virtual storage, the Internet might actually reveals its impossibility of being an archive. „Dump your trash“ is a call to use the Internet as a virtual copy machine of information recycling[251]; the server *sero.org* helps to turn webpages into a seemingly dusty inscription.[252] The company Imagex has created a machine called *Decopier* which sucks printing out of xeroxes to render an empty page. And a couple of artists have created artificial information deserts and voids in cyberspace indeed, such as Mark Napier (New York) with his project *The Landfill*, turning any content of web-pages into graphical raw material. Once again, aesthetics turns out to be ideological, since it sublimely hides the digital truth behind the interface simulacra. The more radical version, though, is the cookie / program *ArchiVirus* created by Manu Luksch, Arnim Medosch and R. Steckel (to be copied from the internet on one´s own computer. Then it decomposes textual documents on the hard disk into its ingredients; alphabetically sorted, all the letters of a file appear on the screen, sense-less, but as a kind of raw material for composing new texts. This is a kind of *reverse engineering* of the archivo-literary phantasies developed by Leibniz and Jorge Luis Borges, from letters to litter.[253]

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

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249 See Stefan Iglhaut, Vom Archivieren zum Navigieren. Anmerkungen zu `Deep Storage´ und zum Medium der Verfügbarkeit, in: Deep Storage. Arsenale der Erinnerung: Sammeln, Speichern, Archivieren in der Kunst, ed. Ingrid Schaffner / Matthias Winzen, Munich / New York (Prestel) 1997, 174-176
250 David Gelernter, Machine Beauty, New York (BasicBooks) 1997, 22f
251 Joachim Blank / Karlheinz Jeron, Information-Recycling, in: netz.kunst. Jahrbuch für moderne Kunst 1998/99, Nürnberg 1999, 92-99
252 See Baumgärtel 2000: 178
253 See W. E., Bauformen des Zählens. Distante Blicke auf Buchstaben in der Computer-Zeit, in: Eckart Goebel / Wolfgang Klein (Hg.), Literaturforschung heute, Berlin (Akademie) 1999, 86-97

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* has been frequently confused with the institutional state archives. The "archival fever"[254] in the cultural field has become inflationatory, and many artistic projects which proudly call themselves "archive" are rather idiosyncratic collections; finally, the term "anarchive" has been liberating but obscuring as well. The phenomenon of the "archival turn" is the symptom of a nostalgic, even melancholic reaction-formation (in Freudean terminology) of traditional memory culture which is confronted with the challenge of contemporary media: technological storage (both "big data" and ephemeral micro-storage), different from the "library", the "museum", and individual or collective "memory". To face this challenge, most advanced algorithmic approaches are required.

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

Media archaeological analysis goes *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.[255] There is a technological equivalent to "latency" as defined by Sigmund Freud for unconscious memory in psychoanalysis indeed. Wire 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

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254 Jacques Derrida, Archive Fever. Freudian Impression, in: Diacritics vol, 25 (1995), 9-63

255 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)

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.[256]

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

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

The function of the "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.[257] "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 [...]."[258] This is archival, symbolically ordered temporality, a kind of kinematographical apparatus where the

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

257 William Aspray, John von Neumann and the Origins of Modern Computing, Cambridge, Mass. / London (MIT Press) 1990, 176

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.[259]

A most radical theory of storage comes from within the essence of computation itself, the *turingmachine* 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'."[260] 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 <...>."[261] 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.[262]

There has been 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. One of the reasons for misunderstanding the term "archive" as metaphor is due to Michel Foucault's idiosyncratic redefinition of *l'archive* in a chapter of his *L'Archéologie de Savoir* (1969) which should not be confused with French *les archives* as legal term for an institution in state bureaucracy. In a rather propositional sense (therefore closer to logical and mathematical diagramatic reasoning than to cultural memory) *l'archive* here is first of all the rule of what can be expressed at all, that is: the system that governs the appearance of statements as individual events, and corresponding to that definition, "archivology" is the analysis of diverse relationships and the identification of their specific regularities - which is algorithms in the computational present. 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; the contemporary conditions of media culture is rather infrastructure than archive[263], an interlacing of material channels with the logistical, in fact:

258Marvin L. Minsky, Computation. Finite and infinite machines, Englewood Cliffs, New Jersey (Prentice-Hall) 1967, 12

259See Vilém Flusser, Die Auswanderung der Zahlen aus dem alphanumerischen Code, in: Dirk Matejowski / Friedrich Kittler (eds.), Literatur im Informationszeitalter, Frankfurt / New York (Campus) 1996, 9-14

260 Alan 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

261 Ibid.

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

263 See Lisa Parks / Nicole Starosielski (eds.), Signal Traffic. Critical Studies of Media Infrastructures, Urbana / Chicago / Springfield (Univ. of Illinois Pr.) 2015

symbolic order (software, replacing the older notion of "library"). If the *archive* is the ensemble of techno-logical conditions of possiblities, 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). For the analysis of dynamic storage technologies which defines the always micro-delayed computational present[264], the category of the archive even becomes a hindrance; expressions like the "archive in motion"[265] sound poetic but are an oxymoron when observed strictly. For an archivology of contemporary media culture which is computer-algorithmic in its operational essence, a 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 logical preservation.[266] Does a truly archival record require to be read or just preserved? A trifold essence of the digital record unfolds: It is physically inscribed as meaningless signal, logical when recognized and processed by software (the algorithmic grammar), and media-phenomenologically "conceptual" only when recognized by humans and / or socio-economic systems. "The rules that govern the logical object"[267] - the Foucauldean *archive* - are independent of how the data are written on a physical medium (which means invariant over time) as long as the code is known. In such readability, technological scanning itself has already intervened.

Operative memory from within technology: Dynamic storage

An example for an object-oriented notion of memory has been the peripheral cassette storage technology used in early Personal Computers like the *Commodore 64*. There is 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 for non-legal distribution of music immediately addressed to the human ears. The "sound of the archive" in computation itself could be experienced from the "Datasette" storage technology in early computing, when e. g. loading a computer game such as the Sinclair ZX81 Flight Simulation, 16k RAM, with the 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". Load time amounted to 6 minutes approximately, while the "POKE" command in BASIC allowed for direct access to the internal RAM and its data location, a direct "imaging" of the

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264 See W. E., The Delayed Present. Media-induced interventions into contempor(e)alities, Berlin (Sternberg Press) 2017
265 See Eivind Rossaak (ed.), The Archive in Motion, Oslo (Novus) 2010
266 See Doron Swade, Collecting Software: Preserving Information in an Object-Centred Culture, in: History and Computing Vol. 4 No 3 (1992), 206-210
267 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)

storage grid on the computer screen.[268] When loading the binary content of such a "Datasette" embodied in two acoustic frequencies was loaded from external cassette recorder to a computer, once could listen to the sound of a modem (or Fax) like rhythm of software memory. Such implicit sonicity radically articulates that digital memory is never *ready-at-hand* as an archive but comes into being only in "musical" operativity. - while the traditional paper-based archive remains silent. Therefore the symbolical order of the institutional archive should neither be confuse with human neuronal recollection, nor with technological storage. Still, digital micro-memory architectures, its topology and organization, preserves some habits of traditional archival and administrative practice - such as the prearchival *registers* in the heart of the Arithmetic and Logical Unit of a microprocessor, as the intermediary and volatile repository of current acts. This corresponds with the echoic memory of the operative present within the human brain, once resulting in the famour cybernetic epistemology of the "computer brain" (McCulloch, Pitts, Wiener). The "register"merges both areas which have been discursively separated into one operational horizon, by including the storage elements *immediately* into the current action and the action of the electric current. The electrons themselves do not remember.

Updating "the archive"

"Radical" media archaeology (in alliance with "digital forensics"[269]) is rooted 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*."[270] In operative technologies, this *arkhe* is not abstract but locatable in temporal and material action. Techno-logified matter (hard- and software) constitutes a nondiscursive *archive* in the Foucauldean sense; its being is not simply subject to cultural discourse when the material and mathematical *veto* intervenes. In Foucault’s distinctive usage of the term *archive*, "the archive cannot be described in its totality", since the observer himself is still part of that archive.[271] The describability of the technological *archive* only arises when its practices start to recede into the past. 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.

A concept of "the archive's two bodies"[272]

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

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268 See Nick Montfort et al., 10 PRINT CHR$(205.5+RND(1)); : GOTO 10, Cambridge, Mass. / London (The MIT Press) 2013
269 See Matthew Kirschenbaum, Mechanisms. New Media and the Forensic Imagination, Cambridge, MA (The MIT Press) 2008
270 Derrida 1995: 9
271 Michel Foucault, Archaeology of Knowledge [FO 1969], trans. A. M. Sheridan Smith, New York (Pantheon Books) 1972, 130
272 Alluding to Ernst H. Kantorowicz, The King's Two Bodies, Princeton 1957

administrative archive in the strict sense is a read-only memory; neither the record nor the archival order as such (its "tectonics") can be easily changed according to a new discursive will. Just like within computing, a rewriting of code in the operating system would make the whole function collaps. It is the nonnarrative 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 renegotiated and updated[273], there is no more archive at all. There is a solution to this dilemma: The physical record (even the "digitally born" file respectively its archivally preserved "disc image") remains strictly untouched, while its digital *double* invites for all kind of knowledge-based algorithmic experimentation.

No anarchy in the digital archive

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", 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; instead there is a rather fuzzy applications of "archival" terminology.

For critical reasons, the inflational metaphorical misuse of the "archive" for memory agencies might be limited. Updating the archive, in digital culture, means, a separation of cultural discourse from "the archive". The term can be replaced by more precise *termini technici* when it comes to the technological "a priori" in hard- and software. Media *archivology* proposes a metonymic shift in which the technological devices themselves *are* the archive, an operative rather than historicizing agency. It can process discourse since it is in itself nondiscursive, not negotiable unless by re-wiring or re-programming.

"The media archive is as much about archiving recordings as it is about storing machines."[274] But technology does not archive but store signals (respectively data). "And the latter, the configuration of the storing of the machines, is also configuring our future access to the archive"[275] - which means access to technological data carriers in the sense of storage location addresses "not memory (or 'history')"[276]. Archival authenticity becomes nonhuman. For technological storage in computing, the term "memory" has been a metaphorical application by engineers, once written explicitely 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"[277]. Only diagrammatically, but not technologically "like an archive", a computer memory is both what is temporally stored and its location.

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273 Cox et al. 2015: 127
274 Morten Sondergaard, Interfaces of Future Authenticity, in: Joasia Krysa / Jussi Parikka (eds.), Writing and Unwriting (Media) Art History. Erkki Kurenniemi in 2048, Cambridge, Mass. (MIT Press) 2015, 191-202 (195)
275 Ibid.
276 Sondergaard 2015: 196

An archive is a cultural technique, whereas technological "memory" is storage of a different kind.

Case Kurenniemi

While in public discourse the archive is frequently (mis-)understood as the "content" of the archive (its records, its data banks), in archival science 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 institition, like media artist Erkki Kurenniemi's textual, audio and video record(ing)s. In the Finnish National Gallery's Archives, Library and Collections section at Helsinki, his estate is predeposited 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 [...]."[278] It is nonhuman 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 [...]."[279] What is required for the memory of the present age is a media archaeological theory of tradition which encompasses both cultural and noncultural messages of such kind.

"Entropic" media memories

"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*. [...] In the physical sciences, the entropy associated with a situation is a measure of the degree of randomness [...]; 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."[280] The video *Entropia* by Andreas Müller-Pohle shows the destruction of photographies by a shredding machine. Negentropic digital coding, on the contrary, persists againsts such entropic material decay, and roots within the mathematical theory of communication engineering itself. The digital code ows its ahistoricity rather to its different form of registering; instead of straightforward signals recording of the physically real event, signals are sampled and encoded which symbolically keep the information. This

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277 Sondergaard ibid., referring to Wendy Hui Kyong Chun, Programmed Visions: Software and Memory, Cambridge, MA (MIT Press) 2011, 8
278 Susanna Paasonen, Fleshy Intensities, in: Krysa / Parikka (eds.) 2015: 33
279 Ibid.
280 Warren Weaver, Recent Contributions to the Mathematical Theory of Communication, in: Claude E. Shannon / same author, The Mathematical Theory of Communication, Urbana, Ill. (University of Illinois Press) [*1949] 1963, 1-28

information is suspended from physical time, leading to memory latency. The Foucauldean *archive* thereby recedes into the coding and protocol, the truly media-*archéo*logical (in fact media-archivological) layer of communication.

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 fully available, or gone"; on / off here does not correlate with the emphatic notions of cultural time any more, which is still based on the chrono-aesthetics of smooth transitions. In most cases, "digitally saved information can either be read without loss of quality, or it is illegible and hence 'completely lost'"[281].

Dynamics *within* memory devices: the "enduring ephemeral"?[282]

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. The core experience in cultural modernism which is perpetual change, corresponds to a shift of emphasis in *actual* archival memory - the transitory file (as part of present administration) gains supremacy agains the enduring record; *acta* are provided with a functional vector of immediacy, they are meant to be *activised*.[283] The archi(ve)texture of technological administration is better conceived in processual rather than structural terms.

Rather detached from its former almost exlcusive orientation towards 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 such addresses is vital for the operations of "memory" in digital computing as data-storage.

The archive does not contain "historic" memory (which is shaped only in historiography), but 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*. The temporal bias of the archive shifts, in times of predictive analytics by NSA dataveillance, shifts from past to *futurum exactum*. "[T]he technical structure of the *archiving*

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281 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

282 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

283 On German *Akte* vs. *Urkunde* see Cornelia Vismann, Akten. Medientechnik und Recht, Frankfurt/M. 2000

archive also determines the structure of the *archivable* content even in its very coming into existence and in its relationship to the future."[284]

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.[285] 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 reconstructing the generative matrix created by technical and logical 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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284 Derrida, 1995: 17

285 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

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", 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 Shannon's mathematical theory of communication 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"[286]. 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.[287] Signal delay lines might be called a micro-memory. But such intermediary memories are not of a logical, calculating nature like the intermediary storage of bit values in registers of Central Processing Units in computing. 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 borderline of becoming "memory" as storage.

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286 Friedrich Kittler, The History of Communication Media, in: online journal www.ctheory.net/articles.aspx?id=45; published 7/30/1996

287 For methods to clear magnetic data remanence see the entry "Degaussing" in http://en.wikipedia.org (accessed April 7, 2014)

The temp*aura*lity of archival storage

Walter Benjamin defined the *aura* as peculiar interlacing of time and space - "einmalige Erscheinung einer Ferne, so nahe sie sein mag".[288] 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*aurality* which used to be based on the indexial trace from the past (the Barthean *punctum* in analog photography) is being replaced by nonlinear time-critical, even bit-critical operations (like the Charged Coupled Device as basis for digital photography nowadays).

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, Marey's and Muybridge's chronophotography then apparently recorded temporal movement itself - but the discrete (in its double sense) archival essence of technical cinematography is mostly hidden to human perception which favours continuous motion.

With the informatisation of archival documents, they loose their physical, material characteristics (the "taste" of the archive, in Arlette Farges sense[289]) 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 takes place in the neuronal net, representing a kind of dynamic micro-storage for moments. Both neurological perception and digital culture turn are radically memory-based, even if such 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 recall of images takes place in the short-cut between immediate perception and virtually stored perception from the past. Thus dynamical recollection (remembrance) is closer to the

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288 Walter Benjamin, Kleine Geschichte der Photographie, in: idem, Gesammelte Schriften, eds. Rolf Tiedemann / Hermann Schweppenhäuser, Frankfurt/M. (Suhrkamp) 2nd ed. 1989, 368-385 (378)

289 Arlette Farge, Le goût de l'archive, Paris 1989

electronic image than to the archival order.[290] 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 the present, but the present itself dissolves into microarchival and micromnemotechnical moments.

With programmable media, remembrance (as defined by Platon and more specifically by Aristotle as *anamnesis*[291]) is not exclusively human any more, but becomes a (Latourean) non-human agency - algorithmic memory.[292] 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 compressed and condensed to be regenerated. Even more radical (in the epistemological sense) are "virtual" media, that is: any object that exists not by indexical reference to an origin in the physical world like chemical photography or phonographically recorded sound, but is generated genuinely by calculation. The virtual archival record is not preserved in its materiality on which its traditional authority has been based, but is regenerated 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.[293] The rules (i. e. algorithms) of such regeneration are the new *archive* (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 recall of a material record.[294] 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, stored records becomes dynamically updatable an any temporal instant.

Once the coded message is trusted to a storage medium, it is suspended and locked in an almost atemporal state. Symbolically coded memory has a good chance to be transmitted with high fidelity against noise, like alphabetic letters are, to a high degree, resistant against entropic degradation since they can be copied ("refreshed") within a broad range of individual variance. "The quality of the medium is of secondary importance, as long as the 'code' can still be

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290 See Maurizio Lazzarato. Videophilosophie, Berlin (b_books) 2002
291 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
292 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
293 See Mario Carpo, Alphabet und Algorithmus. Wie das Digitale die Architektur herausfordert, Bielefeld (transcript) 2012, 72-76
294 Carpo 2012: 144

decoded."[295] 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"[296].

From archival space to storage time

Archives have long been the institutional basis for remembering and forgetting in societies across history[297], 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 rather requires to be described in topological, mathematical or geometrical terms, replacing emphatic memory by reverberative transfer.

Discrete temporal intervals are 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.[298]

Micro-processors in data processing assign intermediary storage locations to current data and provide them with addresse; our "digital present" in *online* 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 electrophysical infrastructure and its metadata (transfer protocols) the internet is *archive*; but in terms of its content, the internet is not an archive at all, just ephemeral storage. Let us therefore restrict the pronunciation of the term to *l'archive* in French.

MATERIALISM OF TECHNO-ARCHIVAL MEMORY

Beyond the traditional archive which is a depository and framing of textual records *set apart* from current administration, digital records take place in a

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295 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)
296 Gschwind 2006: 183
297 Andrew Hoskins, Media, Memory, Metaphor: Remembering and the Connective Turn, Parallax 17:4 (2011), 19-31 (25), chapter "Space, Time, Archive"
298 See Martin Warnke, Digitale Archive, in: Hedwig Pompe / Leander Scholz (eds.), Archivprozesse. Die Kommunikation der Aufbewahrung, Cologne (DuMont) 2002

techno-archival structure *within* computation (be it data storage and processing in the single computer, or in its "online" 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 techno-mathematically rooted in its media materialities. From that derives the necessity for an "archival" concept 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 restistance. Conceptually, the conventional understanding of the institutional archive needs to be supplemented by a more Foucauldean, 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 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.[299] "Bias" originally is a technical term in electronic engineering describing the necessary electric tension to operate a vacuum tube (esp. triode) - a literally pre-condioning, 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 hight frequency signals to improve the signal-to-noise ratio (dynamics). The proper informative time signal thus is overlayed or pre-conditioned by a different *a priori* temporality.

Temporalizing the archive and its material resistance

299 Harold Innis, The Bias of Communication, University of Toronto Press 1991

In terms of historical research, a record from the past is almost immediately subjected to contextual knowledge. Such a reading transforms it from being an autonomous physical and symbolic *monument* into a historical *document*. Michel Foucault decided to redefine this historiographical operation in favor of treating a record(ing) from the past rather in media-archaeological terms as an artefact in its proper materiality: "[I]t might be said, to play on words a little, that in our time history aspires to the condition of archaeology"[300] - to the intrinsic description of the technical (hardware) and logical (software) "monument".

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 analog storage, the signal formation is directly depending of the materiality of the recording medium (like the gramophone groove in its shellac matter[301], 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 (*archê*) for operations in another archaeo-logical sense, such as mathematical calculating numbers by 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* [302] 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 device[303]. 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. 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.[304] 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

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300 Michel Foucault, Archaeology of Knowledge, transl. A. M. Sheridan Smith [*1972], London / New York (Routledge Classics) 2002, "Introduction", 3-19 (7f)
301 See Elody Roy, xxx
302 Claude Shannon / Warren Weaver, The Mathematical Theory in Communication, xxx [*1948] xxx
303 Ira M. Sage, Making Machines Remember, in: Product Engineering, Bd. XXIV (April 1953), 141-149 (141)

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

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.

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"[305]. What used to be secred 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."[306] More or less immobile cultural materialities of memory (books in libraries, material artefacts in museums, medieval parchment in record archives) lose their

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

306Hans Ulrich Reck, Metamorphosen der Archive / Probleme digitaler Erinnerung, in: Metamorphosen. Gedächtnismedien im Computerzeitalter, ed. Götz-Lothar Darsow, Stuttgart / Bad Cannstatt (Frommann-Holzboog) 2000, 221

heterotopic and heterochronic quality of resistance against the technologocentristic desire for immediacy.[307] 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.[308] In an age of increasing mobility, should we rather ask for an immobile archive as its "katechontic" virtue? In ephemeral electronics, "memory is transitory."[309] Archival resistance against change is a virtue in the time of networked documents which dissolve into memory-buffered *streaming data*. What resists such *online* accelleration is the very materiality of techno-archival records.

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-depended 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."[310]

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

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307See 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

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

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

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

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. 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."[311] 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."[312] 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

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

312 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

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".[313]

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.[314] It is only discursive software (narratives) which transforms such 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"[315]

Emulation of both ancient computer hardware and operating sytems software in contemporary computers is a truly "digitally born" answer of contemporary media culture beyond traditional archival care.[316]

Against historical time: archival resistance

Mobilizing 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 is 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

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313 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)

314See Friedrich Kittler, Das Reich des Symbolischen - eine Welt der Maschine, in: same author, Draculas Vermächtnis. Technische Schriften, Leipzig (Reclam) 199x

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

316See Friedrich Kittler, Museums at the Digital Frontiert, in: Thomas Keenan (ed.), The Ends of the Museum, xxx

"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 contempary archival secrecy in media culture is of a new kind, hidden within technology itself, the "protected mode" of micro-processors.[317]

Algorithmic chances and katechontic criticism of 'open access' from the perspective of data- storage theory and media archaeology

A media-archaeology of knowledge is not simply devoted to the effective structuring of databases during the digital cataloguing of a given collection, nor to the design of cultural memory institutions' online web portals as the pitching of such collections in the market fair of the World Wide Web ("Europeana"). Instead, it is directed towards an epistemologically deeper level and, for this reason, concentrates on a few very fundamental observations about the relationship between cultural institutions and digital storage systems.

Algorithmic options of 'open access' aim at that level of the digital world where digitised information is really – that is, operatively – negotiated: at the operating and programming level of the computer. Here data are no longer organised in terms of rigid classifications, but in terms of algorithms, that is, handled in a step-by-step and problem-oriented manner. Entirely new forms of accessing digitised cultural objects thus open up in the areas of text, image and sound. Aside from the question of how cultural institutions present themselves on the surface, that is, on the monitors of the Internet, laboratories might be set up for the experimentalisation of digitised cultural information, since that is what 'cultural information science' means, regarding the arrangement and comprehension of data.

The katechontique critique of 'open access' makes use of a proud term: *Katechon* means delay in the sense of a distance – just as much material as it is spatial and temporal. There are good reasons for deliberate suspense or restraining from immediate entry and access to archives, museological collections and cultural landscapes.

The methodical grounding from a storage-theoretical and media-archaeological perspective aims at the difference of socio-cultural memory as compared to the materiality and technology of storage devices, and the deliberately distanced, momentarily directly 'cultureless' but knowledge-insprining cataloguing of such material.

317See Friedrich Kittler, Protected Mode, in: same author, Dracula's Vermächtnis. Technische Schriften, xxx

Archival materialism

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."[318]

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."[319]

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.[320]

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)[321] 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

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

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

320 See Matthew Kirschenbaum, Materialism, xxx

321 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."[322] The media archaeological approache radically pays respect to the material constitution of media *and* their organizing ratios (techno-logics) which extends "beyond merely human durations"[323], resulting in the current discussions about the *anthropocene* earth age und in terms like "deep time", employed by Siegfried Zielinski's *Media Archaeology* as well.

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 issue[324] 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'."[325] Is this true? As symbolic order (which according to Jacques Lacan always already implies the machinic[326]), 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 photography and phonography, the first apparative media in its modern sense,

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322 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

323 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

324 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

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

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

became subject of the archive, the sense-affective, presence-generating power[327] 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."[328] While the body from which the song originated apparently has aged, being subject to physical entropy, the recorded signal in principle stays invariant agains 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 been preserved by analogue recording technologies, becomes quantified in the transfer to digital recoding (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. *Over*sampling 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 deteriorisation 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.

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

328 "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 Fluser, the essential cultural desire is the negentropic effort to maintain order agains the physical tendency towards equally distributed disorder.[329] "We may think that libraries and archives have stemmed the tide of cultural memory loss."[330] 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 agorithmic motion, in electromagnetic ephemerality and latency.

Digital data, which is: "information", *per definitionem* (Norbert Wiener, Cybernetics 1948) are neither matter nor energy.[331]. The gain of flexibily 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 agains 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 grammphone 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 (hardware)[332] is representative of such new kind of archive (understood in the

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329 Vilém Flusser, Kommunikologie, xxx
330 http://lyra.rlg.org/ArchTF/tfadi.intro.htm#fragility
331 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)
332See Michael S. Malone, The Microprocessor, Berlin et al. (Springer) 1995

Foucauldean sense. There is a well-developed terminology restriced 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[333] 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."[334] 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"[335] - 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)[336]; 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 anachronism, a metaphorical hindrance; it might 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).[337]

333See Charles M. Dollar, Archival Theory and Information Technologies. The Impact of Information Technologies on Archival Principles and Practives, ed. by Oddo Bucci, Information and Documentation Series No. 1, Univeresity of Macerata, Italy, 1992

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

335 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*)

336 Cox et al. 2015: 134

337See Aleida Assmann, Das Archiv und die Neuen Medien des Kulturellen Gedächtnisses, in: Voßkamp / Stanitzek (eds.), Schnittstellen, Cologne 2001, 268-281

The old rule that only what has been substantially fixed can endure and be located does not count any more.[338] 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.[339]

Explicitely 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 techno-logical 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 Immanel 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 regularities[340] - 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 engines[341] not only answer the desire for new ways of access to digitzed 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 pre-cybernetic 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").[342]

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338 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)
339Jacques Derrida, Mal d´archive, Paris (Gallimard) 1985
340Michel Foucault, Archaeology of Knowledge, trans. A. M. Sheridan Smith, New York (Pantheon Books) 1972, 130
341For Constant's *Active Archive*, see Cox et al. 2015, xxx
342 See Ludwig von Bertalanffy, General Systems Theory, New York (George Braziller) 1968

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 quarz 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.

HUMANITIES OF THE DIGITAL: MEDIA PHILOLOGY

Media philology as critical inquiry of Digital Humanities practice

Digital Humanities (DH) - or what more analytically be termed "algorithmicized humanities - as research practice is not only about digitising documents, neither is its focus on "open access" to "big data" only, but methodologically more challenging: the analytic application advanced software tools (called "cultural analytics" by Lev Manovich). This orientation requires a new kind of media philology: a critique of the underlying algorithms themselves, such as the codecs applied for temporarily compressing data archives.

Computational culture is dealing with technologies in its literal sense: not simply the symbolic order of textual *lógos* (be it the alphabet, be it the alphanumeric code), but with their implementation in matter (*techné*). Therefore, next to critical code studies, the other scene of media philology is actual computer hardware (like Kirschenbaum's "forensic" analysis of the hard disk drive), as a contemporary version of what archaeologist Eduard Gerhard in mid-nineteenth century had coined "material philology"[343].

So-called Critical Code Studies defines itself "as the application of critical theory and hermeneutics to the interpretation of computer source code. [...] Working together with platform studies, software studies, and media archaeology and forensics, critical code studies uses the source code as a means of entering into discussion about the technological object in its fullest context [...]."[344]

Media archaeological analysis, complementary to media philology, embraces the material component as well, as technical criterium to otherwise software-

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343 Eduard Gerhard, Zur monumentalen Philologie. Vortrag vor der Philologenversammlung in Berlin im J. 1850, in: Archäologischer Anzeiger 1850, 203 ff.

344 Ian Bogost / xxx Montford, Introduction to their book on BASIC *10 PRINT*, S. 6 f.

focused data exegesis. In the effort to re-enact an obsolete computer architecture within a present computer, the concept of emulation turns former hardware engineering itself from a material object into an alphanumerically coded text, therefore accessible for critical media philology.

New methods: The message of DH

Digital Humanities is employing analytic tools which have not been available before to the traditional canon of humanities - literally *avant la lettre*, in fact the numerical values of the binary code. An example is the tracking of changes in digital texts, the successive different versions of entries in the online encyclopedia Wikipedia, by application of the "diff" operation, which is way of text retrieval well known from "genetical" philology.

The Internet search engine Google includes a tool called the Ngram Viewer for graphically plotting the frequency of terms over time. "An *n-gram model* is a type of probabilistic language model for predicting the next item in such a sequence in the form of a(*n*-1)-order Markov model."[345] The complex techno-logical operation of sampling *alias* digitization of signals (bei it text, sound, or image) into binary data, combined with mathematical and logical intelligence called "software" (effectively embedded within the von-Neumann architecture of stored-program computing) is the very media archaeological condition of possibility for such DH performances, its Kantean *a priori*, understood here in a techno-mathematical sense.

Digital Humanities have been criticized for emphatically browsing "big data" by statistical analysis and producing just trivial results. But evidence such as the predominance of the colour red in late eighteenth century paintings is only the superficial aspect of Digital Humanities practice. In its incubation period, it is less the (adminttedly thin) content that counts for DH, but its medium message (in McLuhan's sense) which is experimentation with algorithms (for which the spreading number of research "labs" is indicative[346]), and the application of stochastic (rather than simply statistical) analysis. In film studies, this goes beyond Juri Trivan's *cinemetrics* which still refers to the *Einstellung*, the camera shot sequence[347] within a single film, calculating with the single frames. More radically, it is possible to count with every pixel in the digitized frame to identify its entropy on the micro-scale[348], or big numbers of films on the macro-scale. Only the algorithmic media-active archive - the central agency of so-called Digital Humanities - can ensure processing and computation of such "big data".[349]

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345 Wikipedia entry "*n*-gram", version 17 Juli, 2014
346 See Jussi Parikka / Lori Emerson / xxx Weshler (eds.), The Lab Book, xxx
347 See xxx Heftberger, xxx
348 See Lev Manovich, How to xxx one million images, in: David Berry (ed.), xxx
349 See Morgens Jacobsen / Morten Søndergaard (eds), Re-Action. The Digital Archive Experience, xxx (Aalborg University Press) 2008

When Lev Manovich asks „How to compare one million images?"[350], attention is not given exclusively to the single text or artifact any more like in traditional (film) philology, but to patterns instead - either combinatorial or statistical. The familiar symbolical archival order transforms into pseudo-random stochastics in the world of computatinal signal processing. In so-called *cultural analytics*, "entropy describes the degree of uncertainty in the date"[351], resulting in a rather un-archival order in fluctuation. Training in the application of algorithmic tools, which is mathematical analysis, is the real effect where Digital Humanities modify traditionally hermeneutics-based Humanities.

Dynamic algorithmic access (such as the page rank in Google's search engine) nowadays replaces the static classification of the traditional catalogue in libraries. From this results the need for flexible tools which allows for the coexistence of different orders without destroying the material structure, that is: *relational* databases and *random* search (familiar from "hashing" in the administration of computer storage), a kind of *order in fluctuation* which is the radical temporalization of order itself.

Beyond classic philology, new technologies of knowledge by flexible access with signal-oriented search functions are not limited to textual addressing exclusively any more.

Good-bye, "archive - towards dynamic data retrieval

From the digitization of vast amounts of records - mostly by necessity, for preserving the data against progressive material obsolescence - arises a creative chance which is progressively performed in 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 Shannon entropy as measure of informational content in records.

In nineteenth century, the notion of physical entropy co-originated with the notion of "social statistics": Quetelet's *homme moyen*. And in Tarde's social statistics, information theory and sociology, for once, converged in the concept of stochastic probabilities: the statitistian, like the archeologist, „jette sur les faits humains un regard tout abstrait et impersonnel“[352] - which in present Digital Humanities returns as "social analytics" (Lev Manovich).

So-called "predictive analytics", both in high-frequency financial trading and the surveillance by agencies like the NSA, does not accumulate data from a long past any more but collect present data to predict immediate future profiles

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350 In: David Berry (ed.), Understanding Digital Humanities, xxx
351 Lev Manovich, How to Compare One Million Images?, in: Understanding Digital Humanities, edited by David M. Berry, Basingstoke (Palgrave Macmillan) 2012, 249-278 (266)
352 Gabriel Tarde, Les lois de l´imitation, Paris 1890, chap. IV (Qu´est-ce que l´histoire?), Absatz „L´Archéologie et la Statistique“, 99 u. 114

- thereby historicizing the present already (as "future in the past"), resulting in new forms of time manipulation - true chronopoetics.

The insistence of "humanities"

In the late Medieval kernel of what later became the academic university, the four "scientific arts" have been music, arithmetic, geometry and astronomy respectively astrology (the Quadrivium). The remaining three arts (the Trivium) constituted the "humanities" – grammar, logic, and rhetoric. In that two-fold form the seven *artes liberales* (kept separate from the mechanical arts) were taught. In DH, "science" and "humanities" fuse (or at least fold) into one again. In the Renaissance, the old Trivium has been re-christened into *Studia humanitatis*, with new emphasis on poetry. Since then, humanist disciplines like history and related academic domains study subject matters to which the experimental method does not apply - "and instead mainly use the comparative method"[353]. With computational humanites, though, comparative research itself becomes *algorithmically experimental*.

"As humans and data machines become equal partners in cultural practice, social experience, and humanistic research, the humanities may no longer look like 'the humanities.'"[354] Digital post-Humanism is no more *Geisteswissenschaft* in Dilthey's sense. Still, DH actually (and partly in the sub-conscious epitemological memory) re-invents the informational aesthetics of cybernetics (Moles, Bense) - which is rather an up-dating than an exorcism of *Geisteswissenschaft*. Against the suggestive term "Digital Humanities", in media theory there is a rather humanistic awareness (*Geistesgegenwart*) of algorithmic knowledge. It is not simply the quantitative increase of big data processing due to available computer storage and processing capacities (Moore's Law) which escalate in so-called digital culture, but its combination with a different quality of data processing: algorithmic programming as techno-logical, rather mathematical "intellectualising" in the double technical and philosophical (enlightenment) sense of computational *intelligence*.

Only once the harvesting of "big data" turns into epistemogenic operations, quantities of digitized cultural sources become qualitative *humanities*. "DH" methods require critical reflection as has been traditionally cultivated within old-fashioned humanities, resulting in "Humanities of the Digital"[355].

Different usages of that slogan are more limited to the human-machine interface, for instance "the human-centered design which aim[s] at 'usability'; the visual aesthetics of screen designs"[356], or in a remarkable definition of the

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353 Entries "Liberal arts (education)" and "Humanities" in https://en.wikipedia.org/wiki, accessed August 7, 2017
354 Anne Burdick / Johanna Drucker / Peter Lunenfeld / Todd Presner / Jeffrey Schnapp, Digital_Humanities, Cambridge, MA (MIT Press) 2012, 105
355 As proposed, in that sense, by Jan Claas van Treeck (Department of Media Studies, Humboldt University, Berlin)
356 Draft for the 13th International Conference on New Directions in the Humanities, 2015 special focus: From the Digital Humanities to a Humanities of the Digital, 17-19 June, 2015, University of British Columbia, Vancouver

computing machinery, instead of being non-human, *within* the human: "While other species have technology, only humans, so far, compute. Thus digital technologies [...], can be brought under humanist modes of study."[357]

Media science of computational practice is appropriately located in the Department of Humanities and not in Computer Science only, since it asks different questions. This is an inheritance of philosophical reasoning, in the way Martin Heideggers questions technology: "The essence of technology is nothing technical."[358]]

Rooting DH: techno-mathematics

The meaning of "humanities" in the term DH stretches back to early modern humanism which has been a primarily text-based knowledge circulation and and communication.

Textuality allows for time-invariant knowledge transmission indeed, as the alliance between code (alphabet) and technology (the printing press). Humanist communication took place in metahistorical con-temporality. With computing, this option has extended from exclusively human performance into the operative machine. At least in theory, "[o]nce a software-based system is working, it *should* work forever" (unless the underlying hardware breaks down)[359]; only then it becomes an issue of awareness or even theoretical contemplation in Heidegger's sense ("ready-at-hand").

While the digital computer is the first theory-born technology, Digital Humanities arose from computing. "The roots of computational work in the humanities stretch back to 1949 when the Jesuit scholar Roberto Busa, working in collaboration with IBM, undertook the creation of an automated approach to his vast Index Thomisticus, a computer-generated concordance to the writings of Thomas Aquinas. <...> Other early projects included the debut, in 1966, of Computers and the Humanities, the first specialized journal in the field. Seven years later, the Association for Literary and Linguistic Computing (ALLC) was founded, with the Association for Computers and the Humanities (ACH) following in 1978."[360] But "algorithmicized humanities" extends beyond the literary text and its "distant reading" (Moretti), sorting images and sound as well *from within* the records (instead of subjecting them to verbal, "literary" descriptions and metadata). This results in an algorithmicallly driven media-active data archaeology.

Media philology - and here it differs from textual philology - "literally" operates *avant la lettre*. Computer code may be considered a kind of writing indeed, and software development "a form of literary production", but its actual

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357 Blog post "Toward a Humanities of the Digital" by Grant Simpson on September 13, 2010, accessed March 28, 2018: https://www.hastac.org/blogs/grantls/2010/09/13/toward-humanities-digital
358 Heidegger, in: The Question Concerning Technology, xxx
359 Ensmenger 2009: 88
360 Burdick et al. 2013: 123

implementation in computing is electronics.[361] The ease with which computer code can be written, modified, and deleted questions the durability of the underlying document. The "palimpsest" <ibid.> of record traces on a hard drive requires media philological forensics indeed. There is a palimpsestuous con-temporaneity in computational hard- and software, a coexistence of different "layers" within the von-Neumann architecture and the operating systems of computing. At the critical moment of the "Year 2K bug", that is in the year 2000, there were still more than 240 million lines of computer code written in Cobol, first introduced in 1959.[362]

In order to analyze what happens inside a computational signal processor requires both physical (engineering) and philological (coding) skills: measuring the signals in operation (with the Logic Analyzer) and deciphering the alpha-numeric code, its hexadecimal or even straightforward binary expression. Therefore, media philology (just like media archaeology) is an auxiliary science for Media Studies.

The technical term "archaeography" itself originally referred to applications of non-numeric computing within the discipline of archaeology[363] - which has been DH *avant la lettre*.

Big textual data and the distant symbol-processing gaze (Moretti's *distant Reading*)

"[T]o see through computer 'eyes'"[364] is "a powerful mechanism of defamiliarisation <...> - a device for seeing what we could have not noticed previously"[365]. The technical scanning of a historic image liberates it from its radical dependence of the cultural context - recalling philosopher Friedrich Nietzsche's "passion for distance". Such non-hermeneutic optics is an option to extract a different kind of knowledge from within the image.

"The computational allows us to perform what literary scholar Franco Moretti has termed 'distant reading' – a practice that moves away from the close, hermeneutical reading of texts in favor of an algorithmic approach that presents overarching structures and patterns. For Moretti, distance is 'a condition of knowledge' because it allows a scholar to 'focus on units that are much smaller or much larger than the text: devices, themes, tropes - or genres and systems'."[366]

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361 Nathan Ensmenger, Software as History Embodied, in: IEEE Annals of the History of Computing 31 (1), 2009, 88-90 (90)
362 M. Swaine, Is Your Next Language COBOL?, in: Dr. Dobbs J., 18 Sept. 2008 (as referred to in Ensmenger 2009: 90)
363 Gundlach 1968 "Maschinelle Philologie als historische Hilfswissenschaft", 232, referring to journal *Computer and the Humanities* New York 1966 ff.
364 Lev Manovich, How to Compare One Million Images?, in: Understanding Digital Humanities, edited by David M. Berry, Basingstoke (Palgrave Macmillan) 2012, 249-278 (276)
365 Manovich 2012: 276
366 TS Presner, http://www.joodsmonument.nl/?lang=en, 23, referring to: Franco Moretti, "Conjectures on World Literature," in: New Left Review

(Mis-)Understanding the "archive"

According to Moretti, one can not study a large archive in the same way one studies a single text. Individual texts have been written to "speak" to the reader, and so, provided s/he knows how to read them hermeneutically, they always end up making some sense; "*but archives are not messages that were meant to address us*, and so they say absolutely nothing until one asks the right question"[367]. There is a fundamental difference, though, between Shannon's mathematical theory of communication as intentional channel-coding, and the administrative archive as depository of legal claims; such archives are (mis-)read by historians as if provided with an intended message from the past to the present, to be transformed into a narrative by historiography. "Archives are not messages that were meant to address us, and yet meaningful information can be extracted from them. This is an exciting idea when the archive is the entirety of literary history, a chilling one when it's our private internet activity or phone records."[368]

"Such archives and methods and technologies permit scholars today to ask different kinds of questions about the materials they investigate. Moretti describes the approach to literary analysis that he develops across his essays as a 'quantitative formalism'; like all formalisms, the point is not just the objective information derived - in this case, through counting - but rather what that counting reveals."[369]

Signal instead of text criticism: sound recording *avant la lettre*

Digital Humanties, in the media-archaeological sense, means "algorithmic hermeneutics": the application of computational software as active archaeologist of cultural knowledge hidden within techno-phyiscal signals. This is not only relevant for harvesting "big data", but for the close analysis of material technology as well.

Different from conventional historical research in archival records, real media philological criticism is not related to the contextual metadata but, paradoxically, derives insight from critical, "forensic" (Kirschenbaum) signal analysis itself.

For librarians as metadata experts, classification is still essential in data retrieval. But since media archivist have started digitizing and processing media such as film and sound recordings, the classification component of such projects has transformed from external to internal, to information retrieval from

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(January / February 2000), 54-68 (57)
367 Kathleen Fitzpatrick, The Ends of Big Data, in: Los Angeles Review of Books, June 27th, 2013, on Franco Moretti's collection of previous essays *Distant Reading*; http://lareviewofbooks.org/article.php?type=&id=1801&fulltext=1&media=#article-text-cutpoint
368 Fitzpatrick 2013
369 Fitzpatrick 2013

within the digitized records. Signal processing in media culture creates a new kind of algorithmic archive. Familiar cultural *analysis* is increasingly replaced by big data cultural *analytics*. There are new options of information retrieval, based on the physical signal qualities, not limited any more to its logocentristic transcriptions (subject to metadata).

Patrick Feaster succeeded in re-sonifying Léon-Scott's 1859 phonautogram of the children song *Au Claire de Lune*. Such a retro-active recovery of an acoustic past from a generation before the invention of the Edison phonograph is possible by means of highly sophisticated algorithmic filters only which becomes itself the active archeologists of signal intelligence.[370]

Algorithms allow for critical signal studies. By optical reading of signals and application of digital filters, it is possible to digitally trace past acoustic signals from records.

The first officially archivized record of sound in Norway is a tinfoil, flattened to a "document" and annotated by a remark by its former collector, as exhbited within a frame at the Technical Museum of Oslo. The Sound Archive Project at the School of Engineering Sciences in the University of Southhampton attempted a digital restauration, by sampling the whole artefact's surface topology with high precision optical sensors. Subsequently, the audio content has been recovered by applying signal and image processing methods to the measured data. "The measurement process for this artefact took three weeks of continuous scanning. Initial attempts at audio recovery from the surface data using existing processing techniques were largely disappointing, leading to the development of a more sophisticated methodology based on feature tracking through the groove. Out of six short tracks found on the foil, four contained significant audio portions featuring both music and speech, the remaining two tracks were both short and contained negligible content."[371]

Finally, the extracted (and reproduced) signal results in true media philology, falsifying the accompanying alphabetic annotation: "The extracted audio <...> was not the expected psalm singing as documented in the contemporary sources, but a mixture of shorter extracts" (ibid.).

From such a digitally enhanced restauration of vintage sound recordings the human listener expect sound, but really what can primarily be heard is noise. In the case of the recording from Norway which survived as a tinfoil flattened to a „document“, an annotatation by the former collector claims this has been the first Norwegian recording of music on Edison cylinder. But the digital restoration of this record resulted in nothing but noise - which in terms of communication theory is a message as well, that is: the communication of the recording medium itself.

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370 For the recovery of early 30line television images from so-called "Phonovision" recording by means of algorithmic image processing, see Donald McLean, Restoring Baird's Image, xxx

371 P. J. Boltryk, J.W. McBride, L. Gaustad, Frode Weium, Audio recovery and identification of first Norwegian sound recording, lecture at JTS 2010 conference in Oslo (Digital Challenges and Digital Opportunities in Audiovisual Archiving); *online* xxx

[Sound: https://www.nrk.no/kultur/xl/kan-verdens-eldste-opptak-av-edison-ha-ligget-i-en-norsk-kjeller-siden-krigen_-1.13727285; accessed November 13, 2017]

"Forensic" media archaeology of the digital "archive" (the storage architectural element ROM)

[Media *archivology*, in an analytical sense, refers to the archive of computing itself - *l'archive* in Foucault's sense, not the institution for record memory which in French would always be expressed in the plural: *les archives*. *L'archive des médias* rather refers to the material and logical conditions of possibility for any kind of technical articulation. Methodologically, the approach *from within* technology expresses the media-archaeological, that is: non-human point of view, distant from the cognitive or bodily perception of "media" which humans experience from interfaces like the computer screen. For such an investigation, media archaeology necessarily departs from the familiar historical research. Radical media archaeology is not simply another variance of historiography but an alternative way of dealing with temporal evidence resulting from times past *in the present*.]

Media philology escalates when computational analysis is not only applied to external signals, but to computers themselves. One specific media-archaeological (or -archival) target is to restore the program code that is stored in a masked Read Only Memory (ROM) chip. In order to extract code from an obsolete Read Only Memory within a micro processor, it requires both physical analysis and software to extract the bits. If the chip itself is using a known architecture and assembly language, reverse engineering can be applied to recover the actual instructions stored in the ROM. By electro-physical signal analysis, "data" become clearly discernible:

Fig.: RAM-aperturelabs-3.png

If the unknown bits is put through a disassembler, that is, reconverted from machine language into mnemonic code, they may make code sense again, restauring them for hermeneutics. Media philology and its twin, media archaeology, is both hardware and software analysis. While software hacking can be destructive on the symbolical level, tinkering with circuits that are directly connected to mains electricity can be dangerous in a bodily sense.

[Contrary to the current claim for keeping the archive "open", for "instant" and "open access", though, there are arguments for preserving temporally sheltered records ("Sperrfrist") in *online archives* - even in terms of computational science where there is the "protected mode" for embedded code.]

Material de-construction of computer chips is driven by material criticism, by operations such as resetting a fuse to allow reading/writing of protected areas or probing a data track to observe data being processed by the chip, "or even

trying to figure out the actual logic of a proprietary chip by viewing and reverse engineering it's construction"[372].

Counting by numbers instead of story-telling: Markov chains

"Information" in the sense of mathematical theory of communication can only appear in relation to some other signals. The single letter "A" is no information at all. As part of the conventional alphabet consisting of 26 letters (in Germany), it has a higher "informational" value (that is, of surprise) than as part of a technical "alphabet" like the binary one, consisting only of the states "A", and "B".

The measuring unit of mean probabilities (entropy) in discrete communication engineering, called *bit* [373], has enabled "information" to raise beyond the constraints of matter and energy, actually treating sequences of letters not as writing any more but literally like numeric *calculi* (pebbles). Markov chains deal with conditional probabilities, where "the likelihood of a given future state, at any given moment, depends only on its present state, and not on any past states"[374].

By tabulating the sequence of vowels and consonants in Puschkin's poem *Eugen Onegin*, A. A. Markov in 1911 emancipated the alphabet from oral poetry (beyond Homer) which once induced the ancient Greek modification of Phenicean syllabic writing into the musicality of the phonetic alphabet (Barry Powell 1992). All of the sudden, a literary text is not a symbolic reflection of world states any more, but becomes operational part of it.

The enunciative mode in Digital Humanities is counting rather than tellling; human expression of knowledge and the datagram clash here:

Fig.: The a-semantic gap: DH-Situation.jpg (literary scholar in front of a beamer projection of statistical text analysis, snapschot taken at workshop *Lektüre in Zeiten digitaler Medien*, end of September, HU Berlin)

If the cultural idea of being "human" is anthropologically linked to story-telling, it is about to be reconfigured in the digital matrix.[375] The notion of the "digital human" is an oxymoron: What looks, sounds or behaves like human is itself

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372 Fun with Masked ROMs - Atmel MARC4, http://adamsblog.aperturelabs.com/2013/01/fun-with-masked-roms.html; accessed 10th July, 2014

373Claude Shannon / Warren Weaver, The Mathematical Theory in Communication, xxx [*1948] xxx

374 Editorische Anmerkung zu: Abraham A. Moles, Cybernetics and the Work of Art [*1965], in: Margit Rosen (Hg.), A Little-Known Story about a Movement, a Magazine, and the Computer's Arrival in Arts. New Tendencies and Bit International, 1961-1973, Karlsruhe (ZKM) / Cambridge, Mass. (MIT) 2011, 217-225 (225)

375 A central hypothesis of the MAC International Symposium *Story, Hypermedia, Digital Human*, Yonsei University Seoul, Institute of Media Art, May 2004

unseparable from the machinic, as indicated by the subtitle of Norbert Wiener's *Cybernetics, or communication and control in the animal and the machine* from 1948. According to Gregory Bateson, in creative art man experiences himself as a cybernetic model. This becomes even more acute when man is coupled to uniquitous computing. In this context, media science identifies the digital human in its very being language-coded already.

A radio play has been composed by the protagonist of informational aesthetics Max Bense (with Ludwig Harig) *and* an early electronic computer as co-author. The plot is aut(h)o(r)-executing: A girl is found knocked unconscious on the beach after a shipwreck. In hospital she starts to produce a monologue which from meaningless fragments of articulation slowly emerges into meaningful bits of a narrative. In *Der Monolog der Terry Jo* (1968), informational is introduced into an apparently meaningless, "noisy" sequence of letters by application of a Markov chain algorithm. "[T]he basic cultural technique is not anymore to decipher the meaning of a chain of signifiers but to identify a message" - literally in this case - "in an ocean of noise (filtering). Human intelligence becomes subordinate to signal intelligence."[376]

In the cybernetic premise, literary texts and categories like the author "style" can be identified by computational analysis of big numbers of words and letters.[377] What in principle had been DH *avant la* lettre became, with increased processing power and available data in computing, massively recursive "deep learning" today. Stylometry is a radical challenge to traditional hermeneutics. According to a basic law of technological media, such a form of analysis can flip into active synthesis itself.

[The archive and the question of "open access"]

Documentary record archives *strictu sensu* are administrative and legal, (often state- or copyright-related) institutional agencies which radically differ from the experimental algorithms for processing "big data" in the Digital Humanities laboratories.[378] When algorithmic access replaces the static classification of the traditional library catalogue, statistical probabilities replace particular knowledge according to information theory, and pattern recognition replaces alphabetical identification), as dynamic articulation of *implicit* record-knowledge.

Archives in times of "digital humanities" can not be reduced to the question of "open access" to "big data". Jean-François Lyotard once formulated the political challenge of *La condition postmodene* (1979): *who* gets access to data banks. In times of DH, this transforms into the question of *how* to access the archives.

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376 Bernhard Siegert, Turn Meaning On/Off: The Flip and Flop of „Understanding“ Media, Ziegler Lecture 2016, St John's College, University of British Columbia, Vancouver; typescript

377 See Wilhelm Fucks, On mathematical analysis of style, in: Biometrica 39 (1952)

378 See Joanna Drucker, SpecLab, xxx

The question of "open access" does not only refer to big data banks but has a material aspect: the shrinking intervals of obsolescence in both hard- and software generations which become incompatible. "Access" of cultural heritage remaining from the digital age becomes a radical media-archival challenge.

With(in) the computational *l'archive* (in Foucault's sense), 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."[379] 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."[380]

An even more radical media archivology results from experimenting with "digital born" archives. Within the computational context of Digital Humanities, criteria borrowed from communication engineering like informational entropy make more sense than out-dated hierarchives of knowledge classification.

"Active archives"

Algorithmicized epistemology is experimenting with the computational *a priori* of data organization which is software.

In the case of Roberto Simanowski's edited book *Digital Humanities and Digital Media*, "[t]he cover image is a visualization of the book’s text. Each interview was algorithmically assessed, paragraph by paragraph, for relevance to “politics”, “culture”, “aesthetics” and “literacy” and the result plotted as a streamgraph. All of the streamgraphs were overlayed to create a composite image of the book", created with Gensim and Matplotlib.[381]

Kaplan's "cliometric" *Venice Time Machine* is based on a graphic visualization of data structures from the millenium-old Venice city archive, exciting historical simulation environments which do not actually represent the past "as it really was" in terms of historical research; "instead, they foreground [...] experimentation, allowing new research questions to be asked and hypotheses to be tested using a wide range of variables. For instance, one may employ time-sliders to visualize when and where certain buildings came into existence [...]."[382]

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379 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)
380 Kittler 1996: 75
381 Legend to the cover image (David Ottina 2016 cc-by-sa), in: Roberto Simanowski (ed.), Digital Humanities and Digital Media: Conversations on Politics, Culture, Aesthetics and Literacy, London (OPEN HUMANITIES Pr.) 2016
382 Burdick et al. 2012: 44; see as well the diagrams in the chapter "Temporal Modeling", in: Johanna Drucker, SpecLab. Digital Aesthetics and Projects in Speculative Computing, Chicago / London (University of Chicago Press) 2009, 37-64

But the promise of metaphorically "animating" the data archive[383] is a misunderstanding of techno-archival processing, subjecting the computational options to a user-centered approach again.[384] All of the sudden, a counter-strategic defense of the *archivium secretum* becomes attractive again, with intelligent algorithms unlocking hidden data knowledge. By digitizing archivally protected, "read-only" records, they can be algorithmically discovered without invading the material source, as applied by the research art collective Constant in Bruxelles with their project "Active Archive" (Nicolas Malevé / Michael Murtaugh)[385] to Finnish artist-enginneer Erkki Kurenniemi's multi-media estate, based on hundreds of hours of audio recordings, video diaries, photographs, preserving the objects of his everyday life, shooting 8mm films and digital videos. "[T]o Constant, archives are understood as a collection" - therefore, no archive in the archivological sense - "of material that is not merely readable but also writable and exectuable"[386].

Algorithmic analytics in the Digital Humanities has a transitive relation to the archive, when "the tools that are used for archiving can be registered as a part of the archive, [...] through the extensive use of / software repositories/archives such as Gitorious, with all scripts carefully documented for future modification and reuse"[387].

The experimental application of creative algorithms to a set of "big data" is a kind of software "carpenty" (Ian Bogost). Such a process-oriented ontology results in digital enunciations for which traditional hermeneutics did not pose the right question. By what Geoff Cox calls *The Speaking Code*[388],"the material is provided with the ability to 'speak' for itself" (134). Addressing the archive with creative algorithms uncovers the archive by a metonymic shift, focusing attention from the archival records to the archival rules (its implicit algorithm).

Instead of making the previous archival taxonomy the "content" of the digital medium again, the real "message" of the new archive is algorithms. Software tools engage differently with structured and / or stochastically distributed sets of digital records, allowing for the co-existence of different orders without violating the archivally protected files.

Active Archive algorithms produce random knowledge; inanimate objects are made to articulate.[389] In the case of the Kurenniemi estate (Central Art Archive

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383 Anne Burdick / Johanna Drucker / Peter Lunenfeld / Todd Presner / Jeffrey Schnapp, Digital_Humanities, Cambridge, MA (MIT Press) 2012, 48

384 "The user-centered - not document- or object-centered - archive must become the rule." Burdick et al. 2012: 115

385 The Constant Association for Art and Media runs its Active Archives project since 2006

386 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 (125)

387 Cox et al. 2015: 126 f.; see http://gitorius.org/kurenniemi

388 Geoff Cox / Alex McLean, Speaking Code. Coding as Aesthetic and Political Expression, Cambridge, MA (MIT Press) 2012

389 See e. g. http://kurenniemi.activearchives.org/spectrum

at the Finnish National Galery), a nonhuman approach[390] has been suggested by the artist himself: His personal "big data" memory shall rest until 2048 when advanced algorithms are expected to symbolically re-create his life on that basis again.[391]

The self-organizing archive

The computational approach to textuality results in the "fuzzy archive", which is "disorderly" at first glance for human readers, but highly patterned in algorithmic view, with data file internal stochastic probabilities instead of metadata indexes and other external inventories.

As long as sound and images are still humanly or automatically tagged by textual metadata, this results in the traditional inventory as an organization of the data base, maintaining the symbolic enframing of what is properly called the archive. An alternative approach does not produce taxonomical metadata for the records but sorts them from within, which is the digital signal-processing based approach. One can either tag an image by, e. g., the painter's name, or one can treat the same image as complex signal which allows for sorting it according to, e. g., colour values or shape detection within. Hereby a different kind of endogenic qualifying arises from such quantification (like in the MPEG7 standard for audio-visual records). The DSP approach is not oriented at the materiality of sound and image storage media any more but at their informational value, once analog photography or electronic video signals have been digitally sampled. This results in an *operative* symbolic regime in a more fundamental sense and allows for a dynamic order-in-fluctuation. Strictly techno-mathematical and numerical operations do not subject records to logocentristic key-terms any more.

The self-organizing map (SOM) is the core concept of the Kohonen algorithm which is a neuronal model net for the similatity-based approach to data. Media artist George Legrady, in his installation *Pockets full of Memories* (which has been extended to the "social web" by his up-dated version Cell Tango) combined both approaches: the algorithmic sorting of objects in the media-archaeological way (as self-organizing map) on the one hand, and the subjective, personal tagging of objects by the individual participants (the human approach, focused on affective semantics). This combination tries to get out the epistemologically "best" from both cultures:

Fig.: George Legrady, *Pockets full of Memories* installation

"Hermeneutics" after Shannon: algorithmic experimentation

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390 http://activearchives.org/wiki/Archiving_the_Data-body:_human_and_nonhuman_agency_in_the_documents_of_Kurenniemi

391 See Lars Bang Larsen, Erkki Kurenniemi. Einführung. dOCUMENTA (13): 100 Notizen – 100 Gedanken, No. 007, Ostfildern (Hatje Cantz) 2011

Media archaelogy unfolds implicit knowledge from within technological configurations, as a material equivalent to traditional hermeneutics uncovering layers of hidden meanings in biblical texts.

For the academically trained *literary* scholar McLuhan, *Understanding Media* (1964) does not mean interpretation, but uncovering the technologically induced message. Techno-logical hermeneutics (and the criterium of "material semantics"[392] applied to media art preservation) is tracing the implicit knowledge within embodied signal processing and its circuitry diagrams. Inductive experimentation with knowledge-inviting (epistemoxenic) things is the media-scientific alternative to textual hermeneutics, such as Nam June Paik's magnetical distortions of the electronic TV image cathode ray tube.

1985, one year after the *The Talking Heads* released their concert movie *Stop Making Sense*, Jens Schreiber's article called „Word-Engineering“ has been a manifesto about the state of literature in the age of signal processing and information theory: "Frequencies, amplitudes, rhythms, cell tissue, matrix connections, electrodes, multi-channel-recorders. There is no more singing, no more staking of heads, but only recording, because it is not about understanding anymore. Below understanding there is transmission and recording."[393]

The basic techno-hermeneutic operation is not to transform a chain of signifiers into meaning anymore but to identify a message "in the presence of noise" (Shannon), such as by signal filtering *alias* communication "intelligence". While in hard-wired technology, the syntax of the signifier replaces the "semantic", in coded symbol programming stochastics replaces the individualizing reading. According to Claude Shannon in the introduction to his *Mathematical Theory of Communication*, "[t]he semantic aspects of communication are irrelevant to the engineering aspects.”[394] In its deterritorialized form information knows only engineering aspects such as discrete sets of signals, frequencies, entropy, redundancy, channel coding.

Epistemological curiosity rather than hermeneutic "understanding" drives media archaeology; electro-physical action can not be "understood". Still, all technology are natural (physical) artefacts encoded by cultural knowledge; therefore (Digital) Humanities asks different questions to technology than engineering and informatics do.

The language of technology is diagrammatic circuitry and mathematical logics. The re-turn of the text within computing is alpha-numeric, not semantic. Conventional "hermeneutics" belongs to the (holy) scriptural regime (the symbolic order of the alphabet), as opposed to signal analysis (such as spectrograms). Media "philology" refers to signals for "analog" technologies, but returns to symbols in the case of digital code.

Media archaeology as one method of Digital Humanities is a heuristic, *temporary* suspense from the hermeneutic imperative. After that "epoché", is it

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392 See Monika Wagner, xxx
393 Jens Schreiber, Das Symptom des Schreibens, xxx
394 Shannon/Weaver, xxx

time for the rebooting of a hermeneutics, in the sense of understanding non-human agencies ("authors") such as algorithms, *algorithmic hermeneutics*.

The core of the techno-mathematical media definition in terms of communication engineering (Shannon 1948) is what happens in the channel of signal transmission, the actual "medium" (Shannon); within that *delta-t*, data are suspended from cultural semantics (the media-archaeological *epoché*), just like electrically pulsed telegraphy is simply isomorphic to the written alphabet.

[While classical hermeneutics inevitably always lead to historization, media archaeology rather copes with the hon-historical temporality of media operativity.]

In algorithmic analysis instead of hermeneutic understanding, audio recordings from the the past are not just cultural objects any more, but become items in an experimental laboratory of "archived presence". Semantic emphasis can be identified as a function of tonal pitch in the recorded voice, just as Nobel prize winner Max Planck - in a recording from 1939 for the Berlin Phonogram Archive (Lautarchiv) collection "Stimmen berühmter Persönlichkeiten"[395] raises (in German: "erhebt") his voice with the very German word "erhebt" itself, and lowers it with rhetorical skill at the end of his phrase in the last word "Gelehrten" (scholars). The techno-mathematical analysis of intonation, performed by Nikita Braguinski with the software Sonic Visualizer, reveals Planck's application of quasi-musical phrasing and thereby bridges the gap between semantics and affect:

Fig.: Lautarchiv-Tonhoehenverlauf-Planck.png

Humans almost irresistably interface to images in an iconologic way, to sound in a musical way, and to texts in a hermeneutic way. But there are layers of sub-semantic knowledge which can be uncovered from within the visual, acoustic or textual endo-data: entering the digitized record itself (data-immersion). Such truly media-archaeological analysis is performed by algorithmic machines of information processing better than by human perception. Such *informatized* organization of knowledge generates diagrams (the Deleuzean intepretation of the Foucaultdean *archive*) - infomapping. Occidental culture is still dominated by semiotically iconic, musically semantic, of literally hermeneutic ways of seeing, hearing, reading; the twenty first century, though, allows for genuinely computer-generated information aesthetics which is closer to processual diagrams than to figurative phenomena within the audio-visual (or textual) regime.

In an exemplary way, the book cover of Friedrich Knilli's analysis of the radio play *Das Hörspiel. Mittel und Möglichkeiten eines totalen Schallspiels* (Stuttgart 1961) does not display an allegory of communication but technical drawings: psychoacoustic parameters and diagrams. Diagrams (rather than representations) eventually enable unprecedented records of the generative archive, a kind of "archaeography" which is the indication of non-discursive media tempor(e)alities: its governing principles, archaic essentials.

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395 See web site of the Lautarchiv, xxx, item B8-29 Max Planck

Text criticism has been a core operation of reading sources from antiquity in the age of Humanism. In times of algorithmicized Humanities, critical code studies is necessary beyond mere reading like in print culture, since executing software (different from its written algorithm) is a dynamic object. As expressed by George Dyson: 'You can’t predict how software will behave by inspecting it'; the only way to plausibly analyse software is 'to actually run it."[396]

Media *archivology*: Kittler's case

The driving mind who once radicalized Foucault's archaeology and McLuhan's media theory into media science, late Friedrich Kittler, has become a memory address himself, with his written papers, self-designed electronical toys and experimental software code now being located at the German Literature Archive in Marbach. To answer the question in which way computing once shaped Kittler’s research in the 1990, media archivology is required.

The German Literature Archive at Marbach has created a software for navigating his estate, the "Indexer", which non-hermeneutically, rather algorithmically searches for patterns not only in Kittler's conventional writings, but as well in his electronic diagrams and source codes.[397] Being a specially designed search engine, the Indexer, after having copied the hard drive and storage discs of Kittler’s computer in sector images, allows for the sub-hermeneutical, chronologically simplest and statistically most reliable search option of looking for modification times of his digital files - a dynamic parameter rather than the historicist focus on straightforward origins (creation time). A "forensic" warning cautions such a media-philological approach: Even if the Indexer offers a search option for creation times of data files, these are not historically reliable as they rather depend on the internal time (*eigenzeit*) of the storage devices themselves.[398]

"Digital humanities" *avant la lettre*: archaeology proper and techno-mathematical reasoning

From Digital Humanities, challenges to traditional scholarship and new opportunities derive. Computer-augmented algorithmic analysis, as applied in classical archaeology among the first disciplines within the "humanities" departments, leads to database aesthetics instead of narrative (as expressed by Lev Manovich in his *Language of New Media*), to pattern-matching *versus*

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396 http://www.wired.com/magazine/2012/02/ff_dysonqa/all/1 (accessed September 27, 2012); same argument by Tobias Matzner, Grasping the ethics and politics of algorithms, https://medium.com/@t_matzner/grasping-the-ethics-and-politics-of-algorithms-c2932804fa9d#.i1oymdxrg, accessed February 2017

397 See Susanne Holl, Friedrich Kittler and the Digital Humanities: Forerunner, Godfather, Object of Research. An Indexer Model Research [= Friedrich Kittler’s Digital Legacy. Part II], demnächst in: Digital Humanities Quaterly

398 See Susanne Holl, Friedrich Kittler and the Digital Humanities: Forerunner, Godfather, Object of Research. An Indexer Model Research, in: Digital Humanities Quarterly (2016), note 2

hermeneutics, to new forms of search with stochastic data analysis instead of traditional statistics (which still refers to the classical archive).

"The mere use of digital tools for the purpose of humanistic research and communication does not qualify as Digital Humanities. Nor [...] is Digital Humanities to be understood as the study of digital artifacts. [...] fields such as classics and archaeology have played just as important a role in the development of Digital Humanities as has, for example, media studies."[399] In media archaeology respectively media philology, both fields converge.

It is not by coincidence but by epistemological necessity that archaeology has been among the first disciplines within the humanities to employ computing and statistical techniques ("Digital Humanities" *avant la lettre*), but still subjected such data-driven evidence to cultural contextualization: "Even the beneficial contribution of such 'hard' science such as radio carbon determinations of date or ground penetrating radar to archaeological interpretation, rely on operators having a close empathy with archaeological material, the context of discovery and the role of post-depositional processes"[400]

Foucault's *Archaeology of Knowledge*, should not be taken metaphorically in the sense of an archaeological dig, but at its implicit mathematical face value, which is the propositional logic of enunciations - even if it looks like cultural semiotics at first sight.[401] In the chapter "Über Methodenprobleme der Klassifikation"[402] of his *Minutiöse Logik* (1902), Charles Sanders Peirce explicitely refers to Flinders Petrie, founder of pre-historical archaeology of Egypt: his system of sequential chronology as quantitative archaeology (genealogy of ceramics); as entries in lists they constitue series. On paper stripes Petrie registered entries of pre-dynastic ceramics by numbers, in relative seriation.[403] This coincides with Egyptian mathematics itself which did not apply a calculus but lists. Results from calculations were listed, especially complex ratios.[404]

More radically "archaeological", the techno-mathematical application of stochastic analysis in "computational" humanities is not simply a special method in classical archaeology (as expressed in journals like the Italian *Archeologia e calcolatori*), but can be identified upside down as the *archaeological* element in mathematics itself.

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399 Burdick et al. 2013: 122; see further Susan Hockey, A Guide to Computer Applications in the Humanities (London, 1980)

400 E-mail Peter Rauxloh (Information Strategy Manager, Museum of London), July 2002

401 See Martin Kusch, xxx

402 In: Charles S. Peirce, Semiotische Schriften, vol. 1

403 See Franziska Lang, Klassische Archäologie, Tübingen / Basel 2002, 139

404 James Ritter, Jedem seine Wahrheit. Die Mathematiken in Ägypten und Mesopotamien, in: Michel Serres (ed.), Elemente einer Geschichte der wisenschaften, Frankfurt/M. 1995, 89

II 0N ARCHIVES (notes)

Archival tempor(e)alities

- *online* communication of records widens the gap to traditional archives: dynamical, temporal forms of storage in streaming media where e. g. video can be consumed *while* its data transfer; clear "archival" distinction between dowloading first and screening second dissolves into micro-buffering of single frames "on the fly" *alias* realtime

- with conversion of analog magnetic tapes (radio, TV) to digital storage for preservation reasons, different ways to hack into these digital memories since the digital archives, once online, are not separated from the actual infrastructure of web-based data circulation any more; emphatic notion of the “archive”; dissolves into electronic circuits, data flow. In a way, the (historically) "deep" archives transforms into a "flat" archive - flat in the sense of the integrated circuit (micro-chip architecture); the needs of an inquiring present and the archival documents; only *online* this ciculation becomes a *closed circuit* (with all its cybernetic consequences: interacticity f. e.). The result is a kind of spatio-temporal entanglement; gap between resident emphatic archives (traditionally) and ultra-speed transfer narrows; emphatic memory is progressively undermined by a shift of emphasis towards *memorizing*, the dynamic process, based rather on a network of micro-memories and interacting mirco-memorial hierarchi(v)es. The alternative "storage *versus* transfer", so useful for the analysis of cultural communication (since Harold Innis, *Empire and Communications*, 1950) becomes oblique; storage is nothing but a limiting value of transfer

- highest degree of disorder (entropy), which contains, in communication theory, the highest degree of (possible) information

- simultaneous arrangement of files allows for jumps to other addresses like in digital computer storage. Synchronisation replaces the historical discourse here, leading to an aesthetics of many pasts folded into the present in latency

- techno-archival temporalities *chronopoetic* once they are not passive storage but dynamically driven by algorithms; search engines like Google efficient in real-time only by creating intermediary "archives" of indexed Web sites and up-dating them in high frequency. In combination with such intermediary storage, predictive analytics in digital communication surveillance allows to anticipate immediate future events by stochastic mathematics (the figure of "futurum exactum" familiar in grammar)

- eliminating human “bias” in the process of making decisions and recommendations, “Spotify strives to be entirely data driven. [...] Decisions that cannot be made by data alone are meticulously tracked and fed back into the system so future decisions can be based off of it. [...] Sounds robotic, but humans cannot be trusted [...]": Jason Palmer, “Analytics at Spotify,” Spotify Labs, May 13, 2013, accessed June 28, 2016, https://labs.spotify.com/2013/05/13/analytics-at-spotify

- message of the traditional storage agency "archive" the typographic world of alphabetic records (the symbolic order of administration), with the discreetness of elementary units privileging analytic reading and classificatory listing; (re-)turn within digital computing (alphanumeric code / algorithms)

- "bias" originally a technical term in electronic engineering describing the necessary electric tension to operate a vacuum tube (esp. triode) - a literally pre-condioning, a ground tension for making the circuitry work at all, an electric (thus truly media-archaeological) *a priori*; current electronically biased use of the term archive, "online data collections labeled archives could in fact be better characterized as perpetual transmission rathe rthan permanent storage"[405]. What used to be "secret" spaces secluded from public insight - the *arcana* of administration, their archival memory, now directly wired to the communication circuit of the present; archive loses its temporal exclusivity as a space remote from the immediate present (access); "katechontic" counter-aesthetics usually associated with the archive. But archives of movement, in the age of YouTube and UbuWeb, themselves get in motion[406]; networked documents dissolve into memory-buffered *streaming data*

- intermediary, temporary storage (RAM) waiting for (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 is was outside (historical) time, kind of archival resistance against complete mobility; suspense (*epoché*) from the temporal economy

From spatial archives to time-based platforms

- residential memories such as archives are being replaced by dynamical, temporal forms of storage in digital space, replacing storage by transfer - literally "metaphor"; automatical up-dating; tracerouters not spatial, but temporal scouts; within the digital regime, all data become subject to realtime processing. "Aus der Perspektive der Realzeit kann man also sagen, dass Vergangenheit nur eine Täuschung ist"[407]

From location to addressability

- mis-considered as an "archive", Internet has not yet even arrived at its own memory mediality. Cyberspace is a transversive performance of communication (Pierre Lévy[408]); thus "cyberspace has no memory"[409]. Only data which are

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

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

407 Semir Zeki, Farbe, Form, Bewegung - Zur Verarbeitung des visuellen Wissens im menschlichen Gehirn, in: Weltwissen / Wissenswelt, ed. Christa Maar / Hans Ulrich Obrist / Ernst Pöppel, Cologne (DuMont) 2000, 170-174 (171)

408 Pierre Lévy, L' intelligence collective,: pour une anthropologie du cyberspace, Paris, Ed. De la Découverte, 1995

409 Christoph Drösser, Ein verhängnisvolles Erbe, in: Die Zeit, 23th June 1995, 66

provided with addressable metadata can be accessed in the cultural archive; in the case of the Internet, this archival infrastructure itself becomes temporally dynamical with the need for *access* data of a given moment in a virtual text. Memorial space is being replaced by a limited series of temporal entities. Space becomes temporalized, with the archival paradigm being replaced by permanent transfer, recycling memory.

- what can be (alpha-)numerically addressed can be located in the (techno-)symbolic order. In this sense the Internet generates a „new culture of memory, in which memory is no longer located in specific sites or accessible according to traditional mnemonics, and is no longer a stock to which it is necessary to gain access, with all the hierarchical controls that this entails"[410]; addressability crucial for media memory. In Platon´s dialogue *Meno* it appears as if the matter of memory is but an effect of the application of techniques of recall. When the indication of temporal "access" data becomes the dominant feature in Internet research, the traditional archival order liquifies, defreezes: "Informational goods require access, not possession."[411] The *networked storage model* turns electronic archives into a generative agency; the traditional classificatory indexing (by meta-data) is replaced by dynamic (thugh still rule-governed, protocol-governed) sorting.[412] The archival does not reside in the content of its files, but in logistic cybernetics (the cyberarchive which is the object of "media archivology". When *parallel distributed processing* in computers replaces traditional *computer memory*, data become rather temporally that spatially locatable. Considered as „une opération technique“ (Michel de Certeau), the archive as cybernetical memory machine, a play of data-latency and data-actualization, retentions and protentions of the present. As long as documents remain within the reach of actual administrations, they are part of a powerful regime. Within the digital regime, all data become subject to realtime processing. Under data processing conditions in realtime, the past itself becomes a delusion; the residual time delay of archival information shrinks to null.

- linked to the Internet rather than to traditional state bureaucracies, organizational memory has become circulating states, constructive rather than re-constructive. After digitization, media memory is not bound to specific materialities any more (like the photographic print, the film roll, or the gramophone record and video tape), but becomes a function of applied algorithms as techniques of recall (retrieval); networked data bases mark the beginning of a relationship to memory that dissolves the hierarchy associated with the classical archive

Data migration

- institutionally the "archive" still an administrative and juridical memory of

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410 Howard Caygill, Meno and the Internet: between memory and the archive, in: History of the Human Sciences Vol. 12 No. 2 (1999), 1-11 (10)

411 N. Katherine Hayles, Coding the Signifier: Rethinking Processes of Signification in Digital Media. Lecture at Humboldt-University Berlin, 11 May 2001

412 See Elena Esposito, Soziales Vergessen. Formen und Medien des Gedächtnisses der Gesellschaft, Frankfurt/M. (Suhrkamp) 2002, 43; as well Alexander Galloway, Protocol, MIT 2004

state or other corporations; in computational culture an *arché* of a different kind has emerged: a generative, algorithmic, protocol-like agency, literally *programmatic*; its relation to the physical world is defined by sampling. Already the traditional, text-based archive consists of digital elements, elementary letters of the alphabet. But in the digital age, the alphabet is reduced to a binary code which, in the von-Neumann-architecture of the computer, does not separate stored data and the processing rules any more (like in traditional archives, where the files are kept in magazins while the archival rules of procedures are kept in books or administrative meta-documents). When both data and its procedures are located in one and the same operative field; classical documentary difference between data and meta-data (known from libraries, where books and signatures are considered as two different data sets) implodes

- new horizons for search operations in the Internet: Not just addressing and linking images, sound and texts by alphabetical addresses, subjecting such files to words and external meta-data once more (the archival classification), but addressing digital images down to the single pixel from within, in their own medium, allowing for random search (apparent disorder as alternative economy of information euqalling the unexpected) - literally "bit-mapping", mapping (by) bits. Since images and sounds thus become calculable and capable of being subjected to pattern-recognition algorithms, such procedures will not only media-archaeologically "excavate" but as well *generate* unexpected optical statements and perspectives from an audio-visual archive that can, for the first time, organize itself not just according to meta-data but according to its proper criteria - visual memory in its own medium (endogenic). Towards the generative archive, the archival paradigm, in genuinely digital culture, is being replaced by sampling; direct random access to signals

Between passive container and active mediator: the archive

- *insistence* of the "archive" in spite *of* the "anarchival impulse" declared in media art; the *instance* of the "archive" as a regulating law in digital technologies, and finally the *instant* of "the archive" as a temporal moment

- looked at in a media-archaeological way, that is: close to the technology itself, nothing "anarchic" in the digital world; every action here is based on precise algorithms; re-define the archive in techno-mathematical terms

- existence in an an(-)archival world, in which everything appears to have been pre-empted = journal *Springerin* 4/2012, thematic issue "Leben im Archiv" ("Living in the Archive")

- media-archaeological focus on the message of the medium itself. Applied to memory agencies and especially to the "digital archive", this method leads to a new interpretation of the different epistemological and aesthetical dimensions of what is commonly called "the archive". So far, "exclusively spatial terms, such as installation, storage, collection, have dominated the art discourse on archival methods and practices, emphasising the stability of archival content

and its narrativity"[413], as once expressed in the exhibition *Deep Storage* on artistic archive practices.[414] While the traditional archival format which is spatial order and classification will in many ways necessarily persist, the new archive is radically temporalized, ephemeral, multimodal, corresponding with a dynamic user culture which is less concerned with records for eternity but with order in fluctuation. This different kind of archive is synchronous with the present itself, in its essence rather generative than memorizing

- "performative archiving" (Panos Kouros) as a dynamic process of archive-making which evolves in the present, open for permanent re-editing and adding of new terms - the logic of the Internet; Wikipedia principle

- not confuse storage with archival input; painting as layered "acumulation" of temporary versions, unlike sectors / overwritings of an image DVD = e-mail Hugo Barata, May 30, 2017; there is analog storage (in the technical sense, such as phonographic records), still a layering of images or an "accumulation" is already an archive, on the contrary: a collection or palimpsetuous superposition is arbitrary, whereas an archival ordering of records follows a pre-structuring sequence of selective steps (the "algorithm" of memory, be it administrative or other). On the DVD, in fact, there is an addressable distribution of data blocks in sectors - archival in the precise sense of addressing

- unlike traditional encyclopedias like the Encyclopedia Britannica, interactive online encyclopedia Wikipedia updated in its knowledge almost by the minute. The radical temporalization of knowledge space transforms the "archive" dramatically, with the new "Web 3" economy being the realtime net.

- if Google search engine architecture and infrastructure may be reminiscent of an archive, not the classical archive any more, but a processual one, with the Page Rank algorithm re-generating the ranking of retrieved information according to statistical and referential (URL links) values and weighting (the genotypical level). It is still a rule governed, programmed system which organizes information so that it may be retrieved, but different to the traditional archive this archival "inventory" is updated - and indeed reconfigured - at an incredible speed: always another archive (on the phenotypical side).

- "Typically the dynamic dimension of the web is largely beyond the scope of search engines. They survey static web pages, relegating real time dynamics to the so called deep web (Halavais 2009, 16). Thus archives still exist, helping you find your way around the anarchive of the net" = Kjetil Jakobsen, Anarchival Society, in: Eivind Røssaak (ed.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010, 127-154 (141) 2010, referring to: Alexander Halavais,

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413 Panos Kouros, The Public Art of Performative Archiving, in: same author / Elpida Karaba (eds), Archive Public. Performing Archives in Public Art. Topical Interpositions, Patras (University of Patras / Cube Art Editions) 2012, 41-53 (42 f.)

414 See the exhibition catalogue Ingrid Schaffner / Matthias Winzen (eds.), Deep Storage, Munich (Prestel) 1998

Search Engine Society, Cambridge (Polity press) 2010

YouTube: An(-)archive?

- video portal like YouTube a repository in archival terms = Frank Kessler / Mirko Tobias Schaefer, Navigating YouTube: Constituting a Hybrid Information Management System, in: Snickars / Vonderau (eds) 2009: 275-291 (277). "The digital archive is by nature a database."[415] Digital media platforms like Facebook, Youtube or Wikipedia represent rather searchable data banks than archives in its proper sense. YouTube is rather a random collection than a well-structured archive, since it is user-generated, a generative archive. Its order depends on the accidental meta-dating (tagging) by the content-providers, not on any archival logic. Its archival logistics is rather the underlying structure of video database management. Archives of moving images, in the age of YouTube and UbuWeb, themselves get in motion.[416]

- in www.ubuweb.com, moving image contents not algorithmically searchable and accessible; rather a media library, "YouTube is not itself an archive. Preservation is neither its mission nor its practice."[417] Rick Prelinger defines the Internet Archive in San Francisco itself as a nonprofit "digital library" = ibid.

Algorithmically questioning / answering the archive

- dynamic access replacing static classification of traditional catalogue, just like statistical probabilities have replaced particular knowledge in information theory, and pattern recognition replaces alphabetical identification towards open forms of adapting knowledge

- reading resp. listening is "distant" when it takes into account the archival metadata; hypertextual links of documents: "computational or algorithmic analysis can be ethical precisely because it takes into account the fullness of the archive insofar as all the indexed data related to the narrative of every survivor is part of the analysis. [...] algorithmic or computational modes of analysis [...] allows a multiplicity of complete queries [...]" = Todd Presner, The Ethics of the Algorithm: Close and Distant Listening to the Shoah Foundation Visual History Archive, pdf *online*; draft March 2012

- "tectonics" as architecture of the archival order; archival principles: in/accessibility ("protected mode" for good reasons, against dilettantism of "open access"), longetivity; mis-understanding: archive not primarily about total memory, but selection / oblivion ("right to forget"); "principles" = *arché*

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415 Pelle Snickars, The Archival Cloud, in: ders. / Vonderau (eds) 2009: 292-313 (304)

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

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

(Foucault); keep separate: internal administrative archive and its algorithmic unfolding; authenticity of the record; "archival body" (*Archivkörper*); provenience / pertinence; *technical* pre-structuring of archivable records (Derrida); "Aktenplan" as kind of flow chart (known from computer programing)

- recording / storing in real-time versus classical archiving as a post-process; "register" (computational term in CPU) vs. "archive" (inbetween: *Altregistratur*); buffer / cache memory; intermediary storage. Digital culture = *registratory* present; distinguish from conventional archives: the pre-emptive mode (*futurum exactum*); predictive algorithms; katechontically resist temporal change (momental rather that documentary); neg-entropic (agains time-arrow of decay, in the symbolic code); archive strictly as Read-Only-Memory (ROM / irreversal), not: RAM or EPROM

- *Register*: 1. One of a small number of high-speed memory locations in a computer's CPU. Registers differ from ordinary random access memory in several respects: There are only a small number of registers (the "register set"), typically 32 in a modern processor though some, e.g. SPARC, have as many as 144. A register may be directly addressed with a few bits. In contrast, there are usually millions of words of main memory (RAM), requiring at least twenty bits to specify a memory location. Main memory locations are often specified indirectly, using an indirect addressing mode where the actual memory address is held in a register. Registers are fast; typically, two registers can be read and a third written - all in a single cycle. Memory is slower; a single access can require several cycles. The limited size and high speed of the register set makes it one of the critical resources in most computer architectures. Register allocation, typically one phase of the back-end, controls the use of registers by a compiled program. [...] 2. An addressable location in a memory-mapped peripheral device" = on-line Dictionary of Computing FOLDOC (Denis Howe), state Feb 27 1993, accessed 1999

Dis-ordering images

- cultural analytics; critical interest in the work of the algorithms themselves, not only their output; Matthias Wannhoff; https://www.medientheorien.hu-berlin.de/hausarbeiten

- experimental media archivology; an ordering can not "tell a story"; in fact algorithmic listing is a critique of narrative ordering itself ("Telling vs.counting"). Ordering digital "images" by id, pseudo-random hashes etc. reminds human culture of different orders of things indeed (quite Pythagorean: world relations as number ratios)

- "searching images": www.suchbilder.de; Flash animation on top: pixels "sorting" themselves, slowly, according to colour affinity; in its dynamics not preservable with archive.org (Wayback Machine)

- "stories" of the listings would rather be hallucinated by their human interlocutors; the narrative approach is not the most in tune with the form of the ordering

Return of the archive

- signal-based, dynamic memory implicitely sonic by nature (time-based, no more subjected to the spatial order)

- signal analysis instead of philology of symbolical notation (alphabet, musical score); access to the indexical, physical traces of past soundscapes; implicit knowledge that is stored inside technology = media-archaeological alternative to Polyani's notion of (only apparently archaeological) "tacit" knowledge. A historical recording like an Edison phonograph cylinder contains physical traces of the past, but a Nintendo "Game and Watch" handheld electronic game from 1981 also does: its electronic circuitry, its ICs and its loudspeaker enable us to experiment analytically, recreating the same auditive events that the device would have produced when it was first sold.

- algorithmically processing information, making it imperative to work with the original hardware - or emulation? - versions of the electronic toys

- archive as symbolic regime returning within digital culture, more than ever. The binary operation is archival by its very electrotechnical essence, but the algorithmicized archive is dynamic, that is: more musical in character

- political, cultural, social and software-driven implications of techniques for data clustering arising with classification by meta-data

- "Whilst accessible tools and cheap storage provide new opportunities to ‘cache’ one’s life, practices of editing and annotation are largely being replaced by passive accumulation" (Katrina Sluis). Against this, "algorithmic memory" makes use new options folded into techno-mathematical records, examining the material und logical structures which support and drive the sorting, searching and filtering of digital memories

- on bit-critical level, all data equal, whether text, image, sound, protocol, or program code; differentiation on format (and transmission protocol / compression) level

- not just the individual data that are being stored in databases, but the structure of the database itself, relationships and correlations between the various data, metadata; "even secret files suffer a loss of power when real streams of data, bypassing writing and writers, turn out merely to be unreadable series of numbers circulating between networked computers."[418]

- data flows once confined to books and later to records and films are disappearing into black holes and boxes that, as artificial intelligences, are bidding us farewell on their way to algorithmic commands. In this situation we are left no longer with reminiscences, that is to say, with stories, but with storage and its numeric addresses.

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418 Kittler, Gramophone 1999, Preface, xxxix f.

- behind almost all activities in the world nowadays lurks an immaterial archive, such as the storage of data from video surveillance and other security equipment: already "living" in the world's online archive, or, more to the point: we are living in the world-as-archive, coupled instantaneously to constellations of databases.

- "Archives no longer just contain our past for inspection by historians, tax collectors and other researchers. We are permanently living in archives: All the sites we visit on the Internet are logged by our search engines. All our shopping is registered by our supermarkets. Each time we perform an electronic act we add information to the running archive of our activities as both individuals and members of target groups. On the basis of such archives the policies for the future are being planned [...]."

- ecstasy of the archive when connected *online* to any present computer-based action (Wireless LAN for example); this means first electrification (speed of light) and second binary mathematization; once instantaneously available and accessible, archives become an essential factor in acting in the present

- digital (like neuronal) memory no static system. "Memory is something that operates in the present and through that act is continually updated. Research into such functions of memorizing or information storage provides not just interesting knowledge in *its own terms* = the (media-)epistemological approach of Media Studies; "models and tools for understanding the possibilities of nonlinear computing and nonlinear database linking technologies"

Information-entropic imagery (Constant)

- www.activearchives.org; algorithmic de-humanization of record memory; case *"Erkki Kurenniemi (in 2048)" (preliminary work towards) an online archive*; Kurenniemi documented his life, but not archived it - wainting for computative intelligence to organize it in 2048; mulitple partial orders coexisting in digital virtuality, *n*-dimensional; trans-archival aesthetics: "data laundry" files have no special meaning in themselves as "originals", viewed through the lens of an algorithm; open computer vision (by algorithms). "Whispers of data": the "archive within" the digital image; in addition: metadata contained in the metadata of a JPG image; f. e. information about the camera at moment of shot; when it was taken*. C*amera stores pictures on internal memory card; same logics like applied by intelligence services; in legal terms: pornographic images protected, modulated / obscured by informational aesthetics

- "image" in its diagrammatic, algorithmic, trans-iconic sense "an interpreted composition of pixels, a collection of statistics, lines of contours or directions, a music score" = Constant: E. K. (In 2048)

- humans incapable to navigate audio-visually through such records; intelligent agents – algorithms – generate patterns by sorting which make data accessible for human "interpretation". Such pre-structing is the media-archaeological act

- the immediate iconological appeal of the digitalised image is arbitrarily deconstructed to provide different patterns and forms of *Gestalt*

- media-*active image* archaeology; "doesn't appear in the viewer's retina"; each image can be understood to contain its own latent "knowledge"

- the "active", algorithmically executable record no longer "archival" (*stasis*); DH results from such algorithmic generation of new insights (Manovich's "visual analytics") comparatively banal? Lev Manovich, How to Compare One Million Images?, in: Understanding Digital Humanities, edited by David M. Berry, Basingstoke (Palgrave Macmillan) 2012, 249-278

- Geoff Cox / Nicolas Malevé / Michael Murtaugh, Archiving the Data-body: human and nonhuman agency in the documents of Kurenniemi, typescript for Krysa / Parikka (eds.) 2015; http://activearchives.org/wiki/Archiving_the_Data-body:_human_and_nonhuman_agency_in_the_documents_of_Kurenniemi

- by-pass privacy and copyright limitations of "open access" to the Kurenniemi estate, the (partly pornographic) images are computationally tumbled / obscured / data cloud - without destroying the unique archival images. By-passing such limitations as productive bias:

- legal (copyright / privacy) contrains creatively force to consider alternative ways of archival re-presentation", by-bassing the “retinal” approach to the original image, rather unfolding different approaches from the nonhuman point of view" (Constant): different algorithms for face recognition, color analysis, contour detection, unfolding implicit knowledge of the non-semantic content of the documents collection

"Algorithmic radio" (Constant)

- Constant, "Data Radio" project; spectrum sort of audio files from the Kurenniemi archive; cp. sonic articulation program "Mr. Kov" (Martin Carlé; speech segments; cp. project Herfried Weiser, quasi-phonetic Kittler-video cutting

- "listening" to Kurenniemi's autio-biographically recorded voice diary on cassette tapes through the ears of the algorithms

- multiple correlations vs. fixed taxonomy; not wholes files, but relations between sound bits within single sound files, *diagrammatic* sonic archive

- Kurenniemi's audio cassettes (Philipps-Recorder); speech with Spectrum sort-Algorithms (loudness / dynamics in decibel), selecting song-like passages; use same algorithm for Lautarchiv, Berlin

- Kurenniemi's cassettes: "Dataradio", ways of navigating the audio-visual recordings; applying Spectrum Sort according to frequencies (FFT) to Kurenniemi's digitized cassettes, breaking the sound into one-tenth of a second framgents, they can be re-arranged according to their loudness (or silence) in the frequency band. Uncannily close to artificial sound and voice synthesis, the algorithmic associative memory reveals the quality of Kurenniemi's

expressiveness: "The algorithm's and the human's voice combine" = Cox et al. 2015: 136

- refers back to Kurenniemi's DIMI-A itself, Digital Music Instrument, Associative Memory, 1969: selection of audio data according to memory content rather than by adresses; hashing

- Amit Pinchevski, proposal of algorithmically "looping" similar expressions in audio Holocaust testimony; most un-human algorithms un-cover the most human / bodily moments in Kurenniemi's cassette recordings; condition for such algorithmic research: that the original tapes remain intact (archival care); combination of both traditional archive and algorithmic laboratory

- signal-to-noisy ratio: separate speech from background

- *specific* search tools for audio archives, different from search tools for "image" archives; Constant file associative_memory.aif

- the *sonic* refers to search algorithms as well: sonic analytics; algorithmic ("automated") tagging (mark-up), a kind of metadata from within the medium; oppose / combine with "social tagging" which is non-classified in similar ways: hybridisation

- algorithmically / automatically tagging "silence" (intentional and non-intantional one); AUDACITY: "Silence Finder"; further: "Echo"; "Beat Finder"; spectral analysis

- algorithmic annotation with software from computational linguistics: temporalizing phonems; software PRAAT (Netherlands), PLP Laboratory; University of Mons: voice synthesizer

New media, memory

- media-archival content presented processually (the moving image / the unfolding of sound as music, be it by analogue or by digital machines required for such monitoring); analogue carrier medium itself (film reel, video tape, musical record) remains a static, "archaeological" object, such as the phonographic record containing the voice of emperor Hiroito declaring the Japanese capitulation at the end of World War II in August 1945, preserved in a climatized vitrine box at the National Museum of Broadcasting in Tokyo; adding a "time-axis" (like in an oscilloscope) to the formerly spatial archive

- mechanical physics of storage against fluid (electro-magnetic) memories: "Of these recording methods, magnetic tape is the worst and needle-in-the-groove mechanical is the best" = McLean 2000: 255

- from long-time exposure in early photography (for techno-chemical reasons) to catching a "pregnant" (Lessing) moment, archiving an instant of time, a dramatic, time-critical escalation, almost mathematization of memory

- film / videography of the dance performance; time-objects (even variable media art installations) can only be caught by storage media which are themselves kinetic; the resulting objects (a film reel, a video tape) is in itself an immobile, very material, rather spatial than temporal object

- classical analogue media such as phonograph and cinematography already preserving the formerly time-based, process-oriented, variable, transitoional - the human voice, music, movement, which formerly could only be symbolically remembered (by notation in the alphabet and music notation, or drawing)

- with the arrival of electro-mathematical media a new level of micro-memories which needs to be described in terms of storage (Babbage) rather than memory or remembrance (even though the metaphorical notions persist even in technical language). "That portion of the Analytical Machine <...> is called the storehouse. It contains an indefinite number of the columns of discs describe by M. Menabrea", the Ada Lovelace comments in "Note B" to her translation of Manabrea's description of Babbage's proto-computational Analytical Engine = L. F. Menabrea, Sketch of the Analytical Engine invented by Charles Babbage, orig. in: Bibliothèque Universelle de Genève No. 82, Oktober 1842, in: Taylor's Scientific Memoirs vol. III, 666-731. Reprint in: B. V. Bowden (ed.), Faster Than Thought. A Symposium on Digital Computing Machines, London (Pitman Publishing) 1953; Paperback edition 1971, Appendix I, 341-362 (text Manabrea), here: 374 ff. (374)

- digital „tele“communication, even though subjectively perceived as almost immediate data transfer, is based more than ever on a system of short-time storage (cache, f. e.) which belongs to the operation of real-time effects. This new media-archealogical layer of time-critical, invisible memories, asks for theoretical reflection in its own techno-logical terms (i. e. taking into account both the electro-physical and the mathematical aspect of so-called „new media“)

- computation keeping data in latency for action - rather a kind of *cache* memory in administration than a detached place of cultural memory

Latency, hysteresis

- a state of *latency* (of deferred presence) aptly describes the nature of transitional, dynamic archives.

- while "transient" is a term for phenomena experiencing a change as a function of time (temporary phenomena), such as the dramatic "content" of a video art piece = Magrab / Blomquist 1971: 320, in reverse, the archival object (the carrier medium: the video tape and hardware facilities) is meant to remain intact and basically unchanged over time.

- a couple to technological terms not denotating storage but, given a second thought, turn out to be dynamic intermediary memories (delay memories), such as the phenonemon of hysteresis, a kind of electronic lag: "The summation of all effects <...> which causes the output of an instrument to assume different values at a given stimulus point when that point is

appraoched first with increasing stimulus and then with decreasing stimulus" = Magrab / Blomquist 1971: 312 such as in magnetic recording

Digital memory

- audible difference, by shifting the sampling rate in digitizing phonographic records, significantly referring rather to the noise of the recording device (the ancient wax cylinder) than to the recorded voice. Here, the medium talks both on the level of enunciation and of reference. What do we hear: message (the formerly recorded songs) or noise (the wax cylinder scratch and groove)?

- media-archaeological awareness; Edison recording primarily memorizes the noise of the wax cylinder itself - which is different kind of "archive", not cultural-historically, but cultural-technologically, a different kind of information on the real. Media archaeology opens our ears to listen to this as well, not to filter this out (against the "cocktail party effect" of hermeneuticised psycho-acoustics).

Not to be confused: Archive, memory, storage

- archival function not semantic "memory" but a storage technology, rather an organizational form, a well-defined system, a format of symbolic order by meta-dating, a rule, non-invasive to its object

- "experimental archives" different from the well-organized institutional archive. Quantized (digitized) analog films can be transformed into a vast image bank which then as data-set can be, unified, subjected to image-based search operations such as matching of similarities, object feature detection, statistical colour value comparison etc.

- *within* storage media, a non-social memory at work, displaying a rich memory culture of its own, inherent logic, specified for the needs of the so-called "von Neumann - architecture" of computers we still use after half a century. Let us name the modules of this techno-mathematical memory - which turns out to be a metaphorical transfer of terms well known in traditional archivology. The closer we look at this micro-memory architecture, the more 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).

- core of digital the single storage element (with its smallest unit being a flip-flop, a binary unit to store or change one bit of information)

- the protected storage as "protected mode", the real "secret archive"; read-only storage

- the register (a term well known from traditional archival sciences, now being used to define the smallest intermediary storage element in computing

- the accumulator as a special register for numeric calculations (thus in need of cells for the storage of intermediary results)

- the buffer (for explicitely transient <vorübergehend> data storage, when these data are being transferred from one functional unit to another)

- storage organization, with its different modes of access to stored data: direct access storage; sequential access storage; indexsequential storage; pushup and -down storage; word-organized storage

- associative storage with its special characteristic that its stored elements can be adresses *by content* (of parts of it)

- "hashing": sorting memory content from within

- for the "content" of this techno-numeric memory, still the format of the "record", the well-known "file"

- cross-referencing of storage and transfer which is characteristic of computer memory becoming apparent with the close coupling of storage to *timing* (Ge/Zeiten): cycle time; latency (the time it takes in a functional unit for data to be shifted and re-located); access time (by definition[419] the sum of latency and transfer time); time-cricital storage; Turing: "scroll"; writing/reading head in a Turing machine is strictly indifferent to any semantic meaning of the symbol strings concerned. But how can human readers resist the temptation of projecting a face upon archival files, As has been performed by a permanent media installation of Christian Boltanski at the Art Room at the University of Lüneburg literally, called *The archives of my grand-parents*; see a notice in the journal: art 11/1996, 8

Archival dancing, archival singing: How to deal with the transitional?

- since end of 19th century a new type of non-archival records: signal storage of the (physically) real; indexical photography / acoustic phonography; "archives" of kinetic (mouvement) / kinetic (mouving) archives

- The William Forsythe initiative, f. e.: His *Motion Bank*, an open source project of the videographic dancing notation in a special software, which can interactively be used online: www.theforsythecompany.de

- traditional function of the (dance) archive to document a performance which took place at one time and one place; emphasis shifts to the re-generating dance performance which is being (co-)produced by the online user for their own needs. There is still an archive, the *arché*: in Kant´s words the condition for the possibility of the performance to take place at all. The real multi-media archive is the *arché* of its source codes, but in a different form of existence: algorithmic dynamics instead of documentary stills.

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419 See DIN 44300 (Deutsche Norm) Informationsverarbeitung: Begriffe, Entwurf March 1982

- sound "archives" dealing with the transitional; challenge of archiving transitory media art

Proposal: a double strategy

- strategical macro-archives, tactical micro-memories

- trans-archival notion of "organizational" instant memory may serve to describe the logic of internet memory; leaving the neurological metaphors beside, this approach dissimulates the existence of material memory agencies - both hardware and institutions, which still govern the power of what can be stored legally and technically, and what will be forgotten; memory-politically still on-going impact of traditional paper records

- differentiate between the documentation of media artistic performances (by video recording f. e.) and the media art monuments themselves (an artistic video tape) - to use a difference articulated by Foucault´s *Archaeology of Knowledge* (monument / document). A centre for Art and Media could be a place of experimenting new, different forms of the archive, the dynamic archive / archival fields, the generic archiv: generated *on demand* by (online) users.

What separates media arts archives from institutional ones?

- institutional archives strictly rule governed, "administratively programmed systems" (Jakobsen)

- unlike analogue broadcasting of radio and television transmission (live transmission), that is: the disappearance of the signal as soon as it has been transmitted, "all digital media communications have a "save" function. Every communication may in principled be frozen and preserved for posterity. Many new digital media platforms like Facebook, Youtube or Wikipedia *are* indeed searchable archives" = Jakobsen 2010

- with Internet economy, reverberating circuits gain dominance over memory involving records (Krippendorf). Internet a data circulation of discrete states, without central agency and an organized memory; "yet something like classical archives are vital to the functioning of the anarchival world. When using a search engine like Google, you are actually not searching the net, you are searching documents that have been *crawled,* that is compressed, and prefixed in the Google repository by docID, length, and URL, before being indexed according to Google’s famous secret formula and archived in virtual barrels"; Brin, Sergey and Lawrence Page, The Anatomy of a Large-Scale Hypertextual Web Search Engine, in: Computer Networks and ISDN Systems, volume 30, issues 1-7 (1998), 107-117

- when archive temporalized and time-critical, loosing its traditional definition as permanent working memory of a *state* (both abstract and concrete). When the archives increasingly becomes an intermediary memory, it is not separated but directly coupled with the operative procedures of a given presence,

involved in just-in-time and real-time prozessing, thus tending more to the register (a temporary deposition) than to the end-archive.

- non-archival forms of memory, transitory memory as experimented by time-delay media art works; genuinely media-inherent memory (storage devices, dynamic memories like the difference between RAM / ROM), which - though looking simply like technical solutions - have an epistemological, memory-cultural dimension (to be worked out by media archaeology which rather concentrates on storage, not - like cultural studies - on discursive memory)

- media archaeology, confronted with Cartesian objects, which are mathematisable things, describing the non-discursive practices specified in the elements of the techno-cultural *l'archive*

- focus on differential storage (delay memories); von-Neumann architecture for the archive (in parallel to computing): data and programs (archival coding / system) in the same operative unit, allowing for instantaneous *chance* of the archivizing system adaptive to the objects (being visual, textual, acoustic)

De-frozen archives

- anecdote Baron of Münchhausen (Raspe 1785): in Winter the brass tube tones freeze and will be de-liquified in springtime, sounding again. Since Phonography (Edison 1877) this became technically true - different from the memory mechanism in the brain (Bergson, neuro-biology), and different from text-based memory (the traditional "message" of the medium archiv is the alphabet)

- analogue media (grammophone, kinematography, magnet tape for music and video); now re-entry of the "discrete" memory, the alphabet, the coded symbols, but alphanumerically, not simple speech-orientated, but as well mathematical, and only operative hwn implemened in physic of computer ("hardware"), a system which now is able to emulate the "analogue" itself (Digital Signal Perocessing in real-time)

Special case: media art born digital

- analogous media arts like photography, phonography, cinematography, then electronic radio, tape recorder, television, video need to be preserved physically (and may only be meta-dated by the digital archival system); media art born digitally: as web-based interactive art f. e.; this can be archivally emulated, like previous computer games such as *Space War*

- proposal Richard Rinehart: Save the „score“, that is the essential qualities of a piece of new media art, by a special purpose descriptive language developed at Berkeley

- difference between simulation and emulation is an ontological one (since when it comes to art, games et al. produced on von Neumann machines, the emulating computer *is* in the "state" of its precursor - a new kind of existence).

While early emulations of, f. e., a Commodore C64 computer game on a much more recent computer, suffered from the fact that just the logic could be re-enacted, but not the electronic components (like the very processor itself), not their physical qualities, deficiencies and ideosyncracies, recent computing emulated its predecessors with physical modelling itself.

- if source code co-archivized (the true hidden archive behind the apparent memory archive as *a priori*), digitally born media art can be truly re-encated within the computer archive (wherease quantized film works, f. e., can only be re-produced)

Micro-media memories: storage devices

- close reading of memory on the media-archaeological level disclosing not transitions, but abrupt, necessarily discontinuous jumps - at least when it comes to analyze memory in digital culture. Since within computing architecture, memory is no discursive flow (equivalent to the electric current), but on the contrary dissolves into discrete elements, with its smallest unit being the bistabile element (or flip-flop) which is the hardware embeddedness of the logical binary digit (bit) representing the smallest unit of information (a sigle pulse position). This smallest unit of memory may consist, f. e., of two correlated (short-circuited) thermonic valves: "A circuit in which the output has two stable states (output levels 0 or 1) and can be caused to go to either of these states by inpout signals, but remains in that state permanently after the input signals are removed" = Magrab / Blomquist 1971: 305

- micro-memories on the level of techno-mathematical storage operations; asymmetric relation between (transitions in) this micro- and macro-level of memories (storage / "social memory")

- memory on demand: *cache memories* as condition for realtime data processing - no memory in the emphatic sense, but dynamic temporary storage

- maximized computer memory capacities still continues an old occidental obsession that culture depends on storage (historic architectures, libraries, museums); future cultural emphasis will be rather on permanent transfer, not storage (without undoing storage, though); already an implosion of storage mania into processual data flows, a different economy of the archive as dynamic agency “online”; notion of immediate data feedback replaces the data separation that makes all the archival difference

- with digital archives - in principle - no more delay between memory and the present, but the technical option of immediate feedback, turning every present data into archival entries and vice versa. The economy of timing becomes a short-circuit

- "Streaming media" and storage becoming increasingly intertwined with intermediary storage

Dynamics in the archive

- as a "monument" the Baird *Phonovision* recording disc is part of the classical archival techniques (inventorisation, keeping) such as any other classical paper record. The difference is *operative*: as a "document" it comes only into being (i. e. "readable", recognizable for the eyes) when being processed / played a) by a technical medium (first the Phonivision electro-mechanical Baird equipment, now the digital restoring computer) and b) when kept operative by an on-going medium, which requires the archival artefact to be processed *online*: http://www.tvdawn.com/silvaton.HTM; D F McLean 1996

- one form of computer memories, the most difficult and most expensive system component in early computing, in one variance (magnetic drum storage) has been literally transitional; the alternative static *versus* dynamic data storage in early computing looks like technologically equal solutions; in fact the difference has an epistemological dimension

- so-called *chaotic storage* method in economy reduces access time and storage space to the max; information in the Internet is transient and "shelved"[420] just for limited time intervals (Delta-*t*); *organizational memory*, like the Prussian State Archives structurally preserved rather the organizational memory of state administration. The authoritative *archive* (in Foucault's sense) of technical protocols replaces the content-based (mis-)understanding of the traditional(izing) archive

- with supremacy of selection over storage, addressability over sorting, no memory in the emphatic sense, rather a function of *transfer* processes

Dynamic storage (delay lines)

- delay considered as temporary storage already: "In communication, delay is a most unwelcome phenomenon, but from the angle described above <sc. "as a hybrid and transition between communication medium and storage medium">, it <sc. delay line> is volatile,short-termstorage. Long-term memory, too, originated from a new interpreation of a technical disturbanec e- feedback. <...> it demonstrated the technical feasability of storage in an ephemeral medium."[421]

- technology of delay lines and storage tubes (acoustic / optic), though being a well-defined device limited to a micro-technological configuration, may at the same time serve as an indicator or a shift of emphasis in memory culture from the classical idea of "eternal" preservation to transitory (as well as vanishing) memories, memories with a "time to live", like in internet data transfer the "Ping" signal

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420 Editorial: The Internet. Bringing order from chaos, in: Scientific American vol. 276 no 3, march 1997, 494 (49)

421 David Link, There Must Be an Angel. On the Beginnings of the Arithmetics of Rays, in: Siegfried Zielinski / same author (eds.), Variantology 2. On Deep Time Relations of Arts, Sciences and Technologies, Cologne (Walther König) 200xxx, 15–42 (30)

- "There are two requirements that must be met to build such a quasi-real-time system. First, the in-transit storage at each node should be minimized to prevent undesirable time delays. Secondly, the shortest instantaneously available path through the network should be found with expectation that the status of the network will be rapidly changing."[422]

The archival "field"

- term from mathematics: vector fields, referring to the calculation of Michael Faraday´s disvocery of the "electro-magnetic field" by James Clerk Maxwell (Maxwell´s Equations). The neo-logism "field" in early 19th century served to describe a phenomenon (electro-magnetic induction) which could not be reduced to terms from Newtonian, classical physics like "matter" and "energy", representing rather a cross-referencing of both ontologies

- different from script-based archive, audio-visual archives operating on the signal level of the physical and physiological real (to follow one again Jacques Lacan´s distinction as applied to technical media by Friedrich Kittler[423]), a dramatically non-symbolic field, closer to the electromagnetic field and its streaming dynamics than to the symbolic order; a re-entry of the symbolic order in post-analog media, in alphanumeric computing

Archival *analysis* (mathematization)

-l content within media archives radically time-based (video or sound files); physical parameter *t* thus adding a "time-axis" (like at an oscilloscope) to the formerly spatial archive

- electronic media content can only be presented processually (the moving image / the unfolding of sound as music, be it by analogue or by digital machines required for such monitoring), the analogue carrier medium itself (film reel, video tape, musical record) has to get in motion

- phonographic record containing the voice of emperor Hiroito declaring the Japanese capitulation at the end of World War II in August 1945, as preserved in a climatized vitrine box at the National Museum of Broadcasting in Tokyo

Re:load. Archive and cybernetics (economy of circulation)

- Internet communication *moving* the records towards an economy of circulation: permanent transformations, up-dating, metamorphoses; "cyberspace" not primarily about memory as cultural record, but rather a performative form of memory as communication. Within this economy of permanent re-cycling of information, there is no need for emphatic, just short-

422 Baran: *Distributed Communications,* I, 24

423 Friedrich Kittler, Grammophon – Film – Typewriter, Berlin (Brinkmann & Bose) 1996

time, "up-datetable" memory - which curiously comes close to the operative storage mechanism in the von Neumann architecture of computing

- shift of emphasis from rather permanent memory to short-time intermediary memories a functionj of shift from mechanic, strictly ordered, classificatory "library" order towards electronic, dynamic, ephemeral technological physiognomies. Intractive, electronic fieldes, under the label of "cyberspace", converge with the human nervous system - intellectual legacy of Norbert Wienerean *Cybernetics* (1948) turned real with interactive media

- With an increasing transformation of knowledge tradition from material book-based storage to processual time-based data migration, the function of the library is redefined: as time channel, she becomes an agency within the cybernetics of knowledge circuitry. Even if hypertext has liberated knowledge from its restrictions to local memory places, and algorithms provide for new options of data navigation, it is the temporal volatility of net architecture which asks for the library as *katechon*, as agency of delayed knowledge transfer.

Channel time and time channel: Transmission replacing storage?

- communicative action-at-distance *from point to point* not limited to spatial channels in the present but to the temporal channel as well across temporal intervals (past / present), conveniently called "the archive". Seen under this (media-archaeological) perspective, transfer and storage are both sides of one coin: Storage is nothing else but a transfer across a temporal distance

- *memory* technically defined as "device into which information can be introduced and then extracted at a considerably later time"[424] - thus closer to what is technically known as a buffer in electronics: "A circuit element which is used to isolate between stages <...>. Storage between the input/output equipment and the computer whre information is assembled in easily absorbed units; storage between the main memory and the computer where information is rapidly accessible" <Magrab / Blomquist 1971: 305>. The difference between emphatic memory and buffer thus is simply a degree of access time speed.

- minimal delay memories (like buffers) are at work even if we do not notice them. More drastically, these micro-memories dissimulate in (apparent) live transmission. In certain technologies like colour television and the oscilloscope some sort of electric signals has to be delayed against other signals (achieved by circuits and coupling of resistance and capacity or simply impelemented in its most crude form in coaxial cables)

- techno-mathematical storage nothing but an extremely dilated form (in fact its liminal value / *limes*) of (that is, in the temporal channel of communication). Storage and transmission thus are relatively bound to each other, a kind of Möbius loop; their are respective opposite extremes (Kehrwerte), just like the

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424 Glossary, in: Edward B. Magrab / Donald S. Blomquist, The Measurement of Time-Varying Phenomena, New York et al. (Wiley) 1971, 314

so-called "analogue" and the "digital" are not absolutely, just relatively differentiated

- traditional separation between transmission media and storage media becoming obsolete; while storage of data on a carrying medium is passive, invariant, and subject only to phyiscal entropy, the "becoming medium" is their processualisation - which is active transfer, data processing. Whenever an archive is being read (by humans traditionally, by machines in the new media age), it is not an archive any more, but in a momentary state of operative, dramatic presence, a memory theatre on micro-level

- with the retro-conversion of analog magnetic tapes (radio, TV) to digital storage for preservation reasons, different ways to hack into these digital memories since the digital archives, once online, are not separated from the actual infrastructure of web-based data circulation any more. In a way, of course, this means the disappearance of the emphatic notion of the “archive”; it dissolves into electronic circuits, data flow. In a way, the (historically) "deep" archives transforms into a "flat" archive - flat in the sense of the integrated circuit (micro-chip architecture). There has always been a data circulation between the needs of an inquiring present and the archival documents; but only *online* this ciculation becomes a *closed circuit* (with all its cybernetic consequences: interacticity f. e.)

- spatio-temporal entanglement; gap between resident emphatic archives (traditionally) and ultra-speed transfer narrowing; emphatic memory progressively undermined by a shift of emphasis towards *memorizing*, the dynamic process, based rather on a network of micro-memories and interacting micro-memorial hierarchies

- alternative "storage *versus* transfer", useful for the analysis of cultural communication (since Harold Innis, *Empire and Communications*, 1950) becomes oblique; storage is nothing but a limit value (Grenzwert) of transfer

- storage itself transforming from an immobile, static state into a dynamic, processual *timing*

- function of the transmitter is to *encode*, and that of the receiver to *decode*, the message. The theory provides for very sophisticated transmitters and receivers - such, for example, as possess `memories´, so that the way they encode a certain symbol of the message depends not only upon this one symbol, but also upon previous symbols of the message and the way they have been encoded. = Weaver 1963: 17

- "The input to the transducer is a sequence of input symbols and its output a sequence of output symbols. The transducer may have an internal memory so that its output depends not only on the present input symbol but also on the past history. We assume that the internal memory is finite, i. e., there exist a finite number *m* of possible states of the transducer and that its output is a function of the present state and the present input symbol" = Shannon / Weaver 1963: 57

- Foucauldean *l'rchive* receding into the coding and protocol layer, the truly media-*arché*ological (media-archivological) layer (*arché* here used in Michel Foucault´s sense as the governing rule, the Kantian *Möglichkeitsbedingung* for the emergence of sensible phenomena at all); already transfer needs a protocol = the essential governing law

- *real time* operations, i. e. the "processing data in time with a physical process so that the results of the data-processing are useful in guidng the physical operation" = Magrab / Blomquist 1971: 316; whereas analogue computer calculates physical processes immediatly and electrophysically itself, the real time digital signal processing (DSP) requires a completely mathematical and at the same time time-critical ("synchronous") analysis of the event under oberservation, that is: a delicate mechanism of intermediary data storage

- well-defined mathematical notion of "information" (with its smallest unit being the *bit*) replaces the cultural desire of storage. The binary information (bit) though is physically incorporated by electronic devices like the flip-flop circuit which is the smallest possible *storage* unit itself.

Archives becoming time-critical

- traditional paper-based non-("new"-)media archives becoming time-critical when subjected to electronic filing systems, with its usefulness being; shorter access times; shorter search times; decentralized online-accessability (beyong "local" space-boundedness; simultaneous (archival) file-sharing by serveral people

- electronic media (such as video art, as defined by Bill Viola) not simply time-based (as defined by Gotthold Ephraim Lessing in 1766 in his treatise *Laokoon* where me makes a semio-aesthetic difference between space-based and time-based media, that is: between visual arts and poetry), but confronted with a new type of artifical temporality: time-critical processes

- notion of "instanciation" in programming computers with its internal "interrupt" procedure reveals the delicate micro-temporal and decision-critical economy (synchronisation, clocking) of data processing in computers, a permanent interplay between internal data processing and input from the outside world, as performed daily in computer games (action games), well described by Claus Pias in his study on *Computer - Spiel - Welten*

- correspoding term in computing is "allocation", that is: the administration of computer memory space, its adressses, its valorization, real-time "archiving"

Feedback memory and timeshifting

- cybernetic memory not, like traditional archives, clearly separated from the prensent operations (such as administration as symbolic form of the bureaucrarcy, and technically), but becomes cybernetically a feedback-ingredient of present operations itself, its basic condition: an almost invisible

sytem of short-time memories (like cache-storage) is the condition for digital data processing

- (neuronal) networks with/out memory; adaptive networks require intermediary storage grids in order to become auto-adaptive („learning“ in the sense of von Foersters definition of a quantum theory of memory). Computer memory devices are closer to human neuronal memory than to cultural memory

- in terms of cybernetic brain-computer analogies, memory a (magnetic core) matrix. In the human brain there is no such thing comparable to fixed storage, rather an enactment of immediate synchronisation of distributed electro-magnetic charges in the neuronal net. On December 6th, 1896 Freud writes to W. Fließ about his assumption of a psychic mechanism which does not diachronically consist of layer above layer, but from time to time re-configures the order of memories = Sigmund Freud, Aus den Anfängen der Psychoanalyse 1887-1902, xxx, 185; corresponds with re-adressable digital memory devices such as the RAM, in synchronous layers

- memory-as-image keeps its archaic form in the magnetic core memory. In W. E., Towards a Museology of Algorithmic Architectures from Within, in: When Is the Digital in Architecture?, ed. by Canadian Center for Architecture, Sternberg Press 2016, the photograph of a magnetic core memory from early electronic computing itself dissolves into pixels - a question of resolution? In this "pixelized" version, this represents almost a visual pun for the argument of "digital architecture" within the computer

- dynamics of adressing and assembling signals as data into „memory“ almost exactly corresponds to the way this magnetic core matrix is adressed and configured by a mesh of copper „nerves“ (resonant with digitally switched electricity). The analogy even extrends to the co-decisive role of chemical processes within the transmission lines (nerves), as compared to inductance in electric cables.

- shifting emphasis from emphatic to intermediary memory, closer to electro-magnetic remanence than to long-time archives

- within digital technologies, interlacing of live transmission and storage media is essential. The techno-culture of analogue technical (mechanical and electronical) media has generated both storage media (like the phonograph and film on celluloid) and transmission media (radio, television, „live“ media). But almost from the beginning, both radio and television had to use storage media to fill its program for both technical (Zwischenfilmverfahren) and program „flow“ reasons; on the level of human perception, though, it has not been possible to differentiate „live“ from „storage“ signals, unless verbally indicated. An uncanny temporal regime thus is at work, undead

- shift from long-time cultural value to intermediary media memories; German public TV channel ZDF, at the IfA Berlin (August 2007) announced a new online-service *ZDF Mediathek* allowing for online-reviewing of bygone programs back to one week, deconstructing the very time format of classical TV itself, the program "flow" (Raymond Williams, John Fiske), individualizing TV time; as well

German Telecom announces *Entertain Comfort*, a choice of TV channel programs from an online Archive (such likea football German Bundeliga game already one hour after the event itself, almost present, near-live; see „live on tape“ concept previously), advertising „timeshift“ for temporally deferred TV athome. Video on Demand = Online Videothek. This requires a set-top box (Media Receiver T-Home X 300T) with Timeshift Function (an integrated Video recorder)

Capitalizing audio-visual memory? The lack of media archives

- historical consciousness of the post-Second World War generations that grew up with radio and television coincidental with its media archives - public broadcast archives that are not paper-based any more but exist in audio-visual form; how to get access to these new kind of archives in a non-proprietary mode; *lack* of a public audiovisual media archives; structurally: most existing media libraries and search engines still dominated by access of images and sound through the alphabetic writing (meta-data)

The alphanumeric

- Turing 1936/37 „On computable numbers“ conceiving a symbolic paper machine based on an unlimited memory tape (derived from the typewriter tape) on which in discrete fields symbols can be read and written; manipulation of symbols strictly formal, time-discrete and machinic: the utmost operational logic of alphabetic writing (inherited by computing with alphanumeric symbols)

- 1974 XeroxParc:GUI (computer as paper simulator, regime of the traditional document-based archive / logics of traditional bureaucracy); original alternative: Theodor Holm Nelsons conceptpf hypertextual, evenmore: hypermedia links, replacing archival and library classification by links - in its extreme -from bit to bit, in fact: on the memory regime of the computer, the registers, from adress to adress, truly digitally linked

- term "audiovisual media" interface-orientated, addressed to human senses (eyes, ears), while behind the surface, on the media-archaeological level, another regime is operative: the alphanumeric code which is the truth behind apparent digital sound files and images. Thus, the very term „audiovisual art“, for digital media, is an appeasement

Streaming media

- "streaming media" auditive or visual content "that is continuously received by, and normally displayed to, the end-user while it is being delivered by the provider"; term "refers to the delivery method of the medium rather than to the medium itself. The distinction is usually applied to media that are distributed over telecommunications networks, as most other delivery systems are either inherently streaming (e.g. radio, television) or inherently non-streaming (e.g. books, video cassettes, audio CDs)" = http://en.wikipedia.org/wiki/Streaming_media; accessed 9-10-07

Archive, memory, storage

- media-epistemic shift from the emphasis on storage to an emphasis of insteant transmission of memory-data; the technologized archive itself is temporalized; practices of short-term storages, for which the notion of "archive" might not even be proper term any more

- organizational memory operating analogous to neuronal memory: “There are actually multiple group and organizational processes occurring <...> *simultaneously embedded* within several other processes”[63]

- archive (opposite to the library) is a memory of procedures, not of information as such. The records kept in the Prussian State Archives, f. e., nowadays exactly mirror the prodedural logic of Prussian administration - but they are themselves non-processual, lacking the dynamic dimension

- being an operational memory, any administration is closer to a computing device than to fixed storage.[425] The difference between the archive and computation is in the concept of the so-called von-Neumann architecture of computing: Whereas in the archive logistics and records are strictly separate, in computing the data and the programs are stored in the same memory location, being reprogrammable "on the fly". Thereby computer memory is recursive, re-generative - the opposite of the juridical task of the archive, allowing for spontaneous and dynamic adaption to new contexts - at the price of loss of endurance. Howard Aiken, on the contrary, for his Harvard computer series Mark I to IV, insisted on the separation of storage of program and storage of numbers <see Coy 2007: 81, note 4>

- storage on magnetic tape can be erased and overwritten, while human memory always keeps traces of almost any impression (Sigmund Freud); neuronal act of remembrance is an active, re-generative one, opposed to the hard-wired machinic memories. Active remembrance itself "wires" the associations always in new ways (or "paths", according to Vannevar Bush 1945)[426]

- Charles Babbage appropriately calling what in electronic computing is namend the *memory unit* of his Analytical Engine "Store"; remarkably this storage does not provide a separate memory space (as the notion of the archive implies opposite to the administative present), but is part of an extended presence of calculation: "The calculating parts of the engine may be divided into two portions: 1st The *Mill* in which all operations are performed /

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425 See Heinz von Foerster, Memory Without Record, in: same author, Observing Systems, Seaside,Cal. (Intersystems), 1984, 92-137; furthermore Klaus Krippendorf, xxx; Elena Esposito, Fiktion und Virtualität, in: Sybille Krämer (ed.), Medien. Computer. Realität, Frankfurt/M. (Suhrkamp) 1998, 269-296, esp. chapter 4 "Die Formen des Gedächtnisses: Vom Speicher zum Archiv", 288-293

426 Norbert Wiener, Zeit, Kommunikation und das Nervensystem, in: Futurum Exactum, ed. Bernhard Dotzler, 2002, 177

2nd The *Store* in which all the numbers are originally placed and to which the numbers computed by the engine are returned"[427]

- principal storage "organ" within computer ALU kind of inter-archive, a short-term memory which later, by Howard Aiken for his Harvard Mark I, has been called "register", whereas for enduring data storage magnetic tapes and punched cards figured. "Numbers may be removed from the calculating unit and temporarily stored in storage position"[428]

- magnetic tape standing for the clash between technological storage ("in motion") and the archival (symbolical) regime. In Samuel Beckett's play *Krapp's Last Tape* the protagonist is confronted with his own memory as recorded as audio-diary on occasion of his successive birthdays; this re-call literally re-presents both his sonic ego (the physial reality of his voice) and the situation, whereas the inventory of his tapes, the chronologial order, stands for the archival regime: ordering, with no physical presence.

- final director's note: "Tape runs on in silence". A kind of dynamic silence, well-known from the archive, but this time a recording tape waiting to be recorded, a virtual archive.

- not conflating human (associative) memory with techno-logical (i. e. numerically adressable) storage

- automatic storage media usually unveal their informationen only according to a (re-)call with adresses. Human memory, though, recalls information according to its "semantic", associative content.[429]

- storage as cultural technolgy (libraries, archives, museums) or as techno-mathematical device (computing) differs from human memory insofar as the human mind does not re-call data from a data bank; human memory is rather remembrance: a processual synthesis of perceptual data, a kind of neuronal auto-stimulation, a re-connaissance without original (according to Gerhard Rusch's radical constructivism and to cognitive science in general), closer to pattern recognition than to archival and adressable re-call.

- main function of the archivist *triage*: the appraisal of what incoming records can be abondoned, according to a fixed set of filtering rules (metadata). Automated search engines, on the contrary, "entropically" navigate through "big data" oceans / clouds which come closer to thermic model of the physical world itself than to be a selective memory.

- computer memory still made of fixed-size cells, that refer to each cell by a numerical address. But in order to understand technomathematical storage, we have to abolish archival or library metaphors

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427 Here quoted after: Wolfgang Coy, Speicher-Medium, in: Wolfgang Reisig / Johann-Christoph Freytag (eds.), Informatik. Aktuelle Themen im historischen Kontext, Berlin / Heidelberg / New York (Springer) 2007, 79-104 (80)

428 Howard Aiken, Proposed Automatic Calculating Machine (1938), as quoted in Coy 2007: 81

429 Karl Steinbuch, Automat und Mensch, 4th, revised ed., Berlin / Heidelberg / New York (Springer) 1971, 75

- storage conceptually based on passive location, with fixed adresses, *versus* human memory associative, as expressed by Vannevar Bush "As we may think" leading to the design of a Memory Extender in June 1945. Today, hashing in programming comes close to the human memory mechanism

- early (digital) computing technological storage like the mercury delay line and the Williams Tube close to human memory in its regenerative sense; computational random access memories ask to be constantly refreshed so that their "ephemerality endures" (Wendy Chun), in an almost Bergsonean vibrational sense

- artistic version of the "active archive", especially the choreographers: the concept of re-enactment of past dance performances; the performative equivalent to operative (technical, digital) "migration" of recorded data

- in non-metaphorial terms, archive legal memory of administrative power; equals operating systems in computing today; call it an aggregation of files: records that can be linked, *via* the archive's index (intentory), to the discursive loops of systems of power (administration, institutions, infrastructure)

- traditional archive for the use of historians. Electronic memories, though, require data archaeologists rather than archivists

- "Computer technology is made for information processing, not for long-term storage."[430] Looking at data banks from the archivist's point of view is not only worthless but even a hindrance in understanding its different nature.

- 21st century increasingly an epoch beyond the archive. With data-streaming and network-based communication, the perspective shifts: the privileged status accorded in Western civilizationb to certain "permanent" cultural values and traditions from the past - the cultural ROM, as it were -, is increasingly giving way to a dynamic exchange, a permanent transfer in the most literal sense. What will retro-actively remain are isolated islands of archival storage, heterotopias of "counter-spaces" as defined by Michel Foucault, monumental resistance against dynamic and permanent re-organization of data.

- "archive" both the name for a building ("hardware") and a symbolic system of organizing documents according to rules, based literally on symbolic letters ("software"). In the technomathematical context of contemporary media, the function of the traditional archive is replaced by the rules governing computer hardware and the algorithms governing data retrieval, a differnt "symbolic machine". This comes closer to Michel Foucault's abstract use of *l'archive* (instead of *les archives* in the bureaucratic, juridical and governemental sense). Still, Foucault's use of the term is a permanent source of misunderstanding, of

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430 Michael Wettengel (Electronic Records section at the Federal Archives, Germany), as quoted in: Gerd Meissner, Unlocking the Secrets fo the Digital Archive Left by East Germany; http://query.nytimes.com/gst/fullpage.html?res=9E00E7DC1731F931A35750C0A96E958260]

confusing *l'archive* as a generative grammar with *les archives* in the traditional meaning. So maybe let us abondon this very term in the age of digital media?

- *l'archive* in Foucauldean sense a hidden agency within computing itself: the Turing machine is "defined by *constraining* laws or by an *algorithm* <...>"[431] - in accordance with Michel Foucault's *l'archive* rather than with the traditional notion of archives as record depositories

- archive returning *within* computer architecture (that is why a core element in the Central Processing Unit is aply called the "register", a term directly taken from archival terminology)

- structure as *archive* in Foucault's sense; not to be confused with the actual records office which is always plurale tantum *archives* in French (a spelling mostly mis-translated in Foucault literature)

- storage referring to "the gesture of setting apart" (Michel de Certeau), of storing matter, energy or information for later re-use. With electronic access time of computer memory tending towards zero, this spatical notion becomes obsolete. Storage and immediate data processing are not ontologically different but differ only in scale. Long-term storage is just an extreme extension of what is called "motion" in the present; even archival storage is dynamic, even if the time span of re-actualization might last so long that it seems immobile

- photography momentary fixation of light, different from the immediate transmission of an electonic image in television or video: In the first case the photonic event is chemically made to have a lasting effect, whereas in the latter case it vanishes from the phosphor screen of the monitor in a fraction of a second. But even this fraction is an interval, a Delta*t*. Delta$t \rightarrow 0$. The long-time, almost painterly, exposure of early Daguerreotypes and Talbotypes, by improved chemical sensitivity to exposure, shrinked down to the notable photographic "click" or "shot"

- "live" signal transmission characteristic of electronic media (radio, television); the Marconi Telerecording system, developed in 1957, intercepted such electronic images by a film camera with fast intermittent mechanism, while sound was recorded on a synchronized tape recorder with perforated recording tape. Such temporary freezing of immediate transmission is the traditional technique of creating artificial memory. But slowness of signal transmission in a channel itself can be considered and used for storage: "Die im Vergleich zur elektrischen Fortleitung langsame Schallgeschwindigkeit wird in Verzögerungs- oder Laufzeitstrecken zur Speicherung ausgenützt."[432]

- Acoustic Delay Line in computing = Turing, "State of the Art"; acoustic media not used for sound storage and transmission, but as a signal for the intermediate storage and recycling of pure data

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431 Moles 1968 / 2011: 264

432 W. de Beauclair, Rechnen mit Maschinen. Eine Bildgeschichte der Rechentechnik, Braunschweig (Vieweg) 1968, 228

- Horst Völz differentiating between to forms of storage, dynamic and static: Storage of events in time and storage of momentary sections of time. Both are not categorically different but rather extreme limits of one and the same. Inbetween is cinema: "Eine deutliche *Zwischenstellung* nimmt der *Kinofilm* ein. Hier werden in definierten zeitlichen Abständen Momentausschnitte des Geschehens festgehalten und später in dieser Reihenfolge wieder reproduziert."[433]

- electronic television image, which is a radical function of a volatile moment in time (a cathode ray "written" on the screen) on the one hand, and its interlaced half-images with a frequency of 50 Hz on the other, interrelates both modes

- in multimedia consumer market Saturn at Berlin Alexanderplatz, looking for fuses to repair an old television set, a shelf bookmarked "Archivierung". What is coined "archivization" here in fact simply means peripheral storage media like CD-ROM, DVD et cetera; indication of the inflationary use of the term "archive" which has lost all his specific connotations until it blurs with the meaning of memory at all; irony is that the archive means the oppositive of what digital storage media promise: almost endless storage space, where the art of selection and of classification, of indexing and critical revision has been lost completely

- different to libraries, traditional archive since Athenian times has not been about providing knowledge but rather to keep administrative data in juridical and legal latency; archive has not even aimed at memory in the emphatic sense of cultural or so-called collective memory: On the contrary, once the archival documents become historic, their are not archivologistically valid any more (like the Prussian Secret Archive after the end of the Prussian State in 1947); reading of archival records for historical research, in a sense, already a misuse of the archive

Mathematization of the archive

- archive in the strict sense returning, even more rigurously than ever: in the form of the laws governing technological and electromathematical communication. Source codes, protocols reign on the level of programming languages in computers; so do the registers (an original archivological term) on the level of the central processing unit (CPU) within computer hardware. Physically and logically (that is: technologically) the archive rules in media culture, thus verifying Foucault's somewhat ideosyncratic definition of "the archive" in new forms even unseen by Foucault himself. Foucault's notion of the archive, like the epistemological aesthetics of his *Archaeology of Knowledge* on the whole, is closer to the generative grammar in linguistics, the logical calculus in logics and mathematics itself than to humanities.

- archival regime referring to the symbolic order (mainly alphabet-based); the audiovisual archive to the real recording of physical signals. With computed binary data, the symbolical regime returns, (alpha-)numerially.

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433 Horst Völz, Information I. Studie zur Vielfalt und Einheit der Information, Berlin (Akademie) 1982, 139

- electronic storage media in the age of the analog such as magnetic tape recorder for sound or data recording literally embodying an archive "in motion" (the reel-to-reel dynamics acquired to access signals), the switch to non-linearly addressable storage media (the hard disc) let a discrete, abrupt, discontinuous, arithmetic regime return, closer to sampling than to continuous reading. Whereas the classical archive has been a timeless space, now time itself becomes mathematized (remembering of the etymological off-spring of "time" from indo-european roots meaning basically "cut", "divide")

- hidden from the public user, as "protected mode" in programmed computer chips. Archival enlightenment, once more (and in the sense thematized by Jean-Francois Lyotard in *The Postmodern Condition*), means unlocking this Foucauldean *archive*

Library, Archive, Médiathèque

- "classified" archival non-accessability; "de-classified" stamp

- Michel de Certeau linking the storage of electronic data to the library: "Insofar as it is linked to the use of the computer, information science, between "input" and "output", organizes arrangements of symbols in reserved sites within a memory and transfers them to agreed-upn addresses according to instructions that can be programmed. It orders placements and displacements in a space of information which is not without analogy to the libraries of the past" = Michel de Certeau, The writing of history, New York / Chichester (Columbia University Press) 1988, chapter "Production of Places", note 60
In archives based on the provenance principle, the incoming documents are rather kept in their original order than re-distributed

- library catalogue following a systematic order of content-oriented classification. In computer memory, though, the mathematization of addressing is complete

- Brewster Kahle's Internet "Archive" rather based on the library model: "In the future, it may provide the raw material for a carefully indexed, searchable library. The logistics of taking a snapshot of the Web are relatively simple. <...> The software on our computers `crawls´ the Net - downloading documents, called pages, from one site after another. Once a page is captured, the software looks for cross references, or links, to other pages. It uses the Web´s hyperlinks - adresses embedded within a document page - to move to other pages."[434]

Motion and immobilization: the audiovisual archive

- scripture-based classical archive a static array of records on the grand scale and letters on the microscale; brought in motion only by the act of human reading line by line

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434 Brewster Kahle, Preserving the Internet, in: Scientific American, vol. 276, no 3 / March 1997, 82f (82)

- Edison phonograph the first form of "archive in motion", since its recording (notably the early ethnographic field recordings around 1900, leading to the Vienna Phonograph Archive and the Berlin Phonogramm Archive) is based on a rotating, technically moving apparatus both in recording and in re-play; parallel to early cinematographical recording and projection. The recording of the acoustically or opitcally "real" physical signal as opposed to symblic notation by the alphabet (the difference between physical signal and cultural symbol) *is* the archive in motion. But even if songs or movements are being recorded dynamically, they become freezed (immotion, becoming archive)

- Albert Lord on the recording of Yugoslav guslari song by the philologist Milman Parry in his effort to reconstruct the fabric of Homeric epic by analogy: unintentionally, technical recording created a "fixed" text. "Proteus war photographiert worden [und] an dieser Aufnahme wurde hinfort jede Veränderung gemessen - sie wurde zum 'Original'."[435]

- electromagnetic recording preserving a unique feature of the oral performance in difference to its alphabetic, immobilizing transcription, which can be derived from how French language calls the recording device: *écriture magnétique*. Electromagnetic recording, in its very physical latency, only comes into existence as part of a dynamical process, the *inductive* act of re-play ("writing" different from "printing"). In his preface to Albert B. Lord's *The Singer of Tales* Harry Levin remarks: "The Word as spoken or sung, together with a visual image of the speaker or singer, has meanwhile been regaining its hold through electrical engineering."[436]

Archive and motion

- first technological visual memory in motion cinematography: mechanically "moving stills", competing from its beginning in 1895 with an electro-mechanical vision of immediacy, live transmission, simultaneity - in fact television. Temporal immediacy *versus* temporally dislocated presence separates both "technologies of time".[437]

- "While in film each frame is actually a static image, the television image is continually moving, very much in the manner of the Bersonian *durée*. The scanning beam is constantly trying to complete an always incomplete image. Even if the image on the screen seems at rest, it is structually in motion. <...> While the film frame is a concrete record of the past, the television frame (when live) is a reflection of the living, constantly changing present. <...> the filmic event is largely *medium dependent*, while television in its essence (live) is largely *event dependent*" = Herbert Zettl, The Rare Case of Television Aesthetics, in: Journal of the University Film Association vol. 30, no. 2 (spring

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435 Albert B. Lord, Der Sänger erzählt. Wie ein Epos entsteht, München (Hanser) 1965, 185; AO: The Singer of Tales
436 Boston (Harvard University Press) 1960, xiii
437 See William Uricchio, Technologies of time. Draft version, forthcoming in: J. Olsson (ed.), Visions of Modernity (working title), Berkeley (University of California Press); http://www.let.uu.nl/~william.uricchio/personal/OLSSON2.html

1978), 3-8, here quoted after: Jane Feuer, The Concept of Live Television: Ontology as Ideology, in: E. Ann Kaplan (ed.), Regarding Television. Critical Approaches - an Anthology, xxx (University Publications of America / American Film Institute) 1983, 12-22 (13)

- video closer to the time-critial nature of the electro-physical signal than to the conventional "image"; "movie" - technically - a function of the archive (storage on celluloid, projected from reel), whereas the TV image has to be (re-)produced, re-freshed permanently; no substantial "ontology" of the tv image; only in memory it gets fixed (magnetic tape / video recording)

- motion brought into the immobile array of symbolic recordings in archival documents only by human act of reading, technological media, starting with literal "movies", depend on an apparatus processing the data in order to produce a document for human senses.

- Vannevar Bush's visionary anticipation of hypertextual storage and retrieval of records "As we may think" in 1945, similarly confronts the telegraphic facsimile transmission of texts or images with electronic television where "the record is made by a moving beam of electrons" for the reason of speed, combined with "a screen which glows momentarily when the electrons hit, rather than a chemically treated paper or film which is permanently altered"[438]. Beyond the Gutenberg era of imprinted letters, information becomes fluid, ephemeral, a temporary moment, a trace in time rather than a point in space, radically dynamic rather than discrete like a written or printed alphabetic letter.

- museum-like crystallization of temporal objects transforms to flow. Recycling instead of finality: the lenght of storage is becoming increasingly more short-term. ROM (long-term memory) is challenged by RAM, by random access. Final storage transforms into interim storage.

- for feedback-based, interactive "memory" in the telematic society, memory-model of the archive is not apt any more

- within context of technical media, term "memory" itself better conceived in cybernetic terms (such as feed-back and recycling, latency and re-activation) than in the tradition of semantics. Neurological science has discarded the emphatic notion of memory in favor of models describing accelerated forms of information exchange.

- not conflate human (associative) memory with techno-logical (i. e. numerically adressable) storage: "A memory function remembers the same response to the same signal: a counting function counts it different each time"[439]

- Vannevar Bush's vision "As we may think", in *Atlantic Monthly* in July 1945, arguing for a memory and information retrieval system based media-

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438 Vannevar Bush, As we may think, in: Atlantic Monthly vol. 176 (1945), 101-108; here quoted after the reprint in: A. J. Meadows (ed.), The origins of Information Science, London (Taylor Graham) 1987, 254-261 (256)

439 George Spencer Brown, Laws of Form, xxx, 65

archaeologically on linkable microfilm, and conceptually rather emulating the associative mechanism of human recollection than the structural classification trees of library catalogues. The difference between memory and storage is not the opposition of humans *versus* machines, but much more a conceptual one which refers to both: "When data of any sort are placed in storage they are filed alphabetically or numerically, and information is found <...> by tracing it down from subclass to subclass. <...> The human mind does not work that way. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with someintricate web of trails carried by the cells of the brain. <...> trails that are not followed frequently followed are prone to fade, items are not fully permanent, memory is transitory" = Vannevar Bush, As we may Think, in: Atlantic Monthly vol. 176 (1945), 101-108; here quoted from the reprint in: A. J. Meadows (ed.), The Origins of Information Science, London (Taylor Graham) 1987, 254-261 (259); electronically with the vacuum tube and finally the transistor computer memory operates at the speed of electricity itself

- Random Access Memory a challenge to one of the most central imperatives of the archive, that records may be kept (at least in principal) permanently; suddenly a media culture where the fading away of records is not only seen as a technological deficiency, but on the contrary is an in-built feature of a new memory culture

- Bush insists: "Selection by association, rather than by indexing, may <...> be mechanized" <ibid.>, and consequently he designs a sort of private library machine called at random "memex", a memory extender

The internet "archive"

- difference between the classical and the hyperspatial archive its dynamics; usage of the term "archive" in the internet, indicating its shift of emphasis on realtime or immediate storage processing, on fast feedback; categorical difference between historic "archival" time and immediate online-time

- a definition of the function of archives in the internet in a narrower, precise meaning: "It was soon realised that each site providing its own anonymous *ftp* area with its own material would make it difficult to find and catalogue the information available. The answer to this problem was to provide archives; machines dedicated to the task of serving files via anonymous *ftp*. These archives collect together material from other anonymous *ftp* areas scattered through the Internet and present it in a single location. The job of the archive maintainers is to keep the archives up-to-date and to try and organise them in an orderly fashion."[440]

- Internet "archive" becomes radically temporalized; rather hypertemporal than hyperspatial, based on the aesthetic of immediate feedback, recycling and refresh rather than on the ideal of locked-away storage for eternity. The

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440 "Information and archives on the Internet", http://www.hensa.ac.uk/www94/internet.html

aesthetics of recycling, sampling and cultural jamming is a direct function of the opening / the openness / the online-availability of (multimedia) archives

- "We plan to update the information gathered at least every few months. <...> In future passes throught the Web, we will be able to update only the information that has changed since our last perusal" = Kahle 1997: 83

- "In the digital age, storage space is no longer the main problem, the problem is rather time. We are not only collecting static objects such as books, but also literally *streams of information* such as the television, the radio and finally the internet. With the internet these streams are radicalized in the sense that these texts or rather new media objects are fluid and unstable entities very often continually updated and replaced."[441]

- radical non-archival nature of Internet memory, while the juridical function of the institutional archive is exactly to secure that the record does not change, such as the legal system itself is based on long-term claims rather than permanently be rewritten or updated

Dynamic memories

- not only search tools, but targets of research becoming dynamical: dynamically generated information in the Internet. "Born digital" means algorithmically dynamic; digital media as such *en arché* a function of dynamic storage by their very nature, since digital calculation, like all advanced mathematics, needs inter-temporal storage for inbetween-data.

- George R. Stibitz in his Memorandum from 23 April 1942 on "Digital Computation for a. a. <sc. anti-aircraft> directors": "Digital computers introduce a consideration not found in kinematic analog computers, namely the ordering of computation steps in time"; refers to the "number train" of zeroes and ones. "Digital computation is dynamic in character" = ibid.; quoted from Robert Dennhardt, Die Flipflog-Legende und das Digitale, Berlin (Kulturverlag Kadmos) 2009, 157

- archival order surviving from the age of print / classificatory order. "Entropic" data trash is, positively, the future ground for media-anarchaeological excavations[442]; instead of thinking the archive in terms of order by classification: entropical thinking, that is: allowing for the highest degree of disorder, which contains, in communication theory, the highest degree of (possible) information

- cloud modelling (developed for weather forecasting) anarchivic dynamics by fast calculation (notably advanced methods such as multirate time integration, time stepping and massive parallelization as condition for numerical

441 Eivind Røssaak, The National Library and the Digital Age. Paper delivered at the seminar, *Words*, arr: Du store verden! Oslo, 20th September, 2008

442 Links to recycling: the Redundant Technology Initiative (http://www.lowtech.org) and Mark Napier´s www.potatoland.org

computations such as spectral cloud microphysics)[443]

- diagrammatic machines different from the archival diagram: additional dimension of temporal processes

- data flow to be kept intact not the file transfer of bureaucracy but the algorithms of computer-based data processing

- chrono-photography (Muybridge, Marey): catch the dynamic element in movement, the kinetic

- Gateway to Archives of Media Art (GAMA) primarily dedicated to *ephemeral* forms of art = http://www.gama-gateway.eu; both to the artistic (performances) and the techno-electronical form ("variable media")

Archival resistance: the un-movable

- message of the storage medium no longer the alphabet; dynamic access replacing the static classification of the traditional catalogue, just like statistical probabilities replace particular knowledge in information theory (and pattern recognition replaces alphabetical identification)

- From the question of how to archivize performance results the performative archiv: actualisation in form of re-enactments

Archival tectonics

- increasing temporalization of the "archive" which has previously been static; "structure" (tectonics) has been the archival essence *per se*. Vector now: the "dynamic" / "algorithmic" archive

- against intellectural or artistic phantasies of "the anarchival"[444], the digital archive still rigorously rooted in its techno-mathematical structure

- media-archaeological examination of the "digital archive" as computational instanciation of a long archival tradition: a negotiation between the symbolic order (administrative records) and its implementations. An archaeology of knowledge in Foucault's sense focuses on the disruptions which separate the technological archive from the traditional institutional archive. The traditional archival record has always been "digital" in the sense of discrete strings of symbolic characters, predominantly written in the phonetic alphabet. But what is termed "digital" todays rather refers to the binary code and its organization

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443 See f. e. the project *HPC for Detailed Cloud Modeling* (Leibniz Institute for Tropospheric Research, Leipzig, and Centre for Information Services and High Performance Computing, University of Dresden): http://www.tu-dresden.de/zih/clouds

444 See Claudia Giannetti (ed.) / Eckhard Fürlus (editing), AnArchive(s). Eine minimale Enzyklopädie zur Archäologie und Variantologie der Künste und Medien, Oldenburg (Edith-Russ-Haus für Medienkunst) 2014

by mathematical algorithms, embodied in the processual computer. Since this binary code encompasses the processing not only of alphabetic texts or numerical mathematics but sound and images as well once such audiovisual signals have been sampled and compressed, all of the sudden the archival regime extends beyond classical textuality. Therefore, digital storage resources ask for a conceptual re-evaluation of the archive. As explicitely expressed in Jacques Derrida's booklet *Archive Fever*[445], technology changes the structure of the contemporary archive; Derrida failing to address this technical change precisely; can be techno-mathematically named: oeprating systems, algorithms and source code, in combination with *specific* hardware *architecture*, constitues the new "two bodies" (Kantorowicz) of the contemporary "digital archive"; no single universal computer, but only computers as concrete implementations of the Turing Machine (Stefan Höltgen)

Media archivology

- Foucauldean archivology remaining space-centered, topological "other spaces". Such analyses autopoietically refer to the alphabet-based world and the symbolic order of textual libraries. But "discourse analysis cannot be applied to sound archives or towers of film rolls."[446] With the age of so-called analogue (technical) media such as the phonograph and cinematography, signs of/in time themselves can be registered. They maintain not just a symbolical relationship to macro- and microtime (such as historiography), but they inscribe and reproduce functions of time themselves; only with the digital computer that the symbolic regime *dia*lectically re-turns: this time in a genuinely dynamic mode (which differentiates implementation of software from the traditional Gutenberg galaxy): algorithmic time, operative diagrams

- navigating sound and images by digital addressability: by-passing verbal language, an im-mediate access to sound and images, unfiltered by words. Images and sounds thus become calculable and capable of being subjected to pattern-recognition algorithms. Such procedures will not only media-archaeologically "excavate" but as well *generate* unexpected optical statements and perspectives from an audio-visual archive that can, for the first time, organize itself not just according to meta-data but according to its proper criteria - visual memory in its own medium (endogenic). The notion of „excavating the archive“ in terms of media-archaeology not meant to be a metaphor; for Michel Foucault, the term archaeology explicitely "does not relate analysis to a geological excavation".[447] What is being digitally „excavated“ by the computer is a genuinely code-mediated gaze on a well-defined number of information patterns which human perception calls "sound" or "images"

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445 Translated by Eric Prenowitz, Chicago (University of Chicago Press) 1998

446 Friedrich Kittler, Gramophone - Film - Typrewriter, Palo Alto, Cal. (Stanford UP) 1999, 5

447 Foucault 1972: 129

The negentropic effort

- with Shannon artificial languages "a stochastic process which generates a sequence of symbols"[448]; Max Bense's computer-generated *Monolog der Terry Jo*

- archival order, corresponding with the library ratio of classification, a function of the political "state" which is the symbolic order (Lacan). Since the emergence of c19 statistics, mathematical culture allows to deal with the virtual, that is: calculated an-archive of entropy/information in a way beyond the conservative desire of reducing it to order/"negentropy" again (Shannon vs. Wiener). Data trash is, positively, the future ground for media-*an*archaeological, that is: stochastic/algorithmic excavations.[449] ; see Constant, *Preliminary Works Towards an Online Archive* of Erkki Kurenniemi's collection of private data, presented at Documenta Kassel 2012; see chap. 9 "Archiving the Databody: Human and Nonhuman Agency in the Documents of Erkki Kurenniemi", in: Krysa / Parikka (eds.) 2015, 125-141

- between Shannon entropy and Boltzmann entropy, two different tempor(e)alities at work here: a) information time, invariant towards historical change, and b) physical time ("tempus edax" known from allegories of Chronos in the Baroque)

- archive(s) with and without "s". In French, Foucault's use of the word *archive* in the singular not idiomatic; institutional archive is always a *plurale tantum* "archives". *L'archive*, Foucault's singular, has a different meaning: the Kantian notion of a condition of something to be articulated at all. For the case of the Internet, this is communication protocols - "[d]ie Regeln, nach denen die Kommunkation zwischen Computersystemen abläuft"[450]

- Martin Kusch, Discursive formations and possible worlds. A reconstruction of Foucault's archeology, in: Science Studies 1/1989, 17-25

- thread to traditional library classification is not fire or violence algorithms; in software, they metaphorically return as programm *libraries*

- chrono-photography (Muybridge, Marey) samples the dynamic element in movement, the kinetic; late 19th century, the scientific urge to store and analyze temporal phenomena culminated in phonograph and film; forms of "archive in motion", since its recording (notably the early ethnographic field recordings around 1900, leading to the Vienna Phonograph Archive and the Berlin Phonogramm Archive) is based on a rotating, technically moving apparatus both in recording and in re-play

Archival emergency and the cold archaeological gaze: *Quick freeze*

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448 Claude Shannon, Collected Papers, Piscataway (IEEE Press) 1993, 5
449 On recycling, see the Redundant Technology Initiative http://www.lowtech.org and Mark Napier´s www.potatoland.org
450 Othmar Kyas, Internet: Zugang, Utilities, Nutzung, Bergheim (DATACOM) 1994, 61

- "quick freeze" as a practice in data surveillance and telecommunication economy rather halts than stores volatile data punctually for a short temporal interval, a kind of memory "interrupt", legally permitted only in case there is a justified suspicion

- cooling down films rolls to withstand decay with time (physical entropy); vocabulary of storage media very much a language of temperature"; technique of so-called freeze frame media-epistemologically important, "cinema's negotiation with time" = cfp conference conference *Archives of the Arctic. Ice, Entropy and Memory*, Humboldt University, Berlin, September 18 to 21, 2013

- in administration of "big data", "quick freeeze" - term taken from preservation of nutrition (*Schockfrosten*) - a preservation order, an administrative *Speicheranordnung* to prevent the almost immediate erasure of telecommuncation data in companies just in case there is need to de-freeze them for legal investigation - the suspended ephemeral, the interval

- analog signal storage: so-called "archival tapes" (magnetophonic records) in broadcast archives (radio, television) need to be gently heated up to de-coalesce in order to play them again for copying, digitizing and migration - literally de-freezing memory from the temperature-controlled room in the Yale archives[451]

- storing digital data carriers in ultra-low temperatures (be it a refrigerator or an iceberg) exponentially increasing the probability for undamaged preservation; "arctic" digital memory

Towards the chrono-archive? Internet tempor(e)alities

- "real-time web" a set of technologies and practices which enable users to receive information as soon as it is published by its authors, "rather than requiring that they or their software check a source periodically for updates"[452]

- real "message" of the online communications format *instant messaging*, in McLuhan's sense, is the immediacy of the character strings, the effect of a pseudo-co-presence between sender and receiver; "cyberspace" becomes cyber-contemporaneity. "Früher ging es um die Schaffung von Räumen <...>, heute geht es um die Zeit selbst, um Chronos, um die Kunst der *longue durée*."[453] The Internet is a chrono-technical compression of time ("Verdichtung von Zeit", ibid.). Suchmaschinen wie Google haben längst darauf reagiert, indem sie Seiten in Echtzeit auswerten und an die Nutzer rückkoppeln. Insofern nicht vorherbestimmbar ist, ob und wann eine Antwort erfolgt, unterscheidet sich dieses Echtzeit-Netz grundsätzlich von Echtzeitberechnung im Computer:

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451 On "frozen" electro-magnetic signals see: Christian Koristka, Magnettonaufzeichnungen und kriminalistische Praxis, Berlin (Ost) (Ministerium des Innern, Publikationabteilung) 1968

452 http://en.wikipedia.org/wiki/Real-time_web; accessed 20th January, 2010

453 Geert Lovink, Was uns wirklich krank macht, in: Frankfurter Allgemeine Zeitung Nr. 140, 21st June, 2010, 27

- real-time computing (RTC), or "reactive computing" as study of hardware and software systems that are subject to a "real-time constraint" - i.e., operational deadlines from event to system response. By contrast, a *non-real-time system* is one for which there is no deadline, even if fast response or high performance is desired or preferred; synchronous programming languages provide frameworks on which to build real-time application software. "A real time system may be one where its application can be considered (within context) to be mission critical"[454]

Non-narrative archival time layers

- storage as catechontic delay time of access: "Die Festungen *schützen Raum* und *gewinnen Zeit* <...>"[455]; with the acceleration of transport and communication media a shift of emphasis from emphatic long-time preservation to ultra-short intermediary storage, as effect of electronic media culture. 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"[456], less concerned with records for eternity but with order by fluctuation

- interconnection through real time flows giving unprecedented priority to the present; memory in the age of electro-mathematical media becoming transitory

- 19th century photography: "Although individual sequences of pictures were often organized according to a narrative logic, one sees clearly that the overall structure was informed not by a narrative paradigma, but by the paradigm of the archive. After all, the sequence could be rearranged; its temporality was indeterminate, its narrative relatively weak. The pleasures of this discourse were grounded not in narrative necessarily, but in archival play" = Sekula 1985: 58

- "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"[457]; media archaeology counts with re-configurations and feed-backs rather than continuous developments

- before the archive: the intermediary, well known from electronics. Registers in the techno-mathematical sense (as a term in archival science) are binary relays

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454 http://en.wikipedia.org/wiki/Real-time_computing; accessed 7th January, 2010

455E. v. H., Die Festungen in der modernen Kriegsführung, in: Im Neuen Reich, 1 (1871), 53

456Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: MediaMatic 8#1 (translation: Jim Boekbinder)

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

(either electro-mechanical or fully electronic) in a calculator for *transient* storage of digitally represented numbers[458]; "Colossus had to 'remember' a bit for a split second until its neighhour arrived. For this task, it used a bank of capacitors which it charged up and discharged as needed."[459]

- commercial trading logistically knows so-called *chaotic storage administration*; on computer discs as well / storage medium Compact Disc: data are interlaced: not sequentially in their temporal sequence, but dissipative; micro-dramaturgy of electronically adressing stored data

The diagrammatical archive

- technical media, once conceived as essentially *processual*, operative diagrams

- archival record management close to the "algorithmic" (provenance, keeping track of genealogies and procedures), different from the arbitrary museum or library collection (corresponding with the "pertinence" of data banks); orientation within the archive is based upon the "repertory" rather than on symbolical search engines like the library catalogue; it reveals structures, not objects

Towards "A mathematical theory of archival communication"

- notion of archival transmission already implying an intentional act, an adressing of posterity - to which the historian (researching in the archive) places himself as the destinee. The term "sending" here can be understood not as destiny in a metaphysical way but as a concrete act of mailing, corresponding as an act of transmission engineering with what Walter Benjamin has called the "historical index" (when images from the past are indexed with a n implicit time code: "The past 'carries with it' a temporal index: the date of its emergence and of its expiration. <...> The address of the past in all its power *will have been* if it is read by the present that it enables; it it is not, it disappears without a trace. <...> Benjamin always thought the address of truth in historical (or at least temporal) terms; translatability, after all, comes about only in time and for a time, and translation is not a mere transcription" = Christopher Fynsk, The Claims of History, in: diacritics vol. 22, fall/winter 1992, 115-126 (123ff); Walter Benjamin, Gesammelte Schriften, Bd. V.1, 577 f.

- minimizing risk of errors in manual copying of charts by radical "digitization" (Alberti); Mario Carpo, "Descriptio urbis Romae". Ekphrasis geografica e cultura visuale all´alba della rivoluzione tipografica, in: Albertiana, Florenz (Olschki) 1, 1 (1998), 111-132. From that practice results an ahistoric form of tradition, nowaday known from the archival rescuing projects of digitizing endangered historic manuscripts

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458 "<...> die vorübergehend eine Zahl speichern können": A. Huber, Programmgesteuerte elektronische Rechenmaschinen, in: Funk-Technik Nr. 24/1957, 828-830 (828)

459 Barry Fox / Jeremy Webb, Colossal Adventures, in: New Scientist Nr. 1081 vom 10. Mai 1997, 39-43 (41)

- in terms of communication engineering, electric (discrete, "digital") impulses clearly identified, filtered and regenerated in the channel than the continuous wave form, against distortions or noise = see Roch 2009: 102; therefore the former amplifier has been replaced by the *repeater-regenerator* (relay), allowing for almost invariant signal transmission. "By using binary (on-off) PCM, a high quality signal can be obtained under conditions of noise and intererence so bad that it it just possible to recognize the presence of each pulse <...> almost independent of the total length of the system" <ibid., 154>. The formerly familiar noisy distortions in the channels of cultural tradition and communicative transmission are replaced by noise at the signifiers (signals) themselves: the "signal-to-noise ratio in PCM systems is set by the quantizing noise alone" = ibid., 155

- "We may assume the received signal *E* to be a function of the transmitted signal *S* and a second variable, the noise *N*. <...> The noise is considered to be a chance variable just as the message <...>. In general it may be represented by a suitable stochastic process"[460]; E = f(S, N), to be supplied by the temporal axis as signal delay within the channel E = f(S, N, Delta-*t*). There is time within the signal already: "In all communication engineering <...> the message to be transmitted is represented as some sort of array of measurable quantities distributed in time. <...> by coding, or the use of the voice, or scanning, the message to be transmitted is developed into a time series"[461]

- in case of storage, the signal arrested ("received) in the channel itself: E = f(S, N, t_1), for arbitrary reading at a later time

- "The basic proposition of cybernetics that signal = message + noise, and that the message, and not the noise, is the sensible term in communication, is applicable in all sorts of contexts <...>. Wiener is the signal, and for us the Wiener-message, and not the Wiener-noise, must be of significance" = Masani xxx: 19

- "This is the study of messages, and their transmission, whether these messages be sequences of dots and dashes as in the Morse code or the teletypewriter, or sound-wave patterns as in the telephone or phonograph, or patterns representing visual images as in telephoto service and television. In all communication engineering <...> the message to be transmitted is represented as some sort of array of measurable quantities distributed in time. <...> by coding, or the use of the voice, or scanning, the message to be transmitted is developed into a time series."[462]

- transmission and storage interlaced, as defined in the invention of magnetic sound recording by Oberlin Smith in 1888: "Imagine that speech could be transmitted over a telephone line at a very slow 'rate of travel', so that at a

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460 Claude E. Shannon, The Mathematical Theory of Communication [1948], in: ders. / Warren Weaver 1963: 29-125 (65)

461 Norbert Wiener, 1942, The Extrapolation, Interpolation und Smoothing of Stationary Time Series with Engineering Application, typoscript dated 1st February, 1942, 3: National Archives and Records Administration, Record Group 227 (Office of Scientific Research and Development), College Park, Maryland (USA), MFR, DIV.7-313.1-M2. See Roch 2009: chap. 2.4 "Statistik gegen Geometrie", 61 ff.

462 Typescript Wiener 1942

particular point in time the entire message would be somewhere in the wire between speaker and listener"[463] - close to reverberative delay lines in early electronic computing

- "If it were possible to 'freeze' this situation" - as described in *Münchhausens Abenteuer*, "the effect would be to store or fix the message, to have recorded it converting a time function into a place function" - a transformation into *archive*

Archives becoming time-critical

- time it takes for access to records in the electronic archive, as opposed to the procedures in the institutional archive, shrinks to a momentary flash

- once material carriers are provided with a time code for non-linear access to single frames in archives of moving images, memory itself becoming a function of its techno-mathematical encoding (and compression)

- new vanishing point of archival theory in its temporal disposition

From space-based to time-based archives

- three-step model of the evolution of memory in occidental society: first the mnemotopic, that is: really and imaginary space-based memory (the rhetorical *ars memoriae*); second the mass-media based communication which is rather based on actuality than on memory recall; third the contemporary and future online communication where both archival memory and "live" actuality are being replaced by the aesthetics of powerful search engines, "algorithmic memory", which is a coupling of human queries with machine "remembrance" - an active digestion rather than passive memory-*Gestell*, following G. W. F. Hegel's distinction between mechanic *Gedächtnis* and interiorized, now mathematical-procedurally appropriated *Erinnerung*) = Wolfgang Hagen, Hat das Internet ein soziales Gedächtnis? Anmerkungen zur medialen Struktur von Erinnerung und Vergessen, lecture given at Leuphana University in Lüneburg (Germany), December 3, 2010; actuality paradigm of print and electronic broadcasting media; algorithmic memory of search memory, Google Page Rank algorithm

- Michel de Certeau's "l'espace de l'archive" becoming radically temporalized. Read with Marshall Mcluhan, this is due to the fact that archives and libraries change from the "Gutenberg galaxy" to the electric, or to be more precise: the electronic age where streaming itself is both the technical condition and the phenomenon of archival information.

- traditional archive (as indicated above) deconstructed by the implications of digital techniques. Since antiquity and the Renaissance, mnemotechnical storage has linked memory to space. But nowadays the static residential archive as permanent storage is being replaced by dynamic temporal storage,

463 Friedrich Karl Engel, A Hundred Years of Magnetic Sound Recording, in: Journal of the Audio Engineering Society, Vol. 36, No. 3 (März 1986), 170-178 (171)

the time-based archive as a topological place of permanent data transfer. Critically the archives transforms from storage-space to storage-time; only transitorically it can deal with streaming data in electronic systems. The archival data lose their spatial immobility the moment when they are being provided with a truly temporal index ("data", literally). In closed circuits of networks, the ultimate criterion for the archiv - its separatedness from actual operativity - is not given any more. The essential feature of networked computing is its dynamic operativity. Cyperspace is an intersection of mobile elements, which can be transfered by a series of algorithmic operations. In electronic, digital media, the classical practice of quasi-eternal storage is being replaced by dynamical movements "on the fly" as a new quality. Classical archival memory has never been interactive, whereas documents in networked space become time-critical to user feed-back.

- audio-visual archives themselves taking place in time, beyond the scriptural regime. AV media phenomenologically address humans on the existential level of their temporal sense. They re-generate temporal experience, thus adressing the human on the sensory (aisthetical, physiological) level as radically present, while our cognition puts it into a "historical" context: here, a dissonance takes place, a gap opens, a *différent* in Jean-François Lyotard's sense (referring back to Kant)

Sorting sound and images: between signal-based similarity and symbol-based logocentrism (George Legrady)

- *Pockets Full of Memories* an online and museum installation by media artist George Legrady in which the audience *creates* a collection by contributing a scanned image of an objekt in their possession to a projected data bank; a similarity-oriented algorithm (SOM) "translates the Keywords (semantic information) and Object Description, and turns them into numbers which is how the mathematically determined organization happens. Many of the other metadata also influence the location, for instance, the date, possibly the object's origins. In a technologically up-dated version called *Cell Tango*, Legrady (with Angus Forbes) displays a collection of constantly changing cellphone photos sent by individuals to pix@celltango.org, projected rhythmically over a large, black screen in a variety of patterns. Fresh snapshops swiftly adjust to that mosaic according for formal criteria (image-based matching) and according to their tags (meta-data), thus mingling with photos taken from Flickr (the photo-sharing website). A gap between the visually associative and the linguistically semantic field opens. In one of the four modalities of the installtion, "Cell_Bin", first the most recent images are placed on the black screen, and an algorithms randomly distributes them. The space left inbetween is successively filled by smaller incoming photographies. This loosely coupled patterns evolve dynamically = the opposite of the traditional archival structure which preserved structures statically (i. e. "monumental"). In fact, the traditional archive derives its very authority from the "veto" against permanent change, such like a book which is meant to last for decades is a rock of enduring knowledge against the permanent up-dating of Wikipedia articles

Concepts for a *generative* archive (KR, Legrady)

- research art team Knowbotic Research designing an online version of tape-recorded lectures from the recordings of media scholar Vilém Flusser donated to the Academy of Media Arts, Cologne: "This is an ambitious program if the on-line archive is not to succumb to arbitrariness. [...] Instead of choosing a very complex and elaborate technical architecture, Hübler and Tuchacek propose to work with a social model, by creating an 'invitation-network'. The idea is that researchers and other professionally involved users of the database create decentrally stored subsets of the data-set that act as local branches of a logical tree in the overall system. Once invited to the network these users can in turn invite other people to join and thus create new sub-branches within their own branch in the overall system" = report Kluitenberg 2000

- archives about selection, not storage: "The question of what to archive in a technical sense leads over to the more general issue of selection. In much of the traditional arts and culture field the identity of cultural institutions and initiatives is not defined by their inclusiveness, but instead by their careful and critical selection. In the on-line world everything, however, seems to fall prone to the ideology of connectivity. It begs the question in how far the seamless connection of on-line archives and databases is desirable at all in terms of definition of identity, meaning and context" = e-mail Eric Kluitenberg, to syndicate@aec.at, December 13, 2000

- in *Pockets full of Memories* sum of the archive of objects organized through a self-organizing map algorithm" (from medialab Helsinki: Kohonen algorithm)

- instead of conceptualizing digital data in archival terms, entropical modelling, that is: allowing for the highest degree of disorder, which contains, in communication theory, the highest degree of (possible) information

- "The exhibition/archive´s aims are to explore digital data structures as a site of collective memory" = handout Legrady; media archaeology of the archive challenges the anthropological notion of "collective memory". Neither does it allow for a hybrid significantly written like this in Legrady´s paper: "to present a realtime construction of an archive/collection of objects". This undecidability obscures the difference between archive and collection (for example, a library or museum)

- sorting of images in Legrady´s installation still subject to verbal indexing, to keywords provided by the userssince the objects scanned are organized by the sorting algorithm "according to descriptions provided by the object contributors; SOM "simulates natural language relationships" = handout; Kohonen Self-organizing map (SOM) algorithm from neural net studies offers a wider range of genuine mediatic options: "to explore organizational methods based on properties such as material, age, etc. and associative meanings such as cultural and personal value by which to map put the relative position between things in a collection" = handout

Data extrapolation: The unfolding of time-critical processes into a temporal horizon

- intermediary storage as necessary precondition for calculating the immediate future from memory of the immediate past - the extended presence in time of digital media. In July 1942 Norbert Wiener (with Bigelow) produced a (then secret) paper on *The Extrapolation, Interpolation and Smoothing of Stationary Time Series with Engineering Applications*[464]. The notion of "preemtive scheduling" was already known to denominate micro-temporal as well as macro-temporal process commands in factory production, but here it dealt with signals coming from the "echoic" present. Historic thinking assumes an infinite or very long period in the past on which to base its prediction. "A real target, by contrast, could be tracked for only a few seconds before the prediction was needed. Starting and stopping the system in a finite time interval introduced noise spikes at the ends of the time series, which corrupted the prediction. <...> if the shell did not explode within about 10 yards of the target, it was worthless"[465]

- emphatic, apparently "deep" dimension of a macro-temporal process being condensed into a series of temporal moments

- epistemologically delicate situation arriving with the anti-aircraft artillery in WWII, when the "enemy" pilot expected to try to manoeuvre around the artillery trajectories. The artillery thus has to anticipate not only the immediate future position of the enemy aircraft, but as well the possible counter-manoeuvres of the pilot to escape this linear prediction. For that reason, a modification of the trivial pre-calculated fire tables has been developed which lead to the rise of a mighty technomathematical tool: the electronic analog, then: digital computer

- in pre-printed or materially pre-impressed mathematical firing tables, relation between in- and output a mechanistic one. When this calculation is meant to takes place just in time, additional aberrations (of the missiles et al.) require that the mechanism is ready and capable for immediate correction by signal feedback (analog computing, real-time digital calculations). "The computer performed <...> *prediction*, or leading the target, modeled its motion and extrapolated it to some time in the future. Second, the *ballistic* calculation figured how to aim the gun to make the shell arrive at the desired point in space and explode" = Mindell ebd.

- figure of time here the grammatical "future in the past", based on a feedback operation: The director multiplied the calculated velocity of the target by the prediction time "to determine a future target position and then converted the solution back into polar coordinates for output" <89>. Thus the machine represented a worldly, that is: timely process by a physical model (that is: the analog computer). In order to do so, the classical firing table data were mechanically fed into this computer as a kind of permanent memory, "roughly comparable to what today we would call *ROM*, or read-only-memory" <89>. "Together, ballistic and prediction calculations formed a feedback loop" <ebd.>. The operators first entered an estimated time of flight for the shell

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464 Norbert Wiener, The Extrapolation, Interpolation and Smoothing of Stationary Time Series with Engineering Applications, DIC Contract 6037 (National Defense Research Council, Section D), Division 7 Report to the Services No. 19, OSRD No. 370, Massachusetts Institute of Technology, Cambridge, Mass., 1. Februar 1942

465 David A. Mindell, Between Humans and Machine. Feedback, Control, and Computing before Cybernetics, Baltimore / London (Johns Hopkins University Press) 2004, 280

when beginning the track. After an initial calculation, "the output of the ballistic calculation <...> fed back an updated estimate of the time of flight, which the predictor then used to refine the initial estimate" <89> - a cumulative, integrating cycle of (re-)corrections, with the aim of minimal dependance on the so-called human element

- analytic term for such a temporal extension: trajectory; difference between machine time and human time[466] is included in the cybernetic model

- micro-temporal data compression an agency in contemporary image communication, notably in streaming video where a series of images is not given like in cinematography any more but has to be algorithmically re-created every given moment.[467]

- central terms from Edmund Husserl's *Phenomenology of the inner temporal consciousness*: the falling-back ("Zurücksinken") of an immant temporal objects from the state of now into the past (retention), while still affecting the presence. In the sonosphere this is known as the echo of tones; visual stimuli result in the after-image which remains on the human eye retina for a moment even if the light source is already extinct. Complementary to this retention, human perception always already pre-calculates (and thus anticipates) the immediate future signal (protention).

- techno-mathematical correlation to such analysis of temporal series the compression algorithm developed by Jacob Ziv and Abraham Lempel: "We employ the concept of encoding future segments of the source-output via maximum-lenght copying from a buffer containing the recent past output. The transmitted codewords consists of the buffer address and the length of the copied segment. With a predetermined initial load of the buffer and the information contained in the codewords, the source data can readily be reconstructed at the decoding end of the process"[468]

Order in fluctuation?

- from statistics (memory) to stochastic time series analysis (dynamic remembrance); Claude Shannon - in terms of technomathematical engineering of communication - defining artificial languages "abstractly [as] a stochastic process which generates a sequence of symbols."[469]

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466 Name June Paik, Norbert Wiener und Marshall McLuhan, in: idem, xxx, 1992, 123-127 (125)
467 "One important method of transmitting messages is to transmit in their place sequences of symbols": David A. Huffman, A Method for the Construction of Minimum-Redundancy Codes, in: Proceedings of the I.R.E. (September 1952), 1098-1101 (1098)
468 Jacob Ziv / Abraham Lempel, A Universal Algorithm for Sequential Data Compression, in: IEEE Transactions on Information Theory, Bd. IT-23, Heft 3 (Mai 1977), 337-343 (337)
469 Claude Shannon, Collected Papers, Piscataway (IEEE Press) 1993, 5

- with algorithmic administration and access, memory becoming radically temporalized. It is rather hypertemporal than hyperspatial, being based on the aesthetic of immediate feedback, recycling and refresh rather than on the ideal of locked-away storage for eternity. The aesthetics of recycling, sampling and cultural jamming is a direct function of the opening / the openness / the online-availability of (multimedia) archives. As the abstract of the festival *Re-*. Recycling_Sampling_Jamming. Künstlerische Strategien der Gegenwart* (Berlin, Akademie der Künste, 26-28 February 2009) declares, the richness of online-accessible text, sound an image repositories has resulted in cycles of re-appropriation; www.recycling-sampling-jamming.de

- in digital memory, not only the archival records themselves but its archival infrastructure becoming subject to increasing speed of up-dates; the traditional "time base" of archive itself becomes a function of temporal change (requiring a "differential analysis of second order", to speak mathematically and alluding to Norbert Wiener's cybernetic concept of "linear prediction")

Conflicting archival tempor(e)alities: Symbolic order vs. indexical signal

- symbolic order according to Jacques Lacan already implying the machinic; Friedrich Kittler, [Ordnung des Symbolischen / Welt der Maschinen], in: same author, Draculas Vermächtnis. Technische Schriften, Leipzig (Reclam) 19xxx

- conventional archival records consisting of strings of symbols (i. e. alphabetic writing); 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; once photography, the first medium in its modern sense, becomes object (or even subject) of the archive, the sense-affective, presence-generating power of signal-based media cuts short the cognitive distance; Hans Ulrich Gumbrecht, Production of Presence. What Meaning Cannot Convey, Stanford University Press 2004

- while media archaeology describes the non-discursive practices of the techno-cultural archive, media phenomenology analyzes "how phenomena in various media appear to the human cognitive apparatus", mind and senses" = Jakobsen 2010, 127-154 (141), referring to Chun & Keenan 2006, 3-4; cybernetic A/D-sensors, "Perceptron"

Archival tectonics vs. signals in/of motion

- cinematography not concentrating on the single image like photography but unfolds inter-frame coherence (even if katachretic), revealing relational qualities otherwise hidden (Foucault's definition of discourse analysis)

- Edison phonograph itself "in motion"; its recording (resulting in the Vienna Phonograph Archive and the Berlin Phonogramm Archive) is based on a rotating, technically moving apparatus, and in re-play

- once digitized and coupled to online accessability, the archive is no longer an institution of administrative memory set apart from the current operations, but rather returns to the registry as "echoic memory" extension of the present itself, coupled to actual processes in feedback loops which result in periodic up-dating (different from inscription which used to remain unchanged). With digital storage, institutionally stable record repositories are increasingly replaced by dynamic files *in motion*. While in pre-"online" administration there has bene a clear separation between the "register" (the short-time depository for administrative records which are not in current use but might be at any moment be needed for re-use, close to the "op room", the administrative office itself) and the "archive" (physically reparated from the working office, a place to sort and select records for long-time legal claims), today the archive merges with the register itself

DEAF 03 "Data Knitting"

- as digital format, image is not simply integrated into an archival structure any more, but itself constitutes an archive; it can be "an interpreted composition of pixels, a collection of statistics, lines of contours or directions, a music score" = E. K. (In 2048)

- "even secret files suffer a loss of power when real streams of data, bypassing writing and writers, turn out merely to be unreadable series of numbers circulating between networked computers."[470]

- ekstasy of the archive its being connected *online* to any present computer-based action (Wireless LAN for example); this means first electrification (speed of light) and second binary mathematization

- once instantaneously available and accessible, archives becoming an essential factor in acting in the present. [...] Archives are becoming just as process-like in character as the present already is. The individual's experience of the present can be increasingly described as the moment when an "unforeseen" link is forged between tagged information clusters that reach him or her through the media. [...] What role does the individual play in this?"

- search engines designed to identify "the proverbial needle in the haystack. A digital archive, like neuronal memory, need not be a static system. Memory is something that operates in the present and through that act is continually updated. Research into such functions of memorizing or information storage provides not just interesting knowledge in its own terms, but also models and tools for understanding the possibilities of nonlinear computing and nonlinear database linking technologies"

Active Archives

- since early sixties, techno-artist Erkki Kurenniemi documenting his life through signal-recording technologies, resulting in audio cassettes, video

470 Kittler, Gramophone 1999, Preface xxxix f.

diaries, photographs, 8mm films, digital videos;
http://www.constantvzw.org/site/Online-Archive-Erkki-Kurenniemi-In.html;
http://activearchives.org/wiki/Archive_in_motion_workshop

- archive contrary to "instant access" claim within a so-called *online archive*: temporally shelter data = "Sperrfrist"

- Constant's Active Archives project since 2006, experimenting with the activation of archives beyond preservation and access. In former times, files were enriched by external historiographical description for different connections, contexts and possible contradictions, but not changing the record from within. But once archival records are given away to creative transformative algorithms and the file is received as transformed, it looses its archival integrity;
http://activearchives.org/wiki/Manifesto_for_an_Active_Archive

- Constant members Michael Murtaugh and Nicolas Malevé running a series of experiments with a subset of the Kurenniemi's archive. *Online Archive: Erkki Kurenniemi (In 2048)* commissioned by Kurator and dOCUMENTA (13) in partnership with Central Art Archive of the Finnish National Gallery and Contemporary Art Museum KIASMA

- Morgens Jacobsen / Morten Søndergaard (eds), Re-Action. The Digital Archive Experience, xxx (Aalborg University Press) 2008

- tools and algorithms to engage differently with structured or stochastically distributed sets of digital documents

- Kurenniemi relying on future (quantum) computing to make sense of his data aggregation: by 2048 technology will be ready for the advent of new forms of artificial intelligence, sorting autonomously the documents he has been recording, capturing, filming, photographing, drawing, and talking about

- exploring the multiplicity of orders contained within the archive: "While there is no clear organization in the different elements rescued from backup drives and workstations of Erkki, it doesn't mean no ordering was present. On the contrary, many orders coexist"; quantum-mechanical superposition

- "data laundry" (see Tumblr) *versus* ordered wardrobe; "learn to look at the images not according to their external description, their stories, but according to their internal composition (are they delicate? Are they chromatically compatible?) and we try to learn how to discover similarities between new sets treated by the same "program" (Constant)

- two kinds of "meta data": technical information (hardware / software, and automatic "semantic" content: MPEG7 standard), and implicit *information* contained (in latency) within the data files themselves; become "known" rather to algorithms than to human eyes

- "communication" with data files *via* algorithms on bit-level organization

- when legal protocols forbid the publication of the images until the people who are pictured have been contacted, the effect is not only hiding, but productive: creating different ways of representing the inherent qualities of the digitized "image", by-passing the immediate phenomenological appearance. The image knows more than what is protected by law (such as the privacy of humans in photography or video). "If the images cannot be ‘shown’, – and perhaps this is a blessing rather than a tragedy – what can be shown are the relationships between them, as they can be narrated to us by agents to which we lend our reconfigured eyes. They can be sensed like a pulse, experienced as time capsules. Leaving aside the 'retinal' approach to the image, we are learning from probes and experiments how the computerized visual traces of Erkki’s life let us feel temporal intensities, carnal distances and proximities. An image is an image is an image. But an image is also many stories told to us by voluble algorithms and their nonhuman points of view."

- use different algorithms for face recognition, color analysis, contour detection and sense how they can gain knowledge of the content about the documents collection, the relationships that tie them together or separate them

- learn from computer to look at images (once digitized) not according to their external description (metadata, tags), their iconological stories, but according to their computer-graphical composition, chromatical compatibilities; "to learn how to discover similarities between new sets treated by the same "program"; Geoff Cox / Nicolas Malevé / Michael Murtaugh, Archiving the Data-body: human and nonhuman agency in the documents of Kurenniemi, in: Erkki Kurenniemi 2015 (MIT Press);
http://activearchives.org/wiki/Archiving_the_Data-body:_human_and_nonhuman_agency_in_the_documents_of_Kurenniemi

- photographic analog images, once digitized, arbitrarily "destroyed" as originals, to allow for different re-configurations (cp. Foucault's "series"); still different from Walter Benjamin's definition of the collector who "withdraws the object from its functional relations" for idiosyncrativ assemblies. The *archival* quality of a record derives from its still functional relation to a (techno-)administrative system

- "Data Gallery" illustrateing results from experimental algorithms. "The image is not what is shown on the page but what exists between knowledge produced by the different outputs. [...] The original image doesn't appear in the viewer's retina but it begins to exist in the imagination, and each image can be understood to contain its own archive";
http://www.kurenniemi.constantvzw.org/db/records/images/view/2543

- algorithmically navigate the digitized audio files according to their various mathematical properties like entropy; Fast Fourier Transform

- not "looking" at image but discover different, non-iconic qualities behind / within the hex file / dump core representation

- spectrum sort of audio files, atomizing the wave forms into tenth-of-a-second chunks with FFT; re-arrange according to criteria like speech-to-humming

(singing), calmness / excitement, pitch / pauses; see program "Mr. Kov", Martin Carlé; DATA Radio

- thereby by-passing the copyrith limitations; "forensic" inquiry replaces the original "image"

– producing "random" knowledge, more "forensic" (Kirschenbaum) than hisetorico-hermeneutic. "The rise of forensics thereby gives an insight into how inanimate objects have been ventriloquised, their testimonies voiced by human witnesses on behalf of the objects"

- Kurenniemi himself advertising for an "inhuman" way of operating with his life-log data, creating a "meta-archive for all human life", just keeping digital data for a future quantum computer to re-decipher

- Larsen, Lars Bang. Erkki Kurenniemi. Einführung. dOCUMENTA (13): 100 Notizen – 100 Gedanken, No. 007. Ostfildern: Hatje Cantz 2011; Mika Taanila, *The Future Is Not What It Used to Be* = documentary film, 52 min., Finnland 2002; Cox, Geoff, Nicolas Malevé und Michael Murtaugh. “Archiving the Data-body: human and nonhuman agency in the documents of Kurenniemi.” typecript version of article, now published in: Erkki Kurenniemi, 2015 MIT Press: http://activearchives.org/wiki/Archiving_the_Data-body:_human_and_nonhuman_agency_in_the_documents_of_Kurenniemi

- waiting for July 10, 2048, Erkki Kurenniemi’s 107th anniversary and the date when his data body is expected to carry on after the biological body has inevitably failed

Operative *kinematographia*

- kinetic aspect widely neglected up until recently in archive terminology and practice. Most archives *of* movement are still subject to immobility. Temporary dynamics affect the archive itself if modelled in terms of the *turingmachine*, evoking the transitory archive

- David Gordon, *24 hours Psycho*: media-archaeologically undermining the story by slowing it down

- indispensable function of conventional archive activities the documentation of administrative processes by preserving the accompanying textual sources over the long term. New options arise for genuinely media-based archives: in chrono-/photographic, then cinematographic and finally electronic form. The movement event (i.e. the kinematic indexicality) can be documented only when continuously embodied and implemented in operative media. Traditional archives rely extensively on a standard carrier medium format: paper and print (script). Inbetween is the storage of analog media like the gramophone record and magnetic tape, esp. for what is known as media art (sound, video). Later in the 20th century, however, the textual regime returns: within the computational media (source code, algorithms, "software" with its alpha-numeric code). “The issue of archiving that had been resolved in classical bibliography has re-emerged" =

Recommendations for the Further Development of Communication and Media Sciences in German. Report of the Wissenschaftsrat [German Science and Humanities Council] from 25 May 2007; online http://www.wissenschaftsrat.de/texte/7901-07.pdf, p. 53. If we differentiate here between the surface (what is available to our eyes and ears via interfaces) and its condition of possibility, then it means that the source codes (the Internet's own intrinsic "archive") also need to be archived.

- aesthetic of interim archives increasingly taking the former place of long-term archiving. Linked to this is another, dynamic cultural concept that is not primarily related to eternal saving but to a permanent transfer – a form of updating as data management. Theatre and dance are already transitory at the moment they are being performed. Dance is not only a physical form of movement art, but also kinetic knowledge and kinaesthesia. Dance archives as archives of movement require storage media that is capable of storing movement, and they are therefore, via the concrete dance form and beyond, of paradigmatic importance. It was the emergence of cinematography that made the no longer merely symbolic recording of movement possible, but at the same time its scientific analysis = Van Schaik, Das kinetische Gedächtnis, in: Theaterschrift 8 (1994)

- movement, previous to cinematographic media, previously retained only in symbolic terms; movement performed in real time has been as ephemeral and un-archivable as the voice. In early photography, with long-time exposure, living people in contrast to still objects such as architecture and sculpture, were only visible as pale shadows or strips. Phonography and cinematography changed all this abruptly. The 20th century generated dynamic archives and archives of the dynamic that related to one another transitively
- critical question in relation to this is the extent to which, in its tighter meaning, it should refer to an art form or a kinesis of bodies. Comparable with poetry in contrast to prose, dance means aesthetically arranged movement (technè). Media archaeology puts emphasis on the condition of possibility of dance in terms of the physical movement (*kínesis*), the distribution of energy, while dance theory concentrates mostly on the art form, i.e the cultural semantics of movement. To arithmetic research came the physical side, first through Descartes and Mersenne, than through Saveurs and later Helmholtz, underlines Marcel Stanislas Ducout in his blueprint for a veritable media dance, which sonified radio-electrically the movement of the dancer with the help of a device called "movline"[471]. This coupling of a dancing human and electronics is part of an epistemological form of dramatic art because it breaks with an occidental tradition, whereby the human body, when faced with technology, was always afforded a controlling role. In contrast to this was a cybernetically closed loop with the aptitude for feedback. In this way, the dancing body is carrying out an analysis of media.

- memory of motion requiring storage media that is itself capable of movement, more allied to film archives than conventional file archives (Müller-Gellert, Hans-Joachim (1969): "Datenverarbeitung und Automation in einem Filmarchiv", in: Der Archivar, vol. 22 (1969), 395 – 402)

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471 See Marcel Stanislas Ducout (1940): La danse sonore. Synthèse de la danse et de la musique. Paris: Presses universitaires de France: 165 et seq

- (with)in time-based media, dynamic focus is on motion; instead of moving inbeween objects fixed in museum space, this corresponds with viewing moving images by manipulating a video tape on its time axis (non-linear jumps, speed forward / backward)

- project of the Institute for Academic Film in Göttingen, under the direction of the behavioural researcher Konrad Lorenz, attempted to put the entire world of motion onto celluloid. Around 4,000 films were made, each of which recorded the motional process of a species. And this cinematographic archive of motions has a more expansive, epistemological notion of motion: “Not only animal species, of course, but also plant species or something from the field of technology, the mechanical strain on steel and so on.”[472] Each film is, by itself, an archive of motions; even if (seemingly) nothing is moving in the picture, the celluloid is moving – and is therefore a movie. Manifestations of life are regular events in the passage of time, but these, paradoxically, are fixed in step-by-step frames in film. Mechanical-cinematic movements have been the test case for dance for a long time: With jerky, avant la lettre cinematographic movements, the robot Olimpia in E. T. A. Hoffmann’s novel *Der Sandmann* / [The Sandman] (1816) lowers her head and repeats the same gesture over and again. Irritated, her human counterpart switches her off; the puppet freezes. The situation escalates in the ballet Coppélia (Arthur Saint-Léon, 1870), based on the book: “A dancer mimics a clockwork dancing doll simulating a dancer. The imitating movements, dancing twice removed, are predictably ‘mechanical’, given the discrepancies of outward resemblance between clockwork dancers and real ones.” (Danto, Arthur E. (1980): “The use and mention of terms and the simulation of linguistic understanding”. In: The Behavioral and Brain Sciences 1980, p. 428) Early cinematography (the camera-projector of the Lumière brothers is driven (synchronised) by the same mechanical clockwork as a spring mechanism, only that the function of this mechanism is not to show time but to record motion. “These discrepancies may diminish to zero with the technological progress of clockwork, until a dancer mimicking a clockwork dancer simulating a dancer may present a spectacle of three indiscernible dancers engaged in a pas de trois. By behavioral criteria, nothing would enable us to identify which is the doll, and the lingering question of whether the clockwork doll is really dancing or only seeming to seems merely verbal” (Danto 1980: 428).

- cinematographic media "archiving" in its most fundamental sense of *sampling* motion. More in the analytical-measuring sense than in the cinematographic-narrative sense, Etienne Jules Marey’s and Eadweard Muybridge’s series photography undertakes a discretisation of life that only becomes an antecedent of cinema in the retrospective perspectives of media history. Marey undertook motion studies, not as a way of fooling the eye, but exactly the opposite, to dismantle motion into individual images analytically. The media-archaeological view becomes the camera’s privilege (Dsiga Vertov), to look behind the optical illusion. In the era of technical perception, motion becomes a function of its discrete measurement. The techniques for storing motion open

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472 C. Carlson, documentarist at the Institute for Academic Film, Göttingen, Germany, interviewed by Christoph Keller, 1998, in: Christoph Keller, Lost / Unfound: Archives As Objects As Monuments, in the catalogue ars viva 00/01 - Kunst und Wissenschaft, Berlin 2000

up the possibility that they be made available for extensive, additional uses for the specific, embodied and kinetic knowledge contained within them

- Henri Bergson’s critique of measuring approach by which technological media grasp the essence of motion; chrono-photographic "analysis" of motion into smallest units of time as time exposure; closer to Bergsonean *durée*: Hiroshi Sugimoto's cinema photographies of an entire film with a single camera view, resulting in the white noise on the cinema screen; see Matthias Flügge et al. (eds.), Raum. Orte der Kunst, Nuremberg (Verlag für moderne Kunst) 2007, 304 ff.

- Karl Ernst von Baer defining the awareness of changes in human cognition as quasi-cinematical: "In one second, we have on average about six life moments, ten at the most."[473]

- long time exposure for works of dance theatre transforming the usual optic experience into a visually extended view that is only possible photographically and which, via the camera, superimposes the activity sequence from scene to scene and bundles it simultaneously into a sculpture of light. Photography does not freeze here the moment but, as a long time exposure, opens up temporal endurance (Bergson) itself. Drama itself is a time span. Theatre and dance as the oldest time-based arts enter into an alliance with the technological time-based media. The media-archaeological view of motion gets its chance to become part of the archiving of media if it (as Dziga Vertov put it) is no longer simply the human way of looking but the dispassionate view of the camera itself – *theoría* actually becomes media-active theory; Aljoscha Begrich / Jo Preußler, Wie sich Theaterstücke einbilden. Für eine dramatische Fotografie des Theaters, in: Hartmut Rosa (ed.), fast forward. Essays zu Zeit und Beschleunigung. Hamburg: edition Körber-Stiftung 2004, 145 – 157

- optical media that accelerates and condenses time providing insights into the essence of motion that remain closed to human perception because their time window only memorises the immediate present (two to four seconds)

- In *Laokoon* (1766), Gotthold Ephraim Lessing decisively differentiating time-based art from space-based art. However, Loïe Fuller had time-frame photographs made of her dances. Does time mean the dynamic integration of motion and number? Chrono- and cinematography slices up motion and “counts” (not arithmetically but in terms of physical media) the motion as time in the sense of its Aristotlean definition of time itself as the effect of numerical measurement of movement. The "digitalisation" (as arithmetisation) of movement is always alread implied when it comes to so-called time-based arts. If time is defined like this, the essential mathematicity of dance is implicit: *touto gar estin ho chronos, arithmos kineseos kata to proteron kai hysteron.*[474]

- camera choreographies in dance archive collections. In video dance, dilatory time and time axis manipulation come into play as a genuine option for electronic-mathematic space in order to create movements that can develop in

473 Karl Ernst von Baer, Schriften. Stuttgart 1907: 141
474 Aristoteles, *Physics*, book IV (219b 1-2)

their time form exclusively in this medium and not on the real, body-focussed stage with its Aristotlean limitation of the drama to unity in space and time and action: compression and acceleration, fading in and fading out.[475]

- performative, body-centered (even if media-augmented) theatre (Fischer-Lichte) *versus* operative media theatre (from within the signal processing)

- time manipulation as superposition (overlay of temporality, or on the time-critical level: supra-position, “underlay”) started essentially with technological recording media; medium of analysis here becomes a dramaturgical medium itself

Dance of the electrons / mathematics in motion

- cinematics formulated systematically at the end of the 19th century by Franz Reuleaux, Theoretische Kinematik. Grundzüge einer Theorie des Maschinenwesen, Brunswick (Vieweg) 1875

- early electrotechnology exclusively "Mechanismus, nach dem sich die Elektronen zu gemeinsamem Tanze ordnen" [“the mechanism according to which the electrons ‘arrange
themselves in a common dance’”] (Möller, H. G. (1930): “Über die Frequenz der Barkhausenschwingungen”. In: Elektrische Nachrichten-Technik (E.N.T.) 1930, issue 11, pp. 411 – 419: 411); electron tube used *within* computers as intermediary storage device is in fact a choreography of symbolicylly coded electrons. This algorhythmic dance on the screen of the image storing tube was hardly visible to the programming engineer: "Meaning can only be given to the 'mad dance' of the picture dots on the Mark I." (Link, David (2006): “There Must Be an Angel. On the Beginnings of the Arithmetics of Rays”. In: Siegfried Zielinski und David Link (Ed.), Variantology 2. On Deep Time Relations of Arts, Sciences and Technologies. Cologne: Walther König, pp. 15 – 42: 42)

- Rudolf von Laban liberating dance from its overdetermined poetic form; he considered dance as a combination of impetus and motion, i.e. more in terms of physics. For the archiving of all forms of movement, the notation he developed understood itself to be, in the wider sense, suitable notation in symbols (Laban, Rudolf von: Choreutik. Grundlagen der Raum-Harmonielehre des Tanzes. Wilhelmshaven 1991: Noetzel). Laban coined the concept of kinesphere; today, movement recording media available beyond the written-graphic notation: electronic (analogue video) or digital; graphic indexing of working motion was developed along the lines of symbolic dance notation; the Fordism of factory work generated its own motion analysis (Pias, Claus (2002): Computer – Spiel – Welten. Vienna: Sonderzahl); in the early period of the Soviet Union Gastev’s “Time League”[476]. It is only one more step from the graphic methods of 19th century physiology to video dance. And in taking it we

475 An example of video dance: Topic I & II, France 1990, director: Pascal Baes, choreography: Sara Denizot

476 On Gastev's enterprise see Siegfried Zielinski, Archäologie der Medien. Zur Tiefenzeit des technischen Hörens und Sehens, Reinbek b. Hamburg (Rowohlt) 2002

move closer to the oscillograph screen, in the centre of which the electronic beam dances. The electronic image on the other hand is not only made up only of 24 small photographs per second, like film, but each individual image is made up of time, in terms of television then more than 600 lines per second that are recorded by a pixel that never stops running.

- cinematographic media still chrono-photographically "still" dance motion; electronic in a position to record real body movement. Only moving media can record movements in their vibrancy; in contrast to cinematography, which is discrete and mechanical, electromagnetic recording (on video) is a differential, a dynamic bridging of sequences of movement. At the beginning of the 20th century, the Italian Futurist Antonio Giulio Bragaglia founded the antithesis to early cinematography. In contrast to the analytical, discretionary aesthetics of chronophotography, “fotodinamismo futurista” located the photographic compression of a movement, that is to say its collective singular, on the frontier of frequency analysis and the aesthetics of the electromagnetic field, so that he staged material, space and time as, concurrently, a homogenous and differential arrangement, as a fundemental ephemeral, as a passage, as a traject = Walburga Hülk / Marijana Erstic, "Vom Erscheinen und Verschwinden der Gegenstände, in: Ralph Schnell / Georg Stanitzek (eds.), Ephemeres. Mediale Innovationen 1900/2000, Bielefeld (transcript) 2005, 43-61 (52 ff.)

Time to think the differential archive

- "archives of motion", on the basis of the media process, sharing an indexical relationship with time, technically integrating memory according to time

- time-critical element of motion understood mathematically (in terms of $\Delta t \rightarrow 0$). Mathematics puts us (through analysis) in a position to master time processes analytically (via deduction according to time). Mathematics itself, however, cannot implement time.

- from the mathematical analysis of movement to its (re-)synthesis in a mathematised machine, the computer. While cinematography is just able to record and reproduce movement, operational mathematics can create motion from nothing

- when calculated, algorithmic objects becoming subject to archival preservation; conventional archive implodes

- not simply continuous analog motion sampled by recording (cinematography, digitization), but motion itself non-linear: "Diff is a Unix command that shows the differences between files. Git is similarly based on a file structure that works on the basis of marking the differences between objects stored in the repository. A diff is based simply on a character-by-character analysis of a file. Every change is logged and is retrievable by choosing the right commit. [...] Archives tend to work with exemplars, not variations. With Git, as with all forms of computer memory that always involve making copies of files, objects no longer need to exist uniquely; indeed, they cannot do so if they are to be used within the system. The archive in this case comes into being as a process of structural differentiation rather than as a thing. Overall, Git is a massive graph

structure and each code object, each archived file is a set of trajectories across this graph" = Matthew Fuller, Andrew Goffey, Adrian Mackenzie, Richard Mills, and Stuart Sharples, Big Diff, Granularity, Incoherence, and Production in the Github Software Repository, in: Memory in Motion. Archives, Technology, and the Social, ed. by Ina Blom, Trond Lundemo, and Eivind Røssaak, Amsterdam (AUP) 2017, 87-102 (97)

- "hashes of symbols and diffs, the archive transitions into a systematization of the archive as an engine of minutely and massively assembled processes of addition and variation. Rather than the archive storing history as a set of exemplary if not necessarily unique entities, history is involuted in the archive rather than stored in it" = Fuller et al. 2017: 98

Archives of motion *versus* archives in motion

- "archiving" web pages (like in archive.org) achieved through freezing the page in time, thus losing the dynamic quality of its updates, reconstructions, etc.; therefore the Wayback Machine allows for stepping backwards on the timeline

- distinguish between archive *of* motion (films and sound recordings) and an archive as a concept *in* motion

- mechanic operation technologically asymmetric compared with human "performance". Taking "dance" in a more general sense as artful movements, such kinetic phenomena are subjects of archivization on the one hand (archives of dance); at the same time, a dynamization of "the archive" itself takes place with time-based and data-processing media (the algorithmization / rhythmics of the digital archive); differentiate between "memory", "storage" and "archive", between "analog" and "digital" recording of movement, between performative and operative "re-enactment" and archival recall

- rhythms performative time-measure; clocking operative time base

- from motion domain to time domain: An archaeological reconstructive indication of tempo, e. g., "can be drawn from the relation of music to movement. We do not know how to match notes to dance-steps"[477], but from the way a tragic or comic chorus enters the stage in a classic Greek drama, we can derive "a fair idea of the tempo. "When they are not / running but walking at a good speed, Aristophanes makes the rhythm iambic" <ibid., 154 f.>.

- essential operation to create an archive of moving arts is recording: either symbolically (by dance notation in the tradition of writing / *graphé*), or by media endowed with the capacity to register the physically real audiovisual signals (media-archaeologically starting with the phonograph and with chrono-photography), thus literally embodying / engraving ("groove") - in respect to Aristotle's correlation of time-number-movement - the over-countable ("überabzählbare") event.

477 M. L. West, Ancient Greek Music, Oxford (Clarendon Press) 1994, 154

- re-enactment of historic media art raising crucial question: Does this require the original technological hardware (video electronics, f. e.), or functionally equivalent devices?

- time, in Aristotle's book on *Phyiscs*, defined by numerical measurement of movements; essential mathematicity of motion analysis is implicit

- technological *apriori*, in the case of dance, leads from passive recording to active *techno-poiesis*: "Operative" performance which is not just recorded by the camera, but produced for the camera eye only (post-production inclusive), different from the gaze of the human spectator in the traditional auditorium or theatre, and has resulted in the sub-genre of "screendance" (*alias* "videodance", "cinedance") which edits time (artful movement) itself, free from the restrictions of physical gravity and duration = argument in the lecture "Screen-Dance/From Stage to Film and Back" by Claudia Kappenberg (Brighton) at the International Symposium ARCHIVE/PRACTICE in Leipzig and Dresden-Hellerau, December 10th-13th, 2009

- cumulative memory one thing; adaptive (algorithmic / algorhythmic) storage another[478]

- media archaeology concerned with media not only on their structural but as well on their *operative* level, thus becoming "diagrammatic". The time-critical, post-structural vector of media archaeology as diagrammatic media theory places it close to signal analysis, with a signal being the physical representation of a message respectively information. Any media event thus is "Zeitfunktionen der Signale"[479]

- essence of digital data processing: storage becoing less enduring ("archival") and more intermediary (ephemeral)

- in stored-program computing, principal storage kind of inter-archive, a short-time memory which later, by Howard Aiken for his Harvard Mark I, has been called "register", whereas for enduring data storage magnetic tapes and punched cards figured. "Numbers may be removed from the calculating unit and temporarily stored in storage position"[480]

Media archaeology: Technology as "archivist" of moving memory (*Phonovision)*

- in media memory culture, intermediary storage dynamics (the RAM) replacing „archival space“ (Michel de Certeau)

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478 See Heinz von Foerster, Gedächtnis ohne Aufzeichnung, in: same author, Sicht und Einsicht, xxx, 1985, 133- (135)
479 Karl Küpfmüller, Die Systemtheorie der elektrischen Nachrichtenübertragung, Stuttgart (Hirzel) 1974, 393
480 Howard Aiken, Proposed Automatic Calculating Machine (1938), as quoted in Coy 2007: 81

- restored Video Recordings 1927-1935; esp. ballett sequence, from Baird's *Phonovision* = http://www.tvdawn.com/recordng.htm

"Really" archiving movement

- as long as scores (like in the time of the Baroque) referred to rigid form of dance governed by fixed sequences of gestures and steps, symbolical notation indeed fixing that algorithm of movement

- different from symbolical dance notation which results in always individual regenerations of actual movement sequences, audiovisual recording able to register artistic expression like music and dance in high temporal fidelity to the unique event, thus suspending it from history in favor of re-presentation. When we watch a video from the archive, even though we cognitively know about the historicity of the performance, our senses cannot but treat it like a present event; liveness by kinetics which no graphical notation can ever approximate[481]

- "countable movement" / chronophotography; no oxymoron, can be analyzed by use of real numbers which can not fully be catched by symbolical notation but only take place in correspinding signal-based media. Only analog media like the phonograph allow for an archivisation of the essential of movement, i. e. its dynamics, and electromagnetic storage media like the magnetophon and video tape are especially capable to catch that *momentum* since their reproduction mechanism is irreducably dynamic itself, being a function of one and only real variable: the time axis.[482] Once dance is not only graphically, but technographically recorded, its dynamic re-play challenges the classificatory order ot the archive itself, to be replaced by probabilities which is the field of mathematical stochastics. William J. Mitchell writes in *The Reconfigured Eye*: "We must abondon the traditional conception of an art world populated by stable, endunring, finished works and replace it with one that recognizes continual mutation and proliferation of variants - much as with oral poetry."[483]

- from complete mathematical (literal) *analysis* of recordings of artful movement (in terms of real numbers) resulting a *dynarchive* which is reconfigurable in order to reveal new analytic insights without destroying the recorded event itself. Cumulative memory is one thing; adaptive (algorithmic) storage another[484]

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481 Dietrich Schüller, Von der Bewahrung des Trägers zur Bewahrung des Inhalts, in: Medium Nr. 4 (1994), thematic issue: *Archive - Medien als Gedächtnis*, 28-32 (28)

482 See Friedrich Kittler, Die Welt des Symbolischen - eine Welt der Maschine, in: same author, Draculas Vermächtnis. Technische Schriften, Leipzig (Reclam) 1991, 58-80 (68)

483 William J. Mitchell, The Reconfigured Eye. Visual Truth in the Post-Photographic Era, MIT Press, 1992, 52

484 See Heinz von Foerster, Gedächtnis ohne Aufzeichnung, in: same author, Sicht und Einsicht. Versuche zu einer operativen Erkenntnistheorie, Braunschweig / Wiesbaden (Vieweg) 1985, 135

Re-enactment and the archive

- watching audiovisual recordings from a dance archive, a disruption between the technology of recording which is measuring, belong to mathematical, physical time (Henri Bergson calls this *temps espace*), and the phenomenological experience of time (Bergson's *temps durée*)[485]

- In Samuel Beckett's once-act play *Krapp's Last Tape*, the act of reading in the tape inventory ("ledger") leading to cognitive time calculation, while the acoustic channel performs physiological signal processing

- technical repeatability leading to almost a-historical functional re-enactment; experience of high-tech media time closer to the criteria of experimentation in natural sciences than to the historicist idea of empathetic history; technological reproduction of a sequence of sound or vision signals succeeding in exactly the same way as the original, even if it successively uses modern formats such as the Compact Disc instead of the previous vinyl record; media-archaeological question in its material sense: What difference is between an active electronic component of previous generations and its actual embodiment (such as the electronic vacuum tube and its functional replacement by the transistor)? In most cases, the performance is as good, exactly because techno-logics is basically operative and not performative - equiprimordal (*gleichursprüngliches*) reenactment

Archive, diagram and movement

- cinematographical motion study not reduced to the iconology of the single image but emerges in a relational web which diagramatically unfolds[486]; any archive of temporal figures marked by such vectors

- analog media allowing for the memory of non-intentional records which elapse the symbolical notation by the alphabet, thus leading to what Marcel Proust (in the age of chronophotography, phonography and kinematography) has identified as *mémoire involontaire*. The recording of dance as well is part of such an audiovisual *anarchive*. But attention once more, let us not confuse *recording* and the archive. *Records* represent the content of the archive; the archive itself, though, is rather an address structure, a logistical function, closer to *logos* than to *physis*.

From spatial to time-based archives

- the non-archivable, like Fluxus art in its self-estimation once claimed (though it later became subject of documentation); electronic technology of the new archive privileges the ephemeral. The authoritative stability of the archive

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485 See Henri Bergson, Perception du changement, Oxford 1911, and same author, Données immédiates de la conscience, Paris 1889

486 See André Wendler / Lorenz Engell, Medienwissenschaft der Motive, in: Zeitschrift für Medienwissenschaft 1/2009, 38-49 (42)

liquifies in the age of electronic communication; even the signature becomes digital; Jacques Derrida, Archive Fever, xxx. Electronic memory is transitory and thus comes closer to the dynamic essence of dance itself.; The electronic archive transforms from a stabile data storage to a dynamic, self-organisational system of fluid data.[487] The principal storage in computers is a kind of temporary archive, a short-time memory which has been called "register"; essence of digital data processing that memories become increasingly intermediary

Concept for a *generative* archive

- traditional archive has been a *read only memory*, not to be re- or overwritten while reading (a concept still maintained by the CD-ROM). In multi-media space, however, the act or reading, that is: the act of re-activating the record, can be dynamically coupled with feedback.

- hidden archive: compression algorithm of digital video streams in order to make them storable and transmittable at all. While in the transmission of archived text in the occidental tradition every letter counts - which is critical for philology -, by compressing and decompressing digital records, subtle amounts of data are lost. This ratio is measured against the bandwidth of human senses (like film frame frequency in regards to visual motion detection). The aesthetic illusion of multi-media, then, is for human eyes only

- average record of the archive still textual; re-think archival terminology towards a signal-based (anlog) and processual (algorithmic) media-archival concept

- archive traditionally institutionally, even legally, sealed off its records from present access; online use of digital records is "checking it out, constantly evaluating"[488]. Thus media memory is de-monumentalized, just as Erasmus detected in putting together his *Adages*: "I could add things even during the printing, if anything came to hand which should not be left out" - mobile letters, as quoted by Sawday in Sawday / Rhodes (eds.) 2000: xxx

- sum of objects in Legrady's installation organized through a self-organizing map algorithm" (from medialab Helsinki: Kohonen algorithm); the sorting of items is no longer subject to verbal indexing, to keywords provided by the user-archivist ssince the objects scanned are organized by the sorting algorithm "according to descriptions provided by the object contributors." The SOM simulates associative memory. Kohonen Self-organizing map (SOM) algorithm from neural net studies offers a wider range of genuine mediatic options: "to explore organizational methods based on properties such as material, age, etc.

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487 Aleida Assmann, Das Archiv und die neuen Medien des kulturellen Gedächtnisses, in: Georg Stanitzek / Wilhelm Voßkamp (ed.), Schnittstelle: Medien und kulturelle Kommunikation, Cologne (DuMont) 2001, 268-281 (280)
488 Mark U. Edwards, Jr., Printing, Propaganda, and Martin Luther, Berkeley / Los Angeles / London (University of California Press) 1994, 163; Neil Rhodes / Jonathan Sawday (eds.), The Renaissance computer: knowledge technology in the first age of print, London / New York (Routledge) 2000, 12

and associative meanings such as cultural and personal value by which to map put the relative position between things in a collection" <handout>; cp. Vannevar Bush's design of a *Memex*

- an active media archaeology, George Legrady's installation *A pocket full of memories*, dis-covering the hidden archive behind the apparent collection: "Data structures by which digitized information come to us are normally hidden from view but my postion is that the design of these structures is the key site of aesthetic practice where the author´s (or a culture´s) point of view <...> are encoded and expressed" <handout> - literally encoded, that is: programmed. His installation show (unwillingly?), that behind every "story" there is a naked technological structure, an archival skeleton, actually hidden from the discursive user interface.

- HTML as a protocoll more than just texts. Nelson comments of Vannevar Bush's 1945 design of an associtative, micro-film based memory machine, the famous *Memory Extender (MEMEX)*: "Bush rejected indexing and discussed instead new forms of interwoven documents."[489]

Computer games and narrative

- new media "literacy" about bits which the *turingmachine* reads and (re-)writes

- Jesper Juul, Games telling Stories? in: Games Studies (2001), 7: games not narrative, but configurative; cp. TM "m-configurations" = Turing 1936

- games double-rendered, on the time-axis (play) and on the spatial axis (programming)

- computer games time-critical, with short-term moves and short-term neurological memory. The message of the medium computer games is not stories, but: cybernetics. Man experiences himself as a cybernetical model when interacting with digital media. In computer games a new concept of time is introduced

- aesthetics of CD-ROM: Programmer not interested in story; jump addresses (to Hot Spots). Designing a Computer Game = 95 % adminsitration (links); 5 % authorship; algorithm replaces story-board

- un/balance between storytelling (plot) and interactivity

- when players enters the scene in *Myst*:, no narrative guide; "story" unfolds only in experimentation; Aaseth, "ergodic" literature

- narrative structures in computer games a function of accelerating hardware, software, graphical resolution, memory capacities

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489 Theodor H. Nelson, „As We Will Think", in: James M. Nyce / Paul Kahn (eds.), From Memex to Hypertext: Vannevar Bush and the Mind´s Machine, San Diego / London (Academic Press) 1991, 259 (245 u. 253)

From the archive to the anarchival impulse and back again

- media-politically naive to confuse the phenomenological appeal of the *dynarchive* with its underlying techno-mathematical infra- and substructures (algorithms, DRAM) which are more strictly 'archival' than ever in their media-archaeological realities

- current hypertextual World Wide Web with its underlying techno-mathematical substructures of algorithms embedded in the storage-programmable computer and its literally *dynamic* Random Access Memory (DRAM) more strictly "archival" than ever in its media-archaeological realities

- interrupting the "anarchival" discourse; inbetween the archival and the anarchival, the dynarchive has has emerged. Digital data need constant up-dating (in terms of software) and "migration" (in terms of hardware to embody them); a change from the ideal of archival eternity to permanent change. Both the archive in its media base and the archive as discourse have literally got in motion, as is indicated by terms like the "processual" archive; Eivind Røssaak (ed.), The Archive in Motion. New Conceptions of the Archive in Contemporary Thought and New Media Practices, Oslo (Novus) 2010. By definition, the "storage-programmable" von-Neumann-architecture of current digital computers interlaces real-time processing and intermediary storage of data. Micro-archiving the present has become the signature of digital culture in times of online communication media.

- traditionally enduring time base of the archive itself replaced by restless reconfiguration

- archival endurance (oscillating between symbolically coded and materially entropical time) undermined when a record is not fixed any more on a permanent material storage medium like parchment but takes places electronically; flow (the current) replaces the static inscription

- Foucault's *Archéologie du Savoir* (1969); his definition of *l'archive* as the laws of what can be expressed and administrated at all.[490] "The archive is first the law of what can be said, the system that governs the appearance of statements as unique events."[491] Foucault's term archaeology explicitly “does not imply the search for a beginning; it does not relate analysis to a geological excavation" = Michel Foucault 1972 / 2002: 148

- "It is also possible, however, to understand technological a prioris in a technological sense."[492] Media archaeology understands the archive and the

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490 Michel Foucault, Archaeology of Knowledge, transl. A. M. Sheridan Smith, New York (Random House) 1972, 128 ff.

491 Michel Foucault, The Archaeology of Knowledge, transl. A. M. Sheridan Smith [1972], London / New York (Routledge Classics) 2002, 145

492 Friedrich A. Kittler, Gramophone - Film - Typewriter (transl. Geoffrey Winthrop-Young / Michael Wutz, Stanford, Cal. (Stanford UP) 1999: 117

"archival drive" (Mackenzie) in its Kantean and Foucauldean sense: as the *a priori* of the techno-logical event, the condition of possibility for electronic signals and data to circulate and be retrieved at all, "generated by the referencing and storage structures of the networks themselves"[493] = the *generative* archive. Instead of the traditional idea that there are objects taken out of current circulation to be preserved in an electronic archive, there are truly virtual, i. e.: algorithmically generated "records"

The transient archive: From permanent memory to intermediary storage

- "past" what has been irreveresibly recorded for (and into) storage, while the present is Markov-process uncertainty about future states - an anarchival condition

- cultural parameters like "historical tradition" or "cultural heritage" under attack, to be replaced by immeditate archiving of the present in real-time on the one hand, and re-presencing the archive at an instant, as practiced in Web platforms like Facebook and necessitated by photography services like Instagram.[494] Presence is shifted to an always already archived present; tangible reality is digitally absorbed immediately.

- generalizing term "memory" more sharply replaced by "storage" when it comes to address time-shifted signals and data. German "Speicher" (store) derives from Latin *speculum* which is the granary in its material presence. This "memory" consists of a rather stochastic distribution of its single atomic elements, as opposed to the symbolic order of e. g. alphabet words in a textual record. Granularity has been discovered in recent Digital Signal Processing to emulate the physicality of e. g. musical instruments (instead of their just functional simulation)

- museum, library and archive fulfilling the function of storage of cultural memory "capital" so far; but digital storage media are rather governed by dynamic Random Access Memory, based on repetitive refresh cycles; appears anachival, but the opposite is the memory-administrative truth. Each memory cell is being addressed by the most precise coordinates of numerical codes

- "When engineers refer to a computer´s `memory´ they really don´t mean an emphatic memory but refer to "recording electric signals which when needed for further manipulations can be layed back again. [...] `memory´ is a misleading metaphor for recording devices" = Heinz von Förster, Thoughts and Notes on Cognition, in: Paul L. Garvin (ed.), Cognition: A Multiple View, New York / Washington (Spartan Books) 1970, 25-48 (29 f.)

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493 Adrian Mackenzie, The Mortality of the Virtual. Real-time, Archive and Dead-time in Information Network, in: Convergence vol. 3, no. 2 (1997), 59-71 (61)

494 See Instant-Glück mit Instagram. Die Rückkehr der Aura in der Handy-Fotografie, in: Neue Bücher Zeitung, June 10, 2013: www.nzz.ch/aktuell/feuilleton/uebersicht/instant-glueck-mit-instagram-1.18096066 (accessed May 15, 2014)

- cultural value shifting from its material embodiment in objects like printed texts, paintings or architecture towards a dynamics which itself is a function of algorithmically processed, storage-programmable computing

- recycling replacing teleological finality; traditional line of production - accumulation - consumption - devaluation - waste or rubbish is condensed into closed circuits; catalogue „Ex und hopp. Das Prinzip Wegwerf. Eine Bilanz mit Verlusten“ on the principle of throw-away, ed. Ot Hoffmann (for Deutscher Werkbund) 1989; Michael Thompson, Rubbish Theory. The creation and destruction of value, Oxford UP 1979

- inner life of computing and communication engineering itself: a delicate system of "sampling" audio-visual signals in high frequencies and its mathematical processing which consists of ultra-short moments of intermediary storage (the "registers" in the Central Processing Unit, a term borrowed from archival science) and volatile short-time storage chips for intermediary calculation, facilitating compression algorithms for massive data transfer in digital tele-communication

- oscillating between short-time memory and instant erasure, archival value in its web-based existence not linked to archival institutions any more but literally *online* coupled to permanent feedback in present negotiation. In this process, "*negative feedback* influences the sender to correct or change the message because of observed undesired effects

- communicative homeostasis, the maintenance of a steady state" - different from *positive feedback* which reinforces existing structures[495]

- inbetween the imaginary of cultural time ("history" as a function historiographical narrative) and the real (the "event"): the symbolic regime with its archive-texture and tectonics

- algorithmic record processing down to its atomic bits (instead of simple file "management") disrupting alliance that the traditional paper-based governmental archives have maintainted with historicism since eighteenth century. "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."[496]

- algorithms providubg memory with a new kind of "combinatory power" = Kittler 1996: 74; not static but dynamic. Many virtual collections enables the user to work within the digital metaphor of the archive; the institutional freezing of archival classification is counter-balanced by flexible and direct access to data storage, thereby allowing to sort data objects into different groups. Such software offers the user an active role, closer to the *generative* than the preserving archive

Memory / Information / Entropy

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495 See Winfried Nöth, Handbook of Semiotics, Stuttgart 1990, 178
496 Kittler 1996: 75

- traditional state archive a function of well-regulated rules of transformation passing records from administration into permanent residence according to provenance; symbolic order; radically differs from the ratio in communication engineering where information is measured as entropy value, derived from stochastic transition probabilities which have been statistically pre-calculated; concept of entropy as the second law of thermodynamics has found its way into data transmission; here, informational entropy as the degree of uncertainty of a given string of discrete signals

- once analog material digitized, tension between storage and dissemination at the base of such an archive resolved by the option of immediate online-accessability of data files

- according to Jurij M. Lotman and B. A. Uspenskij[497], culture defined by its capacities to transform the inclination towards oblivion into memory; growing predominance of intermediary storage contributes to a radical transformation of the cultural economy. The ideal of accumulation is part of the humanist legacy: To renaissance readers, the letter of the text was latent energy waiting to be activated by the act of reading as interpretation. "Libraries are capital which contribute countless interest silently", Goethe expressed after visiting the university library at Göttingen 1878. This language is being replaced by - alluding the *new historicist* vocabulary - circulation, by recycling „mnemonic energies“ (Aby Warburg); electronic *media* inducing the illusion of an im-mediate "online" access to memory from the past

- economy minimizing the temporal lenght of storage (which then is „dead capital“); the electronic (and algorithmically predictive) supply systems of warehouse companies virtually program storage time to zero by a supply-demand-relationship aiming at real-time. Electronic random access to the stores turn memory into the omnipresence of commodities

- electronic age arriving at erasing the opposition between monumental inscription and discursive flow. Precision and fast variability are next to each other; digital codes are able to register and to undo those registers in virtual real-time.[498] The analysis of the radical restructuring of our relationship with the past has to be as fast as its object; in order to achieve that, negotiation with what is perceived as past has to be freed from the supremacie of historical discourse which has controlled such negotiation for the last two hundred years. What is needed under pos-modern conditions is free accessability of storage spaces (J.-F. Lyotard)

- computer interested in algorithms to master data, re-calling what is known in writing as quotes; stable relation between sign and reference undone in favor of juxtaposing symbols - which has been the spatial principle of museums,

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497 Jurij M. Lotman und B. A. Uspenskij, "Zum semiotischen Mechanismus der Kultur", in: *Semiotica Sovietica* 2, ed. K. Eimermacher, Aachen 1986, 853–880: 859

498 See Aleida Assmann, Fest und flüssig: Anmerkungen zu einer Denkfigur, in: same author / Harth (eds.), Kultur, 181–198, note 18

archives and libraries already. Against the euphoria of hypertextual navigation through data landscapes and the liberation of the text from its restrictions in the print era, against the impression of the seeming arbitrariness and endless shifting of signifiers, attention to the kind of barriers which arrest such flow in a non-arbitrary way, such as pass words. Engineering of memory involves hierarchical modularisation; each modul strives at hiding as much information about its own processing as possible - *information hiding*[499]

- digitalisation of images and sound recordings decoupling signals from their denotative reference in real archives; *memory* transformed cybernetically into synchronic information networks. This decontextualisation has been put forward by analogue techniques of reproduction (xerox copy f. e.) already

- hypertextual expansion replacing storage; the placement of items is being defined by its relations, formally to be described in terms of arrays, trees and grids. The ordering of coded elements, its distribution in structures or at random become a function of memory capacities. Demography makes this challenge transparent: We have arrived at an epoque where space represents itself in terms of storage relations.[500]

- Internet transforming the notion of the archive into a metaphor for *data retrieval*: "The Internet has had plenty of time to evolve. <...> It was soon realised that each site providing its own anonymous *ftp* area with its won material would make it difficult to find and catalogue the information available. The answer to this problem was to provide archives; machines dedicated to the task of serving files via anonymous *ftp*. These archives collect together material from other anonymous *ftp* areas scattered through the Intenret and present it in a single location

- (magnetic) *Core war*: computer program viruses search for memory to be destroyed. *Office 95* by *Microsoft* manages to deal with mixed documents (schedules and texts, dealt with in the mixed genres of Word processing and calculation by Excel. Word though fills the empty spaces, being kept for schedules, with *lieu*-tenants - usually empty spaces of zero numbers. *Office 95* though fills those voids with data from effaced files - memory of electronic waste; rubbish data may become visible when edited with special programs; sent as a-mail attachments through the internet they can be deciphered in public[501]

- to resist filling these gaps, something like „empty signifiers“ required; how the represent a void without turning it immediately, and by the very process of signification, into a presentation, i. e. a mark of presence? Mathematically, the cipher (which means literally) *zero* is to fulfill this function; on my keyboard, it is the key for *blanc* which performs this (which, in digital terms, is nothing but a – positive – bit as well, indifferent to other ciphers or letters or ASCII signs); way

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499 Entry "Software-Engineering", in: *Schüler Duden: Die Informatik*, ed. Meyers Lexikonredaktion, scientific editing by Volker Claus and Andreas Schwill, 2nd edition Mannheim et al. (Dudenverlag) 1991, 473

500 Foucault ibid., 36 f.

501 „Nach uns der Müll“, in: *Die Zeit* of 20th October 1995

out is to quit the semiotic realm, not talking about signs any more, but reconsidering signs as signals, i. e. as very physical impulses – the very flow and energy of internet (as) information

- state of affairs described as Markov process: a specific stochastic probability which, for the calculation of future developments of continual time(*t*)-dependend accidental values, requires just the knowledge of the present state

- no more creating monuments for future memories but providing documents for case studies in *real time* analysis[502]

- feedback control of linear & nonlinear systems[503]; evolution as algorithmic or stochastic process; example of population modells of the Verhulst-dynamics can be demonstrating that a non-linear relation $f(x_n)$ with square maximum can lead to leaps and even to chaotic behaviour - deterministic chaos; application of the feedback algorithm[504], reminding of Mendel´s nineteenth century re-crossing of plants in search of genetic laws, proving the discreteness of genes and their free combination

(Neg-)Entropy and dis/order in times of binary information processing

- redefining *archival value* in terms of information theory, towards an entropic definition of the informational anarchive. Entropy as statistical parameter which measures how much information is produced on the average for each letter of a text can be extended to every object which is symbolically coded in alphanumeric strings - *vulgo* "digital communication". Whereas statistics is still an "archival" (list-based) approach, stochastics (deciphered as Markov chains) shifts the past / present correlation towards predictive analytics

- economic concept of "chaotic store administration" corresponding with "hashing" approach[505]

- dis-covering the informational value from *within* the objects stored in an archive or museum, such as the histograms in digital image processing, calculating the aesthetic entropy of an image; therefore re-define archival value" in terms of information theory

- current fascination with the "anarchival" as discursive or artistic category corresponding with a functional criterium of techno-mathematical communication theory: the signal-to-noise ratio. Twentieth century communication engineering has resulted in a positive connotation of what culturally had been rejected for centuries: noise. In addition, disorder (from the point of view of second order cybernetics) has become a situation not to be afraid of any more.

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502 Foucault op. cit., 246f

503 Book title by D. Hinrichsen and A. Isidori, Berlin (Springer) 1982

504 Seifritz, op. cit., 41

505 See Vief 143, note 11

- mathematical statistics and stochastics developed in the nineteenth century to cope with death rates in live assurance policies (on the level of social administration) and with the laws of thermodynamics in energy management. According to the Second Law of Thermodynamics each system tends, when mapped upon the temporal axis, to increasing dis-order. Ludwig Boltzmann's calculus of entropy (the tendency from order to disorder as a physical manifestation of the arrow of time) has been used as a model for measuring the degree of probabilities in digital information theory.

- Marshall McLuhan, The Gutenberg Galaxy. The Making of Typographic Man, Toronto UP 1962; digital culture defined as a secondary *Gutenberg galaxy* (). There have been two "digital" cultures so far: the *Gutenberg galaxy* dominated by the alphabetic text and printed records, followed by an inbetween "analogue" media culture of signal recording and transmission (phonograph, radio / television). Nowadays we live in a secondary Gutenberg galaxy of alphanumeric digitality (discrete symbols); the binary code, different from the printed book, makes symbol manipulation possible by mathematical intelligence

- in terms of mathematical communication theory, archival value losing its apparent semantic meaning in favour of statistical probabilities. Indeed: "The concept of information applies not to the individual messages (as the concept of meaning would), but rather to the situation as a whole, <...> indicating that <...> one has an amount of freedom of choice, in selecting a message"[506]

- information source in this model „selects a desired *message* out of a set of possible messages"[507] - a virtual archive, with the notion of the archive itself turned upside down. Archives are indeed not simply storage as time channel but primarily defined by their records filtering function which is a quality automated search engines mostly lack

- techno-mathematical diagram applied to pre-technical agencies of cultural transmission as well: „The selected message may consist of written or spoken words, or of pictures, music, etc."[508]

- concept of information referring not to the individual meaningful message but rather to the situation as a whole, indicating that "one has an amount of freedom of choice, in selecting a message"[509] - order wrenched from disorder.[510]

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506 Warren Weaver, Some recent contributions to the Mathematical Theory of Communication (*1949), in: Claude E. Shannon / ders., The Mathematical Theory of Communication, Urbana / Chicago (University of Illinois Press) 1963, 1-28 (9)

507 Weaver: 7

508 Weaver: 7

509 Warren Weaver, Some recent contributions to the Mathematical Theory of Communication (*1949), in: Claude E. Shannon / same author, The Mathematical Theory of Communication, Urbana / Chicago (University of Illinois Press) 1963, 1-28 (9)

510 See Heinz von Foerster / Margaret Mead / Hans Lukas Teuber (eds.), Cybernetics. Circular causal and feedback mechanisms in biological and social systems. Transactions of the Ninth Conference March 20-21, 1952, New York, N.

- with concept of entropy, classical thermodynamics once expressed the universal trend toward more probable states; archival value creation such as algorithmic data mining as negative entropy

- statistics still an "archival" (list-based) approach, stochastics (deciphered as Markov chains) shifting the past / present correlation to the present / future by predictive analytics

Inbetween storage and transfer

- cyberspace not "space" in the Kantean *a priori* sense, but a topo-logical configuration; no *lieux de memoire*, rather: data servers and addresses. In the Internet, the address structure of communication and the adress structure of archival holdings merge into one. Storage becomes functional; „only what has been stored can be located“ - and *vice versa* = 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)

- supremacy of selection over storage, addressability over sorting; no memory in the culturally emphatic sense; the archive transforming into a literally "metaphorical" *transfer* process; oxymoronic "transfer protocol" becoming itself *l'archive* (Foucault)

For an informational aesthetics of cultural value: (Neg-)Entropy in times of a secondary *Gutenberg galaxy*

- material (archaeological) relics from the cultural past subject to physical erasure and entropy; symbolically encoded information - the cultural technique of preserving musical information despite the ephemerality of acoustic articulation - can be almost time-invariantly transmitted to posterity

- cultural "heritage" subject to entropic temporality as such; by classifying the objects and sorting them into groups (increasing information by selecting a message) that physical time transformed into a symbolic "historical" (which is no real time) order

- media-archaeologically dis-covering the informational value from *within* the objects stored in a digital archive / library or digitized museum objects

- two "digital" cultures so far: the *Gutenberg galaxy* dominated by the alphabetic text and printed records, followed by an inbetween "analogue" media culture of signal recording and transmission (phonograph, radio / television); nowadays a secondary *Gutenberg galaxy* (McLuhan 1962) of alphanumeric digitality (discrete symbols); the binary code though (computing), different from the printed book, makes symbol manipulation possible by mathematical intelligence

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Y., New York (Macy) 1953, ”A note by the editors”, xiii

- entropy in discrete signal transmission a statistical parameter which measures how much information is produced on the average for each letter of a text[511]; this definition can be widened to every object which is symbolically coded in alphanumeric strings - *vulgo* "digital culture"; cp. telegraph code

- re-phrasing a notion like "cultural value" in terms of the mathematical communication theory developed in World War II engineering; "value" thereby loosing its apparent semantic reference in favour of statistical probabilities

- information (in terms of communication engineering) a relative measure of improbabilities. "It is misleading <...> to say that one or the other message conveys unit information. The concept of information applies not to the individual messages (as the concept of meaning would), but rather to the situation as a whole, <...> indicating that <...> one has an amount of freedom of choice, in selecting a message"[512]; data mining and information value hereby interact; cultural agencies like the museum meant to take out cultural commodities (like art works) from the economic circulation of the present in order to increase the probability that is might in future contexts provide for unexpected newness, i. e.: "information" in Claude Shannon's sense. So let us concentrate on cultural value in its engineering aspects.

- mathematical theory of communication applicable to pre-technological agencies of cultural transmission (cultural techniques) as well:„The selected message may consist of written or spoken words, or of pictures, music, etc." = Weaver 1949/1963: 7

511 C. E. Shannon, Prediction and Entropy of Printed English [*1950], in: xxx, 50- (50)
512 Warren Weaver, Some recent contributions to the Mathematical Theory of Communication, in: Claude E. Shannon / same author, The Mathematical Theory of Communication, Urbana / Chicago (University of Illinois Press) 1963 [*1949], 1-28 (9)