

[Wolfgang Ernst: NOTES ON TECHNICAL MEDIA]

NOTEBOOK "TECHNICAL ARCHIVES, SO-CALLED 'MEMORY', AND STORAGE"

[unedited cursory notes, theses, excerpts, grouped into thematic blocks]

Single chapters:

- NOTES ON ARCHIVES AND *L'ARCHIVE*
- NOTES ON "MEMORY" AND / OR STORAGE
- NOTES ON THE PHOTOGRAPHIC ARCHIVE
- NOTES ON SORTING IMAGES AS SIGNALS
- NOTES ON ARCHIVAL SOUND

Detailed chapter content:

NOTES ON ARCHIVES AND *L'ARCHIVE*

- Techno-Archival Tempor(e)alities
- From spatial archives to time-based platforms
- From location to addressability
- Between passive container and active mediator: the archive
- YouTube: An(-)archive?
- Algorithmically questioning / answering the archive
- Return of the archive
- Digital "memories" arising from the Internet
- Archival dancing, archival singing: How to deal with the transitional?
- Proposal: a double strategy
- What separates media arts archives from institutional ones?
- Special case: media art born digital
- The archival "field"
- Time-Based Archival Recording
- Re:load. Archive and cybernetics (economy of circulation)
- HyperCard
- Capitalizing audio-visual memory? The lack of media archives
- The alphanumeric
- Streaming media
- Mathematization of the archive
- Library, Archive, Médiathèque
- Motion and immobilization: the audiovisual archive
- Archive and motion
- The Internet "archive"
- Dynamic memories
- Archival resistance: the un-movable
- Archival tectonics
- "Excavating" the Media Archive from Within
- Archival emergency and the cold archaeological gaze: *Quick freeze*

- Towards the chrono-archive? Internet tempor(e)alities
- Non-narrative archival time layers
- The diagrammatical archive
- Towards "A mathematical theory of archival communication"
- Archives becoming time-critical
- From Space-Based to Time-Based archives
- Data extrapolation: The unfolding of time-critical processes into a temporal horizon
- Conflicting archival tempor(e)alities: Symbolic order vs. indexical signal
- Archives in / of motion
- DEAF 03 "Data Knitting"
- *Active Archives*
- Operative *kinematographia*
- Dance of the electrons / mathematics in motion
- Time to think the differential archive
- Archives of motion *versus* archives in motion
- Media archaeology: Technology as "archivist" of moving memory
- Re-enactment and the archive
- Concept for a *generative* archive
- From the archive to the anarchival impulse and back again
- Archival (neg-)entropy and dis/order in times of binary information processing

NOTES ON "MEMORY" AND / OR STORAGE

- Dehumanizing "memory"
- Storage / entropy
- Memory / storage
- For an informational aesthetics of cultural value: (Neg-)Entropy in times of a secondary *Gutenberg galaxy*
- Not to be confused: archive, memory, digital storage
- Channel time and time channel: Transmission replacing storage?
- Between storage and transfer
- New media, memory
- Latency, hysteresis
- Feedback memory and timeshifting
- Phonographic memory of Noise
- Archive, memory, storage
- Micro-media memories: storage devices
- Dynamics in the record
- Dynamic storage (delay lines)
- Transient memory: From permanent to intermediary storage
- "Negative" Storage
- Confusing media "library" with media "archive"
- Between storage, memory and archive
- The multiple embodiments of the archive

NOTES ON THE PHOTOGRAPHIC ARCHIVE

- Archives as non-narrative alternative to historiography

- Archival resistance against *streaming data*
- Photography in the archive: between the indexical and the representational
- "Cold memory"? Archival times and different tempor(e)alities of photography
- Timeless? Entropic *versus* digital photography
- Archival nostalgia? The analog photographic print
- Historicism and photography
- Dis/order in photographic archives
- The acceleration (temporalization) of the visual archive

NOTES ON SORTING IMAGES AS SIGNALS

- Sorting / Searching
- Automatized audio content identification tools
- Bit-Mapping
- Auto-associative pixels: Suchbilder in the active sense
- New "anarchival" options in re-remembering digital images
- Sorting photography: between image-based sorting of photography and logocentrism
- Temporalizing photographic: From space-based to time-based archives
- Flexible access to the chrono-archive
- Experimentation with the art historical archive: histogrammatology
- Visual im/mediacy: sorting images
- Similarity-based un/order: the pre-modern museum
- "Social" archives in Web 2.0?
- From semiotic analysis to cultural analytics of the moving image
- Dis/order in photographic archives
- The acceleration (temporalization) of the archive
- New memory options of image retrieval
- Visual im/mediacy: Towards a dynamic technology of photographic (and moving) image retrieval
- Image archives on the threshold of their digital approachability
- Visual archiving: Sorting and storing images
- Moving image retrieval
- Excavating the cinematographic archive by algorithmic im/mediacy: digitally counting (with) moving image retrieval
- Media-"Active Archives"
- Dis-ordering images
- Sorting sound and images: between signal-based similarity and symbol-based logocentrism (George Legrady)
- Concepts for a generative archive (KR, Legrady)

NOTES ON ARCHIVAL SOUND

- Material entropy of the signal *versus* symbolic (archival) endurance of sound recording
- Automatic music transcription (AMT)
- Algorithmicizing the Archive: "Data Radio" (Constant)
- Indexical recording: sound from the real world

- Media as active archaeologists: SpuBiTo
- Acoustic archaeology
- Active media archaeology: Sonic revelations (articulation) from the past (*Au Claire de Lune*)
- Sonic Media Archaeology

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NOTES ON ARCHIVES AND *L'ARCHIVE*

Techno-Archival Tempor(e)alities

- online-accessability of radio as "livestream", media "library" (French *mediathèque*) actually "spatializing" / geometrizing, or - more technomathematical - topologizing (Internet protocols) previous time-linear broadcasting in favour of nonlinear media-"archival" access
- "online" communication of records widening 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 downloading first and screening second dissolves into micro-buffering of single frames "on the fly" *alias* realtime
- with conversion of analogue magnetic tapes (radio, TV) to digital storage for preservation reasons, new options to hack into these digital memories arising; 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). There has always been a data circulation between the needs of an inquiring present and the archival documents; but only *online* this circulation becomes a *closed circuit* (with all its cybernetic consequences: interactivity 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-conditioning, 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 rather than permanent storage" = Frank Kessler / Mikro Tobias Schäfer, Navigating YouTube: Constituting a Hybrid Information Management System, in: Snickars / Vonderau (eds.) 2009: 275-292 (276); formerly "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; archives of movement, in the age of YouTube and UbuWeb, themselves get in motion; networked documents dissolve into memory-buffered *streaming data*

From spatial archives to time-based platforms

- Harold Innis developing his pre-"media theory" from research into the economical history of Canada such as fur trade; "Carthage paradigm"

from a privilege of transmission over storage, or rather: networking (naval trade routes in the case of Carthage), with "nodes" (ports) and *staples* which are intermediary storage; emphasis on transfer, not (imperial) storage; Innis later differentiating between space- and time-"biased" empires; Canada relating to the latter one, the US to the rather space-based Roman Empire, allowing for a direct a-historical short-circuit between Rome and ROM - the name for the imperial order within computing, the Read Only Memory chip

- residential memories such as archives 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" = 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)

From location to addressability

- *records* the documentary content of the archive for historiography, while the archive itself, though, is rather an address structure, a logistical function, closer to *logos* than to *physis*

- mis-considered as an "archive", Internet not yet even arrived at its own memory form; "cyberspace" rather a transversive performance of communication = Pierre Lévy, L' intelligence collective, : pour une anthropologie du cyberspace, Paris (Ed. De la Découverte) 1995; "cyberspace has no memory" = Christoph Drösser, Ein verhängnisvolles Erbe, in: Die Zeit, 23th June 1995, 66; only data 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" = 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); 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" = N. Katherine Hayles, *Coding the Signifier: Rethinking Processes of Signification in Digital Media*. Lecture at Humboldt-University Berlin, 11 May 2001; *networked storage model* turns electronic archives into a generative agency; traditional classificatory indexing (by meta-data) replaced by dynamic (though still rule-governed, protocol-governed) sorting; the archival not rooted 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 than 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; residual time delay of archival information shrinking to zero

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" = 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.) - as once expressed in the exhibition *Deep Storage* on artistic archive practices = exhibition catalogue Ingrid Schaffner / Matthias Winzen (eds.), *Deep Storage*, Munich (Prestel) 1998; while the traditional archival format which is spatial order and classification necessarily persisting, the new archive radically temporalized, ephemeral, multimodal, corresponding with a dynamic user culture which is less concerned with records for eternity but with order in fluctuation: different kind of archive 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

- painting as layered "accumulation" of temporary versions unlike sectors / overwritings of an image DVD; on DVD an addressable distribution of data blocks in sectors - archival in the precise sense of addressing; a painting composed from graphical strokes always analog, vs. alphanumerically coded pixels; layering of images, or a palimpsestuous superposition never archival but arbitrary, whereas archival ordering of records following a pre-structuring sequence of selective steps; symbolic order (Lacan), coded materially; the "algorithm" of memory, be it administrative or other

- unlike traditional encyclopedias like the Encyclopedia Britannica, interactive online encyclopedia Wikipedia updated in its knowledge almost by the minute; radical temporalization of knowledge space transforming 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, Search Engine Society, Cambridge (Polity press) 2010

- traditional record offices symbolic orderings of textual documents in archival *space* which is provided with a sense of symbolic time by external narratives only; electronic records such as video recordings "time objects" (Edmund Husserl) themselves, provided with their inherent temporality, their proper *Eigenzeit* as memory

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" = Pelle Snickars, The Archival Cloud, in: ders. / Vonderau (eds) 2009: 292-313 (304); digital media platforms like Facebook, Youtube or Wikipedia representing rather searchable data banks than archives in its proper sense; YouTube 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 rather the underlying structure of video database management

- 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" = Rick Prelinger, The Appearance of Archives, in: Pelle Snickars / Patrick Vonderau (Hg.), The YouTube Rader, Stockholm (National Library of Sweden) 2009, 268-274 (268); defining 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 replaced particular knowledge in information theory; pattern recognition replacing alphabetical identification towards open forms of subsymbolic signal-adapting knowledge

- with emergence of c19 statistics, mathematical culture allowing to deal with probabilities, that is: an-archival calculation of informational entropy in a way beyond the conservative desire of reducing it to order / "negentropy" again (Shannon vs. Wiener)

- 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"), longevity; mis-understanding: archive not primarily about total memory, but selection / oblivion ("right to forget"); "principles" = *arché* (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 programming)

- 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 (monumental rather than documentary); neg-entropic (against time-arrow of decay, in the symbolic code); archive strictly as Read-Only-Memory (ROM / irreversible), 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

Return of the archive

- signal-based, dynamic memory implicitly 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
- 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
- available "big data" storage devices providing new opportunities to "cache", annotate and post-productionally "edit" one's own life (Katrina Sluis); beyond passive accumulation of data, "algorithmic memory" allowing for new options folded into techno-mathematical records, examining the material and 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
- structural memory: not just individual data being stored in databases, but the structure of the database itself; relationships and correlations between the various data
- "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" = Kittler, Gramophone 1999, Preface, xxxix f.

Digital "memories" arising from the Internet

- storage of data flows once confined to books and later to records and films disappearing into black holes and boxes that [...] 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" = Kittler 1999, xxx

- an implicit "archive" arising from the storage of data in video surveillance and other security equipment: already "living" in the world's online archive, or, more to the point: living in the world-as-archive, coupled instantaneously to constellations of databases

- archives no longer just containing cultural 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" = xxx

- 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

- no "deep" memory / history, but "flat" temporality / "thick presence" (Gumbrecht), immediate feedback / feed forward to / with new "states"

- archive as virtual regeneration of presence; database logic becoming decisive (Manovich)

- from within the framework of digitalization a redefined concept of the archive arising, "moving away from its traditionally static nature to embrace an inherently generative form, where traditional methods of archiving and classification are fundamentally transformed by the mathematical and microtemporal character of digital processes" = "Abstract" by translator Murilo Gonçalves to W. E., "A caminho do sistema binário. ARQUIVOS CLÁSSICOS E MEMÓRIA DIGITAL", in: revista de teoria da história 27|1 2024, 134-147 (135); original text in English in: Netpioneers 1.0: Contextualizing Early Net-Based Art, Berlin (Sternberg Press) 2009

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 (moving) 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

- 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" memory to describe the logic of internet memory; leaving 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 (such as video recording) and the media art monuments themselves (an artistic video tape); difference articulated by Foucault's *Archaeology of Knowledge* (monument / document); experimenting different forms of the archive, the dynamic archive / archival fields, the generic archive: generated *on demand* by (online) users

What separates media arts archives from institutional ones?

- Igor Stromajer, pioneer of "erroneous" net art, with May 2011 action *Expunction* ["aus dem Register löschen"] erasing his works from his server (while still keeping documentation / "de-digitalization" / records of single works on external storage media); see netzkunst.org resp. netartdatabase.org

- 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 principle 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, losing 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 processing, 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)

- 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 archiving 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)

- signal-storing "analogue" media (grammophone, cinematography, magnetic tape for music and video); now re-entry of the "discrete" memory, the alphabet, the coded symbols, but this time alpha-numerically: not simple speech-orientated, but as well mathematical, and only operative hwn implemented 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: requiring physical preservation (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)

The archival "field"

- 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, 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

Time-Based Archival Recording

- 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
- video image recording overlapping both processes, the temporal and the spatial; ferrit core magnetic memory medium, in digital storage, finally allowing for nonlinear access to every single stored bit by addressing well-located storage cells = Völz 1965: 654
- no elementary archival "unit" in video archives like the photographic "still" frame, rather processual, consisting of time (Viola, "Sound of One-Line Scanning"), close to sound ephemeral recording than than to archival time-discrete exposure
- difference between archival digitizing the (analog) video tape and "born digital" images
- media-archaeological grounding / technical clarification (instead of aesthetic metaphors): RAM principle vs. "archival" ROM, in a technical sense: storage vs. remembrance (Hegel)
- time-continuous signal-based electronic media memory can only be "re-presented" (rather than: represented, in semiotic terms) processually (the unfolding of sound as music); memory otherwise remains "in latency"; the analogue carrier medium itself (video tape, musical record) has to get in motion (electro-magnetic inductance); different from time-

discrete, clocked / intermittent replay: the moving image (transport of film reel), digital machinery; alternative option: solid state memory

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-time, "up-datable" 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 function of shift from mechanic, strictly ordered, classificatory "library" order towards electronic, dynamic, ephemeral technological physiognomies. Intractive, electronic fields, under the label of "cyberspace", converge with the human nervous system - intellectual legacy of Norbert Wiener's *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, becoming 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.

HyperCard

- computer interested in algorithms to master data, re-calling what is known in writing as textual quotes; stable relation between sign and reference undone in favor of juxtaposing symbols - which has been the spatial principle of museums, 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* = 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

- HyperCard a "variety of applications as hypertext (permitting the easy access of other texts from a central text or 'script') or hypermedia (allowing the integration of visual - graphics, texts, images, and video - and audio data) [...]. Its ability to work on a nonlinear representational mode [...] permits, through association, the free connection of ideas, words, and images" = Terri Frongia / Alida Allison, "We're on the Eve of 2000": Writers and Critics speak out on Cyberpunk, HyperCard, and the (new?) Nature of Narrative", in: George Slusser / Tom Shippey (eds), Fiction 2000: Cyberpunk & the future of narrative, Athens, Georgia (University of Georgia Press) 1992, 279 f.; random referentiality: not library classification but archaeological clusters, academically controlled only by inter-subjective probability, stands against "the controlled linearity of traditional literature" = *ibid.*, 281

- Vanevar Bush, As We May Think, in: Atlantic Monthly (1945); „can no longer be reduced to some linear statement" = Hypertext. The convergence of contemporary critical theory & technology, Baltimore 1992

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 address to address, 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

- Albert Speer on telecommunicative command (infra-)structure during Third Reich: "The telephone, the teleprinter and the wireless made it possible for orders from the highest levels to be given direct to the lowest levels, where, on account of their absolute authority behind them, they were carried out uncritically [...]. To the outside observer this governmental apparatus may have resembled the apparently chaotic confusion of lines at a telephone exchange, but like the latter it could be controlled and operated from one central source" = Albert Speer at the Nürnberg War Criminal tribunal, as quoted by Marshall McLuhan, *The age of outwit*, in: *Location*, Heft 1/1963, 41-44 (42), nach: Hjalmar Schacht, *Account Settled*, London 1949

Mathematization of the archive

- archive in the strict sense returning, even more rigorously 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 archival 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-)numerically.

- electronic storage media in the age of the analogue signal recording 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); switch to non-linearly addressable storage media (the hard disc) lets 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")

Library, Archive, Médiathèque

- "classified" archival non-accessability; "de-classified" stamp

- Michel de Certeau linking the computational storage of electronic data to the library: "information science, between "input" and "output", organizes arrangements of symbols in reserved sites within a memory and transfers them to agreed-upon 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 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" = Brewster Kahle, *Preserving the Internet*, in: *Scientific American*, vol. 276, no 3 / March 1997, 82 f. (82)

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

- 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 optically "real" physical signal as opposed to symbolic 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 frozen (immotion, becoming archive)

- Albert Lord on the recording of Yugoslav *guslari* songs by philologist Milman Parry in his effort to reconstruct the fabric of Homeric epic by analogy: unintentionally, technical recording creating a "fixed" text. "Proteus war fotografiert worden [und] an dieser Aufnahme wurde hinfort jede Veränderung gemessen - sie wurde zum 'Original'" = Albert B. Lord, *Der Sänger erzählt. Wie ein Epos entsteht*, München (Hanser) 1965, 185 [AO: *The Singer of Tales*]

- still: "affective release from the machine" (Ananya Kabir), once a *guslar* voice emanates from the wire spool of a Webster Wire Recorder

- 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" = Boston (Harvard University Press) 1960, xiii

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" = 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>

- "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 structurally 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 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-critical 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" = Vannevar Bush, *As we may think*, in: *Atlantic Monthly* vol. 176 (1945), 101-108, quoted after the reprint in: A. J. Meadows (ed.), *The origins of Information Science*, London (Taylor Graham) 1987, 254-261 (256); beyond the Gutenberg era of imprinted letters, information becoming 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 length 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" = George Spencer Brown, *Laws of Form*, xxx, 65

- Vannevar Bush's vision "As we may think", in *Atlantic Monthly* in July 1945, arguing for a memory and information retrieval system based media-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 some intricate web of trails carried by the cells of the brain. [...] trails that are not followed frequently 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 real time or immediate storage processing, on fast feedback; categorical difference between historic "archival" time and immediate online-time
- Internet "archive" becoming 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 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 through 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" = Eivind Røssaak, The National Library and the Digital Age. Paper delivered at the seminar, *Words, arr: Du store verden!* Oslo, 20th September, 2008
- 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 processual: 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; digital calculation, like all advanced mathematics, requiring inter-temporal data storage for inbetween computation states
- cloud modelling (developed for weather forecasting) anarchivic dynamics by fast calculation; instead of data derived from "archived" data statistics advanced methods such as multirate time integration,

time stepping and massive parallelization as condition for numerical computations such as spectral cloud microphysics); 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>

- 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 textual alphabet but signals
- resulting from question of how to archive performance: the performative archive; 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 intellectual or artistic phantasies of "the anarchival", the digital archive still rigorously rooted in its techno-mathematical structure
- media-archaeological examination of the "digital archive" as computational instantiation 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" today's rather refers to the binary code and its

organization 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 explicitly expressed in Jacques Derrida's *Archive Fever* = Chicago (University of Chicago Press) 1998, technology changes the structure of the contemporary archive; Derrida failing to address this technical change precisely; can be techno-mathematically named: operating systems, algorithms and source code, in combination with *specific hardware architecture*, constitutes 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)

"Excavating" the Media Archive from Within

- 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 becoming calculable and capable of being subjected to pattern-recognition algorithms; such procedures not only media-archaeologically "excavating" but as well *generating* 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)

- notion of "excavating the archive" in terms of media-archaeology not meant to be a metaphor; for Michel Foucault, the term archaeology explicitly "does not relate analysis to a geological excavation" = Foucault 1972: 129; digitally "excavated" by the computer a genuinely code-mediated gaze on a well-defined number of information patterns which human perception calls "sound" or "images"

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

- "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 *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 (*Schockfrost*) - a preservation order, an administrative *Speicheranordnung* to prevent the almost immediate erasure of telecommunication 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; on "frozen" electromagnetic signals: Christian Koristka, *Magnettonaufzeichnungen und kriminalistische Praxis*, Berlin (Ost) (Ministerium des Innern, Publikationabteilung) 1968

- 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" = http://en.wikipedia.org/wiki/Real-time_web; accessed 20th January, 2010

- 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*" = Geert Lovink, *Was uns wirklich krank macht*, in: *Frankfurter Allgemeine Zeitung Nr. 140, 21st June, 2010, 27*; Internet 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:

- 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" = http://en.wikipedia.org/wiki/Real-time_computing; accessed 7th January, 2010

Non-narrative archival time layers

- storage as catechontic delay time of access; 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" = Tjebbe van Tijen, We no longer collect the Carrier but the Information, interviewed by Geert Lovink, in: MediaMatic 8#1 (translation: Jim Boekbinder), 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 paradigm, 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 1986: 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" = Michel Foucault, *Archaeology of Knowledge*, transl. A. M. Sheridan Smith [*1972], London / New York (Routledge Classics) 2002, "Introduction", 3-19 (7 f.); media archaeology counting with re-configurations and feedbacks 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 (either electro-mechanical or fully electronic) in a calculator for *transient* storage of digitally represented numbers = "[...] die vorübergehend eine Zahl speichern können": A. Huber, Programmgesteuerte elektronische Rechenmaschinen, in: Funk-Technik Nr. 24/1957, 828-830 (828) "Colossus had to 'remember' a bit for a split second until its neighbour arrived. For this task, it used a bank of capacitors which it charged up and discharged as needed" = Barry Fox / Jeremy Webb, Colossal Adventures, in: New Scientist Nr. 1081 vom 10. Mai 1997, 39-43 (41)

- 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 addressing stored data

The diagrammatical archive

- diagram "no longer an auditory or visual archive but a map [...] an abstract machine. It is defined by its informal functions and matter and in terms of form makes no distinction between content and expression, a discursive formation and non-discursive formation. It is a machine that is almost blind and mute, even though it makes others see and speak" = Gilles Deleuze, Foucault [1986], transl. by Seán Hand, Minneapolis (University of Minnesota Press) 1988, 34

- 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 addressing 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 an 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; if 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 (123 ff.); 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, nowadays known from the archival rescuing projects of digitizing endangered historic manuscripts

- 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 interference so bad that it is 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" = Claude E. Shannon, *The Mathematical Theory of Communication* [1948], in: ders. / Warren Weaver 1963: 29-125 (65); $E = f(S, N)$, to be supplied by the temporal axis as signal delay within the channel $E = f(S, N, \Delta-t)$

- time dimension within the signal already: "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." = 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.

- 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

- 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 particular point in time the entire message would be somewhere in the wire between speaker and listener" = 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) - 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-critical" not referring to crucial moments *within* the "time" domain, but rather in the constructivist sense of *timing* by discrimination / measuring / counting

- 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 in archives of moving images provided with a time code for non-linear access to single frames, memory itself becomes a function of its techno-mathematical encoding (and compression)

- new vanishing point of archival theory in its temporal disposition

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; July 1942 Norbert Wiener (with Bigelow) producing a (then secret) paper on *The Extrapolation, Interpolation and Smoothing of Stationary Time Series with Engineering Applications*; notion of "preemptive scheduling" 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" = David A. Mindell, *Between Humans and Machine. Feedback, Control, and Computing before Cybernetics*, Baltimore / London (Johns Hopkins University Press) 2004, 280

- 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-manoevres 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 take 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; the machine representing 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" = *ibid.* "Together, ballistic and prediction calculations formed a feedback loop" = *ibid.*; operators first entered an estimated time of flight for the shell 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" included in the cybernetic model = Name June Paik, Norbert Wiener und Marshall McLuhan, in: *idem*, xxx, 1992, 123-127 (125)

- 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. "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)

- 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-length 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" = 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)

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 unfolding inter-frame coherence, revealing relational qualities otherwise hidden
- 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
- chronophotography (Muybridge, Marey) sampling the dynamic element in movement, the kinetic; late 19th century scientific ambition to store and analyze temporal phenomena, culminating in phonography and cinematography; 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) based on a rotating, technically moving apparatus both in recording and in re-play
- once digitized and coupled to online accessibility, 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 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 separated 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" = Kittler, Gramophone 1999, Preface xxxix f.

- ecstasy 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 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 loses 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

- 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, colour 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 idiosyncratic assemblies. The *archival* quality of a record derives from its still functional relation to a (techno-)administrative system

- "Data Gallery" illustrating 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>

- not "looking" at image but discover different, non-iconic qualities behind / within the hex file / dump core representation

- 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

- 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

- new options arising for genuinely media-based archives: in chronophotographic, 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" = Marcel Stanislas Ducout (1940): *La danse sonore. Synthèse de la danse et de la musique*. Paris: Presses universitaires de France: 165 et seq.; coupling of a dancing human and electronics 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)

- (with)in time-based media, dynamic focus is on motion; instead of moving inbetween 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" = C. Carlson, documentarist at the Institute for Academic Film, Göttingen, 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; each film 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 Olympia 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 seem 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 (Dziga 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 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 Bergsonian *durée*: Hiroshi Sugimoto's cinema photographs 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" = Karl Ernst von Baer, *Schriften*. Stuttgart 1907, 141

- 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; Loïe Fuller had time-frame photographs made of her dances - 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

- 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 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

- 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 Maschinenwesens*, 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, 411-419 (411); electron tube used *within* computers as intermediary storage device is in fact a choreography of symbolically coded electrons. This algorithmic 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" = Siegfried Zielinski, Archäologie der Medien. Zur Tiefenzeit des technischen Hörens und Sehens, Reinbek b. Hamburg (Rowohlt) 2002; only one more step from the graphic methods of 19th century physiology to video dance. And in taking it we 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, discrete aesthetics of chronophotography, *fotodinamismo futurista* located the photographic compression of a movement, its "collective singular", on the frontier of frequency analysis and the aesthetics of the electromagnetic field; staged material, space and time as differential arrangement, as fundamentally ephemeral, 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 / rhythmicity 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
- 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.
- 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 *Physics*, defined by numerical measurement of movements; essential mathematicity of motion analysis is implicit
- cumulative memory one thing; adaptive (algorithmic / algorithmic) storage another = Heinz von Foerster, *Gedächtnis ohne Aufzeichnung*, in: same author, *Sicht und Einsicht*, xxx, 1985, 133- (135)
- 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" = Karl Küpfmüller, *Die Systemtheorie der elektrischen Nachrichtenübertragung*, Stuttgart (Hirzel) 1974, 393

- essence of digital data processing: storage becoming 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" = Howard Aiken, Proposed Automatic Calculating Machine (1938), as quoted in Coy 2007: 81

Media archaeology: Technology as "archivist" of moving memory

- (culture-)technical 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, 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", as 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

- in media memory culture, intermediary storage dynamics (the RAM) replacing spatial location

- restored Video Recordings 1927-1935; esp. ballett sequence, from Baird's *Phonovision* = <http://www.tvdawn.com/recordng.htm>

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*)

- 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 - equiprimordial (*gleichursprüngliches*) reenactment

- cinematographical motion study not reduced to the iconology of the single image but diagrammatically unfolds; any archive of temporal figures marked by such vectors

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 of 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" = Mark U. Edwards, Jr., *Printing, Propaganda, and Martin Luther*, Berkeley / Los Angeles / London (University of California Press) 1994, 163; media memory 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 in Neil Rhodes / Jonathan Sawday (eds.), *The Renaissance computer: knowledge technology in the first age of print*, London / New York (Routledge) 2000, 12

- 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 position 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; installation showing (unwillingly?), that behind every "story" there is a naked technological structure, an archival skeleton, actually hidden from the discursive user interface

- HTML as a protocol more than just texts. Nelson comments of Vannevar Bush's 1945 design of an associative, micro-film based memory machine, the famous *Memory Extender (MEMEX)*: "Bush rejected indexing and discussed instead new forms of interwoven documents" = 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 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; "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.

- Foucault's term *archéologie* explicitly "does not imply the search for a beginning; it does not relate analysis to a geological excavation" = Michel Foucault, *The Archaeology of Knowledge*, transl. A. M. Sheridan Smith [1972], London / New York (Routledge Classics) 2002, 148

- media archaeology understanding the archive and the "archival drive" (Mackenzie) in its Kantian and Foucauldian 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" = 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)- 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"

Archival (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 = Vief 143, note 11

- 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.

- 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 disorder. 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* (); 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 of alphanumeric digitality (discrete symbols); the binary code, different from the printed book, making symbol manipulation possible by mathematical intelligence

- in terms of mathematical communication theory, archival value losing its apparent semantic meaning in favour of statistical probabilities

- information source in this model „selects a desired *message* out of a set of possible messages", be it "written or spoken words, or of pictures, music, etc." = Weaver: 7; 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, a quality automated search engines mostly lack

- order wrenched from disorder = 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. Y., New York (Macy) 1953, "A note by the editors"*, xiii

- 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

NOTES ON "MEMORY" AND / OR STORAGE

Dehumanizing "memory"

- text-based "archival" resp. "coded" / genetic heritage vs. non-hereditary memory (Lotman); traumatic heritage not inherited but transmitted

- memories of crimes against humanity intertwined with de/humanizing aspect of technical storage operation; recording rather than simply instrumental ("mediated") transmission; technical media and traumatic

experience co-existent

- railway tracks / sounds (Steve Reich, Different Trains): infra-structural / inherent memory
- subsymbolical / affective vs. semiotic memory
- passive heritage vs. active transmission

Storage / entropy

- linear (tape / scrolling) vs. nonlinear access time (time-critical) = Horst Völz, Versuch einer systematischen und perspektivischen Analyse der Speicherung von Informationen, in: Die Technik 20 (1965) 10, 650-659 (655); energy-consuming: thus re-entry of thermodynamically increased entropy, vs. archival ideal of irreversible recording / Landauer principle

Memory / storage

- memory "storing information in the system for different periods of time, and retrieves it" = J. Miller 1978: 3. "It does for information what the matter-energy storage subsystem does with matter and/or energy" = International Encyclopedia of Systems and Cybernetics, ed. by Charles François, Munich (Saur) 1997

- "often used analogy of computers memory with memory as a function of the brain is very misleading, as strongly emphasized by H. von Foerster in many of his papers (1981)" = International Encyclopedia of Systems and Cybernetics, ed. by Charles François, Munich (Saur) 1997

- batteries / capacitors: energy vs. information storage

- culture defined by its capacities to transform the inclination towards oblivion into memory = Jurij M. Lotman und B. A. Uspenskij, "Zum semiotischen Mechanismus der Kultur", in: *Semiotica Sovietica* 2, ed. K. Eimermacher, Aachen 1986, 853-880: 859; growing predominance of intermediary storage contributing to a radical transformation of the cultural economy; ideal of accumulation 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 length 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 able to register and to undo those registers in virtual real-time; analysis of the radical restructuring 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 supremacy of historical discourse which has controlled such negotiation for the last two hundred years. What is needed under post-modern conditions is free accessibility of storage spaces (J.-F. Lyotard)

- digitalisation of images and sound recordings decoupling signals from their denotative reference in real archives; *memory* cybernetically transformed 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 epoch where space represents itself in terms of storage relations = Foucault xxx: 36 f.

- Internet transforming the notion of the archive into a metaphor for *data retrieval*: "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

- (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 e-mail attachments through the

internet they can be deciphered in public = „Nach uns der Müll“, in: Die Zeit, 20th October 1995

- to resist filling these gaps, something like „empty signifiers“ required; how to 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 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 out: 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

- technical records resulting in "tertiary retention" of the present (Stiegler); recording media, though, with no "historical" sense of the past, not even a sense of "pastness" at all; storage rather than "memory"; artistic "de-archivisation"; *9 Beet Stretch* by Leif Inge, using advanced sound processing technology to digitally stretch a recording of Beethoven's 9th Symphony over 24 hours, "with no distortion or pitch-shifting" = Heloisa Amaral, between speakers and splinters: how musical performance stages the archive, ed. Kate Nialla Fayers-Kerr, script ("final draft") June 2020; time-stretching in Inge's *9 Beet Stretch* media-archaeologically dating rooting in Dennis Gabor's 1947 definition of the "acoustic quantum"; "find myself caught between currents of sound; listening oscillates between two temporalities, pure duration, and organised musical time" = Amaral *ibid.*; "Inge's experiment would not have worked so well with a piece less known than Beethoven's 9th . While the peculiarities of the original interpretation disappear in the long duration, the rough melodic and harmonic unfolding are still recognisable, triggering both the listeners' capacity to remember and their expectation towards that which is yet to come" = Amaral *ibid.*; kind of media-phenomenological laboratory / experiment with Husserl's categories for technically externalized / objectified "inner" time consciousness, in its mechanism of re- and protention, exemplified by the recognition of a "melody"; "interaction between live and recorded" (Amaral) in *NUMBERS #2: Variations on a theme by Brahms* by Alberto Bernal resulting in true media theatre / "how musical performance stages the archive" (Amaral): (re-)enacting the archive (storage) resulting in a defreezing of the motionless archival record into a "time object" (Husserl); obsessive reenactment of the past since it is present in its recording, thereby the archive technically becoming co-present; from functionally "ready at hand" in media consumption becoming reflexive "present at hand" (Heidegger) in artistic appropriation in the moment of friction, glitch, noise, resistance

For an informational aesthetics of cultural value: (Neg-)Entropy in times of a secondary *Gutenberg galaxy*

- 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
- entropy in discrete signal transmission a statistical parameter which measures how much information is produced on the average for each letter of a text = C. E. Shannon, Prediction and Entropy of Printed English [*1950], in: xxx, 50- (50); 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" = 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); 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; cultural value in its engineering aspects

Not to be confused: archive, memory, digital storage

- memory functions specified for the needs of so-called "von Neumann - architecture" of computers still used after half a century; naming the modules of this techno-mathematical memory - which turns out to be a metaphorical transfer of terms well known in traditional archivology; a close look at this micro-memory architecture revealing its topology and organization 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 explicitly 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 addresses *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 the sum of latency and transfer time); time-critical storage;

Turing: "scroll"; writing/reading head in a Turing machine strictly indifferent to any semantic meaning of the symbol strings concerned

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" = Glossary, in: Edward B. Magrab / Donald S. Blomquist, *The Measurement of Time-Varying Phenomena*, New York et al. (Wiley) 1971, 314 - close to what 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 where 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 implemented 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 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 physical 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

- 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

- *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 guiding the physical operation" = Magrab / Blomquist 1971: 316; whereas analogue computer calculates physical processes immediately 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 observation, that is: a delicate mechanism of intermediary data storage

- well-defined notion of "information" (with its smallest unit being the *bit*) replacing the cultural desire of storage; binary information (bit) though physically incorporated by electronic devices like the flip-flop circuit which is the smallest possible *storage* unit itself

Between storage and transfer

- cyberspace not "space" in the Kantian *a priori* sense, but a topological configuration; no *lieux de memoire*, rather: data servers and addresses; within the Internet, address structure of communication and the address structure of archival holdings merging into one; storage becoming 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)

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; phonographic record 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; counter-argument: non-tactile nature of EM field, almost no mechanical erasure by replay (Hornbostel's galvano copies)

- 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, transitional - 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-archeological 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 memories

- 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 denoting 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

Feedback memory and timeshifting

- cybernetic memory not, like traditional archives, clearly separated from the present operations (such as administration as symbolic form of the bureaucracy, and technically), but becomes cybernetically a feedback-ingredient of present operations itself, its basic condition: an almost invisible system of short-time memories (like cache-storage) is the condition for digital data processing

- digital (like neuronal) memory no static system; with Bergson: memory (different from external storage) operating in the present and through that act is dynamically updated; processual memorizing functions vs. information, creating knowledge in *its own terms* - the (media-)epistemological approach of Media Studies; models and tools of nonlinear computing and hypertextual database linking technologies

- (neuronal) networks with/out memory; adaptive networks requiring intermediary storage grids in order to become auto-adaptive („learning“ in the sense of von Foerster's 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-addressable 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 addressing and assembling signals as data into „memory“ almost exactly corresponds to the way this magnetic core matrix is addressed and configured by a mesh of copper „nerves“ (resonant with digitally switched electricity). The analogy even extends 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 (like a football German Bundesliga 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)

Phonographic Memory of Noise

- 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; the medium talks both on the level of enunciation and of reference; 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).

Archive, memory, storage

- media-epistemic shift from the emphasis on storage to an emphasis of instant 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) a memory of procedures, not of information as such; records kept in the Prussian State Archives, f. e., nowadays exactly mirroring the procedural logic of Prussian administration - but records themselves non-processual, lacking the dynamic dimension

- being an operational memory, any administration closer to a computing device than to fixed storage; Heinz von Foerster, *Memory Without Record*, in: same author, *Observing Systems*, Seaside, Cal. (Intersystems), 1984, 92-137; furthermore Klaus Krippendorf, xxx; difference between the archive and computation 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 = 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) = Norbert Wiener, *Zeit, Kommunikation und das Nervensystem*, in: *Futurum Exactum*, ed. Bernhard Dotzler, 2002, 177

- Charles Babbage appropriately calling what in electronic computing is named 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 administrative 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 / 2nd The *Store* in which all the numbers are originally placed and to which the numbers computed by the engine are returned" = 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)

- 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" = Howard Aiken, Proposed Automatic Calculating Machine (1938), as quoted in Coy 2007: 81

- in Samuel Beckett's once-act play *Krapp's Last Tape*, the act of reading in the tape inventory ("ledger") leading to cognitive symbolic time calculation, while the acoustic channel performs physiological signal processing; 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 physical reality of his voice) and the situation, whereas the inventory of his tapes, the chronological 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 unveil their informationen only according to a (re-)call with adresses. Human memory, though, recalls information according to its "semantic", associative content = Karl Steinbuch, *Automat und Mensch*, 4th, revised ed., Berlin / Heidelberg / New York (Springer) 1971, 75

- storage as cultural technology (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 addressable re-call

- main function of the archivist *triage*: the appraisal of what incoming records can be abandoned, 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

- storage conceptually based on passive location, with fixed addresses, *versus* human memory associative, as expressed by Vannevar Bush "As we may think" leading to the design of a Memory Extender in June 1945; hashing in programming 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 Bergsonian 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

- 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 electronic 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 Δt . $\Delta t \rightarrow 0$. The long-time, almost painterly, exposure of early Daguerreotypes and Talbotypes, by improved chemical sensitivity to exposure, shrank 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 synchronised 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" = W. de Beauclair, Rechnen mit Maschinen. Eine Bildgeschichte der Rechentechnik, Braunschweig (Vieweg) 1968, 228

- 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

- Horst Völz differentiating between two 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" = Horst Völz, Information I. Studie zur Vielfalt und Einheit der Information, Berlin (Akademie) 1982, 139

- 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 opposite 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, they are not archivologically 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

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 bistable element (or flip-flop) which is the hardware embeddedness of the logical binary digit (bit) representing the smallest unit of information (a single pulse position). This smallest unit of memory may consist, f. e., of two correlated (short-circuited) thermionic 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 input 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 continuing an old occidental obsession that culture depends on storage (historic architectures, libraries, museums); future cultural emphasis 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 record

- 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 Phonovision 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>

- 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" = Editorial: The Internet. Bringing order from chaos, in: Scientific American, vol. 276 no 3, march 1997, 494 (49), 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-term storage. Long-term memory, too, originated from a new interpretation of a technical disturbance e- feedback. [...] it demonstrated the technical feasibility of storage in an ephemeral medium" = 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)

- 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

- "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" = Baran, Distributed Communications, I, 24

Transient memory: From permanent to intermediary storage

- "past" what has been irreversibly 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 immediate archiving of the present in real-time on the one hand, and re-presenting the archive at an instant, as practiced in Web platforms like Facebook and necessitated by photography services like Instagram = 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; presence 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 anarchival, 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.)

- 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

- 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 maintained 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" = Kittler 1996: 75

- algorithms providing memory with a new kind of "combinatory power" = Kittler 1996: 74; not static but dynamic; virtual collections enabling 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

"Negative" Storage

- while musing about technological storage and / or archival technology in March 2021, (Post-)Bank informing that they will, from now on, charge 0,5 % of bank account by new European Central Bank law - which is "negative interest" (in an almost Hegelean sense); quite a revolution of old-European idea of accumulating money (literally "that which lasts"), even more immediate than any ontology

Confusing media "library" with media "archive"

- thirteenth international symposium series called *The Gift of Nam June Paik*; 13th Gift of Paik conference (Yongin, Korea, November 27, 2021), "Program": NJP Roundtable; "practical discussions will take place on Paik's Video Library, a new video digital archive." = symposium website: <https://videodigitalcommons.com>; symposium website: the "moving poster" design by Kyuho Kim is brilliant, in its digital aesthetics, already inviting to reflect upon the difference between Paik's "analog" video colour synthesis and its "digital" archivization; Paik's Video Study going to open on January 29, 2021: njpvideo.ggcf.kr; an "online archive platform"; transcription of the round table discussion from November 27th: new perspectives on the "archival" legacy of Nam June Paik's (video) works; lot of differentiations becoming apparent, such as "archive" in the precise institutional sense (for preservation) vs. the more experimental "generative" media-artistic digital repository, as well as the differences between archive, library, museum, and collection as regimes for passive / active memories; dichotomies between the "analogue" and the "digital" archives well discussed by the panellists; final plea for surpassing this dichotomy leaving potential for further debates in the technical, organizational, and aesthetic sense

Between storage, memory and archive

- storage as gesture of setting apart from immediate (con-temporary) consumption of matter, energy or information for later re-use; progressive digitalization of records and online-accessability

- temporalization, that is: acceleration of access and mutability of online image collections counterbalanced by archival resistance against *streaming data* on the material and structural level; archival record still unable to resist against time, even if in storage it seems time-suspended

The multiple embodiments of the archive

- new kind of archive which emerged within the Internet: its protocols (Galloway); old archive becoming a mere simulacrum ("content") in the digital world and dissolved into dynamic re-ordering; a new "permanent" (or at least stable) *archive* of rules has emerged
- on symbolic level of digitized record management a permanent re-ordering possible in n -dimensional space, without changing the conservational actual order to the material records
- parallel to rigid meta-dating (the archival thesaurus and classification), an ever transforming set of addressing records possible once records exist in digital, that is: mathematicized space: not fixed meta-data there, but permanent metamorphosis

NOTES ON THE PHOTOGRAPHIC ARCHIVE

- Corbis Corporation's image "archive" located in the Iron Mountain, Pennsylvania; See Jorinde Seijdel, Cold Storage, in: Open 2004, Heft 7 "(No)Memory", 66-77; keeps the physical photographs and negatives of which it commercializes their digital distribution and rights. In the cold technical language of computing *memory* nothing but a metaphor for a kind of storage which is not about remembrance but simply a function of addresses, of loading and intermediary storage, since the original photograph can only accessed digitally any more. Albert Kahn (in the case of his *Archives des la Planète*) "[...] probably did not foresee that the material recorded with the new media of his time - autochromes and films - would become accessible in another medium only. Since most of the shots in the archive only exist in one screening print due to their lack of exhibition, and since the autochromes could only be reproduced through re-photographing, the material has been almost entirely inaccessible until today. The archival imperative of digitization has made the documents accessible only as a world in bits. The FAKIR database, available on the premises of the Albert Kahn Museum, and its small web version Mappemonde" = Trond Lundemo, Mapping the World: Les Archives de la Planète and the Mobilization of Memory, in: Ina Blom, Trond Lundemo, and Eivind Røssaak (eds.), Memory in Motion. Archives, Technology, and the Social, Amsterdam (AUP) 2017, 213-236 (226); in less user-interface oriented perspective, the digitized images allowing to navigate their informational content from within, by intelligent algorithms in terms of Digital Humanities research. The power of cultural memory now takes place technologically. Opening new options of dynamical (re-)search, the algo-rhythmicized photo-archive becomes "poetic" in the sense of knowledge-generation itself. Disorder is not just a threat to photographic archives but a chance for a different aesthetics of memory. Once photographs from the past have been digitized, creative new ways of sorting and retrieving images are possible, with algorithm-based criteria such as similarity, pattern recognition, object extraction, shape

distribution. Not just being subjected to logocentric metadata, true content-based image retrieval makes use of the photo-data *from within*, endo-informationally

Archives as non-narrative alternative to historiography

- algorithmic logistics of image orders undercutting the iconologic narrative by discrete counting (alphanumeric metadata); tight coupling of symbolical evidence ("history") replaced by a loose ("mediatic" in terms of Fritz Heider) archival coupling

Latency as resistance against *streaming data*

- transitional records; the chemical nature of photography (the temporal gap between exposure and development); "negative" first: latency providing a temporal shelter (Hegelian *Enthobenheit*) against immediate consumption, a chronotemporal an-economy (de-coupled) and a guarantee against permanent transformation: keeping the *monument* (in Foucault's sense)

- better speak of libraries of photography, of "Phototheque"? The archival keeps unique, singular records - like Daguerreotypes. The library keeps multiple, mass-reproduced printed documents - like Talbotype

- with digitalization of analogue photographic prints or negatives, the original not becoming redundant but is the only way to unhold authentication evidence. Once turned into numerical information, the (former) photographic image loses its touch with irreversible physical inscription, the temporal mark

- undoing historicity, there is media-material transcendence in photography. In medieval Europe, light in cathedrals meant to transcend the material boundaries of architecture. With photographic emanations, light itself becomes a "historiographical" index (or even media-phenomenologically transcends history by its affect of immediacy on the human temporal sense: preserving the past as present). But still this is not immaterial but bound to a chemical storage medium; *temporal* transcendence of materiality a faculty of operative media technologies

Photography in the archive: between the indexical and the representational

- photography interpreted as an archive itself: "Bertillon sought to embed the photograph in the archive. Galton sought to embed the archive in the

photograph" = Allan Sekula, *The Body and the Archive*, in: *October* vol. 39 (1986), 3-64 (55)

- between "temporalities" and "tempo-realities"; temporalities of archives referring to the inherent temporal essence (the *Eigenzeit*) of archives as memory institution and storage media, whereas the tempo-realities refer to the function of the archive both *in* historical time and *as* condition (Kantian *a priori*) of historiography

- Henry Fox Talbot in *The Pencil of Nature* explaining plate III (a photography of „Articles of China“): "The whole cabinet of a Virtuoso and collector of old China might be depicted on paper in little more time than it would take him to make a written inventory describing it in the usual way. The more strange and fantastic the forms of his old teapots, the more advantage in having their pictures given instead of their descriptions."

- photography subjected to the bibliographic rather than the archival order; "open access" policy of collection (library, museum, data bank) is confused with the strict rule-governed system of the archive, even Alan Sekula in his *Archivology of Photography*: "Roughly between 1880 and 1910, the archive became the dominant institutional basis for photographic meaning" = Sekula 1986: 56?. The bibliographic paradigm ruling photographic memory organization soon became clear. What looks like the "archive" in a metaphorical sense, turns out to be the order of the library: "At a variety of separate but related congresses on the internationalization and standardization of photographic and bibliographic methods, held between 1895 and 1910, it was recommended that photographs be catalogued topically according to the decimal system invented by the American librarian Melvil Dewey in 1876. The lingering prestige of optical empiricism was sufficiently strong" = Sekula 1986: 56?

- different from the phonographic record which is a storage medium as well, photography not depending on an operative apparatus to articulate its content but can be processed by human perception immediately (without interference of a technical medium of re-generating the registered signals)

- how the authority of information can be established or preserved in a new medium; digital photograph or any other document can be "altered" without (almost) leaving a trace of such manipulation; digital "forensics" (Kirschenbaum)

- symbolic order of the alphabetic re-turning, with digital photography, in a new sense: as the regime of the alphanumeric code. The completely coded image replaces signals by arbitrary symbols which can be processed (that is, computed) algorithmically

- from that archival authority (contextual "situative" authenticity) photographs deriving their authenticity: "The dominant culture of photography did rely heavily on the archival model for its legitimacy. The shadowy presence of the archive authenticated the truth claims made for individual photographs, especially within the emerging mass media" = Sekula 1986: 57.

"Cold memory"? Archival times and different tempor(e)alities of of photography

- "archival time" of photography differing from the temporality of other analog storage media (phonography and cinematography); electronic media (audio and video tape recording) different in every aspect; (almost) immediate (not in the Newtonian, but Maxwellian sense) transmission of light ("live" transmission in "Hertzian" media which are based on electro-magnetic waves) is the reversal of what the permanent registering of light (waves) on photographically sensitive emulsions (the photographic negative) embody

- photo-chemical record different from electronic media whose essence is ephemeral "live" transmission; electronic image coming into being only by technological operation; "live" transmission the characteristic of electronic (mass) media (radio, television) and at first sight looks like the very opposite of what the almost immobile archival keeping of records over time ("tradition") is. But storage and immediate data processing are not ontologically different but differ only in scale; comparing the photographic moment, i. e. the fixation of a moment in time, to the immediate transmission of an electronic 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 Δt . $\Delta t \rightarrow 0$. The media archaeology of photography itself reveals how the long-time, almost painterly exposure of early Daguerreotypes and Talbotypes by progressing mechanical and chemical means shrank up to the notable photographic "click" or "shot"

Timeless? Entropic versus digital photography

- archives emerging with the symbolical code of writing; symbolical code can be transmitted (now "migrated") with a high degree of fidelity in copying, regardless the material support; symbolic code (like the genetic code), esp. in the alphabet, mostly invariant towards historical, i. e. entropic time = 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); digital data,

which is: "information", *per definitionem* (Norbert Wiener) neither matter nor energy

- archive's status as mnemonic device manifold: on the one hand, as a certain technology of representation, on the other hand revealing its relationship with a certain modality of the past that constitutes its material basis

- "PHOTOGRAPHY was the mechanization of the perspective painting and of the arrested eye"; "Telephone, gramophone, and RADIO are the mechanization of post-literate acoustic space"; "We are back in acoustic space" = McLuhan, "Five Sovereign Fingers Taxed the Breath" (1954); such sonic space understood here as the epistemological existence of sound

- a JPEG file on hard drive. "There's visual information there, but it cannot be seen until interpreted by a piece of software that projects or prints an image" dynamically = Richard Beaudoin / xxx Kania, A Musical Photograph?, in: Journal of Aesthetics and Art Criticism, xxx, 122, closer to musical performance / zigzagging of eye scanning an image / eye-tracking / systematic scanning of image by electronic camera

- "visual detachment of the Gutenberg galaxy opposed to the full sensory involvement of pre-Gutenbergian manuscript cultures; latter are said to be "intensely audile-tactile compared to print culture; and that means that detached habits of observation are quite uncongenial to manuscript cultures [...]. In place of cool visual detachment the manuscript world puts empathy and participation of all the senses" = Marshall McLuhan, The Gutenberg galaxy. The making of typographic man, New York (Routledge) 1962, 28

Archival nostalgia? The analog photographic print

- Oliver Wendell Holmes 1859 on photography of the cathedral Nôtre-Dame in Paris: "Form is henceforth divorced from matter. [...] Give us a few negatives of a thing worth seeing, taken from different points of view, and that is all we want of it. Pull it down or burn it up if you please. [...] Matter in large masses must always be fixed and dear; form is cheap and transportable" = Oliver Wendell Holmes, The Stereoscope and the Stereograph, in: Atlantic Monthly (1859) H. 3, 733-748 (747); Jens Schröter, Die Macht der Stillstellung. Zur technologischen Abtastung und Verfolgung am Beispiel der Fotografie und des Computers, in: Andreas Gelhard / Ulf Schmidt / Tanja Schultz (eds.), Stillstellen. Medien - Aufzeichnung - Zeit (Zeiterfahrung und ästhetische Wahrnehmung, vol. 2) 2004, 60-74; symbolic trade-off between recording media and physical matter. "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. [...] 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" = quoted here from: Wolfgang Kemp, *Theorie der Fotografie I (1839-1912)*, Munich, 1980, 121; *Ge-stell* (Heidegger) of storage of these forms is, in an epoch that has brought about an audio-visual memory, no longer the library. In place of fixed order, sampling allows for the digital storage and manipulation of tones and sounds, images and glimmers

- photography once time-analogue in terms of optical indexicality; with digital sampling, open for mathematical intelligence; analog photography by its very materiality inscribing traces of time, whereas in digital photography, the temporal index becoming a stamp, a date without physical evidence of aging

- notion of "digital photography" metaphorical when perceived by human eyes; a former single physical medium like the photographic image as print does not exist behind the surface of computer interfaces but as a data format, an array of bytes which are addressed and processed algorithmically

- by November 1946, single bits stored (and permanently changes or refreshed) on the screen of a standard radar CRT. With the Williams-Kilburn Cathode Ray Tube memory in early electronic computing, each phosphor charge, on and off, not only represented but embodied a binary "zero" or "one". This is not video art but functional TV. Since the charge would decay within 0,2 seconds, a detector was placed in front of the CRT, obstructing human insight, allowing for an electronic beam again to refresh the charge just in time to keep it = R. B. E. Napper, in: Rojas / Hashagen (eds.) 2000: 366; Fig. 1; actual observer the computer itself. In a canonical artistic engineering demonstration from 1947, the CRT was made to self-express its own number of digit capacity: "2048 DIGIT STORE". For once, the relation between display and computer has been not metaphorical but indexical.

- in current media art, the "archaeological" use of anachronistic media like 16mm film like a retro-effect against digital atemporality - an archaic counter-practice, archival resistance; Malin Wahlberg, *A Relative Timetable. Picturing time in the era of new media*, in: John Fullerton / Jan Olsson (Hg.), *Allegories of Communication. Intermedial concern from cinema to the digital*, Rom (John Libbey) 2004, 93-103

- digital photograph preserving the iconic quality while loosing the indexical trace. Or rather, indexicality itself here is of a different kind. While the analogue photographic print keeps a physical trace of the past, recording the light intensities, the digital pixels keep a schematic, mathematically abstracted relation to their generating (and then sampled) analogue signals - a *diagrammatic indexicality*

- multi-media "archive" representing an operative diagramm, a diagrammatic machine, still topological (graphs, nodes) but with the additional dimension of temporal processes

- Vilém Flusser: mechanical code (formatting by the apparatus) obtained that comprehends images; leading to activate the code and to create new images out of the code language

Historicism and photography

- Lessing's notion of the "transitory": Laocoon; or the limits of poetry and painting [1766], transl. William Ross, London (Ridgway) 1836; chap. III, 28; all representational arts "necessarily restricted by its material *limits* to a single instant of time." This holds true for traditional art, even more to photography, but the instant, in photography, ranges from the punctual micro-moment to long-time exposure, thus extending the presence

- photography catching interval as temporal mediality ("in between"): from long-time exposure (for techno-chemical reasons) to catching a moment, archiving an instant of time, a dramatic, time-critical escalation

- differentiating the punctual temporality of photography from the processual temporality of the electronic image

- technological reproduction media with presence-generating power over human perception of time, resulting in a cognitive-affective gap within humans between historical contextualisation and temporal appeal: "In [...] sound recording the men and women of the past are present. Marcel Proust makes me think *of* bygone times. When I hear Kirsten Flagstad as Isolde, with the Royal Opera House Orchestra under the leadership of Sir Thomas Beecham, the voice of the opera legend is concretely present to my ears. The intellect tells me that the recording is 72 years old and stems from Covent Garden, but for my senses, she is with me in space, here and now" = Jakobsen 2010: 6

- on 16th August 2010, a postcard finding its destination into mail box, sent from Southern France, Aix les Bains; postcard reproducing an ancient photograph with yellow-brownish colour: L'entrée du Casinao "Grand Cercle", from the postcard series entitled "Image d'autrefois". What does it mean, this *autrefois*? very term expressing a difference to what is considered as historical time, rather displaying a chronotopical time (Bachtin), or a heterotopical time (Foucault)

- tracing shadows (like Etienne de Silhouette did) in a way that follows the physically (or in Lavater's ambition: physiognomic) given rather than

pictorial conventions (like painterly portraits) opening a fundamentally different regime of signal processing. Fidelity of translation ("une tradition littéraire" writes Barante) - culminating in the daguerrotype which "automated" visual translation = Stephen Bann, Three Translators: Silhouette, Barante, Rossetti, in: Twentieth-Century Studies, vol. 11 (September 1974), 86-101 (here: 91 and 95 f.)

- the non-discursive elements in dealing with the past: not the speaker's agency, but rather the machinic agency; cp. Bann 1995: 80. While Ranke's historiography tried to efface the speaker's marks in order to let an objective "pastness of the past" appear = *ibid.*, technical media do this. The camera eye deplaces the subjective vision - which allows for a sharpened reading of count Paul Yorck von Wartenburg's comment on Ranke's historiographical aesthetics as "ocular" = letter Paul Yorck von Wartenburg to Wilhelm Dilthey dating from 6th July 1886: "Ranke ist ganz Auge als Historiker, [...] es ist ein Geschichte sehen [...] Ranke ist ein großes Okular", as quoted by Martin Heidegger, *Sein und Zeit*, Tübingen, 1980, 400; artefact of the camera objective enters the stage. "Bloss sagen, wie es eigentlich gewesen": Leopold von Ranke, Preface to his *Geschichten der romanischen und germanischen Völker von 1494 bis 1535* (1824), VI; implications of this phrase discussed in: Stephen Bann, *The Clothing of Clio. A Study of the Representation of History in Nineteenth-Century Britain and France*, Cambridge (Cambridge UP) 1984, 8 ff.

- the panorama (1808 Schinkel displays in Berlin his panorama of Palermo) and diaphanorama (Frank Niklas König); 1822 Louis Jacques Mandé Daguerre opens his first diorama in Paris, while Joseph-Nicéphore Niépce's first experiments with photographic representation (dating back to 1822) would hardly have been known to Ranke; inbetween dividing line between techniques of visualizing history scenically and the strictly technical medium of photography

- with emergence of photography, the theatrical gaze of "staging the past" (to quote another chapter from Bann 1995) displaced by the cold machinic eye, a technically neutral code instead of a subjective discourse. The vanishing point in perspectival pictures (and successively media like photography and film) since the Renaissance has been a literally *theoretical* formalization, even mathematization of the subjective betrayer (the "I/eye"), an exteriorization of the human eye by technical optics. "As McLuhan and others have suggested, the simultaneous development of perspective theory and printing technology imposed an increasing degree of abstraction upon Western systems of communication, substituting an idealised 'vision' for the close conjunction of visual and haptic skills which characterised [...] the reading of a medieval illuminated manuscript" = Bann 1990: 116. Finally photography (as notoriously explained by Roland Barthes) annihilates the distance between *Dasein* and *Dagewesensein*, the gap between past and

present = Bann 1978: 264 - this has actually been ("ça a été") = Roland Barthes, *Die helle Kammer*, Frankfurt, 1985, 90; orig. *La chambre claire. Note sur la photographie*, Paris, 1980; a photography documenting exactly the absence of this particular moment which has passed.

Together with Bob Chaplin Stephen Bann created *A Mythic Topography*, a series of prints such as "Jullieberry Downs. The Absence of the Past" = referring to Hilaire Belloc, *First and Last*, London (Methuen) *1911, 3rd edition 1924, "The Absence of the Past", 48-52: a diptych displaying the photographic presence of a landscape devoid of evident historical marks but receptive for the injection of historical imagination which can fill that gap; visual evidence a "cold medium" of the past as opposed to "hot" historiography (Marshall McLuhan's distinction in *Understanding Media*)

- as long as representation of colour not available for photography (until around 1900), new medium remained rather on the side of archival, text-based and thus black & white - printing page aesthetics of registering the past coldly - as opposed to painterly animation and historical imagination

- photography's mnemonic energy does not reside upon the presence of a spectral referent, but in the physical event: Rays of light, which emanated once from a real object, touch the viewer upon regarding the picture; Wolfgang Beilenhoff, *Licht - Bild - Gedächtnis*, in: Anselm Haverkamp / Renate Lachmann (eds.), *Gedächtniskunst*, Frankfurt/M. (Suhrkamp) 19xxx, 444-473 (447)

- beyond rhetoric of metonymy or synecdoche, the chemical essence of photography indeed registering the physical trace of light beams which one illuminated the photographic plate

- photography performing what Foucault claims in the introduction of his *Archaeology of Knowledge*: suspending the past from historical discourse (which is always anthropomorphic), in order to make source data accessible for different configurations. When literary strategies of historiography are being replaced by "an appropriate technical means for signalling the purity of the historical code" = Bann 1978: 263, the rhetoric of media (which is a technical figure of *dissimulatio artis*, a dissimulation of the mechanistic) substitutes the former episteme. In the same manner like history in Romanticism became seemingly real "through the fiction of the transparency of historical discourse" = Bann 1978: 263; blueprint for media set

- historian's ambition to let the archival record speak for itself; visual equivalent in the notion of an unmediated registration of the reality of the past" = Bann 1995: 127 f.; no representation ever un/mediated. Like the rhetorical *dissimulatio artis* in Ranke's historiography which aims at an apparent self-expression of history, technical media make forget their technical operativity on the machine-to-human interface in order to let the illusion of pure "content" appear; only in a moment of technical

break-down the medium becomes visible

- illusion of lifelike presence in the museum, corresponding with the "photo-realistic" idea of an unbiased historiography; referential illusion of a possibility to "live the past" created; Stephen Bann, Living the Past, in: Bann 1995: 130-162 (146)

- photography not only the object of research of media archaeology, itself a media-archaeological way of remembering the past in a way radically alternative to history. All of the sudden, the historians' desire to preserve the original sources of the past becomes true - for the sacrifice of the discursive

- technical difference between the French Daguerrotype and the British Talbotype negative/positive-technique corresponding with two different discursive emphases; Talbot's "photogenic" process emphasising "the possibility of 'close contact', of an indexical link between the image and its referent" - in fact a reproduction with a (in itself technically time-crucial) "signature in time" = Bann 1984: 134; former antiquarian phantasma of "re-presencing" (Sobchack) - the direct touch with the past via the archaeological fragment - automated

Dis/order in photographic archives

- once digitized, electronic image opening to almost real time access and new search options like similarity-based image retrieval; at the same time, the "virtual" essence of the electronic image becomes more fragile and subject to alteration than ever

- traditional architecture (*tectonics*) of the archive based on classifying records by inventories; this paradigm being replaced in the digital media by order from fluctuation, that is: dynamic order. *But this is an "archive" no more*, but algorithmically ruled processuality.

- digitally sampled into the symbolic order, images not only be retrievable as contained in their frames, but even by their atomic elements, pixelwise. Thus even what has not been meta-dated at all by human indexing can be automatically retrieved, opening new options of visual memory (be it in photography, be it in film)" = Harun Farocki, Arbeiter verlassen die Fabrik, in: Meteor - Texte zum Laufbild, Nr. 1 (Dezember 1995), 49-55 (50); such a distribution of image elements not belonging to the library or the traditional archive any more, but builds up a new, mathematized generative principle, thus: an archive in the Foucauldian and Shannonean sense, being based on information itself. This new panopticism is being applied by commercial and military agencies already. New software like Microsoft's *Photo DNA* which allows for the automated identification of - for example - child pornography on

websites already indicates by its name that the basis of biological and technomathematical life forms start to converge.

- new electronic media like video appearing like being integratable smoothly into the traditional archival system. But in themselves they already represented a radical alternative to archival order.

- on recycling: the Redundant Technology Initiative (<http://www.lowtech.org>) and Mark Napier's www.potatoland.org

The acceleration (temporalization) of the visual archive

- conditions of archiving challenged by current regime of *online* communication; photography from the beginning not just about permanent fixation of images but as well about immediate transmission; Alexander Bain in 1844 inventing a system for image telegraphy. With photography, the image not only became durable but as well in an antithetical way evanescent - a tendency enhanced by the very nature of the electronic image (*fluxus* in every sense), and in the age of digital media the image becomes coded information in a channel.

- in terms of an auto-associative network, an electronic switch-principle for visual memory discussed for explaining image generation in the brain (esp. in the cortex region)

- auto-associative networks, in computer science, with properties comparable with human visual memories. "You have to imagine a matrix of parallel-switched neurons whose synoptic links react on themselves in loops with the aim of being able to store a great deal of content at the same time" = Schulz *ibid.*, 27

NOTES ON SORTING IMAGES AS SIGNALS

Sorting / Searching

- replacement of photo-chemical images by electric voltage levels (symbolically interpreted as binary numbers) in *imaging* techniques; "image" micro-memory becoming magnetic latency

- ancient tradition of *ars memoriae* in rhetoric killed by the Cartesian analytic geometry which replaced images by numbers; addressability of every single pixel in an image (or image sequence) once it is digitized; media archaeological emphasis on this decisive rupture in how to approach image as memory / as archive; Pias / Hagen, "kein digitales Bild"

- in most Internet search engines, sound or images retrieval still logocentrically subject to textual key terms; once digitized (or "born digital"), signals equipped with all kinds of nonsemantic, descriptive meta data (MPEG7); digital sound or image file considered a stochastic character string (Hex values), from perspective of information engineering (Shannon 1948)

- use now being made of graphical searching devices on maps. Churches may have the same symbol on maps, but they look different on the ground. The favoured approach here is to "teach" the computer to recognize a type of object = Davies 1990: 154; instead of encyclopedic order: audio-visual search for linkage at random / by similarity, by digital association, connectivism; "iconoclastic" option; types of iconicity: image-like (iconic in its literal sense, graphical similarity); diagrammatic (structural homology, isomorphic one-to-one mapping); semantic

- term "semantics" central for Humanities; in information science became a tool to enable automated processing of information not "interpretable" by software agents, beyond the simple listing of controlled vocabulary like in Weizenbaum's ELIZA bot). "Ontology engineering aims at making explicit the knowledge contained within software applications" = *ibid.*; John Davies (ed.), *Semantic Web Technologies. Trends and Research in Ontology-based Systems*, Wiley 2006

- mapping as setting objects into relations; hashing distributed storage

Automatized audio content identification tools

- turning away from classic subject-centred, language-oriented types of sound classification toward a post-human, algorithmic "listening" by machine-based "ears"

- distinction between digitally "exact" processes of identification and probabilistic measurements of similarity as a specific mode of measuring / defining identity; algorithmic content identification tools understood as epistemic formations, casting such technologies into a new light of *technológos*

- instead of imposing external, taxonomical metadata on a sound object, such as the archival inventory or the library catalogue which is the logocentric, language-oriented approach (in reference to Jacques Derrida), once it has been digitized, algorithmic procedures allow for the automatic generation of metadata from within the sound material itself - a different *technológos*; difference between these two sorts of *logoi*

- in "deep machine learning"-systems, the algorithmic (techno-mathematical or techno-logical) order of machine listening (with no human sense of music at all) intersecting with human, or cultural, understanding of music

Bit-mapping

- image files containing basically a *bit map*, a long string of bytes, each of which describes an individual pixel of the image; better "infra-dating"; extracting data from within the image, the sound file; find all edges in a bit-mapped image

- navigation implying the sea: which defies cartography, no territory; rather random; navigation in the Internet / chronometer

- graph composed by knots plus lines: net with one center; loop (each knot linked with two others); tree (hierarchical, thus vulnerable / encyclopedic hierarchy); mesh (each knot linked with at least two, mostly more, or each with each linked)

- according to Ted Nelson, time an important property of links.

"Information concerning time stamp is a crucial for possible reposition of objects on a digital map and their integration with dynamically changing environment" = Jakub Klust, Linking Mind-maps and Digital Maps with Hypertext, Roskilde University Master Thesis (Autumn 2012), URL xxx, 67, referring to: Theodor Holm Nelson. Xanalogical structure, needed now more than ever: parallel documents, deep links to content, deep versioning, and deep re-use. ACM Comput. Surv., 31(4es), December 1999

- data traffic in WWW in discrete packets between server / router locations; no linear transfer, but time-discrete, micro-archival caching at various points; "being-to-death" (Heidegger): packets with stepped TTL (Time To Live) settings . To produce a map of data traffic, tracerouter tool sends out a series of packets with increasing TTL values = Wendy Chun, *Fiber Optics*; cyber"space" principally un-mappable cartographically for its dynamic existence

- elementary functions the condition of possibilities for the computer to start operating at all (the BIOS for the Operating System) "are burned into silicon and thus form part of the hardware" = Kittler, There is no Software, the autobooting mechanism

- electronic, digital media: mapping movement dynamically, "on the fly" new quality; classical maps could neither be interactive not time-critical; feedback

- mapping as reduction of data complexity; neg-entropical (that is: a cultural technology); "transformation of matter from entropy to information, from a million sleeping transistors into differences between electronic potentials" = Kittler, "No Software"

- representations of the Internet as communication tool (logical nodes) and mapping of Internet showing physical nodes (cables etc.); Internet engineers focus more on logical connections than in questions of human communication; a map of such connections not a spatial notion; difference between cultural technique of "mapping" which refers to maps / cartography; as opposed to techno-logical and mathematical use of the term: "mapping one content on another" (German *abbilden*)

Auto-associative pixels: *Suchbilder* in the active sense

- www.suchbilder.de, flash animation of pixels which progressively affiliate themselves according to color similarity

- flash animation on the website of Berlin conference in 2002 *Searching Images* ("Suchbilder"). By means of the wayback machine which takes regular snapshots of Internet web sites, web site can be traced back at archive.org. The text and the image of the website are being kept, while the moving elements within escape the archivizing mechanism; www.suchbilder.de; progressive sorting of distributed pixels according to colour similarity; the algorithms of similarity-based image retrieval; W. E. / Stefan Heidenreich / Ute Holl, Editorial. Wege zu einem visuell adressierbaren Bildarchiv, in: *Suchbilder. Visuelle Kultur zwischen Algorithmen und Archiven*, ed. same authors, Berlin (Kulturverlag Kadmos) 2003, 9-15

New "anarchival" options in re-membering digital images

- kind of "anarchival impulse" (international workshop *The Anarchival Impulse in the Uses of the Image in Contemporary Art*, Museum of Contemporary Art, Barcelona, October 24th, 2012) engendering photography collections in terms of mathematical stochastics once images exist have been translated into the digital regime. In virtual memory space, new options of sorting images arise, different from categorical logocentrism and indexing by metadata, in fact: arrangements which arise from within the digital image itself ("imaged-based image retrieval"); different from textual logocentrism and the regime of metadata: image-based image retrieval (stochastic rather than categorical)

- progressive neg-entropic sorting of distributed pixels according to colour similarity; an anarchical or rather para-archival impulse can be identified in the algorithms of similarity-based image retrieval

- instantiation of dynamic image retrieval; IBM search engine "Query by Image content". QBIC retrieval system for computer-based search for non-semantic aspects of a digital image (a mathematical operation), but can be supplemented by human help (tagging) for the semantic, iconological aspects

- experimental algorithmics different from the well-organized institutional archive. Quantized (digitized) images can be transformed into a vast image bank which, once unified as data-set, can be subjected to image-based search operations such as matching of similarities, object feature detection, statistical colour value comparison etc.; new kinds of search engines not only answering the needs of knowledge retrieval but develop into a creative art of revealing implicit data-"intelligence"

- media arts as avant-garde in experimenting with new forms of access to image down to its single pixels; strict basis for such experiments still is algorithmic knowledge; nothing "anarchic" in the digital *Forschungskunst*

- image-based search for images taking information itself as criterium in the order of images; loss of material authenticity in technomathematical reproduction in return leads to arriving at another level of abstraction; its mathematical intelligence is based on technically standardised, unified alphabets; nothing really anarchic in the digital world, since the alphanumeric regime is always symbolic order

Sorting photography: between image-based sorting of photography and logocentrism

- Heinrich Wölfflin's *Kunstgeschichtliche Grundbegriffe* (1915) aiming at formal criteria for sorting art historical images according to criteria like "open" vs. "closed" form; today, this vision realized by automatic image-based image grouping. Such a clustering successively liberates image configurations from word-based *tagging*. Even commercial digital images sorting software for private photographs sometimes offers the display of histograms (diagrams displaying the statistical distribution of colour in images); this is a perfect training in image-immanent navigation of the visual archive.

- tagging and meta-dating of images a supplementary, belated symbolical operation applied to images. Automated sorting of images to a large degree still depends on such annotation: "Computers can help us. But only after we help them first by feeding images descriptions" = Lev Manovich, "Metadating" the Image, in: same et al. (eds), *Making Art of*

Databases, Rotterdam 2003, 3; once an image has been turned from a physical carrier into information by the act of digital scanning, transforms into a mathematical representation devoid of semantics; computer has to be trained in order to gain icono-logical knowledge; to teach the computer human "thinking" has been the dead end of Artificial Intelligence; turn this argument upside down: apparent computational lack, the "semantic gap" which separates the Turing machine from human understanding, as its virtue, since it opens an aesthetics of parametrical sorting and archiving - opening un(fore)seen spaces of visuality

- feedback-driven non-linear dynamic model, as realized in Harold Cohen's drawing machine Aaron since 1973, which was rather oriented at human *Gestalt* perception, as described in: Pamela McCorduck, Aaron's Code. Meta-Art, Artificial Intelligence, and the Work of Harold Cohen, New York (Freeman) 1991

- in optical scanning, computer not recognizing an "image" in its cultural (thus human) sense, but rather its elementary parameters: statistical colour distribution, edges, lines, shapes et cetera. Stochastic rather than library-oriented, classification-based sorting of images thus becomes feasible. At the same time, digitization of images results in an ultimate addressability of each single picture element, the so-called pixel; addressability a central characteristic of the archival operation; by digitization image becoming essentially archival

- transforming cinematographic movies which consist of sequences of discrete photographic frames into a vast searchable data-set

- correctness of computer memory when compared to human remembrance operations which rather distort memories; according to the inventor of the graphical user interface in computing, Licklider (1960), the human is a "fuzzy, noisy device", but in turn gifted with the capability of parallel signal and data processing. From that results a different attitude towards image collections:

- fuzzy computer-sorting makes comparisons of similar (but not identical) images on the basis of new protocols; alternative to "alphanumeric labelling and keywording of pictures [...] aided by re-born analogue machines" = Duncan Davies, Diana Bathurst u. Robin Bathurst, The Telling Image. The Changing Balance between Pictures and Words in a Technological Age, Oxford (Clarendon) 1990, 64 f.; closing the "semantic gap" between the anarchic element within humans and computing; not training computers to behave counter-logically

- operation of the brain "physically quite analogous to optical processing" itself = P. J. van Heerden, The foundation of empirical knowledge, Wassenaar 1968, 29

Temporalizing photographic memory: From space-based to time-based archives

- photographies "on the line", most literally the cinematographic stripe and reel of celluloid; Aby Warburg's *Mnemosyne* panels functioning "like screens on which the phenomena produced in succession by the cinema are reproduced simultaneously" = Michaud (2004), 262; Philippe-Alain Michaud, *Aby Warburg et l'image en mouvement*, Paris 1998; basic unit of his picture tables still the photographic frame. With digital sampling of images, all of the sudden photograph can be literally addressed down to the single pixel.
- digitizing photo-chemical images transformation of the material storage into electromagnetic ephemerality and latency. The gain of flexibility and computability, is paid for with a dramatic loss of durability.
- digital photography no material light inscription any more, but its numerical information - as becomes evident when the "core dump" mode is chosen for its representation on display
- in trans-photographical data spaces the message of the medium is the alpha-numerical code; profound mathematization (instead of iconization)

Flexible access to the chrono-archive

- dynamic access; flexible tools which allow for the coexistence of different orders without destroying the existing database structure
- digital storage of large amounts of photographic objects resulting in new types of transmission, compression and retrieval which are based on differentiation like the send-on-Delta sampling which only registers decisive alterations to sequences of similar images; dynamic access now replacing the static classification of the traditional logo-centric catalogue, just like statistical probabilities have replaced particular knowledge in information theory, and pattern recognition replaces individual identification
- chrono-photography performing the time-discrete recording of life itself
- but the essence of technical cinematography hidden to human perception

Experiments with the art historical archive: Histogrammatology

- *Active Archive* project of artistic research group Constant (Bruxelles) applying algorithmic processing of digital scans of the huge photographic

archive of the Norwegian avantgarde author Ansgar Jorn; in 1965 Asger closed down his Scandinavian Institute of Comparative Vandalism (SISV), reborn algorithmically:

http://sissv.activearchives.org/w/Histograms_in_the_distance; see http://sissv.activearchives.org/w/Quick_guide_to_the_experiments

- a non-ocular aesthetic essence of images which can only be articulated by computational (informational) aesthetics; looking at images the way a scanner does; experimentation with histograms for exploring the digital photo-archive

- Bill Viola's video installation with 20 minutes of just visual noise. But this highly improbable flimmering of electrons on the screen, according to the mathematical theory of 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*

- Latin *scandere* 'to scan verse'; technical scanner a technological "device trying to mark off verses in digital images, fueling its algorithms with matrices of pixels rather than the metric feet" =

http://sissv.activearchives.org/w/To_scan_and_skim, accessed December 11, 2014

- Photography, literally understood (Herschel / Roland Barthes, *La chambre claire*) as a photonic emanation of an object) "memorizing" rays of light to the viewer in the present - a delayed transfer of what otherwise would have vanished into the dark. This inscribes physical tempor(e)ality into the image. In addition, chrono-photography then performed the temporal archivization of life itself - but the archival essence of technical cinematography is mostly hidden to human perception

Visual im/mediacy: Sorting images

- Descartes killing the *ars memoriae* by subjecting the image to the numerical code (Frances Yates, *Art of Memory*); "digitization" took place with analytic geometry already

- physical world items, once sampled into digital information units (bits), *telegraphised* - the Nipkow disc television image paradigm; applied to genome sequence and the body: Norbert Wiener, *God & Golem, Inc.: A Comment on Certain Points Where Cybernetics Impinges on Religion* [1986], Cambridge, MA (MIT Press) 1986, 36

- In digital culture the essence of the image itself dissolving into alphanumeric data - the ultimate victory of the archaeological alphabet

(which, in early Greece, has been used for verbal, geometrical *and* mathematical operations equally.

- Vilém Flusser's definition of the technical image: "Technobilder beruhen auf Texten, sie sind post-historisch" = Flusser Archiv, University of the Arts, Berlin, typescript "Von der Zeile ins Bild (zurueck)", 3; idem, *Into the Universe of Technical images* [1985], Minneapolis (Univ. of Minnesota Press) 201; not an "end" to art history in the linear sense (this would still re-affirm the historical narrative), but a structural *end* as fulfillment in the media-archaeological sense

- computer which "deciphers" images as data-sets. When visual content of museums - once it has been digitized like in Picture Disk editions of art historical works - becomes alpha-numerically addressable, new options of mobilizing the inherent information by intelligent algorithms is possible.

- addressing and sorting audio-visual media content by non-scriptural means with the arrival of fast-processing computers, after digitizing analogue source material, resulting in the unforeseen ability to address not just sound recordings by chunks and images by frames, but every single acoustic or picture element. Images and sounds thus become calculable and capable of being subjected to pattern-recognition algorithms; such procedures not only media-archaeologically excavating but as well generating unexpected optical statements and perspectives from the audio-visual archive that can, for the first time, organize itself not just according to meta-data but according to its proper criteria - media memory from within its own logic (endogenous). Only what is being algorithmically „excavated“ by the computer (such as the media archaeology of analog sound recordings which had become inaccessible) is a genuine technological retro-action

- the digitalization of image archives actually liberates the photographic memory from being subjected to external, metadata-based iconographic search operations at all, opening the possibility for image query by images themselves (similarity-based image retrieval)

- light and sound frequencies belonging to the regime of the real; according to Jacques Lacan, the real always returns to its place. This quality is transformed by the mathematization of the analog signal into the symbolical (algorithmic) regime

- ahistorically, the non-iconological and non-historicist "Petersburg hanging" of pictures according to their formats returning with algorithmic sorting of digital images; cultivate the informative dis-ordering of art history; SOM Legrady, *Pockets full of Memories*

Similarity-based un/order: the pre-modern museum

- calculating similarity as opposed to rigid classification; "early modern version of field theory and chaos theory is Montaigne's observation that "toutes choses se teignent par quelque similitude" (similitude binds everything together)" = Rhodes / Sawday 2000: 13, referring to: Michel de Montaigne, *Oeuvres complètes*, ed. Albert Thibudet / Maurice Rat, Paris (Gallimard) 1962, 1047

- "In a world which seemed to present itself as a wilderness of forms, a variety of analogous or synonymous systems could provide the equivalent of a visual search-engine, much as we search a modern electronic database by finding an exact alphabetic or ASCII match for a tagged semantic item. [...] Dominique du Cange, the sixteenth-century French philologist, suggested (incorrectly) that the words 'musaeum' and 'mosaic' were cognate" - raster scan imaging, indeed = Claire Preston, *In the Wilderness of Forms: Ideas and Things in Thomas Browne's Cabinets of Curiosity*, in: Neil Rhodes / Jonathan Sawday (eds.), *The Renaissance computer: knowledge technology in the first age of print*, London / New York (Routledge) 2000, 170-183 (174 f.); media-cultural difference, though, technological: algorithmicized calculation instead of intuitive human match. "Measurement enables us to analyse like things according to the calculable form of identity and difference" = Foucault, *Order of Things*, 52 f.

"Social" archives in Web 2.0?

- with(in) the World Wide Web, emphasis shifting from the storage imperative (in occidental culture) towards on-going transmission and circulation

- photography portal Flickr rather a repository than an archive (in proper terms) = Frank Kessler / Mirko Tobias Schaefer, *Navigating YouTube: Constituting a Hybrid Information Management System*, in: Snickars / Vonderau (eds.) 2009: 275-291 (277); digital archive "by nature a database" = Pelle Snickars, *The Archival Cloud*, in: ders. / Vonderau (eds.) 2009: 292-313 (304); so-called *social media* platforms like Facebook, Youtube or Wikipedia represent rather searchable data banks than archives in its proper sense. Flickr rather a random collection than a well-structured archive, since 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 algorithmic structure of image database management

- most image contents still not algorithmically searchable and accessed. The uncalculable is the real challenge to the "digital archive". Most photographic collections in the Web are rather libraries and not itself an

archive. Rick Prelinger defines the Internet Archive in San Francisco itself as a "nonprofit digital library"; preservation is neither its mission nor its practice = Rick Prelinger, The Appearance of Archives, in: Pelle Snickars / Patrick Vonderau (eds.), The YouTube Rader, Stockholm (National Library of Sweden) 2009, 268-274 (268); open access which distinguishes such a library (or *musée imaginaire*) from the archive which tends to keep secrecy by definition - like the *protected mode* within microprocessors; Thomas Little, Das PC-Buch: die Hardware und ihre Programmierung, Munich (System Verlag) 1990, 97-107; Friedrich Kittler, Protected Mode, in: Manfred Faßler / Wulf Halbach (eds.), Inszenierungen von Information. Motive elektronischer Ordnung, Gießen 1992, 82-92

From semiotic analysis to "cultural analytics" of the moving image

- in Digital Humanities, archaeologists of knowledge not exclusively human scholars any more but algorithmic media as well; connected with a subtle shift from cultural (mostly semiotic) analysis of photography to "Cultural Analytics" (in terms of Lev Manovich), that is: computer-based matching
- Matthias Wannhoff, "Finden, was wir nicht suchen können." Ein Versuch in algorithmischer Spielfilmanalyse mittels Cultural Analytics (summer 2012), <http://www.medientheorien.hu-berlin.de>, section "Hausarbeiten online": statistical (rather than semantic) analysis of huge amounts of grabbed single photographs (of which one special form is films as dissected into single frames) with digital image processing such as pattern analysis and subsequent two-dimensional re-visualisation of such algorithmically calculated data by computer graphics; new kind of iconology arising, based on logical operations rather than content analysis; method Axel Roch, video *Visualisierung von Texten durch Bilder*
- dominant criteria for the sorting of digital or digitized (sampled) photographs from within their media essentiality, that is: digital pixel values such as color: "Hue describes the color type, or tone, of the color (and very often is expressed by the „color name“), saturation provides a measure of its purity (or how much it has been diluted in white), and lightness refers to the intensity of light reflected from objects" = Oge Marques, Practical Image and Video Processing Using MATLAB, Hoboken (Wiley) 2011, 398
- describing images with images; Lev Manovich, How to Compare One Million Images?, in: Understanding Digital Humanities, edited by David M. Berry, Basingstoke (Palgrave Macmillan) 2012, 249-278 (263)
- Software Studies Initiative at the University of California in San Diego; a couple of tools, available online; terms derived from statistical mechanics

and physical thermodynamics enter which have been adopted for the mathematical theory of information by Claude Shannon et al.: "Hohe Entropie entspricht einer 'zufälligen' (= wahrscheinlichen), niedrige Entropie einer hoch organisierten (= unwahrscheinlichen) Anordnung" = notes on paper Matthias Wannhoff, presented 1st November 2013, University Library, Amsterdam

- Cinematics software for *Schnittanalyse*; not film frames as basic unit of analysis; *editing* based on gaps between the images
- line diagram can be transformed in ImagePlot; allows for direct addressing of single frames; ImagePlot diagrammatic in Peirce's sense: activated in moment of observation which brings temporality in image analysis
- pixel-by-pixel analysis re-chronographising film
- evidence of graphs produced by the image processing software ImageJ; how this "reading" of a graph relates to approaches already established in "non-digital" humanities (hermeneutics, ekphrasis, semiotics)
- *Mapping time in the moving image*; average shot length still regarded dominant parameter in quantifying moving images, see approach developed by film scholar Yuri Tsivian, CineMetrics; data desired by this approach can hardly be gathered automatically by a computer but inevitably requires manual annotation; theoretical deficiency. "Does a frame-per-frame approach to visual data (as doable and automatable through Cultural Analytics) not take the material much more seriously than the abstract counting of spaces (= cuts) between images?"

Dis/order in photographic archives

- with intelligent analytics (algorithms), the photographic (ex-)archive, once sampled into computational numerics, becoming poetic in terms of knowledge and new insights itself, generating new patterns of making use of stored visual evidence
- reverse proportional memory economy at work with photographic archives. Physical storage of the photographic print provides, when being taken care of by professional conservation, a relatively stabile enduring memory, but more difficult to access; once being digitized, electronic image open to (almost) real time access and new search options like similarity-based image retrieval; at the same time, the "virtual" essence of the electronic image becomes more fragile and subject to alteration than ever

- traditional architecture (*Tektonik*) of the archive based on classifying records by inventories; in the digital media rather sorting records in fluctuation, that is: dynamic order; this is an "archive" no more, but algorithmically ruled processuality. In such a new order, images can not only be retrieved as contained in their frames, but even by their atomic elements, pixelwise. Thus even what has not been meta-dated at all by human indexing can be automatically retrieved, opening new options of visual memory (be it in photography, be it in film) = Harun Farocki, *Arbeiter verlassen die Fabrik*, in: *Meteor - Texte zum Laufbild*, No. 1 (December 1995), 49-55 (50); such a distribution of image elements not belonging to the library or the traditional archive any more, but builds up a new, mathematized generative principle, thus: an archive in the Foucauldian and Shannonean sense, being based on information itself. This new panopticism is being applied by commercial and military agencies already. New software like Microsoft's *Photo DNA* which allows for the automated identification of - for example - child pornography on websites already indicates by its name that the basis of biological and technomathematical life forms start to converge

- instead of thinking the archive in terms of symbolic order by classification, rethinking it entropically, that is: allowing for a certain amount of signal disorder, which contains, according to communication theory, a higher measure of (possible) information

- rather stochastic "excavation" of knowledge; traditional archaeological "cluster analysis" of burial grounds

The acceleration (temporalization) of the archive

- digital art challenging "the conditions of archiving in our current regime of telecommunications" = Charlie Gere, *New Media Art and the Gallery in the Digital Age*;

<http://www.tate.org.uk/research/tateresearch/tatepapers/04autumn/gere.htm>; photography from the beginning not just about permanent fixation of images but as well about immediate transmission; Alexander Bain already in 1844 invented a system for image telegraphy. With photography, the image not only became durable but as well in an antithetical way evanescent - a tendency enhanced by the very nature of the electronic image (fluxus in every sense), and in the age of digital media the image becomes coded information in a channel.

- an electronic switch-principle for visual memory for explaining image generation in the brain (esp. in the cortex region): "Auto-associative networks, now under theoretical study by computer scientists, have properties that are comparable with visual memories. You have to imagine a matrix of parallel-switched neurons whose synaptic links react on themselves in loops with the aim of being able to store a great deal of

content at the same time [...]" = Schulz *ibid.*, 27

- unlike traditional encyclopedias, *online* Wikipedia updating its entries almost by the minute; radical temporalization of knowledge space transforms the "archive" dramatically, with the new "Web 3" economy being the realtime net

- whole Google architecture reminiscent of an archive. But this is 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)

- dynamic dimension of the web "unarchivally" escaping the scope of search engines: "They survey static web pages, relegating real time dynamics to the so called deep web (Halavais 2009, 16)

New memory options of image retrieval

- scholarly publication of Warburg's *Mnemosyne Atlas* inevitable freezing such dynamic reconfigurations in momentary snapshots; digital publication allowing for combinatorial access to the single elements of such visual tables; van Huisstede 1995: 158: "Wenn es jemals ein Projekt gegeben hat, das in einem elektronischen Medium wie der CD-ROM angemessen zu präsentierten wäre, dann ist es der Mnemosyne-Atlas"

- human and / or cultural memory not accessing images like a visual search machine. It is inevitably rooted in iconological and semantic vectors which in their culturally contextual fuzziness can not be performed by a machine which can only operate with exact data. Even similarity-based retrieval algorithms like the Kohonen Self-Organizing Map (Legrady) would necessarily miss the cultural order of images. Is this quality of Turing machines a deficiency to be eliminated by "cognitive" or "neuronal" computing or rather an alternative to be cultivated to enrich the notion of cultural memory by non-human points of view?

- "sorting pixels by colours", a dynamical Flash-animation in operative framing of the former conference *Suchbilder* www.suchbilder.de

- GAMA (the Gateway to Archives of Media Art) requiring a new art of search engines, allowing for multimedia content search; develop "automatic metadata indexing and video segmentation tools (face detection, motion detection, shot boundaries, representative frame

generation) in order to provide fast access and content browsing capabilities"; "advances search facilities (like image query by example, or visual similarity search) combined with key-words to ease the finding of media art items" finally arriving at navigating *within* the digital file

Visual im/mediacy: Towards a dynamic technology of photographic (and moving) image retrieval

- expressing digital pictures by numbers undermining the dichotomy between image and meta-data; rather an implosion of images and numbers in digital time

- most extraction in analogue photo archives by grip on the single print, the storage medium only, not accessing its smallest elements

- a digital image still a photographic image? photography a set of signals / data, a format; at what moment becoming an image? By human perception only, or independent from human awareness already within its medium? 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 beholder“ only; computer can deal with the symbolical analysis of physical data / pattern only, not with the imaginary

- Foucault's archaeological and archivological analyses autopoietically referring to the alphabet-based world of textual libraries. But "discourse analysis cannot be applied to sound archives or towers of film rolls" = Friedrich Kittler, *Gramophone - Film - Typewriter*, Palo Alto, Cal. (Stanford UP) 1999, 5; digital space allowing instead the option of navigating images in their own medium - without changing from visual to verbal language at all. Different from printed letters in a book, the symbols in digital technoscapes are arranged and distributed algorithmically.

- humans irresistably interfacing to photographic images in an iconologic way; search for visual knowledge instead uncovered from within the visual endo-data: entering the image itself (data-immersion), which is the media-archaeological gaze that can be performed by machines of image processing better than by human perception. Such *informatized* organization of visual knowledge generates diagrams (which is as well the Deleuzean interpretation of the Foucaultdean *archive*) - infomapping. Our visual culture is still dominated by semiotically iconic, photographic-like images; the twenty first century though allows for genuinely computer-generated visual information, closer to diagrams than to "images", which will eventually take their place and enable unprecedented types of "visual" representations

- computer-based retrieval identifying all edges in a bit-mapped image. Such a „digital image“ is an image no more; what looks like images, is

rather a mathematical function of data distributions

- coding of body movements or facial expressions (eigenface) involves the development of units that, while easy to see, are difficult to describe adequately by verbal description; VID-R tool for the analysis of motion picture film or video tape "builds a visual dictionary by utilizing the procedures described for temporal reorganization" = Paul Ekman / Wallace V. Friesen, A Tool for the Analysis of Motion Picture Film or Video Tape, in: American Psychologist, vol. 24, no. 3 (1969), 240-243 (242)

Image archives on the threshold of their digital approachability

- visual search engines dealing with "semantic" queries; crawling the web for illegal trade-mark copying. Search & destroy: „the similarity-based images retrieval technology is either militarily or commercially, not really culturally driven“ (Lev Manovich). In his film called *Eye / Machine*, the film maker Harun Farocki draws our attention to *operative images*; so-called intelligent weapons become data-driven by matching images, not pre-directed by meta-data any more

- iconological heritage and cultural semantics hindering analysis of imagery; rather Manovich's "visual analytics" (Digital Humanities). "Humans are much better than computers at extracting semantic descriptions from pictures. Computers, however, are better than humans at measuring properties and retaining these in long-term memory. One of the guiding principles used by QBIC is to let computers do what they do best - quantifiable measurements - and let humans do what they do best - attaching semantic meaning" = Myron Flickner et al., Query by Image and Video Content: The QBIC System, in: Maybury 1997: 7-22 (8) - which establishes a feedback-loop between man and machine and stages the difference between analogous and digital data processing, thus not trying to efface, but to creatively enhance the human-computer-difference where they meet on the interface

Visual archiving: Sorting and storing images

- image processing within computers radically differing from the iconological / logocentric semantics of cultural vision

- algorithmically "intuitive archives" (SOM / Legrady); modelling similarity, alternative to meta-data annotation; query by visual example; automatic feature extraction; not replicate human behaviour

- microblogging platform www.tumblr.com for photo, text and video as anarchival order clustering in current media culture: throw images into

the computer and see how he, the computer, orders it; adjust humans to understand computer perception

Moving image retrieval

- basic unit of video to be represented or indexed usually assumed to be a single camera shot, consisting of one or more frames generated and recorded contiguously and representing a continuous action in time and space. Thus, temporal segmentation is the problem of detecting boundaries between consecutive camera shots; definition of a suitable *quantitative* difference metric which represents significant *qualitative* differences between frames = Zhang et al. 1997: 142

- truly "image"-based retrieval of digital image banks; using statistical object modelling techniques (so called Hidden Markov Models, probability scores which are deformation tolerant), i. e. the user searches an image database intuitively by applying simple drawings, sketches

- options (beyond archival meta-data) of re-arranging "found footage" in algorithmic ways, as opposed to the idiosyncracies of previous filmmakers; technology of the cinematographic apparatus for cutters / the completely different electronic video image; not taken as simply "zuhanden" in hermeneutic analysis; media archaeology aims at opening machinery as "vorhanden"

- visual archive rather as a CD-ROM which can be read/seen vertically and horizontally, i. e. paradigmatically and syntagmatically, different from the linear reading of analogue film and video

Excavating the cinematographic archive by algorithmic im/mediacy: digitally counting (with) moving image retrieval

- Steenbeck / AVID editing devices ("analog" / digital) the hidden "time" machine of the film event, its cuts / montage hidden behind the apparent narrative

- with film, enters a different aesthetics in the succession of images technically, to achieve the illusion of continuity in time and space; actual cuts are dissimulated; Karel Reisz, *The Technique of Film Editing*, New York 1968; differences in image (frame) sequences can - by cutting - result in coherent units of perception.; allows for non/linear searching films according to these rules of organization of images

- digitizing every fifth film frame and letting his program arrange the iconic data bank according to pictorial similarities, identifying and counting with differences of objects (shapes, colors) in digitized images.

While the single film frame becomes two-dimensional pixel format, their sequence results in three-dimensional vectors (Knuth 1973); extend Quadrees unfold to Octrees, from 2^2 to 2^3 branchings per knot (Samet 1990); mathematical transformations (Fourier or Wavelet) rather differentiate than recognize images according to similarities

- digital visual archive calculable, literally counting images by numbers not only externally (as suggested by Peter Greenaway in his experimental film), but internally as well. To play a bit with German words: The digital image-based archive will be accessible only in a media culture which is not tempted to defigure archival memory by historical narratives (*Erzählung*), but by counting (on) it (*Zählung*); rhetorical tradition of iconic *ars memoriae* displaced by Cartesian analytic geometry which replaced images by numbers (Frances Yates); addressability not simply of single photographic frames but down to every single pixel in an image (or image sequence) once it is digitized; media archaeology focuses on this decisive rupture in how to approach image - from cultural memory to discrete archive

- expressing pictures by numbers undermines dichotomy between image and meta-data; rather an implosion of images into algorithmic space

- "Digital Computers introduce a consideration not found in kinematic analog computers, namely, the ordering of computation steps in time. In a vague sense, therefore, digital computation is dynamic in character" = Stibitz 1942b, 3 - all the difference between the physical meaning of "energetic" and "kinetic", equalling impulse vs. wave

- kind of second-order visual knowledge, cartography, diagrams - infomapping; visual culture still dominated by semiotically iconic, photographic-like images in the twenty first century; genuinely computer-generated visual information, closer to diagrams than to "images", eventually takes their place and enables unprecedented types of visual representations; Constant Active Archive initiatives

- aesthetics of image-based image retrieval based on visual patterns rather than verbal metadata, "read" by computer scan / algorithms in a way familiar to premodern order of things (Foucault): "as comparative contingencies or juxtapositions, as a system of potential *matches*" = Claire Preston, In the Wilderness of Forms: Ideas and Things in Thomas Browne's Cabinets of Curiosity, in: Neil Rhodes / Jonathan Sawday (eds.), The Renaissance computer: knowledge technology in the first age of print, London / New York (Routledge) 2000, 170-183 (174 f.)

- www.suchbilder.de: pixel migration, matching by colour similarity values

Media-"Active Archives"

- 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 equalling 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

- in classical, alphabet-based archives, sound and image records traditionally tagged by textual metadata. The inventory belongs to the symbolic order of what is properly called the archive. An alternative is the approach which does not produce metadata for the external ordering of such records but sorts them from within, which is the signal-based approach; either tagging an image by, e. g., the painter's name, or treating the same image as complex signal which allows for sorting it according to entropy, colour values or shape detection from within the file

- metadata approach still belonging to the familiar archival symbolic regime, whereas the signal (or rather the approximative Digital Signal Processing) approach is truly oriented at the materiality of sound and images. When images are not recorded, e. g., as analog photography or electronic video signals, but digitally sampled and quantized in binary values, this results in a symbolic regime in an even more fundamental sense and re-introduces the archival order; foundational *l'archive* (in Foucault's sense) of digital sound and images strictly techno-mathematical and numerical, not metadata in the traditional sense which subjected sound and images to logocentric key-terms expressed alphabetically

- *Glocal Similarity Map Engine* by Jet Thorp;
<http://www.glocal.ca/resources/toolkits/similarity-maps>; similarity maps change over time, as more images are added to the pool and more similarities are identified

- spatial aesthetics of collage currently being replaced by operational post-archival interaction

- 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 taxonomy by verbal classification

- *online* www.suchbilder.de: pixel sorting at work according to colour affinity

- in one of the four modalities of George Legrady's *Pockets Full of Memories* installation, *Cell_Bin*, "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 narrative pathways" = argument by George Fifield (Boston Cyberarts Inc.), "Can you see me now?", in: *The Boston Globe*, http://www.wellesley.edu/DavisMuseum/exhibitions/exhibitions_celltango.html, accessed August 2010 - even non-narratively; contemporary, dynamical version of the rather spatial modernist aesthetics of montage (cut-up) and collage

- humans incapable to navigate audio-visually through digital records; intelligent agents – algorithms – generating patterns by sorting which make data accessible for human "interpretation"; such pre-structuring an *arché*, a media-archaeological act

- the immediate iconological appeal of the digitalized image 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 resulting 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

- algorithmic image manipulation (and filters) allowing, in representation, to by-pass privacy and copyright limitations of "open access" to the Kurenniemi estate; partly pornographic images / videos computationally tumbled / obscured / data cloud - without destroying the unique archival images; by-passing such limitations

- legal (copyright / privacy) constrains 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

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 rather be hallucinated by their human interlocutors; the narrative approach is not the most in tune with the form of the ordering

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 snapshots 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 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 photographs. 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 users; scanned objects 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 offering "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" = ibid.

NOTES ON ARCHIVAL SOUND

- BBC World Service "Save our Sounds" project, looking to "archivize" unique sounds (different from reproducible records) that may soon be lost; sound compressing and filing algorithm ruling the process of sound provenience to permanent storage

- silence itself becoming part of the archive; software for sound analysis *Audacity* actually providing an algorithm called "Silence Finder"

- the pre-emptive archive: bias (cultural recording projects under the temporal perspective of "future in the past") pre-dated by the Berlin Phonogram Archive past 1900 (Erich Moritz von Hornbostel) for ethnological music (that is, acoustic recordings across endangered cultures); Albert Kahn's photographic and cinematographic Archives de la Planète in Paris; Paula Amad, *Counter-Archive. Film, the Everyday, and Albert Kahn's Archives des la Planète*, New York / Chichester (Columbia University Press) 2010, esp. 153: phonographic inspiration of Kahn's project: Archives de la Parole, founded by the linguist Ferdinand Brunot in 1911 at Sorbonne university in Paris

Material entropy of the signal versus symbolic (archival) endurance of sound recording

- Bill Viola's essay on the implicit *sound* of electronic images; "the current shift from analogue's sequential waves to digital's recombinant codes" in technology = Viola 1990: 47; sampling and quantizing of acoustic signals analytically transforming the time signal into the information of frequencies which is the condition for technical re-synthesis (Fourier transformation); digitalization inducing a radical transformation in the

ontology of the sound record - from the physical signal to a matrix (chart, list) of its numerical values; media culture turning from phonocentrism to mathematics

- the techno-mathematical *archive*; transfer techniques of audio carriers from technically extended "writing" such as analog phonography to calculation (digitization), not just another version of the materialities of tradition, but conceptual change; basically atemporal dimension. Against the noise of the real culture (especially techno-logical, that is: „digital“ culture) poses a negentropic insistance, a negation of decay and passing-away

- past sound not just "restored" by applying digital filters; rather wants to be remembered with all the traces of decay which has been part of its tradition, its media-temporal (entropic) characteristics must be archivized as well; remain close to the physical record which is achieved by over-sampling; stay tuned to such non-archival sonicity

Automatic music transcription (AMT)

- Software trAVis (Musikzentriertes Transkriptionsprogramm für AV-Medien); see Christofer Jost, Computer-Based Analysis of Audiovisual Material, in: Dimitri Zakharine / Nils Meise (eds), Electrified Voices. Medial, Socio-Historical and Cultural Aspects of Voice Transfer, Konstanz (Unipress) 2012, 359-375

- *sonic* signals previously requiring human decoders to be transcribed into *musical* scores; for media-archaeological ears of data processing devices, audio signals can be automatically turned first into digital samples - with the digital audio signal $s(n)$ representing a transformed time signal by means of the time index n

- sampled audio signal can be processed into formats like the spectrogram, and/or be printed as conventional musical score by the digital Score Generator. What has been first developed for automated speech analysis is extended to the musical field. The "Onset Detector" recognizes the beginning of regular notes; primarily this automated analysis gives access to the temporal realm of the sonic event by identification of micro-temporal structures, beats and rhythm; real time components of such a software creates waveforms to be analyzed by Discrete Fourier Transformation and then is (re-)translated (re-mediated, in fact) into culturally familiar categories of musical time structures like Harmonic Analysis. "Grundlegend ist die Tatum-Erkennung. Dieses Kunstwort wurde von 'Time Quantum' abgeleitet und bezieht sich auf das kleinste im Eingangssignal gefundene Zeitintervall. Hierauf baut der Beat (*Tactus*) auf, welcher mit dem wichtigsten wahrnehmbaren Puls gleichgesetzt wird" = Roland Stigge, Automatische Musiktranskription

(ATM), paper from June 16, 2003, developed at the chair for Signal Processing and Pattern Recognition at the Institut of Computer Science, Humboldt University, Berlin; accessible *online* <http://www.antcom.de/~stigge/studium/amrtarticle.pdf> (Zugriff Juli 2013); apply to even higher levels of sonic dramaturgy (which is the culturally familiar "musical" ordering of time)

Algorithmicizing the Archive: "Data Radio" (Constant)

- accidental sorting of sound according to signal-based similarity
- Constant, "Data Radio" project; spectrum sort of files from the audio Kurenniemi archive
- algorithmically navigate the digitised audio files according to their various mathematical properties like entropy; Fast Fourier Transform
- 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
- "listening" to Kurenniemi's auto-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 analysed 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
- Kurenniemi's DIMI-A ("Digital Music Instrument") with "Associative" memory, 1969: selection of audio data according to memory content rather than by addresses; 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-intentional one); AUDACITY: "Silence Finder"; further: "Echo"; "Beat Finder"; spectral analysis

- algorithmic annotation with software from computational linguistics: temporalizing phonemes; software PRAAT (Netherlands), PLP Laboratory; University of Mons: voice synthesizer

Indexical recording: sound from the real world

- Barthes describing the affective experience of looking at an ancient photography as *punctum* - a short-cut between past and the present: a punctual moment, while in acoustic recording by gramophone there is a processual, time-based signal; its re-play generating a different sense of the past; for Ludwig Wittgenstein when associating a tune recorded for a gramophone "this is the most elaborate and exact expression of a feeling of pastness which I can imagine" = Ludwig Wittgenstein, here quoted after: Gregory Ulmer, *Applied Grammatology*, Baltimore (John Hopkins University Press) 1985, 110

- even if less of a difference in phenomenological (human) perception, sound, when being re-generated out of electro-magnetic latency, embodies a tempor(e)ality different from the almost scriptural engraving in the gramophone groove

- as engraved index (in Peirce's semiotic sense), a sound forming a sharp contrast to its symbolic notation. *Indices* represent their objects "by virtue of being in fact modified by them", in a truly analog way = Charles S. Peirce, letter to P. E. B. Jourdain [*1908], in: Carolyn Eisele (ed.), *The News Elements of Mathematics*, 3/2, Berlin (Mouton) / Atlantic Highlands, NJ (Humanities Press) 1976, 879-888 (887); gramophone groove literally in-formed by sound, but this is still a material, physical shaping, whereas

digital information is no question of matter or energy any more; acoustic signal not losing its temporal indexicality when being recorded; aggressive acoustic signal even in its media-technological reproduction retaining its physically *effective* and physiologically *affective* reality, being co-originary in terms of its frequency values

- "schizophonic" (Schaeffer) effect of sound coming out of loudspeakers from a technical record; response to the real non-narrative signal

- Walter Benjamin identifying kind of "optical unconscious" which reveals itself only to the camera eye; analogous for sonic phenomena: phonographic records unintentionally co-registering a whole world of additional information, starting from background noises; no "message" from the past; Soundscape Project in Vancouver

Media as active archaeologists: SpuBiTo

- item in Berlin Lautarchiv no. (ID) 9311 (type "Plastisches Objekt"): two electromagnetic pick-ups, as media-archaeological, material condition for past sound analysis at all

- necessity of digitizing phonographic records against physical decay, epistemological option emerges; SpuBiTo project = www.gfai.de: "The retrieved sound documents can directly be stored on digital media (e. g. CDs) for archiving or processing"; "big data" generated by retro-digitization of analog sound archives; surplus value in the algorithmization of these data, not pure quantity; unstructured data as such useless

- real archaeologists of sound past technical measuring media which are able to de-cipher physically real signals techno-analogically, and to represent them in graphic forms alternative to alphabetic writing, requiring "moving" diagrams as sinusoidal articulation in time, such as the oscilloscope

- dis-closure; opto-digital image processing of sound tracks on early Edison cylinders allows for listening again to otherwise inaccessible sound recording, by a hybrid of mechanical stylus (haptic transitivity) and optical scanning

- below the phono-archival regime, media decoders become active archaeologists of "signals from the past" themselves.

- glyphic voices on the analogue, vulnerable storage medium of wax cylinders are currently being de-frozen by digital means; Berlin Society for Applied Informatics has developed a method to gain acoustic signals from negative traces of galvano-copies from Edison-cylinders by opto-

endoscopic „reading“ - scanning its "visual" (glyphic) information into sound; making stored acoustic waves actually sound not demanding rhetoric imagination but on the contrary a hermeneutically distant gaze, an exteriority of interpretation

- opto-technical scanner only can provide for a distant *aisthesis*; media Archaeology as specific method of "Digital Humanities". Technical media provide a different option of reading: reading without (premature) understanding. The archaeological gaze mimicks this ascetic confrontation of signals, resisting the narrative temptations of figuration

- *Phonogrammarchiv* at Ethnological Museum, Berlin, partly consisting of *negatives* of early wax cylinder recordings (copper galvanos) which, like Talbot's negative photography, require a conversion into positive sound signals again. With such a technical operation (in visual and in audio memory), an attitude to remembrance of the cultural past is trained which differs from historical narrative: negative-to-positive conversion, transforming a latency into manifest re-enactment

- system not damaging the unique negatives, therefore allowing for a truly *archival* reading; retrieved sound documents can *directly* be stored on digital media for *secondary* "archiving or processing" = Gfal - where in fact the archive is coupled to algorithmic manipulation itself, thereby undergoing a complete metamorphosis (from intransitive to transitive) of its traditional state as monumental *stasis* and *distinct* heterotope of the present. "The central part of SpuBiTo is the height detection algorithm measuring the height of the tracks, computing the movement of the diamond stylus and reconstructing the acoustical information" = "SpuBiTo - From Image to Sound"; <http://www.gfai.de/english/projects/image-processing-industrial-applications-projects-/spubito.html>; German acronym for "Spur - Bild - Ton"

- "sonic analytics" referring to the technological analysis itself (different from the subsequent humanist "cultural analysis" of the resulting audio signal findings)

- close reading of sound as *image* dissolving any continuous wave form into discrete blocks, which are accessible for analysis only by operative techno-mathematical diagrams - a media-archaeological deciphering of sound from the past

Acoustic archaeology

- Edison wax cylinders from the beginning of the 20th century containing background recordings of environments that were never intended for memory; within the temporal figure of resonance, an earlier event can

recall a later one. What once has been considered as undesirable noises may from a different perspective (or better: hearing) turns out as a kind of acoustic cinema. This leads to the counter-historical idea of simultaneity, the co-existence of two different times, including the now-time of listening (Moore / Kiefer)

- differentiate between the cultural "social" respectively "collective" (Halbwachs) memory of sonic events and the actual (media) recording of sonic articulation from the past. For an archaeology of the acoustic the human auditory sense does not suffice; therefore track the sonic trace with genuine tools of "media studies" which is technological. One way of "acoustic archaeology" is to play a musical score on historic instruments. But the real archaeologists in media archaeology are the media themselves - not mass media (the media of representation), but measuring media which are able to de-cipher physically real signals techno-analogically, and representing them in graphic forms alternative to alphabetic writing, requiring "moving" diagrams (since sound is articulation in time): the oscilloscope

- storage-and-transfer techniques of audio carriers changing from technically extended "writing" such as analog phonography to calculation (digitization); "graphical method" (Marey) still in accordance with the recording and representation practice of event time as a function of historiography); not just another version of the materialities of tradition, but a conceptual change. From that moment on, material tradition is not just function of a linear time base any more (the speed of history), but a new, basically atemporal dimension (acceleration), short-cutting the emphatic time arrow and demanding for a partial differentiation (just like the infinitesimal calculus was introduced by Leibniz as a measure of non-linear change *within* speed)

Sonic Media Archaeology

- transmitting sonic information to future ages by coding (Carpo on Alberti), allowing for a later re-sonification, not by direct audification (like the phonographic record) but in terms of parameter mapping, has been the musical score - depending, though, on a physical "medium" - be it the human voice or the appropriate music instrument - to be re-implemented into the physical world. Another variance is the survival of original instruments from the past which allow not for the exact re-play of every melody which has been produced upon it but at least to re-produce the fidelity of the defining and definite sound spectrum = "Model-based sonification" as described by Florian Dambois, Sonifikation. Ein Plädoyer, dem naturwissenschaftlichen Verfahren eine kulturhistorische Einschätzung zukommen zu lassen, in: Petra Maria Meyer (ed.), Acoustic turn, Munich (Fink) 2008, 91-100 (92)

- media installation *Voice of Sisyphus* under Legrady's artistic direction, methods of "digital archaeology" (operative image analysis) are being used to sonify the image-as-memory itself. A black & white photographic image from the 1970s displaying a hotel scene "At the Bar" is filtered by a computer program which then reads the segments and produces sounds out of them resulting in a continuously evolving composition; no deliberate, but a algorithm-based, rule-based, in Foucauldean terms *archival* transformation; like for digital image compression, an image region is selected, this block then "linearized" and "read" for FFT like a analog TV signal, line by line. Giving a voice to the image; <http://vimeo.com/30238729>; with sound: <http://vimeo.com/34859885>; VOICE OF SISYPHUS: AN IMAGE SONIFICATION MULTIMEDIA INSTALLATION presented at The 18th International Conference on Auditory Display (ICAD-2012), June 18–22, 2012, Atlanta, USA; paper: http://www.mat.ucsb.edu/Publications/McGee_ICAD_2012.pdf

- term *archeo-acoustics*; "pre-historic" not in the temporal/historic but *structural* media-archaeological sense of non-discursive (cultural), rather implicit sound; situation Sirenen expedition

- cultural appearance of acoustic echo, digested as Greek mythologem, re(oc)curing (equi-temporally) by electro-mechanical, technical, afterwards computational means: generative echo resp. reverb, *without bodily source*

- tecsound signal rather than sign; "sonicity" as implicit sound, non-human dimension of sound

- Anthony Hempell, "The Resonating Interval. Exploring ..."; McLuhan differentiating between "pre-" and "post-Euclidean" acoustic space