[Wolfgang Ernst: NOTES ON TECHNICAL MEDIA]

NOTEBOOK "COMPUTATION, ANALOGUE AND TIME-DISCRETE COMPUTING"

[unedited cursory notes, theses, excerpts, grouped into thematic blocks; online www.medientheorien.hu-berlin.de, section "Ernst in English"]

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- Archaeology, computing

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- Asynchronous communication "online"
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- The Pandemic Crisis as "Data Drive", and the "Great Transcription"

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NOTES ON ANALOG COMPUTING

- "The incalculable in matter measures" = e-communication March 13, 2024 Scott Lash, concerning Longo, Cauchemar

x therefore emphasis on analog computing: "The analog computer measures, while the digital machine counts" = Norbert Wiener, Mathematik - Mein Leben, Düsseldorf / Vienna (Econ) 1962, 119

The "post-computational" has been the pre-computational: analog computing

- "analog computer" not simply mimicking the physical behaviour of the real world; analogy derived from a common mathematical analysis of both real physics and the physics of the analog computer: simulation based on the mathematical equivalence of analog electronics to dynamic beings in the world; epistemology of electrical analogies (Charles Care)

- contemporary media culture almost automatically identifying "the computer" with digital computing; analog computer as apparatus not simply a dead end in the history of calculating technologies; taken as a method, analog mathematical modelling and continuity (the core of analog computing) remaining a radical alternative to algorithmic computation

- Simondon conceptualizing evolution of *analog* technical devices (techno-logical individuations); different for computational machines;

analog (and therefore as well future quantum-)computing making a decisive multi-valued difference

- "post-computational" not (only) quantum computing and hypercomputation but a re-turn (recursion) of analog computing; conventional philosophy rather not adequate for analog signal transducing technologies (electro-engineering); different with techno-mathematics; two deeply philosophically routed disciplines, mathematical reasoning and philosophy of technology, here merging

- scientific experimentation by computing usually associated with the digital computer, where the mathematical algorithm is a model of the physical event to be simulated; on the contrary, simulation by analog computers performing mathematical simulation by (electro-)physical means itself

- simulation when the material object not even yet exists, such as the simulation of a nuclear reactor by analog computing

- analog computing: material elements which embody certain mathematical structures like integration and multiplication coupled according to a model analogous to the simulated object; analog machinery not a metaphysical, instransitive abstraction from the world (a "language"), but part of physics itself - physically real, mostly unaccessible world to what can be perceived by human (measuring) senses, as defined by Max Planck; technology man-made, thus: culturally variable

- analog computing *not* computation; message of analog computing: doing mathematics in the engineering way (different from Claude Shannon's mathematization of engineering)

- in analog computing interface differing from numerical computing (until the graphical user interface turned the digital computer itself into a quasi-analog machine - on the surface)

- analogisation not a construction of cultural knowledge, but an implicit knowledge from within nature itself; amazing analogous behaviour of a swinging pendulum (a mass, suspended at a leaver) and a "Schwingkreis", an electronic short-circuiting of induction (coil) and capacity (condensors); Fig. 1.1 and fig. 1.2 in: Giloi / Herschel o.J.: 12; syllogistic "medium term" of both operations, mechanical and electrical, is a mathematical differential equation: Fig. 1.1, ibid., 11

- "One of the most powerful applications of analog computers is simulation in which physical properties, not easily varied, are represented by voltages which are easily varied. Thus the "knee action" of an automobile front wheel suspension can be simulated on an analog

computer in which the weight of the automobile, the constant of the spring, the damping of the shock absorber, the
nature of the road surface, the tire pressure and other conditions can be represented by voltages. In practice these factors cannot be readily changed, but on the computer any one or all of these may be varied at will and the results observed as the changes are made. Analog computers are especially useful in solving dynamic problems in which the motion can be expressed in the form of a differential equation" = Operational Manual for the Heath Educational Analog Computer Model EC-1, 3

- simulation as performing experiments on a *model* in order to gain insights into the physically real, modelled system; today in most cases this modelling is computer simulation

- philosophy of software tools like *Simulink* (a derivate of the radically matrix-based mathematical tool *Matlab*, a commercial product of *The MathWorks*) differing from previous generations of simulation software, in that it is time-based simulation, and *Stateflow* which is event-oriented simulation; such software is based on signal processing itself, thus respecting the micro-temporalities of signal behaviour itself. Signals are temporal events, defined as "the variation through time of any significant physical quantity occuring in a useful device or system [...] a time-varying quantity" = Edward B. Magrab / Donald S. Blomquist, The Measurement of Time-Varying Phenomena, New York et al. 1971, 1. Whereas an emulation re-enacts the functions of an object, simulation rehearses its temporal qualities (*Eigenzeit*) as well

- different from purely material (archaeological) relics from the cultural past which are subject to physical erasure and entropy, symbolically encoded information - which is the essence of digital computers and has been the cultural technique of preserving musical information despite the evanescence of acoustic articulation - ideally / almost time-invariantly transmitted to posterity. "Consequently, the EDSAC simulator is textual rather than artifactual in spirit. [...] the attention that other projects have given to physical authenticity has been directed at obtaining authentic program texts. [...] as with musical scholarship, this texual approach permits the informed and explicit filling in of lost textual fragments" = Campbell-Kelly 2000: 399

- on "reenactment" Collingwood's 1928 lecture "Outlines of a Philosophy of History", in: R. G. Collingwood, The Idea of History, Oxford 1946 (rev. edn. 1993), 440-443

Analog computing for / as simulation

- temporal behaviour (the "time-window", be it real-time or delay) a criterium for the definition of simulation

- message of analogue computing experimentation: doing mathematics in the engineering way, but different from Claude Shannon's mathematisation of engineering

- analog computing different from numerical computing (until the graphical user interface turned the digital computer itself into a quasi-analog machine - on the surface

- analogisation between physics and the analogue computer not a construction of cultural knowledge, but an implicit knowledge in nature itself. Again and again scientists have been amazed by the analogous behaviour of a swinging pendulum (a mass, suspended at a leaver) and a "Schwingkreis", an electronic short-circuiting of induction (coil) and capacity (condensors): Fig. 1.1 and fig. 1.2 in: Giloi / Herschel o.J.: 12

- syllogistic common denominator of both operations (mechanical and electrical) a mathematical differential equation

- simulation defined as performing experiments on a model
in order to gain insights into the physically real, modelled system; today in most cases this modelling computer simulation

- philosophy of software tools like Simulink (a derivate of the radically matrix-based mathematical tool Matlab, a commercial product of The MathWorks) differing from previous generations of simulation software, in that it is time-based simulation, and Stateflow which is event-oriented simulation; such software based on signal processing, thus respecting the micro-temporalities of signal behaviour itself. Signals are temporal events , defined as "the variation through time of any significant physical quantity occuring in a useful device or system [...] a time-varying quantity" = ???, whereas an emulation re-enacts the functions of an object, simulation rehearses its temporal qualities (Eigenzeit) as well

- temporal behaviour (the "time-window", be it real-time or delay) a criterium for the definition of simulation

- time axis manipulation not easily performed with purely physical, electro-techical mechanism. "Der Erkenntnisvorteil von Simulationen liegt in ihren Extrapolationsmöglichkeit für Bereiche, die zu klein oder zu groß sind, zu schnell oder langsam ablaufen" = Gabriele Gramelsberger, Im Zeichen der Wissenschaften, in: Gernot Grube / Werner Kogge / Sybille Krämer (Hgg.), Schrift. Kulturtechnik zwischen Auge, Hand und Maschine, München (Fink) 2005, xxx-xxx (448 f.) - chrono-morphing experimental events or even creating "events" which otherwise have not been percetible to human senses.

Approximating analogue physics: RealFlow's "daemons"

- RealFlow a 3D software to simulate fluids in physics - thereby answering the differential equation (analog computing) by the difference method (discrete computing); can a time-discrete computing model (computer physics engine) only approximate the physical flow event, or computer-graphically display the *effects* of physical dynamics, not such dynamics itself

- with RealFlow technology using particle-based simulations, Maxwell's (negentropic) information intelligence ("daemon") now itself simulating physical entropy: "These particles can be influenced in various ways by point-based nodes (daemons) which can do various tasks such as simulate gravity or recreate the vortex-like motion of a tornado." = https://en.wikipedia.org/wiki/RealFlow, accessed February 23, 2022

NOTES ON MACHINE(-)WRITING AND TIME-CRITICAL COUNTING

Still human? Counting and adding

- alphabêtise (Lacan); "reading" with a scissor in hand, cutting redundant text passages down to its relevant, recombinable pieces. "It is entirely possible to build something without understanding it" = George Dyson, The Third Law. The future of computing is analog, in: Possible Mind: Twenty-Five Ways of Looking at AI, edited by John Brockman, Penguin Press, 2019; quoted here from https://medium.com/s/story/the-future-of-computing-is-analog-e758471fbfe1, accessed February 25, 2019 - which is Gödel's procedural mathematics, and Turing's symbol-manipulating machine.

- human hands enabling tasks resulting in cultural techniques (Leroi-Gourhan); elementary fingers which literally lead to digital counting in its most basic form: adding to ten decimal numbers

- intuitive tuning instead of exact counting: operating the slide rule; difference between machine and instrument; adding without numbers

- mechanical mathematical operation. "Adding" to which all computing can be reduced is a kind of archaic symbol operation: when counting, humans are in a machine state; adding with fingers not simply a cultural technique any more (defining culture as symbolic act), but already an externalization of the animal (body). The media-archaeological approach removes the borders between human and machine: with the counting hand already as "extension" of man, as prosthesis, as first media coupling of the body

- mechanical "adder" mechanism: fig. "mechanische analoge Addierwerke" in: Pflüger 2005: 30. Pflüger asking "ob der Computer überhaupt 'rechnet'"; rather: "symbol manipulating device", operating on binary symbol chains. Rather information processing in terms of entropy (Shannon); "Rechnen im herkömmlichen Sinn stellt dabei nur eine operative Möglichkeit unter anderen dar." Opening the notion of computing.

- treating binary discrete electronic states as "numbers" an arbitrary symbolisation; binary computer: counting with integers; analogue computer: real numbers

Back into counting

- humans counting (adding) numbers by fingers; binary computer, on the contrary, adds numbers by gates, derived from Boolean logics: digital-electronical circuitry for adding binaries; the logical and mathematical implications; cp. *analog*-electronical adding circuitry: physical voltage, or even more basic: analogical adder with wire ropes (Lego or Fischer Technik)

- no "GO TO" for "for / while"

- computer the operative entanglement of logics and matter: therefore it counts rather than narrates - close to "machine language" (Assembly) where algorithmics precedes narrative

- digital computer (on silicon chip) not counting with positive or electric electrons (0 / 1), i. e. charges (Ladungen) but with electric force (voltage / Spannung). "0" symbolizes not a single electron but a whole assemblage, sufficiently different in numbers from symbolical "1" = significantly other voltage (ex-5 V, now: 3,3). Statistical rather than exact amount - the oppositive of what adding of whole numbers (integers) appear as on the symbolical level. There is no truly "binary" adding but physically fuzzy numbers of electrons (like electron "shot" effect in vacuum tubes as binary switches). Becomes critial only on the quantum-computing level

- addition / counting time by seconds: clock mechanism; Mumford, Technics and Civilization, 1934 / 1963

- UNIX time, atomic time clock (PTB Braunschweig), "broadcast" via DCF77: de-couples "cultural" time from natural astronomical time, creating anachronisms which are compensated by leap seconds. A media-epistemological moment: cultural techniques of time-keeping transform into trans-cultural technologies. Within the computer, there is

both a physical clock (called "realtime clock", hardware: quarz oscillator) and a logical clock (software); computing turns time-measurement into information, resulting in "multiple times" = Jeremy Rifkin, Uhrwerk Universum. Die Zeit als Grundkonflikt des Menschen, Munich (Kindler) 1988 [A0 Time Wars, 1987], 134, referring to David Bolter, *Turing's Man*

- according to Helmholtz, inner ear acting as a Fourier analysator; computing (analog / digital) within hearing; electronic non-human voice synthesis nothing but another version of what is inside the human understanding already where the physiology of hearing privileges "musical", i. e.: harmonic sensation; Ferdinand Trendelenburg, Klänge und Geräusche. Methoden und Ergebnisse der Klangforschung, Schallwahrnehmung, grundlegende Fragen der Klangübertragung, Berlin (Julius Springer) 1935, 13

- central register named ›Accumulator‹ in early-Mikroprozessors (8-Bit-Prozessors) like Z80, where arithmetic and logic operations take temporarily place

The "gesture of programming" (with Flusser)

- media-archaeological devices from early electronic computing to demonstate how hardware to perform discrete numerical operations - nowadays almost exclusively be associated with integrated circuitry - literally transfered from a voice communication technology, such as manual telephone switchboard

- Flusser on "gesture" of telephoning; concentrates on dialling. In the analog mode, numbers from zero to nine which can be dialled not manually but usually by the index finger. The meaning of "the digital" in current media culture refers to computer-based technologies. More precisely, the real "message" of the digital (in McLuhan's sense) is the binary code - which in fact reduces the hands with 10 fingers (Latin *digitus*) to just two micro-movements of on/off gestures. This is bound to decimal arithmetics (logarithm basis 10) which shifts to logarithm basis 2.

- the hand "human" at all, or half way to a machine (mechanism) already, an interface in the technical sense? uncanniness of the hand: humans not sure any more - faced with robotic and other prosthetic "hands" - that this is an integral human body part, its extension of even its autonomous brain-hand-system in the cybernetic sense

- doing things symbolically ("machine notation", with Babbage) vs. wiring / patching manually, close to the "real" of hardware

- "Archaeological *data* consists of recorded observations. These might be measurements of the size of a handaxe, the stratigraphical relationship between two layers or the geographical location of a site. Whilst archaeological data is frequently numeric, it can equally well be non-numeric, such as the name of the material or colour of a object. It also comprises visual data, such as photographs, plans or maps" = J. D. Richards / N. S. Ryan (eds), Data Processing in Archaeology, Cambridge U. P. 1985, 1 f.

Proto-programming

- archaeology of Russian computational thinking not restricted to paper-based research in State archives or explicit oral history interviews, but implictly embedded within the remaining machines themselves

- "After American weapon factories during the Civil War had already delivered guns which exchangeable parts, World War One extended the exchangability of guns like the notorious 08/15 to an extend that its single parts could be produced in bicycle and typewriter factories as well. Only such really modular systems, as having been claimed by Babbage for his proto-computer already, inaugurated the option of programmable hardware to a limited degree [...]" = Friedrich Kittler, Hardware, das unbekannte Wesen, in: Lab. Jahrbuch 1996/97 für Künste und Apparate, edited by Academy of Media Arts, Cologne 1997 (Walther König), 348-363 [350, transl. W. E.]; only a digital computer can be "structurally programmed" = Michael Conrad, The Prize of Programmability, in: Rolf Herken (ed.), The Universal Turing Machine. A Half-Century Survey. Hamburg-Berlin 1988, 289

Algorithmicized editing

- "intro email" sent from online platform successing instructions for step-wise editing / schedule reading like a machine-generated text (part of "Technológos" theme already); confidence, through, that there is still a human behind - unless a Turing test: "but it was still sent by me and so definitely a human behind that" = electronic mail Joseph Gautham, 23 November, 2020; production of Techno*lógos* book: technical language of this procedure in the full sense of techno*lógos* argument indeed

Computing symbols

- "The length of numbers in binary notation is at least double that of numbers in the decimal system [...]. This makes the binary system impractical for human calculators, but it does not upset computers in the least. From the computer's point of view, these sequences of 1 and 0 are

convenient, for they are easily codified in electric signals; the passage of current expresses 1, its interruption 0" = Denis Guedj, Numbers. The Universal Language, xxx (Thames & Hudson) xxx, 59

- computer processing whatever can be reduced symbolically to a set of numbers and (electro- or otherwise physically) really to sufficiently distinctive binary states

- *operational* machine always already trans-symbolic

- non-verbal, diagrammatic and algebraic language describing the technical transfer of speech by pulse code modulation (analog-to-digital sampling, different from FM) not philosophical but techno-epistemic in the most precise sense = B. M. Oliver / J. R. Pierce / C. E. Shannon, The Philosophy of the PCM, in: Proceedings of the Institute of Radio Engineers vol 36 (1948), 1324-1331

- technical design / the diagram becoming operative in its implementation as a machine; such mind / astral body transsubstantiation becoming symbolical with algebraic programming and its implementation as software

Human and / or media-archaeological moments: computing

- pressing a key on a computer keyboard usually associated with some kind of symbolic meaning, as part of a word, a sentence, forming longer sections etc., which consequently then gets displayed on our computer screens, making us able to read it. But, through a media archaeological viewpoint, the keyboard sign is transformed into a electro-physical signal, thus loosing all its semantic referentiality and becomes a coded element, an electrical signal, within a physical computer, loosing the traditional symbolic meaning and gaining electro-physical indexicality. This introspective of the "algorithmic sign" (Frieder Nake) induces a more diverse understanding to the relationship between encoded symbols and their physical manifestation - a non-discursive, algorithmic configuration of the alphabetic symbol as signal events. The symbols loose their semantic meaning and become electrical indexes that have a new meaning and application inside the electro digital circuity.

- for FlipFlop circuit as signal event to happen, not necessary to know the genealogy of this technological device; the technical event functions like an analog version of the Markov chain: probabilities of immediate future behaviour is dependent only on its present state

- "calculating machine" post-human (Kittler) or rather intra-human (Turing 1936 / Lacan)? cultural or equi-primordial (implicit) knowledge? Krämer, *Symbolische Maschinen*, 4: Genealogy of logical formalisation "in

der wir gelernt haben, uns beim Operieren mit Zeichen so zu verhalten, als ob wir eine Maschine seien." While for Kittler elementary cultural techniques are absorbed in technologies, Krämer still defends habituation: "Eine Kulturtechnik ist für eine Praxis, die so transparent ist, dass sie nicht mehr bewusst erkannt wird" = Arndt Niebisch, Die Liebe zur Ziffer. Positionen einer posthumanen Philologie, in: Pál Kelemen et al. (eds.), Kulturtechnik Philologie, Heidelberg (Winter) 2011, 163-183 (177), parphrasing Krämer; *dissimulatio artis* in rhetoric

- theoretical distinction by Jacques Lacan, the real, the symbolic, and the imaginary: "We learned to read RSI as gramophone, typewriter, and film" = Axel Roch, Hegel is Dead: Miscellanea on Friedrich A. Kittler (1943-2011), in: Telepolis (November 17, 2011); http://www.heise.de/tp/artikel/35/35887/1.html (accessed June 26, 2017)

Both discursive and nondiscursive: "Media archaeology of the stack"

- stack ["Stapel-" / "Kellerspeicher"] a) "an operative structure that exits materially within the program code of software systems" = Rory Solomon, Last In, First Out. Network Archaeology of/as the Stack, in: *online* magazine Amodern no. 2 (2013), thematic issue "Network Archaeology", http://amodern.net/article/last-in-first-out; b) "a class of diagrams" (Solomon) which only come into being / become dynamic when time-operations by electric biasing (Zachary Dempster)

- physical media channel as nondiscursive infrastructure for the passage of discursive enunciations; triodes / transistors as discrete media channel?

- physical hardware and hidden data processing algorithms of computational media as subsemantic layers, *both* discursive (source coding) and nondiscursive (operationally implemented)

Digitality **instead of the whole "hand"**

- digital "sampling" ("Abstasten") - the central momentum in the conversion of analog signals in the physical world to numerical computing - corresponding with the discretization of the human hand into single "fingers" (Latin *digitus*); for Marshall McLuhan, even the cathode ray in the television tube is a "scanning finger" which is a *massage* to the retina in the human eye. With McLuhan's extension of the "haptic" qualities and of tacility to *all* senses (not just the finger tip), all of the sudden, even if he seems to have neglected the emerging computer as medium, he is a media-archaeologist of the "digital": "Our very word 'grasp' or 'apprehension' points to the process of getting at one thing

ghrough another, of handling and sensing many facets at a time through more than one sense at a time. It begins to be evident that 'touch' is not skin but the interplay of senses" = Marshall McLuhan, Understanding Media,New York et al. (McGraw-Hill) 1964, 60

- difference between the nature of haptic (acoustic) and electro-magnetic (visual) signal sensation matters. While Aristotle could not admit a self-induced signal transfer like it happens since James Clerk Maxwell discovered the nature of electro-magnetic wave dynamics, he had to suppose a fictional medium called "ether"; for the Aristotle all signal transmission happened in a material, almost haptic medium (*to metaxy*)

- for age of electricity, McLuhan identifying return (reoccurrence) of the primordial (oral language-controlled) "tacility". Its decisive criterion is its (almost) instantaneous speed of transmission. With electric media - not to be confused *electronics* and with strictly more "digital" electronic computing - begins the technical formation of tactility = Till A. Heilmann, Digitalität als Taktilität. McLuhan, der Computer und die Taste, in: Zeitschrift für Medienwissenschaft 3, no. 2 (2010), 125-134 (128)

- correlation between discrete arithmetic numbers / cultural technique of counting with fingers: "All of these anticipate later electric forms because, like the digital computer with its mulitple yes-no dots and dashes, they caress the contour of every kind of being by the multiple touches of these points. Electricity offers a means of getting in touch with every facet of being at once, like the brain itself. Electricity is only incidentally visual and auditory; it is primarily tactile" = McLuhan 1964: 247 f.; electric current stroke / impulse; pointillism, Morse code) pre-figuring digitality; sampling of analog signal qualities (image telegraphy / television) = Heilmann 2010: 131

- Henry Fox Talbot envisioning, with chemical photography, the liberation of visual art from the painterly hand. "[...] photography made people realize that art was not necessarily the manipulation of a plastic substance like paint or materials of any kind. It is an act of selection, you press the shutter" = Jonathan Benthall, The Computer as Medium, in: Rosen (ed.) 2011: 461-465 (461); in unexpected recursion, artistic hand coming back to the picture, but not in a painterly mode any more: "The artist no longer directly touches or manipulates color, material, or objects. He or she manipulated algorithms, which are more or less abstract" = Abraham A. Moles, Introduction to conference *Computers and Visual Research*, Center for Culture and Information, August 3-4, 1968, Zagreb, reprinted in: Margit Rosen (ed.), A Little-Known Story about a Movement, a Magazine, and the Computer's Arrival in Arts. New Tendencies and Bit International, 1961-1973, Karlsruhe (ZKM) / Cambridge, Mass. (MIT) 2011, 263-266 (265)

- finger(s) on the Morse key / telegraphy; Heilmann 2010: 133: the world of the symbolic (order); counting with fingers / mathematization / mechanizations: "fingers-on", only two fingers: binary, typewriter MIGNON

- programming in *assembly languages*; these machine orientated languages „do things“ directly = "The Gesture of the Programmer" (Stefan Höltgen, abstract conference Brünn, 2014). In the sense of John L. Austin, they connect elements of hardware; they make the electrical signals flow in a distinct way through the circuits; and beyond all that their syntax and semantic stand for a theoretical model for the computer itself (Turing completeness). So the coder at the keyboard becomes much more than only a writer/autor of code. He applies a theoretical "symbolical" machine to a physically real machine; programming forces the „universal Turing machine“ to become a „special purpose machine“ – only by using words from a special alphabet, the programming opcodes

- articulated speech (*lógos*) deriving from biomotoric bipedality that liberated the fingers for grasping, and the face for speaking: "[T]he development of the cortex, of technology, and of language all follow from the adoption of an upright stance." = core argument in: André Leroi-Gourhan, Gesture and Speech, Cambridge, Massachusetts / London (MIT Press) 1993, as paraphrased in the entry "André Leroi-Gourhan", https://en.wikipedia.org/wiki/André_Leroi-Gourhan, accessed March 25, 2024

Not hands, but fingers: the "digital"

- Jeron Lanier 1989: presentation of a "data glove"; immersion / reentry of "mani"pulation in form of the computer mouse / the pointer on the screen

- limited manual precision in anloge computing with sliding rule; "on the other hand" infinite variability of "real numbers" which the digital computer always misses; Abakus: discretisation. Numerical computing turns the hand into fingers: "analysis" (elementarization) with which symbolic notation (alphabet / numerical mathematics) corresponds different from geometrical drawing

- hands on instruments: *soldering* as opposed to type-writing (and programming for digital mechanisms); in TM reduced to two "keys" (binary code / bit)

Hand-writing *versus* type-writer

- Nietzsche's use of typewriter inducing a different kind of reasoning; key-

board of Nietzsche´s Malling Hansen; animation of the transporting ribbon mechanism, clock-like; implicit Turing machine; analyse Nietzsche ´s typewriter (at the Weimar Classic Collection) by writing: an operative analysis, where any textual hermeneutics of the poems written by Nietzsche on this very machine cannot reveal his experience with the ostacles of the mechanism. It is in their operativity that technical media *time-criticvally* (crucially) unfold

- media-archaeological view of early printing culture: not appearance (the Gutenberg Bible emulates handwriting, with the previous medium being the "content" of the new one according to McLuhan's law of media); technology of identical (re)production: identical "letter" casts from matrix negative

- media revolution not printing as such (in fact the typography of the Gutenberg Bible explicitely aims at emulating the appearance of the illuminated handwritten manuscript - with the previous medium being to content of the following one). It is rather the hidden technology of identical casting of metal letters (not the writing as such) from a master mould which lead to a new technological mode of identical reproduction of textual knowledge (and printed illustration, giving rise to scientific knowledge exchange - as emphasized by Elisabeth Eisenstein's classical study on the Printing Press as an Agent of Chance). Once more, media archaeology rather focuses on the non-discursive technological pre-conditions of discoursive knowledge in the Gutenberg era.)

- Russia and Persia around 1850 establishing telegraph lines on their territory to facilitate communication with the Indian sub-continent; lines suffering from heavy signal degeneration over space; therefore a readable telegram between London and Kalkutta was rather improbable through the agency of personel with deficient language facilities; solution their replacement by non-human repeater-regenerators

Machine-writing

- term "manu-script" not relating to human hand-writing any more but the typographic original of the printed book = Peter Stein, Schriftkultur. Eine Geschichte des Schreibens und Lesens, Darmstadt (Wiss. Buchges.) 2006, 176

- alphabetic writing (MCLuhan) pre-conditioning epistemology of analysis (elementary practive, combined with the eye: reading), vs. "acoustic space" (returning with electricity)

- Polhem's "mechanical alphabet" (Sweden, 17th century), including, analogous the alphabetic vowels, core dynamic mechanisms (lever, wheel, wedge, screw); his Laboratorium Mechanicum; cp. Franz Reuleaux

- hand-driven phonograph / grammophone (Emile Berliner); the ear much more sensitive to unregularities. "Bei der Wiedergabe musikalischer Töne macht sich jede Unregfelmäßigkeit bei der Drehung der Walze, die ja durch Handbetrieb erfolgt, unangenhme bemerkbar" = Report in *Leipziger Illustrierte* from 1878, quoted in: Herbert Haffner, "His Master's Voice". Die Geschichte der Schallplatte, Berlin 2011, 20

- hand-held endoscope / stethoscope in medicine *versus* ultrasound image; artefactuality of the camera objective

"Thinking with the machine. Nietzsche and automatic writing" (Kittler / Striano)

- Francesco Striano's translation of Friedrich Kittler, pp. 293-301 of GFT (concerning Nietzsche and the typewriter); passage named here: "Pensare con la macchina. Nietzsche e la scrittura automatica", in the open access journal: Kaiak. A Philosophical Journey, 8 (2021): "Interfaccia" issue. Date of publication: 12.04.2021

- additional essay by Francesco Striano, framing Kittler's interpretation of Nietzsche, entitled "Nietzsche secondo Kittler. L'interfaccia e il pensiero" ("Nietzsche according to Kittler. Interface and Thought", ibid.; link to the current issue of the journal: http://www.kaiak-pj.it/it/rivista.html

- Striano's "Nietzsche secondo Kittler" commentary to Kittler's core thesis in GFT (with Lacan, and Foucault), with special footnote on "tecnica culturale" (which here concerns alphabetic hand-writing vs. truly techno-logical machine type), and with outlook on Turing beyond Nietzsche; concerning the end of Striano's second commentary paragraph, in a non-historicist approach to media temporality, rather not say that in Nietzsche's times the symbolic order was "not yet" (Striano) ready for the computation machine, since there has been Babbage's Analytical Engine already - or "all-ready" / "bereit(s)", and Boole's symbolic algebra

- translator Striano suddenly, after initial on-line publication, realizing that the journal's editorial team had made a minor correction in one sentence which would have completely changed the meaning of the translation; had the error corrected, so a new file uploaded to journal Kaiak; a reading test? basically "translated 'als angeschriebener Leser, der die »delicate« Schreibkugel namens Nietzsche in aller Zweideutigkeit »benützen« würde' with 'così come il lettore destinatario che si troverebbe a sua volta ad “adoprare” la «delicata» (Nietzsche 2004, 171) Schreibkugel chiamata Nietzsche in tutta la sua ambiguità'. The point is

that "die Schreibkugel namens Nietzsche" is important, since it refers to the identification of Nietzsche with his writing medium [...]. The editorial team, however, thought that "chiamata Nietzsche" was a typo, as it probably seemed strange to them that a typewriter was called 'Nietzsche'. So they changed it [...] in "la «delicata» Schreibkugel chiamata da Nietzsche in tutta la sua ambiguità", which, however, would mean "the 'delicate' Schreibkugel called by Nietzsche in all its ambiguity" = April 19, 2021 Francesco Striano; "humanist" ideas of authorship apparently not ready to admit techno*lógos*; this incidence in the "corrected" translation is media-metonymic of a much deeper, and more general, dilemma in human culture when confronting the machine; after Striano's report, the file on the journal's online page replaced / updated

- Kittler's expression "die Schreibkugel namens Nietzsche" ["a typewriter called Nietzsche", p. 299] referring to the identification of Nietzsche with his writing medium ("a writing machine "like me: made of iron")

- Nietzsche on typewriter: 'Una sfera ["Ball"] per scrivere è come me: di ferro,
ma facile da manovrare, specialmente in viaggio" - somewhat *mobile medium*.
"Pazienza e tatto bisogna avere
e dita delicate, per adoprarci' (Nietzsche 1965, 459).

- "speaking error" of the journal editors "correcting" the apparent "typo" in initial translation of the central sentence by Kittler on Nietzsche's co-identification with his writing machine; in parallel to the well-known "Freudean slip of the tongue", and Lacan's "insistence of the letter in the unconscious", an incident of the "technological unconscious" which human-centered discourse does not want to admit; "humanist" ideas of authorship not ready to admit techno*lógos*; this incidence in the "corrected" translation media-metonymic of a much deeper, and more general, dilemma in human culture when confronting the machine; in his initial remarks (1937), Turing more at ease with the idea that the culculating human, when writing and manipulating numbers on paper, is already in a "machine" state

- this significant / "telling" translation incidence recalling experimental article to a forthcoming publication (edited by Jens Schröter and Till Heilmann from Media Science at University of Bonn), called *Kittler 1985 / 86*: W. E., "AUSTREIBUNG DES EIGENNAMENS AUS DEM NACHLASS 'KITTLER'. Vom Subjekt zum Objekt von Medienarchäologie", forthcoming (Kittler's re-thinking media in transition / break between *Aufschreibesysteme* and *Grammophon, Film, Typewriter*); accentuating the breaks and ruptures which occured between the paradigms of *Aufschreibesysteme* and *GFT*, so that both works are not simply linear succession, but rather Foucaultean media-epistemic dincintinuities (esp. regarding the role of computation / computing); daring to replace the

author name "Kittler", much in the sense of the translation incidence in your Kittler / Nietzsche text(s), rather by "author functions" such as "Nachlass-Kittler", "Computer-Kittler", "Kittler-Synthesizer", and foremost "Text-Kittler" and "Machinen-Kittler"; convince the editors to let this be written as intended

Automated Machinery of Academic Publishing Business

- page-long "editorial" software instructions; rejection to take part in text production in times of last capitalist publishing; off-line work not tightly coupled to such a databank machinery; writing texts rarely connected online (ironic in the context of "Internet" logics); not inscribing into the automated machinery; somewhat antiquated approach to academic authorship (the "Old Europe" style)

McLuhan at the borderline of digital computing

- McLuhan's focus on electricity blinding him to conceive the computer as a primarily techno-mathematic, algorithmic device (*aka* Turing machine); alphanumeric processuality (with its non-linear branching) escalating the analytic transformation of signals into symbols privileged by the alphabetic order, resulting in the "Euklidic control system" (McLuhan)

- a media-episteme which is the opposite of the alphabetically elementary "Euclidic centralism" as cultural technique - electricity with its acoustic qualities = Bruce Powers in dialogue with McLuhan, in: Marshall McLuhan / Bruce R. Powers, The Global Village. Der Weg der Mediengesellschaft in das 21. Jahrhundert, Paderborn (Junfermann) 1995, Kapitel "Von Engeln zu Robotern: Vom euklidischen Raum zum einsteinschen Raum", 169-184 (178); recursion of the alphabetic regime *within* the digital technologies

- operations of the symbolic machine called typewriter (discrete fingertips)

- chapter 11 of *Understanding Media* defining the nature of the number as "an extension and separation of our most intimate and interrelating activity, our sense of touch" = McLuhan 1964: 107 - when fingers are used for discrete counting; counting in times of mechanized mathematics takes another dimension

- finishes McLuhan's Understanding Media with a chapter on "automatization"; Jens Schröter, Von Heiß/Kalt zu Analog/Digital. Die Automation als Grenze von McLuhans Medienanthropologie, in: Derrick de Kerckhove / Martina Leeker / Kerstin Schmidt (Hg.), McLuhan neu

lesen. Kritische Analysen zu Medien und Kultur im 21. Jahrhundert, Bielefeld (transcript) 2008, 304-320

- McLuhan, with his servomechanistic concept of man-machine symbiosis, heavily referring to the cybernetic epistemology of his days, but significantly blinding out its mathematical foundation on which Norbert Wiener always insisted - a mathematization which ultimately replaced McLuhan's vision of a synchronous, instant and resonant "acoustic space" by digital calculation

- McLuhan's media theory not updated in a linear way (as understood in history of technology or in signal processing: linear signal transfer between input and output), but rather as a toolbox, opening an awareness for media-induced phenomena acting upon humans

- McLuhan re:loaded? transforming McLuhan from a historicised media theorist into an up-to-date model by reading him in his posthumous work, that is: as inbetween-time (almost alive, nevertheless dead)

"Contingent Computation"

- digital computation originating from formalizing the limits rather than the data processing power of computation; "founding paradox of computer science [...] that it is a field that is defined by what it cannot do" = Fazi 2018: 56; crisis of axiomatic formalism its own incomputablity; "something in computation remains unknown and [...] beyond representation" = ibid.

- human "me" of understanding computatation against the computational (algorithmic) "it"; will emerging non-classical computers themselves truly appreciate the message of Fazi 2018

- taking Whitehead further where the philosopher once stopped, to "computational prehension" = Beatrice Fazi interviewed by David Beer on "Explorations in the Indeterminacy of Computation", on her *Contingent Computation* book, in: *Theory, Culture & Society* (2020); computational *aisthesis* "in its own terms" (Fazi) and computation as "in act" (idem) actually overlapping with "techno*lógos* in being" hypothesis (even if media-archaeological approach radical diverging from the recent "affective turn" in media theory); in favour of a post-Heideggerean "representation" of computing

- "Man are flexible, capable of 'programming themselves contingently' on the basis of newly received information. Computing machines are single indeed, constrained by their 'pre-programming'" = Licklider 1960: 6

NOTES ON WRITING (THE PAST) COMPUTATIONALLY

Discrete methods: Writing the past retro-actively

- radical media archaeology a non-historicist investigation into technologies from the present past; by-passing contextual information about past media, but close reading getting into contact with technological media in their radical operability and temporality itself. Media archaeological as research method restrains from interpretative approach in history of technology but shares the techno-mathematical situation of media machines in their non-historical presentness. Their functioning operations are the media archaeological moment that is at its core un-historical; see Jussi Parikka, http://mediacartographies.blogspot.com

- occasional / event-driven technologies; dynamic media archaeography as it happens in the stored-program computer (von Neumann), in synchronous layers, describes techno-logical recursions, dis- and replacements (McLuhan's "tetrads")

- "Freudian concept of 'retroaction' (in French “après coup”; from German “Nachträglichkeit”); Digital Retroaction: A Research Symposium (The Digital Cultures Project), UC Santa Barbara, September 17-19, 2004; "retroactively" the operations of digital data processing in the present redefining understanding of cultural engineering in the past

- in digital data circuits, "retro-action" not a translation between the past and the present any more, but a cybernetically closed circuit (the feedback-option / back channel). When we load a document, it does not come from a materially, but just logically separated "storage" space (the von-Neumann architecture of computing merges programs and the data to be processed dynamically into the same working memory); computers "retro-actively" transforming narrative aesthetics into non-discursive configuration of events - a formal, algorithmic chronography

- digital media today transforming the present immediately into past ("antiquity", according to Walter Benjamin) by the very speed technological formats and data themselves pass by; "media archaeology of the present" leads to a different perception; past suddenly turns out to be storage - a digital retroaction. Since the tradition of the past suddenly looks like "a medium, in which past idas and meaning is present in a coded form" = Ulrich Veit et al., Spuren und Botschaften. Interpretationen materieller Kultur, Münster / New York 2003, 11; be it material artefacts or records. As long as a culture stores its knowledge in pyramids or DVDs, archaeology as technology of revelation will be practices but might become redundant in a culture which switches from the mode of storage to permanent transfer

- electronic computing where electronic circuits perform logical operations; technical term for this is "inductive retroaction" (flip-flop, designed by Eccles / Jordan 1919). The digital computer operates in terms of numbers represented by simple pulses (a reverse interrelation between physics and representation). Information, numerical *or otherwise*, is represented by means of distinguishable (discrete) characters

***Er/zählen*: narrative *versus* calculation**

- "Cohesive but Not Coherent: Music Videos, Narrative, and Culture" = paper presented at the 1988 Popular Culture Association Conference by Steve Jones, "schematized narrative as mimetic, analog, and digital, specifying that in digital narrative, a nonlinear `mosaic of fragments', `information is presented in discrete steps, bearing no resemblance to what it communicates.' [...] texts whose form stresses descrete digital mo<nu>ments [...] and those whose subject matter is the representation of our increasingly digital culture [...] with digitalization, information beomes easily edited into different forms" = Brooks Lundon, Not what it used to be: The overloading of memory in digital narrative, in: George Slusser / Tom Shippey (Hg.), Fiction 2000: Cyberpunk and the future of narrative, Athens, Georgia (Univ,. of Georgia Press) 1992, 153-167, note 2

- Alan Turing's notion of a computing mechanism to calculate computable (real) numbers based on the unconditional assumption that this machine can only exist in discrete "states"

- nondiscursive, algorithmic configuration of events; operation of the machine itself with no discursive agenda, or agency, other than to execute a specific task of functionality

- writing itself not derived as means of communication, but of calculation

- with the proto-Sumerian counting "tokens", truly digital. "Counting by numbers": Media archaeology stratigraphically dis/covers a layer in cultural sedimentation which is neither purely human nor purely technological, but literally inbetween (cultural techniques): symbolic operations which turn the human into a machine as well as they can be performed by machines (once that numbers were abstracted from the material things and could then be re-implemented in matter again, as "calculi" - stones included in a clay cube, sealed, with their written on it) or in computer hardware = Denise Schmandt-Besserat, Before Writing. From Counting to Cuneiform, Bd. 1, Austin, Texas (University of Texas Press) 1992

- every detail regarding phyiscal tone, colour, shape and movement,

after A/D sampling, expressed as quantified rows of binary numbers; this world view conceptually resembling that of Pythagoras, creating a media archaeological short circuit between ancient Greece and the present digital reality, but difference in the micro-physical knowledge (Fourier-analysis) of the vibrational event; "time" dimension mastered by transforming it into the frequency domain

- while Pythagoras saw integer ratios embedded nature (like Leibniz´ "deus calculans"), computer literally numbers the world; Leibniz´ speculation on the possibility of an eternal recurrence of things, *Apokatastasis panton*. „The alphabet encompasses the world“ writes the German Brockhaus Encyclopedia; more strictly, the alphabet only registers what can be addressed by symbols. Leibniz´ literary fragment *Apokatastasis panton* culminates in the option for an imaginary library in which whatever has happened in human past could be shelved - by consequentially performing all possible combinations of letters.

- "The power of repeating the cards [...] reduces to an immense extent the number of cards required", Ada Lovelace comments in her "Note F" (Lovelace, in: Bowden 1971: 395), and hereby describes the power of recursive loops in algorithmic operations: "It is obvious that this mechanical improvement is especially applicable wherever cycles occur in the mathematical operations, and that, in preparing data for calculations by the engine, it is desirable to arrange the order and combination of these processes with a view to obtain them as much as possible symmetrically and in cycles" = ibid.; von-Neumann architecture of stored-program computing actually allowing for self-modifying (input-adaptive) calculations in realtime

- task looks immense but is finite - as long as the alphabet is a finite one. Only whatever has been recorded in symbols can return by this play of alphabet = Ulrike Steierwald, Wissen und System: zu Gottfried Wilhelm Leibniz' Theorie einer Universalbibliothek, Cologne (Greven) 1995, 65; 23 Latin letters once saluted by Lucretius as elements of an unlimited combinatorics of thought = *De rerum nat.* 1. 823-827; Leibniz' effort to *calculate* a virtual protocol of the world epistemologically still refers to the genre of Annals and Chronicles "by which everything that can be told can be found" = Leibniz to Herzog Johann Friedrich von Braunschweig-Lüneburg, ca. 1671; Hans Blumenberg, Die Lesbarkeit der Welt [*1983], 3rd ed. Frankfurt/M. 1993, 121-149 (128 ff.), on Leibniz´ spectulative *Apokatastatis* (fragment 1715); alphabet the *type-writer* of narrative - the condition which governs what can be told at all - "everything between past and alphabet" (John Cage); whatever cannot be registered in discrete letters will escape memory: „semper enim forent discrimina etsi imperceptibilia et quae nullis libris describi possint" = Gottfried Wilhelm Leibniz, Apokatastatis panton, published in: Max Ettlinger, Leibniz als Geschichtsphilosoph, München 1921, 31; Leibniz even reducing this digital alphabet to two (binary) symbols only: "Wonderful

origin of all numbers from 1 and 0, which provides an image of the secret of creation, since everything stems from God and otherwise from nothing: Essentiae Rerum sunt sicut Numeri" = Letter by Leibniz, 18 May 1696, quoted after: Hans J. Zacher, Die Hauptschriften zur Dyadik von G. W. Leibniz. Ein Beitrag zur Geschichte des binären Zahlensystems, Frankfurt / M. (Klostermann) 1973, 209

- discrete processing at odds with continuous recording; can continuity be calculated. Once energy is turned into electricity (our physical basis of information processing), we already move within a discrete universe, since electricity is not a coherent, continually disseminating flow or fluid, but rather composed of discrete elements = Laszlo von Szalay, Moderne Technik. Elektrotechnik, Berlin (Safari) 1954, 386; natural language made up of discrete, finite elements (phonems) so that all descriptions of continuous processes happpen by a finite discrete sequence of finite elements = Pattee 1974: 130; Leibniz offering a solution by his differential and integral calculation: "A continuous dynamical system, such as the motion of several mass points in a potential field, can be calculated in practice by approximating the values of the continuous variables over a discrete mesh, and representing the mesh behavior by an automaton."

- "data" derived from whatever can be measured and thus recorded. Remains what is being filtered out by digital registration - imperceptible differences which are not being remarked by human senses (aisthetically) and electronic sensors (CCD chip)

- media archaeology dealing with the new possibilities of *pétites perceptions* (Leibniz), i. e. the subliminal operations (of nerves: von Helmholtz) as well; Shannon-Nyquist interpolation theorem, the interface between what humans (aesthetics) and machines (media-*aisthetics*) processually perceive; René Descartes referred to the slow growing of tree day by day: Who has ever noticed the little elements operating to make this tree grow? Such elements are so small and slow that they cannot be remarked naturally. But digital culture nowadays privileges an over-sampled reading of such processes

- once pixeled, that is: digitally coded, an image losing all continuous information, that is: information "inbetween"; a digital image of a pebble beach can easily be compressed, that is: calculated. Latin *calculatio* is derived from calculi themselves, that is: counting with pebbles in the sand; at the limit of digital computing: although a micro-ship materially built on sand (silicon), it is not able to calculate the random distribution of sand without aliasing effects; a human image drawn into the sand at the seashore will (an allegory designed by Foucault) vanish in specific waves in ways no digital computer will ever be able to emulate (except quantum computing); after a while, will rather look like the jammed images in early analogue TV

Computer games and / or narrative

- new media "literacy": bits which the *turingmachine* reads and (re-)writes

- Jesper Juul, Games telling Stories? in: Games Studies (2001), 7: games not narrative, but configurative; cp. TM "m-configurations" = Turing 1936

- games double-rendered, on the time-axis (play) and on the spatial axis (programming)

- computer games time-critical, with short-term moves and short-term neurological memory. The message of the medium computer games is not stories, but: cybernetics. Man experiences himself as a cybernetical model when interacting with digital media. In computer games a new concept of time is introduced

- aesthetics of CD-ROM: Programmer not interested in story; jump addresses (to Hot Spots). Designing a Computer Game = 95 % adminsitration (links); 5 % authorship; algorithm replaces story-board

- un/balance between storytelling (plot) and interactivity

- when players enters the scene in *Myst*:, no narrative guide; "story" unfolds only in experimentation; Aaseth, "ergodic" literature

- narrative structures in computer games a function of accelerating hardware, software, graphical resolution, memory capacities

- computer games content-based narratives within the framework (Heidegger's *Gestell*) established by the game developer's concept / algorithm

- Grand Theft Auto 3 as "open world game": still determined, but drastic increase of computable situations letting it appear as if with no predetermined path (in user perception), therefore "ergodic" (Aarseth)

- game-*scientific* approach to obsolete computer games: reverse engineering; difference to historical / archival research into vintage code fragments: reversibility of operational computing time, against irreversibility of temporal entropy ("history"); the "operational chain" inaugurating vintage Graphic Adventure Games not reducible to the heroic / inventive human programmer, but including non-human agencies; "see video game creation in a human context" = John Aycock, An Archaeogaming Primer, lecture for online-workshop *Game Science - Digital Humanities for Games and Gaming*, March 12, 2022 (operation

base: Signal Laboratory, c/o Stefan Höltgen, Media Science, Humboldt-University Berlin): rather anthropocentric "historical" (man-made) perspective, vs. truly "archeaological" approach to computational artefacts: presence of culturally in-formed matter, in the absence of humans; focus on human traces (idiosyncrasies of vintage programmers in codes, manual annotations in proto-digital game code printed on paper) missing the medium message: human, once coupled to the logical and material constrains of computer platforms, only co-authoring the creative options of the machine; while media historian recognizing the "human" element (intentionality), media archeaologist recognizing the "human" defined by techno-logical "play" itself; anthropocentrism of Turing 1936 (machine can emulate any calculating performed by human on paper) turned upside down: human, when calculating / programming "games", himself becoming game engine

- games *science* correlating with the non-semantic efficacy of computing: "science does not think" / "Die Wissenschaft denkt nicht" = Martin Heidegger, Was heißt Denken?, Tübingen, 1961, 4, as quoted in: Friedrich Kittler, Universities: Wet, Hard, Soft, and Harder, in: Critical Inquiry, vol. 31, no 1 (Autumn 2004), 244-255 (254)

Computers *avant la lettre*? Writing media history as media archaeology

- crucial difference between the "Renaissance computer" logic and technological machine metaphors, and the machine itself that actually in a real physical process handles the data, and not just a symbolic calculation of data; even if the theoretical foundation for the development of the computer was present many centuries before its physical manifestation, there is a substantial difference between regarding the computer and its theoretical foundation solely as a symbolic machine and regarding it as a physical object that actually conducts the calculations in a real physical process

- Neil Rhodes / Jonathan Sawday (eds.), The Renaissance computer: knowledge technology in the first age of print, London / New York (Routledge) 2000, Introduction: Paperworlds. Imagining the Renaissance Computer, 1-17

- "Knowledge of automatons, or of clockwork toys, played no part in the story of cinematography, nor is there any link between it and the production of animated 'scenes'. We can therefore omit plays, the baroque automatons, and the marionette theatre. Even the 'deviltries' of Porta, produced with the camera obscura, the phantasmagorias of Robertson, the 'dissolving views' of Child, are not to the point. All these discoveries did not lead to the first genuine moving picture sequence" = C. W. Ceram, Archaelogy of the cinema, as quoted by Erkki Huhtamo,

"From Kaleidoscomaniac to Cybernerd. Towards an Archeology of the Media" = http://www.debalie.nl/dossierartikel.jsp;jsessionid=7E2098DE44FCDF3B4368D087406665AF?dossierid=10123&articleid=10104

Digitizing signals from the receding present / recent past

- light and sound signals belonging to the regime of the real, while their digital sampling translating them into the symbolical, that is: countable (accessible for computing) as frequencies. But within sampling, quantization errors occur: the real always returns (Lacan)

- media-archaeological recording primarily memorizing the noise of the wax cylinder itself - 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); phonograph as media artefact does not only carry cultural semantic like words and music, but is at the same time a frozen, implicit (en-folded) knowledge of its engineering as well, by its very material fabrication, which- waits to be de-frozen, liquified

- with an analog-to-digital converter, the sampling rate controling how many samples taken per second / per year (in the case of the St. Gall annals) - all depending of the quantization level. On the time-axis: year 700, 701 .... and sine wave of events / sampling time; annals as the graphical indication of a conscious quantification, that is: digitalisation of temporal processes - the abstraction of a temporal-successive quality as a geometric, thus static figure, no history at all

- Fourier transformation of a temporal function or sequence of signals into a spectrogramm; not historiography any more, dealing with macro-temporal processes, but genuine mediography which deals with temporal micro-events, with time-critical operations

- for each private live hour of an individual, Leibniz calculating 10 000 letters and thereby makes live finitely countable, explicitely annalistic = Leibniz in Ettlinger 1921: 29

- according to Norbert Wiener, telegraphic transmission of a human being, if sufficiently describes as information; "streaming" data a metaphorical disguise; see media art installation Jim Campbell, *Church On Fifth Avenue*, 2001: Jim Campbell, *Church on Fifth Ave* (2001): passengers pass through screen, transform from discrete into continuous appearance. Custom electronics; movie: http://www.jimcampbell.tv: "A matrix of 32 x 24 (768) pixels made out of red LEDs displaying a pedestrian and auto traffic scene in NY from an off street perspective. There is a sheet of diffusing plexiglass angled in front of the grid. As the

pedestrians move from left to right the figures gradually" - continuously, or in discrete steps? - "go from a discrete representation to a continuous one (or metaphorically from a digital representation to an analog one)." But even the impression of continuous movement, in digital projection, is always already discrete; see the artefacts at margins of the Campbell insetallation QuickTime Movie. The analoge becomes a nostalgic re-entry

- dis-affection; media-archaeological gaze adequate to machine aesthetics itself which is implanted into the human *mind* (like Turing could imagine the human as "paper machine"

Archaeology, Computing

- the very term "memory" for permanent (ROM) and ephemeral (RAM) data storage in early digital computing; instructions like "Memory" in the text saving menues of computer software a semantic archaism; difference between procedural presence and storage of data is a function of directing codes; during the the second Gulf War both missiles and news (about missiles) were in principle transmitted by similar (or same) electronic rays

- memory not linked to the past but rather radically present; mathematically informed archaeology practicing *cluster analysis*; historiographic concepts of past times nothing but a narrative disguise of material entropy, the final equilibrium into which accumulation transforms. *Cluster analysis* is a non-discursive statistical technique, the true memory of waste; computer disposes of a better memory of waste *to count on*; only its calculating operations are able to make sense out of apparent disorder

- computational *imagineering* as metonymic transformation of non-intuitive data into graphics; techno*lógos* "collecting" (*legein*) fragments into shapes: Thomas Quarry announcing it in an advertising for IBM from Casablanca where Jean-Jacques Hublin unearthed a few fossiled skull fragments. Hublin and a team of IBM scientists "fed this shattered jigsaw puzzle into a unique program called Visualization Data Explorer. The tiny pieces helped form an electronic reconstruction of our early ancestor, the first Homo sapiens. This new IBM technology has turned time back 400.000 years, uncovering clues to the origins of mankind" = in: *Wired* 3.03, March 1995

- Sphinx sculpture in front of the Cheops pyramid restored by aid of computer in detail; Mark Lehner of the Oriental Studies Institute (University of Chicago in Illinois) has overlapped photographies of the sphinx with portraits of pharaoe statues and by photogrammetric composite pictures reconstructed the most probable archetype of the

sphinx which might bear the features of pharaoe Chefren (4th dynasty) = Frankfurter Allgemeine Zeitung from 15th July 1992

- project undertaken by the Parisean École Française d'Extrème Orient, dealing with the reconstruction of the nine hundred years-old ancient Baphuon temple of Angkor in Kambolia; 500 000 stones, scattered around the ruin, to be restored to their previous placement. An infographics company provides three-dimensional photographies as computer modelling of the temple, serving as conceptual grid to insert the fragment into = "Steine mit dem Computer sortieren", in: *Frankfurter Allgemeine Zeitung* of 12th April 1995; computer providing a better memory of waste than historical, that is: human imagination can cope with

NOTES ON RE-ENACTMENT: COMPUTING IN / AS NON-HISTORICAL TIME

The operative presence of technological artefacts from the past

- media archaeological focus on the *operative being* of technological artefacts; only here that artistic materialities deserve to be called *medium* in the sense of information engineering; Paddy Scannell's book *Television and the Meaning of Life* (Cambridge 2014) an up-date of Heidegger's philosophy of artefactual tempor(e)ality. Heidegger's ontological distinction between beings (things) and their beeing. The use of the hammer; only in its accidental failing the tool becomes apparent as such: Heidegger 1927/1962: 98; *vorhanden* is the distant observation / measuring of the object; *zuhanden* is its "handy" use: "I know what a hammer is by using it properly" = Scannell 2014: 60, hammering is *operative* ontology - a "thing-for-use"; technological configurations are *media* only when being in operation; Scannell 2014: chap. 5 "Turning on the TV set", 60-77

- ancient electro-magnetic telegraphy relay; to what degree "digital" communication not only comes after, but actually preceeded the time of analog telephony and radio

- Davis (2000) observing the particular importance of the electromechanical relay (with its two "binary states" open and closed): "It was only with the development, beginning in the 1930s, of electromechanical calculators using electrical relays, that machines were built having the scope Babbage had envisioned."[80] = https://en.wikipedia.org/wiki/Algorithm, accessed January 16, 2019

- time-based character of both theatre / drama and the von-Neumann-computer architecture which links both; transform this into experimental performances which (re-)translates the sublime data processing in machines (otherwise unrecognizable for slow human senses) into three-

dimensional, audio-visual space

- "antique" technological items not primarily objects from the past; they require presentation (and re-presencing) as "time objects" (Edmund Husserl), not as frozen pieces of hardware to be stored in shelves; focus the visitors' attention towards the inside and the function of the objects; "open source" and "open access" meant literally here, with a hands-on bias

- magnetic core memory grids essential in early electronic computing to keep data for storage in a non-volatile way. It takes operative analysis to decode this message. Such an artefact may be read out data-forensically to reveal its latent information after 40 years; delayed memory of such kind not historical but embodies a different kind of tempor(e)ality

- different from other archival records, technological diagram not historically distant but allows for re-generative experience of a past as presence - such as a musical tone or electrified voice; fig.: Alexander Graham Bell's circuit diagramm for a tune fork telephone

- in terms of historical research, meaning of a past material object in the information attached to it in the form of associated textual records = David Crowther, Archaeology, Material Culture and Museums, in: Susan M. Pearce (ed.), Museum Studies in Material Culture, London 1988, 35-46 (esp. 42); media archaeology dealing with objects which can be reenacted by virtue of their own inherent techno-logics, momentarily un-doing the "cultural history" gap

- re-enactment of "obsolete" electronic circuitry by operative diagrammatic reasoning; techno-mathematical ratio electronically unfolding again as arche- or genotype, not simply historically distant. In electro-acoustics, harmonic oscillations, by virtue of the medium specifity of mechanical or electro-magnetic vibrations, still behave the same; the present can share the original experience

- Heinrich Hertz' late 19th century experimental setting of wireless "radio" spark transmission in the lecture room of Karlsruhe Technical University; can still be rehearsed and still behaves the same. Media operativity allows for time- tunnelling which is well known from human experimental archaeology; all the difference is the active agency when it comes to *media* archaeological artefacts

- escapement-driven mechanical clocks since late medieval times though liberated oscillations from the impulse of the human hand; electric circuitry since nineteenth century enabled the resonant circuit which is essential for generating non-material oscillations and for receiving electro-magnetic waves.

Re-enacting logical machines

- Heidegger, "Altertümer im Museum". "An artifact is something that happened in the past, but, unlike other historical events, it continues to exist in our own time. Artifacts constitute the only class of historical events, that occurred in the past but survive into the present. They can be re-experienced: they are authentic, primary, historical material available for first-hand study. Artifacts are historical evidence" = Jules David Prown, The Truth of Material Culture: History or Fiction, in: Steven Lubar / W. David Kingery (eds.), History from Things. Essays on Material Culture, Washington / London (Smithsonian Institution Press) 1993, 3 - though rather media-archaeological than "historical", since historical discourse is bound to textual, narrative historiography. Against a "textual" reading of artifacts, a material techno-logical configuration is non-discursive, non-narrative

- "Reverse ingineering of past techniques provides a way to 'fill in the gaps' in the text. It can also substitute for the text when 'technological processes cannot be adequately described with words [...]'" = xxx, Reconstructions, Historical and Otherwise, in: xxx

- digital photography ideally (if not practically) "eternal; it is not subject to entropy, to the second principle of thermodynamics" = Vilém Flusser, The Photograph as Post-Industrial Object. An Essay on the Ontological Standing of Photographs, in: Leonardo 19 (4), 329–332 (331). But "[a]lthough digital information is theoretically invulnerable to the ravages of time, the physical media on which it is stored are far from eternal" = Jeff Rothenberg, Ensuring the Longevity of Digital Documents, in: Scientific American, Vol. 272, No. 1 (January 1995), 42-47 (42)

- computational media definition not primarily the technology but formats; former technical media like television or radio or the book become formats to be perceived on the computer screen; behind them is the software which defines these objects and enables old media to re-entry the digital sphere; underlying software therefore a cultural document of our time, but how to a) preserve software, b) how does museology put software on display?

- source-code based media art as software "eternal" in the techno-*logical* (Platonic) sense: "Software does not wear out or break down in the traditional sense. Once a software-based system is working, it *should* work forever (or at least until the underlying hardware breaks down [...]. Any latent 'bugs' subsequently revealed in the system are considere flaws in the original design or implementation [...]" = Nathan Ensmenger, Software as History Embodied, Editorial in: IEEE Annals of the History of Computing (2009), 86 and 88 (88)

- to what extent the archival record (document) depending on its material medium (monumentality); symbolical code can be transmitted (now "migrated") with a high degree of fidelity in copying, regardless the material support. Thus the symbolic code (like the genetic code), esp. in the alphabet, is mostly invariant towards historical, i. e. entropical time. Digital *bits*, as informational units, *per definitionem* (Norbert Wiener) are neither matter nor energy dependent = Rudolf Gschwind / Lukas Rotenthaler (interviewed by Ute Holl), Migration der Daten, Analyse der Bilder, Persistente Archive, in: Zeitschrift für Medienwissenschaft vol. 2, no. 1 (2010), 103-111 (104)

- "The quality of the medium is of secondary importance, as long as the 'code' can still be decoded" = Rudolf Gschwind, Digitisation and Long Term Archival of Digital Data, in: Lioba Reddeker (ed.), Gegenwart dokumentieren / Archiving the Present, Vienna (Eigenverlag basis wien) 2006, 183-195 (185); results a rather ahistoric form of tradition, different from the scratchy audio signal as phonographic record or the "stealthy disintegration due to the relatively low stability of photographic material" = Gschwind 2006: 183

- documentary science, notion of "logical preservation" = Hans-Joergen Marker, Data Conservation at a Traditional Data Archive, in: Edward Higgs (ed.), History and Electronic Artefacts, Oxford (Clarendon Press) 1998, 294-303 (296); any information grounded (material *arché*) in or on a material support (storage medium), which introduces another, different tempor(e)ality: entropy. "*Prentice Hall's Illustrated Dictionary of Computing* (Nader 1992: 412) irreversibly severs the material link by noting that 'software is independent of the carrier used for transport'" = Doron Swade, Preserving Software in an Object-Centered Culture, in: Edward Higgs (ed.), History and Electronic Artefacts, Oxford (Clarendon Press) 1998, 195-206 (195); metonomy which takes the Floppy Disc as a material support for the software itself a hint to the material link. If past information is not just symbolically emulated but simulated, its temporal (entropic) behavior must be archivized as well - like the scratch, the noise of an ancient Edison phonographic cylinder when being digitized. One method is known from computing as physical modelling.

- epistemological difference between material degradation to the new phenomenon of obsolescence of multi-media data formats; well-known danger to cultural goods, physical entropy, in the logial sphere replaced by a flat tempo(e)ality which is rather a logical state than a temporal ("thermic") object

Emulation: between ahistoric algorithm and its entropic implementation

- not only algorithmic thinking in its impact *on* architecture; media-archaeological perspective even from within: the "architecture" of implemented algorithms itself; first-person perspective in *Minecraft* inducing "to walk through the vast formation of loc gates and Redstone lines that reach the horizon" = S. Pleikies, "Building a BCD Decoder in 'Minecraft', in: Stefan Höltgen et al., A Case of Toy Computing. Implementing Digital Logics with "Minecraft", forthcoming in: A. Adamatzky (ed.), Alternative Computing, Singapur (World Scientific) 2021, sub-chapter 5.1.; no undo button, therefore inducing more "thoughtful planning" (Pleikies) for building blocks architecture; a more immediate experience of "both signal propagation time and duration of the construction" (Pleikies); software *Logism* (simulating circuits with digital components) "before building the real hardware" - an electronic *archi*-tecture, literally = Thomas Fecker, "Digital Circuits in 'Minecraft' and the Remains of Electroncs", in: Höltgen, op. cit., sub-chapter 4.2.; "The player in 'Minecraft' is therefore the signal itself and runs along the path of the line" = S. Divani, "Walking the way of the Signal", in: Höltgen, op. cit., sub-chapter 5.3.

- "algorithm" in the context of computing (instead of abstract computation) not logo-centristically reducible to the written code lines (like a musical "score") but techno-logically implemented in the hardware, as *executable* program, in computing architecture. In itself, an algorithm just a mathematical notation which enacts nothing by itself. It has to be *read* by (human or nonhuman) machines (the Turing machine "tape reader"); better not limited by capacity-limited human eyes. It has to be implemented into physical matter (the "computer" as artifact) in order to be *effectively* gifted with time-critical operativity, to become processual

- operative media preservation of early digital works in architectural design linked with the challenge of re-enacting its (techno-)logical machines; ahistoricity of / in computer architecture. How to exhibit computational machines? Doron Swade, as curator of the computer department at the London Science museum, pointed out this challenge for curators. "It’s very complex to preserve software on the original hardware; the new option is to emulate the former computer architecture itself as software in order to display its programs (be it computer games, or dynamic media art). It has to do something and then you need again the running system to operate this software" = Swade 1998: 195

- an algorithm surviving its actual electronic implementation; techno-archival "two bodies" (Kantorowicz) the tectonics of computer hardware (in its von-Neumann architecture), *and* its algorithmic codes

Simulation / Emulation of EDSAC

- EDSAC simulator "relatively abstract, not being defined by an underlying hardware implementation" = Martin Campbell-Kelly, Past into Present: The EDSAC Simulator, in: Rojas / Hashagen (eds.) 2000: 408

- "the goal of producing a working facsimile - in the sense of executing an origial program or routine", in museological tradition of "functional replicas" like Stephenson's *Rocket* locomotive = Campbell-Kelly 2000: 398

- "The EDSAC simulator is a very different kind of re-creation that fits much more closely with what Lowenthal" in *The Past is a Foreign Country* "terms *emulations*. These he describes as 'self-conscious period revivals' and 'respectful yet creative reworkings of earlier forms and styles [that] transcend mere copying' (p. 301). Lowenthal view an emulation as an on-going and evolving acticity that is always of its time - thus a Tudor revival of the 1990s would be quite different to one of the 1930s, and that, in turn, would be quite different to an origina Tudor building of the 16th century. Yet an essential Tudorness persists in all the variations and derivatives. The EDSAC simulator is likewise intended to be fluid and of its time, while always capturing the essential EDSAC" = Campbell-Kelly 2000: 398; insisting ahistoric essence of operative technology, existing in technochrony rather than "historical" time

- Campbell-Kelly applying Lowenthal's notion of *emulation* (The Past is a Foreign Country) to EDSAC *simulator*

- EDSAC *simulator* progressively updated; Campbell-Kelly expecting "this periodic reincarnating" to continue into the future. "The reason for the fluidity of the EDSAC simulator is that its purpose is to enable resent-day computer users to understand what it was 'like' to write programs for the EDSAC. The simulator has consciously sought to bridge the ever changing gulf between past and present" = Martin Campbell-Kelly, Past into Present: The EDSAC Simulator, in: Raúl Rojas / Ulf Hashagen (eds.), The First Computers. History and Architecture, Cambridge, Mass./ London (MIT Press) 2000, xxx-xxx (399)

- "The most important aid for authenticating the software behaviors of the simulator are five original programs, for which both the original program and a physical copy of a photograph of the output exits" = Campbell-Kelly 2000: 409

The ahistoricity of computer architecture

- digital computer essentially a "paper machine" (Turing 1937); possibility to disentangle code from the hardware needed to process it, just as, with musical scores or literature, the performance of playing or reading re-enacts the symbolic instructions. Is the a-historicity of performed code,

or of performed music, coherent with the a-historicity Ricoeur sees in the written text when it is actualised through the performative act of reading? Computation is logical and mathematic in essence, so when a new computer emulates an old computer's video game, it actually functionally embodies that old computer during the actualization process. Still it is far slower or faster than the obsolescence-driven hardware that originally supported their existence; preservation should not concentrate on the code only (the "literary" work) whose instructions are perhaps the only time-resisting matter of computer art's "two bodies". Some programming languages may become more obscure than others, but an instruction book on a programming language is also symbolic based, hence time-resistant, work. In Washington, the Library of Congress early movies *paper print* archive preserves early films that can now be restituted, re-enacted, re-animated - like information from the optical images of flat digital fossils like an early RAM where bits are indicated by colour. Much of what will be preserved in terms of computer culture from the on-going decades will be actually patent-related (thus "archival"), rolls of code printed on paper for copyright purposes still in libraries, hundreds of years after the electro-magnetic supports on which they were created are lost; task of a library or archive, in art museums: physically located bitstream on the storage medium must be preserved as *raw images* for future analysis = Thorsten Ries, Die Geräte klüger als Ihre Besitzer. Philologische Durchblicke hinter die Schreibszene des Graphical User Interface, in: Editio 24/2010, 149–199 (155)

How to exhibit computational machines?

- software, considered as cultural artefact, not a material object any more, rather an executable file which unfolds only when being processed (a truly processual time-object). This pushes the possibilities of museum display to its limits. A computer as hardware can be traditionally displayed as an immobile object, but its time-critical and „bit-critical“ processes are never in *stasis*, just like frequency-based acoustics (sonic evidence in museums) needs performance in time to take place. With the electronic image, this extends even to visual evidence

- essence of digital computing the *temporalization of mathematics* by media-operative algorithms; change the sensational mode from the visual screen to the auditory mode which is the (substitutional) "time organ" in human senses

- "musical" techno-mathematical regime of computing with its vectorized signal processing

- time-criticality a feature of media-archaeological analysis which does not simply media-philologically read source code but focuses on the (f)actually (technomathematically) implemented algorithms

- "What does 'break' over time is the larger context of use" = Doron Swade, Preserving Software in an Object-Centered Culture, in: Higgs (ed.) 1998: 195-206 (195), its adaption to new needs, its implemention into the historical context. "Coded electric pulses is very immaterial, you can not touch software as such. This is a big challenge for the traditional object/artefact orientated museum" = ibid.

Computational Re-Logic: Preserving the Symbolical Machine

- Klaus Wohlfarth, Zur Rekonstruktion der Z3, in: Wissenschaftliches Jahrbuch 1992/93, Deutsches Museum München 1993, 205 ff.

- physical and logical laws of material media suspended from relativistic cultural historicism. At the same time, techno-logical knowledge has to be materially implemented as "hardware" in order to become media-active; this implementation embeds the process in a temporal context with its proper "historical index" (Walter Benjamin).

- in media archaeological terms, radically different preservation strategies for electronic art and computer art. Both have "two bodies": the electro-physical one, and the circuit design / logical block diagram. Contrary to analog electronic devices like radio and video, the computer is essentially logic, therefore the preservation of the logical design is mandatory, while for analog electronics such as video art, signal processing is a direct function of its hardware

- Edward Zajec Collected Works 1984-2004 DVD, edited by Marko Ornik, published by uho;oku: Institute for Art and Technology Maribor (MKC Maribor); truly media-archaeological documentation of vintage computer art or *computing* art since any of such artwork can only exist when the (re-)producing medium is processually active - be it the computer itself, or the video version); Zajec's conceptual entanglement of the musical score with the computer programming of visual imagery

- while museum of cultural and technological history successfully presenting a mechanical object such as an early telescope, even if it is broken and mutilated, software collections "imply a functionally intact copy with the promise or potential of running it" = Doron Swade, Collecting Software: Preserving Information in an Object-Centred Culture, in: History and Computing, vol. 4 No 3 (1992), 206-210 (208), to fulfill its "enunciative function" (a term from Foucault's *Archaeology of Knowledge*) since software belongs to propositional logics itself; "mode of existence" (Gilbert Simondon) of computational algorithms necessarily unfolds in its operational vectors only. Functional intactness in *archived* program software (only the archive or the archive-library ensures the possibility for unforseen future enquiries - which is the condition to

generate newness from old records, that is: *information*) demands the ongoing maintenance of "bit-perfect records" = Swade 1992: 209 and compatibility with the original hardware - unless this is itself emulated in logical (as distinct from physical) replication, that is: became software itself (a *mise-en-abîme*), maintaining even the original execution times, which is: the *aura* of implemented and running software as *time object*. For a future historian, it is not sufficient to just re-create the "feel" of an early computer game; it rather has to be inherently authentic, even on the subliminal level below human perception (the "formal materiality" as defined in Kirschenbaum 2008: 34); emulators "mimic the behaviour of hardware" = Rothenberg 1995: 47 - true co-originary *mimesis* (in a temporal sense beyond "history")

- contextual metadata recorded in unspaced bitstreams; a way to mark the difference in out-reading the data. "Computer scientists call the solution to such a recursive problem a *bootstrap* which provides "some context, which humans can read, that explains how to interpret the digital storage medium" = Rothenberg 1995: 44

- *different* from the familiar material artefact in museums, digital media artefacts in a dialectical synthesis combining what has been separated so far between historical and archaeological sciences: textual code and materiality. Since in its most literal sense techno/logy means first of all logical (mathematical, diagrammatical) knowledge which can be symbolically coded as "software" and thus be transmitted across time almost without loss through re-enacment. Any coding is an act of encryption. The risk is known from Bletchley Park where the British intelligence tried to decipher the German Enigma coding of wireless telegraphy messages: Any encryption makes it difficult (and in time-critical terms) even "impossible to recover the original bit stream without the decryption key" = Rothenberg 1995: 47; has been a cryptographer (Ventris) who finally deciphered Linear B writing from Bronze age Greece

- digital documents primarily consisting of a non-material, non-energetic, rather informational (Wiener) essence: a binary, logical object structure, which can be dissociated from the actual material data carrier and can be losslessly copied, transmitted and stored = Thorsten Ries, Die Geräte klüger als Ihre Besitzer. Philologische Durchblicke hinter die Schreibszene des Graphical User Interface, in: Editio 24 (2010), 149–199 (153); computer not simply a mathematization of a material mechanism and thus strictly dependent on a specific apparatus like previous media technologies (the phonograph, electronic television), but in a dramatic epistemological rupture born from mathematical theory (Turing's "universal" symbol-manipulating machine 1936/37), a radical mechanization of mathematics

- in algorithmic coding the task to be performed developed into a time series; in order to be executable, any algorithm has to take place in

matter - even if this is just numbers and letters on paper, written and read by humans (the Turing machine)

- so-called Mechanism of Antikythera from late Hellenistic times, even if corroded to an almost entropic mass of metal, still remodelled by Derek de Solla Price; experimental archaeology of material cultural knowledge oscillating between implicit (latent) knowledge in terms of physical and mathematical self-evidence and "tacit knowledge" (Polanyi's undocumented social skills / *techné*)

Operative rather than "dead" media collections

- for techno-epistemological analysis of media art, emphasis not on the phenomenology of user-interaction but on the material artefact, its media-art(e)factuality, encompassing the materiality of both analog and digital media for cultural tradition, and software as new objects of knowledge transmission and as a challenge to museum-like conservation

- imperative for *operatitive* preservation of media-archaeologically relevant objects (as argued by Peter Donhauser, Technical Museum Vienna, for his operative re-creation of the historic Bechtstein electronic piano, or Doron Swade, when curator of the computing department in the Science Museum, London, on the museological challenge of "preserving software")

- objects whose main function is processuality (both material and algorithmical), as *archive in motion* (Rossaak) requiring a dynamic preservation museology

- methodology of "operationality". If the cultural and discursive knowledge of media is not meant to be limited to images (in texts and books), to distant observation (in museums) and to pure documentation (in archives), there is a need for real places and digital platforms where technical objects can be confronted in their primary materiality and virtual operativity. Analysis here means actually or symbolically opening the "black box" to get insight into what media do. For analog technologies this means actual disassembly; for software-driven media this means to get acquainted with programming languages like Assembly (close to the machine). This means expanding further from representational approaches towards the idea of operationality of the devices in collections. Hence through operationality, the focus of the archival work turns from the normal function of preservation to issues of technological education, theoretical inquiry and artistic practice; counter-strategy to “black boxing” design strategies of modern technical media; expand the usual archival or museum functions concerning cultural heritage of technology and scientific apparatuses

- practices of disassembling and reassembling becoming integrated as part of the activity of the operational media archaeology labs

- technical objects in "media" state / being only when implemented in operation. In a comparison with traditional practices of media-historical display (with representatives from museums, archives and collections), the specific need for an operative assemblage of technical objects in the context of cultural and academic teaching and research shall be outlined - both for the epoch of analog and of digital media. The specific "triad" of Media Archaeological Fund (the presence of artefacts), Signal Laboratory (digital signal processing), and Media Theatre (machinic-operations confronted to human performance) provides for a model of operative media analysis

The temporal challenge of Internet art

- genuine, medium-specific (and not just content-oriented) Internet art from an error: "In December 1995 Vuk Cosic got a message, sent via anonymous mailer. Because of incompability of software, the opened text appeared to be practically unreadable ascii abracadabra. The only fragment of it that made sense looked something like: {...]J8~g#\;Net.Art [...]" = Alexej Shulgin, Nettime, quoted in Galloway 2004, motto to chap. 7 "Internet Art"

- Cosic interested in ASCII code during research "on low-tech aesthetics, the economy, ecology and archaeology of the media, on the intersections between text and computer code, on the use of spaces in information, its fluid nature and infinite convertibility. Out of this came [...] Deep ASCII and ASCII History of Moving Images, a history of the cinema converted into text format" = https://en.wikipedia.org/wiki/Vuk_%C4%86osi%C4%87 (accessed January 16, 2017); created File Extinguisher, an online service that allows to delete files with absolute certainty; http://www.ljudmila.org/~vuk/ascii/film

- Galloway 2004: 217: the 404 error code, used by artist Lisa Jevbratt's *Non-Site Gallery*. Since 1995, in early explicit *net.art* (including, f. e., Jodi) , the medium is the message - like every first, media-archaeological technologically self-reflexive media art (video), "is concerned primarily with the net/work, while later Internet art [...] has been concerned promarily with software." = Galloway 2004: 218 f. "As computers and network bandwidth improivged during the late 1990s, the porimary phsical reality that governed the aestehetic space of net.art began to fall away" = Galloway 2004: 220; the shift from media-archaeological aesthetics to content.

- Swiss initiative *Aktive Archive* (www.aktivearchive.ch) dedicated to preserving so-called "instabile media", symbolically re-enacting even an

online-art work on flash-based dynamics as CD = Vera Kuni, in: Müller / Scheidgen (eds.) 2007, 312; Variable Media Network www.variablemedia.net

- in theory, no "digital decay"; Boltzmann-entropy differing from Shannon-entropy; option to chisel zeros and one or whole web-sites in stone like an ancient epigraph, as has been drastically performed by Joachim Blank / Karlheinz Jeron 1999 in the exhibition *net_condition* for Natalie Bookchin's and Alexej Shulgin's *Introduction to net.art* (1994-1999) = www.easylife,org/netart; catalogue: Timothy Druckrey / Peter Weibel (eds.), net condition, Camrbidge, Mass. 2000

- erasing records; artists created artificial information deserts and voids in cyberspace indeed, such as Mark Napier (New York) with his project *The Landfill*, turning any content of web-pages into graphical raw material. But such aesthetic interfaces hide the digital truth behind the simulacra. The more radical version is the cookie (micro-program) *ArchiVirus* created by Manu Luksch, Arnim Medosch and R. Steckel (to be copied from the internet on one´s own computer) which decomposes textual documents on the hard disk into its ingredients; alphabetically sorted, all the letters of a file appear on the screen, sense-less, but as a kind of raw material for composing new texts

- crucial difference between media art which is simply represented, indexed and mapped online, and the Internet itself as the material for artistic work, like art produced in HTML code itself, using ASCII-symbols of the source code of homepages (as done by the artists Blank & Jeron (Jodi) = Inke Arns, "Unformatierter ASCII-Text sieht ziemlich gut aus". Die Geburt der Netzkunst aus dem Geiste des Unfalls, in: Kunstforum International vol. 155, 236-242

- Vera Kuni differentiating between technical emulation and "conceptual" emulation = 2007: 311, resulting in a re-creation while preserving the original concept - the diagrammatic preservation of media art

- what had been the cultural-historical "context" for previous art works, today replaced by a techno-media ecology as Internet browser "environment" - consisting of plug.Ins and image, text or sound formats (un/compressed) like .jpg, .mov

- Jodi's ASCII art displaying raw source code itself. "No other style of net.art reflects so directly on the nature of the Web as medium." = Galloway 2004: 220

- conservation of new media art challenged by the the obsolescence of digital technology accelerating in ever smaller intervals. The planned ephemerality of Fluxus (video) art (Nam June Paik; Wolf Vostell)

unintentionally correlates, in the analog signal domain, with the ephemerality of Internet art in the algorithmic domain

- http://newmedia.umaine.edu/interarchive/three_threats.html: a dynamically generated synopsis of the site 'Three Threats to the Survival of New Media' in printable form; the interactive version at http://newmedia.umaine.edu/interarchive/three_threats.html

- "The centralized storage strategy that has served as the default preservation paradigm for culture in the 18th through 20th centuries will utterly fail as the preservation paradigm for the 21st. Archivists specialize in keeping the works in their care as static as possible, but new media survive by remaining as mutable as possible

- archaic work no longer functioning with current browsers; most external links expired; no more interface for storage medium; demagnetization

- remaking "variable media" from archived screenshot evidence and few of textual records, vs. emulation, as functional re(non-)interpretation; different from reenactment of historical events by amateur actors

- term "archive" frequently applied to cultural memory institutions such as traditional musums and libraries. But in this media alliance, culture should not be thought of by de-differentiating its storage media. The notion and the institution of the archive dissolves in(to) the Internet. Let us mention, f. e., the HILUS intermedial "Informationssystem Kunst + Neue Technologien" (based in Vienna); advertizing postcard declares three sections: "*ARCHIV*/Bibliothek, *ARCHIV*/Videothek, *ARCHIV*/CD-Rom-Sammlung". HILUS Intermediale Projektforschung beendete seine Tätigkeit mit dem 31.12.1996; http://thing.at/hilus/server2.htm (1992-1996)

- will the future experience these works as physical traces (hardware) or rather as coded documentation, or in its dialectiv synthesis which is emulated media artifacts

- radical change in the engineering of cultural tradition with the digitization of analogue (signal-based) audio-visual media art archives (sound art, video)

- http://www.archive.org aware of the accelerating obsolescence of media art Web pages in the Internet; it provides for a symbolic time machine: the so-called Wayback Maschine. For an Internet address (URL) it presents a chronologically ordered list of links to the same web page at different times

- "The Internet Engineering Task Force develops "technical standards that give a unique identification name to digital documents. These uniform

resource names (URNs) [...] could supplement the URLs that currently access Web documents. Giving a document a URN attempts to ensure that it can be traced after a link disapears" = Kahle 1997: 83

- collecting principle of the museum and storage principle of computing belonging to different eras, even if they co-exist in the present. For dynamically generated web content of the Internet, no archive (the "dark web")

- *Permanence Through Change: The Variable Media Approach*; http://www.variablemedia.net/e/preserving/html/var_pub_index.html

- media-archaeological imperative to preserve the technological message of media art, not only its aesthetic content. "Marshall McLuhan once claimed that the medium is the message. Replace medium with format. How far does it hold true? And how much may we permissibly change the message on oder to give access to it, in a newer format, say, or over the Internet?" = Ray Edmondson, AV archiving philosophy - the technical dimension, in: Proceedings of the IAMI-IASA Joint Anjual Conference, Perugia 1996, xxx no. 8 (November 1996), 28-35 (29). "Marshall McLuhan once claimed that the medium is the message. Replace medium with format. [...] Whenever content is moved from one format to another, *what is lost or chanced* and *does it* matter?" = George Boston, lecture at IAMI/IASA Joint Annual Conference, Perugia 1996

Towards the dynamic "archive"? Rhizome ArtBase (since 1999)

- EAS emulator service

- ISO file an "image" of a CD/DVD; using a burning program like Nero, or ImgBurn, to burn that ISO file directly to a disk; Tim Fisher, updated October 20, 2016; "single file that's a perfect representation of an entire CD, DVD, or BD. The entire contents of a disc can be precisely duplicated in a single ISO file. Think of an ISO file like a box that holds all the parts to something that needs built - like a child's toy you might buy that requires assembly. The box that the toy pieces come in does you no good as an actual toy but the contents inside of it, once taken out and put together, become what you're actually wanting to use" = https://www.lifewire.com/iso-file-2625923, accessed 24 March, 2017

" e. g. image of Operating System MAC OS 9, put onto an emulator; accompanied by "delta file" to record just the modifications

- taking care of migration of emulators, instead of migrating every single web art work content; EML (emulator); Rhizome strategic decision: concentrate on art works based on custum computer software / OS / browser, unequal independent media (archaeological) art from scratch

- "Webrecorder" (free software, deposited on GutHub) allowing for "archiving" one's personal encounter with the Web / symmetrical web archiving; recording of interaction with the web-site within one browser / record traffic between browser intalled on PC and Internet, as "performative archiving"

- moving image portals like Like YouTube; Internet itself the dynamic library of performative media art, autopoetically prolonging its tradition by countless data file copying and mirroring the operating system; when the technical, infra-structural context expires, the records will expire as well

- digital culture aware that there is no work for eternity any more, resulting in the preemptive archival perspective of *futurum exactum* for ephemeral technologies like software code, websites, moving images and sound, interactive games, and browsers. Since contemporary computers are mostly unable to "perform" many of the artworks as they were originally experienced, the Rhizome initiative in New York City (in affiliation with the New Museum of Contemporary Art) started its Digital Preservation program so that net art works from the recent but technologically dis-continued past may be reperformed in their media-environmental context, with an emphasis on providing contemporary users "a sense of their initial form" = URL xxx - which is the phenomenological, human-oriented approach to preservation of media art; media-archaeological alternative sets priority on the preservation of the underlying technology which is the generative grammar of "aesthetic knowledge" behind (genotypal rather than phenotypal)

- Rhizome's ArtBase less an online archive but collection of born-digital art (net art works and other forms of projects with online elements). Its primary task is up-dating obsolete code. As a challenge to inherited museum authority for cultural heritage preservation, its focus is on the development of open source web tools "to decentralize web archiving and software preservation practices" = https://en.wikipedia.org/wiki/Rhizome_(organization), accessed March 13, 2017; ensure continuing access; conceptually, *open source* does not simply mean the media-political for open domain, but to reveal its algorithmic structures. Rhizome launches social media "archiving" tool Colloq which replicates the interface of social media platforms - once more, the phenomenological appeal is given priority, by re-generating its operating systems. Even if the inside of the algorithmic machine is the pre-condition for such sensual preservation, the emphasis is not on its insight. In its media-phenomenological orientation, "Colloq pays special attention to the way a user interacts with the social media interface at the time of creation, using a technique called 'web capturing' to store website behaviors" = ibid.. For the art blog VVORK, Colloq used to archive the entire website. "Archiving VVORK allowed Rhizome to tackle

the challenge of archiving embedded video content, which is often hosted on a third-party site" = ibid., different from the limit of the Wayback Machine to non-dynamic objects: website previously archived by Internet Archive, "but this recording did not include embedded media like videos that Colloq was built to capture" = ibid.; Jon Ippolito: "you're going to get the experience of interacting with the actual site" = quoted ibid.; performative *historical re-enactment* rather than operational techno-archival display

- since 2016, Webrecorder tool as free web archiving tool "allows users to create their own archives of the dynamic web" = ibid., rather than static webpages; classic archival terminology starts to be misleading, demanding replacement by a more "born-digital" terminology of such storage such as *embedded software*. Web 2.0 trans-archival ethics (like social tagging in virtual museology) is is an attempt to place web preservation tools in the hands of individual users. Web historicism: "It uses a 'symmetrical web archiving' approach, meaning the same software is used to record and play back the website. Webrecorder actually records users "browsing the site to capture its interactive features" = ibid.

- Rhizome's oldweb.today project; view archived webpages within emulated versions of legacy web browsers - dissimulating the contemporary Internet itself; new media historicism: project gives users a "deeper understanding of web history"; browsing environments alter one's experience of the internet. "It is an example of 'Emulation as a Service' technology, imitating old software programs so that they can run on new computers" = ibid.. This aks for a media-archaeologically reminder of the metahistorical theory of computing itself: New computers with the very symbolical recoding of obsolete computer hardware are still based on the Universal Turing machine model - which deserves to be placed into the center of discussing digital media art preservation, and to path a way through the growing confusion of key terminology ranging from "updating", "preserving", "reenacting", "archiving" to "restaging"

Re-enactment of *The Speaking Clock*

- emulating John Cayley's computer poetry generator *The Speaking Clock*; several compatability layers (immanent "interfaces") within computers; translates previous operating system requests into the "language" (syntax) of new (WINE); triple stragety: maintaining hardware; emulating operating system to maintain the time-critical (not just logical) behaviour; like printing press: re-create "matrix" for new series of lithographic microprocessors (electronic core devices): embodiment of logics

- structural architecture of electronic and computational media allowing for a *non-historicist* form of preservation which is the co-originary re-creation of a hard- and software logic instead of the niqueness of its once individual implementation

- preservation of computer not reducible to the "ontology" of the algorithmic archive; loss of the real hardware support of media art (by migrating its data) would make posthumous investigations into the technological *a priori* of its aesthetic phenomena impossible. For historians it is imperative *not* to substitute the original archival record by a high-resolution copy

De-historicizing ELIZA

- David Barry part of a group that has been looking at Weizenbaum's ELIZA code: "(technically, as you all know, really all we have is the DOCTOR script) and as part of the research we have uncovered the original actual ELIZA code written in MAD-SLIP. As far as I am aware this is the first time it will have been seen for more than fifty years! We are just checking with the library and getting clearances for the IP, but hopefully we will be able to make public the code soon. At the moment the MAD-SLIP code is pretty strange to read, but we have the MAD manuals although the SLIP extensions are still eluding us so far. We will start looking for a MAD emulator, if one does not already exist, and also try to get the SLIP extensions. [...] I'll send on a web-link when the code is made available." = electronic communication by David Berry, April 24, 2021; all computer archaeology as well computer "archivology" - due to the nature of this "symbolical machine"; making the original ELIZA code public, and emulating the Michigan Algorithm Decoder in order to run it, deserves full support, will de-historicise ELIZA for an operative re-enactment in the present - more "interactive" in the radical (source code) sense. This makes all the difference between museum objects, and computational objects/subjects (or "Zeug", in Heidegger's term). Media-philological "post script" (as a symbol-oriented sister to hardware-oriented media archaeology): "questions emerging about the fact that the DOCTOR script doesn't appear to run on ELIZA and may have been slightly edited for publication! Operative media questions indeed = electronic communication David Berry, April 26, 2021; archival source criticism required

Whirlwind program (Fedorkow)

- Project Whirlwind, paper Guy Fedorkow, "Whirlwind I/II. Recovery of Track-While-Scan" (version 1.0, April 2021, for IEEE Annals): real media archaeology - since "radical" media archaeology (the "radical" playing with the connotation of the mathematical square root symbol) not only

referring to "obsolete" hardware like the material Whirlwind computer, but to the mathematical diagram / code as well (which makes all the difference between material "techniques" and computational "technologies"); reader following step-by-step reasoning in re-deciphering and re-enacting the code; Fedorkow thereby providing an insight into assembly programming aesthetics in these vintage computing times - close to the machine (its "memory" limitations, as mentioned on p. 9)

- such early "real time" digital computing application might be contrasted with the contemporary "analog computing" approach which performed such applications (like flight simulations for pilots) by completely different means; very term "real time" simulation stemming from analog computing

- concerning "simulation": text using the terms "emulate" and "simulate" in an equivalent sense? developed a Whirwind simulator or emulator? emulation referring to the functional reenactment of a vintage computer, while simulation rather creates the interface "feeling" of such a machine, but achieving it by different hard- and software means; analog computers, as expressed in early source texts, "simulating" events in the physical world by equivalent electro-physics (equivalent in terms of applying the same differential equations)

- "calculated time in the future" (p. 7) reminding of Norbert Wiener's central time-figure of "cybernetic reasoning" which is futurum exactum in anti-aircraft prediction during WWII (Cybernetics 1948)

Y- remark on the irreducible "uncertainty" in the moment of digitizing continuous aircraft signals (p. 5) media-epistemologically stimulating; media-theoretical attention on the technical device "in operation" / "in being"

NOTES ON "COMMUNICATION NETWORKS"

There is no "digital space"

- Foucault's "archive" a diagram (Deleuze); computational networks embodying an operative machine, still topological (graphs, nodes) but with the additional dimension *t* (temporal processes)

- what is metaphorically addressed by notion of "digital space"; Internet "platforms" rather techno-mathematical topologies, and graphs (both concerning the material infrastructure, and the logical protocols governing such kind of communication); "space" itself (in the sense of Kant's a priori) is replaced by dynamics; individuals, once "online" in digital telecommunication systems (mobile, "radio"-signal based media),

in cybernetic terminology, becoming coupled with a techno-mathematical (computational) machinery, and subject to its temporality, in (a-)synchronous communication forms; "user" him-/herself "used" as data source. What the term "digital space" misunderstands is not only "space", which in fact has been replaced by the operative diagram (technical networks), but as well the power of algorithms which are the real agency behind the "digital". "Digital" only refers to discrete data processing, but with algorithms, infrastructure becomes, so to say, intelligent; book edited by Kornberger et al. (eds.), Thinking Infrastructures (in its double sense of the title) discussing nonhuman algorithmic tools like social media analytics (SMA) which replace privacy by the cold media-archaeological gaze. When the "digital" (better: "algorithmic") archive becomes active media matter, "space" does not make sense in that context any more; so-called "cyberspace" starting to reveal a techno*lógos* of its own, and might better be addressed by the terminology of cybernetic system theory (and its actual engineering)

- V2I (vehicle-to-infrastructure) in autonomous car traffic having no spatial sense of place but rather enduring sensoring via light waves, defining space by run time differences in the signals (implicitly sonic) and pattern recognition. "Space" is replaced by dynamic infrastructures like the 5G mobile communication standard.

Asynchronous communication "online"

- net-topologically induced asynchronous communication (its "digital" lag / latency) in video conferencing chats; trying to send question, "but for some reason YouTube blocked my attempts" = electronic mail Raviv Ganchrow, November 26, 2020; forwarding "the time-delayed question" *via* e-mail, allowing to be answered in the delay mode; "analogue" counter-piece: video installation *Present - Continous - Past(s)* by Dan Graham (1974); Bruce Nauman's techno-acousmatic installation *Get out of my mind, get out of this room* (1968); Alvin Lucier's re-iterative / recursive tape loop-based installation *I'm Sitting in this Room* (1969)

"Digital Teaching" During the Pandemic University Crisis

- "Old Europe" receding in terms of its academic idea; 2020 / 21, after months of online teaching, due to the pandemically induced closure of universities for students, reconsideration what actually is the kernel of university teaching & learning, and to what degree can it be "digitized" as both agency and the subject of media-theoretical, and media-archaeological, (self-)reflection; not making traditional academic seminars the "content" of video formats like Zoom, but rather redeveloping university from within the "digital" itself (even if too traditional as an academic teacher, to be part of that avantgarde)

- necessity for a resistant pause: no "online" performances (unless obliged); fascination by "the digital" as object of media-theoretical and media-archaeological research, while at the same time, privately and academically, withdrawing from it (in Husserl's sense of *epoché*). "Digital teaching" at university, in the media-scientific sense, instead of simply "digitized" performances (like video lecture transmissions) by teaching / learning *from within* the digital, so that university is not simply another format communicated as "content" by computing, but becomes a media-specific "message" of academic knowledge (in terms of McLuhan); probably this would still require accompaniment by the teacher's voice from the acousmatic "off", a hybrid; the algorithmic and its online infrastructure as new form of acousmatics, hidden behind the curtain of visual interfaces; rather "online" transmission of non-human media-archaeological investigation, in Signal Laboratory c/o Höltgen; voice from the "off"; e. g. "Core memory explained and demonstrated" = https://youtu.be/AwsInQLmjXc

- transforming university by the pandemic-induced "online" situation in 2020; speaking into a camera different from a lecture theatre; media criticism without falling back into any kind of metaphysics of (bodily) presence; to what degree can the "core" of academic university be "digitized" without loss; rather a question of academic *lógos* (in its multiple sense) in relation to techno*lógos*

- transsubstantiation of educational climate; Covid-19 inducing switch to online-teaching, accidentally triggering "digitization" of university, or inherent logics resp. trick (*mechané*) of (technical) reason (in Hegel's sense) resp. techno*lógos*? will sheerful switching to "digital teaching" be more irreversible than most academics (and students) are aware, even "after" the virus crisis; will be a lot more "viral" digital discourse enduring instead; will academic life lose its "heterotopic" (and increasingly "heterochronic") uniqueness it had in culture and society so far; new digital learning environment "both very familiar and alienating" = electronic communication Michael Century (Rensselaer Polytechnic, Troy, NY), April 17, 2020

- "digitization" of university due to the pandemically (COVID-19) induced academic online teaching; actually replace current "digitized" performances (like video lecture transmissions that are nothing but the old "content" of academic formats amateurishly mirrored in the new medium) by teaching / learning from within the digital, so university is not simply another format communicated as "content" by computing, but becomes a media-specific "message" of academic knowledge (alluding to McLuhan). But probably this would still require accompaniment by the teacher's voice from the acousmatic "off", a hybrid. The new form of acousmatics is the algorithmic and its online infrastructure, hidden behind the curtain of visual interfaces

- "how to make digital teaching possible in a context in which technology are still mainly built on metaphors of physical spaces and processes, thus stimulating digitized performances of the physical. The challenge is how to subvert existing platforms, and figure out ways to pursue proper digital teaching"; necessity of "a virtually injected presence of the teacher by means of voice mediation [...], but probably the role of the teacher changes, in that he would be part of an algorithmically developed environment where his body merges with digital space. A true cyborgization of teaching instead of bodily transmitted apparations in the digital realm"; requires "a bit of technology development to that, and in the meanwhile we have to, invoking Flusser, subvert available platforms and their limits" = electronic communication Marcus Bastos (professor for Multimedia, Sao Paolo), August 14, 2020

- the "cyborg(ani)zation" of academic teaching involving two levels: technical solutions (to be develop "open source"), and a parallel reflection on what are actually the core features which uniquely define university transmission of knowledge and have to be either preserved or transformed in new formats (I think of "Udacity" in California, e. g.). That even extends to a media archaeology of classic "Kybernetische Pädagogik" as it has been developed by Helmar Frank at his Institute of Cybernetics in Paderborn in the 1960s and 70s in Germany, where he not only argued for using media (and early archaic computers) as learning aids for kids, but to replace the corporeal teacher by a teaching algorithm - very radical, and deserves to be re-actualized not simply for historical curiosity, but for re-enactment. Frank's *lingua franca* for academic communication has been Esperanto - which, as a distancing approach against hermeneutics, finds its equivalent in programming languages today

- viral contageon; Madame Corona already "touching" and transforming academic environment; digital "Zoom" teleconferencing, and "Warning-App" data tracking, resulting from the crisis, literally making sense of Michael Century's originally proposed title for the Berlin talk: "Exstatic Time Machine". When "time is out of joint" (as expressed by Shakespeare, and updated by Derrida), so-called real-time taking its place, techno-logically; virus re-scheduling academic life, while "it"self (rather "her-" or "himself") a virus does not count as "life" form in the full sense, but as "similar to life" - where the "symbolic", in Lacan's sense, already touches the "real"

- prolonged lockdown, in 2020 / 21, triggering "digitization" of academic teaching, learning, and research; weekly "ghost lectures" into a camera CCD for "livestream" transmission to student auditory; technological analysis of what "digitization" means in the media-archaeological sense, that is: *underneath* the discussion of its discursive "social" surface effects; current "great transcription" of the analogue physical world into

telecommunicative digital formats challenging "old European" idea of university in real-presence; SARS-CoV-2 therefore a challenge for media theory as well

The Pandemic Crisis as "Data Drive", and the "Great Transcription"

- Martin Heidegger arguing that modern science and technology rest in their entirety on computation: Martin Heidegger, The Age of the World Picture [GO 1938], in: idem, The Question Concerning Technology and Other Essays, New York, NY (Garland) 1977, 115-154 (154)

- "If the humanities are moving away from interpretation, where are they heading to?" = guiding question of research group Data Drive, University of Amsterdam; https://asca.uva.nl/content/research-groups/data-drive%5B2%5D/data-drive.html?cb; towards (turing-)machine reasoning

- Data Drive project gaining a different meaning in the context of "big data"-driven (from "social media") Deep Machine Learning and AI; the present "turbulent circumstances" *topos* (expression referring to pandemic Corona crisis in 2020) readable in terms of information entropy / thermodynamics; in so-called Boltzmann Machines for Machine Learning, "Boltzmann" part referring "to a probability distribution that has to do with the states of particles in a system based the particles' energy and on the thermodynamic temperature of that system" = Andrey Kurenkov, A Brief History of Neural Nets and Deep Learning, in: Skynet Today, 2020; https://www.skynettoday.com/overviews/neural-net-history, accessed 4 November, 2020

- massive push of "digitization" under lockdown-induced "home office" and "video conferencing" condition; these circumstances (within the academic and cultural context) providing the desktop metaphor (and its "archival" dynamics) with a different meaning, making Erkki Kurenniemi's diagnosis of the "great transcription" (carried further by Eivind Rossaak, editor of the *Archive in Motion* volume) actually accur; binary registration (if not "archiving") of material and social reality accelerating media-dramatically; differs from the "great transformation" by which Karl Polanyi, in 1944, described the impact of industrialization on 19th / 20th century Western society: an increasing autonomization of economy, such as the fencing of agricultural areas, and political nationalization = Karl Polanyi, The great transformation, New York / Toronto (Farrar & Rinehart) 1944

- current push in digitization, as the "great transcription", primarily an act of coding, of alphanumeric "writing", and therefore relates to HKW's project *The New Alphabet* indeed. This technical sampling of the analog world (in its physical and bodily signals) into the binary code is a "data

drive" in the well-defined sense of computation; this act of archiving not related to the past in the archive-institutional sense, but a function of *l'archive* in the Foucaultean definition, a techno-mathematical (algorithmic) set of rules which governs the way the world is converted into "big data" made accessible for all kinds of technical *intelligence*; this techno-archival practice, according to the media-archaeological premise, not performing on the visible user-friendly desktop but unfolding beneath, within the "subface" (Frieder Nake); is it finally with the pandemic bias that Martin Heidegger's diagnosis of modern science and technology (resting in their entirety on computation) becomes "vir(tu)al" reality.

- "new alphabet" (HKW) in fact the *great transcription* (digitization / algorithmicizing)

- when getting an external message from, for example, Berlin, a bar automatically "alarming" staff of Univesity "CAUTION: The Sender of this email is not from within Dalhousie" - already a side-effect of the pandemic crisis, transforming from the micro-biological virus (the "real") to computer viruses (the "symbolic")